LEGISLATIVE ASSEMBLY OF QUEENSLAND

TRAVELSAFE COMMITTEE

Report
on the

Road Environment and
Traffic Engineering

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and Ordered to be printed
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CHAIRMAN’S FOREWORD

To the Honourable the Speaker and Members of the Legislative Assembly.

On behalf of the Travelsafe Committee of the Forty-sixth Parliament, I present the report of the Travelsafe Committee on the Road Environment and Traffic Engineering.

The Travelsafe Committee was established by the Legislative Assembly on 10 May 1990, at the instigation of the Minister for Transport and Minister Assisting the Premier on Economic and Trade Development, the Honourable David Hamill, Member for Ipswich.

It was constituted as an all-party Select Committee to report on and make recommendations on all aspects of road safety in Queensland.

This is the third major strand of the investigation into ways of reducing road trauma. The need for this investigation arose out of incidental information provided to the Committee in October 1990 during Western Queensland public hearings. These hearings were held to gather information for the first major report which was presented to Parliament in December 1990.

While all evidence points to driver attitude and the lack of driver education as the major cause of road trauma, from our earliest investigations, we have received indications that roads could be made safer and that this would reduce the seriousness of incidents that are caused by drivers.

Incidental evidence at each hearing has touched on this subject.

The Committee began Brisbane hearings on the specific subject at Brisbane on 4 and 7 October 1991. Hearings in Townsville on 14 October and Mackay on 16 October followed.

Evidence has been given on the subject of a "forgiving environment" which reduces the number of fatalities and serious injury.

Conversely, witnesses described engineering standards which contributed to the road toll. In some cases, the fault lay in standards being ignored or lowered.

A glaring example is the location of power poles placed at the kerbside, when the standard requires that all substantial trees be removed for a stated distance from the pavement.

Finance is always a consideration but it seems clear that greater use must be made of guard rail (e.g. Armco), particularly on the outside of curves where there is an embankment falling away.

There is also clear evidence available, that many drivers are ill-equipped to drive on our roads and that the best planned and designed roads and traffic systems can be rendered inadequate by bad driving practices.

This leads to frustration in other drivers, leading to further unsafe practices and can only be overcome by a complete reassessment of the present system and means of educating and informing drivers and other road users.

However much of the criticism from regular road users and expert witnesses, is directed at inadequacies in our road system, which also contributes to frustration and fatigue, both of which contribute to, or cause many accidents.
A prime example is the lack of efficient co-ordination of traffic lights along major roads, despite effective technology having been available for the past 15 years.

Pedestrians are often the forgotten aspect of road safety and more consideration should be given to providing a safe crossing over major roads at regular intervals. Co-ordination of traffic lights allows this to be achieved without serious delay to vehicles. Pedestrian (zebra) crossings over multilane roads have been proved to be unsafe unless the crossing is protected by traffic lights of some description.

The lack of a cohesive standard of traffic engineering practice, throughout the 134 local authorities and State Regions of Queensland, also contributes to a lack of confidence, and that situation must be improved.

Accepted road building standards are usually modified, depending on the funds available, and are sometimes ignored. Many relics of the horse and buggy age are still evident because of lack of funding available to Councils to correct them.

An increase in funding must be provided if we are to seriously attempt to remove these causes of road trauma. There is no doubt that projects which efficiently improve road safety are cost effective, as the annual cost of road trauma in Queensland has been estimated at $1.37 billion.

The Committee acknowledges the present efforts of the Department of Transport and local authorities, with the limited funds presently available for traffic engineering, maintenance, and road construction. However, the funds are inadequate for the task. This is particularly so in traffic engineering and highway maintenance.

Travelsafe Committee has taken evidence on the subject of the road environment and engineering practices throughout the State and has also discussed these matters with a wide range of road users and acknowledged experts. We have also received considerable correspondence on the subject from the public and have driven on some thousands of kilometres of roads of every description around Australia.

I wish to acknowledge the efforts of all Travelsafe Committee Members and the three respective staff members involved over the period of eighteen months of the investigation, Don Bletchly, Rex Klein and Rob Downey as well as the witnesses involved in the hearings and the Hansard reporters who accompanied us.

A great degree of unanimity has been reached.

We sincerely commend the report for the consideration of the Queensland Parliament.

Len Ardill, MLA
Chairman
1. **INTRODUCTION**

1.1 **Purpose**

The purpose of this report is to recommend the implementation and/or adoption of road safety measures related to the road environment, road design and traffic engineering with the aim of reducing the road toll through safer, better designed and better constructed roads.

1.2 **Scope**

This report will be based on the information gathered by the Committee from formal hearings; from written submissions; and from discussions with road safety authorities and the public.

It does not attempt to provide technical solutions. Rather, it emphasises the need for available technical solutions and counter-measures to be more widely adopted.

1.3 **Definitions**

For the purposes of the investigation and of this report, the Committee defined the road environment as the road and any of its immediate surroundings which may impact on the safe passage of traffic.

Traffic engineering refers to technical or non-technical road design factors or specific solutions which, when adopted or implemented, reduce the chances of accidents occurring.

1.4 **Background**

The Travelsafe Committee of the Forty-sixth Parliament was appointed by the Legislative Assembly on 10 May 1990 to inquire into, report and make recommendations in relation to all aspects of road safety in Queensland.

In appointing the Committee the Legislative Assembly determined the Committee's Terms of Reference to be:

- to monitor, investigate and report on the causes of road crashes in Queensland, and issues of road safety; and

- to review and report on countermeasures aimed at reducing deaths, injuries, and the social and economic costs to the community arising from road crashes or inappropriate road user behaviour.

Furthermore, it was requested that the Committee give urgent consideration to the following matters:
(a) the need for some form of compulsory periodic inspections of passenger vehicles as an effective means of reducing road crashes, and the severity of associated injuries;

(b) the need to improve the standards of motor vehicle repairs as a means of improving vehicles and road safety; and

(c) current traffic law enforcement methods and penalties, and their effectiveness.

Travelsafe decided to add to this, an additional matter which was put forward during early discussions and evidence. This was:

- the need for effective road safety education to educate all road users in the safe use of roads. This includes effectively informing the public of changes in traffic rules, adopting safe driving habits and respecting the rights and responsibilities of all road users.

1.5 Methodology

Since its earliest investigations, the Travelsafe Committee has received submissions indicating that a proportion of the road toll can be attributed to unsafe roads. Unsafe roads may eventuate from a number of factors. These include deficiencies in initial design and planning, quality and appropriateness of materials used, non-adherence to standards, lack of consultation, and lack of resources to name but a few.

Consequently, on 30 May 1991 the Committee agreed to call for public submissions into matters relating to the road environment and traffic engineering. An advertisement (see Appendix A) was placed in major newspapers on 22/23 June 1991. The closing date for submissions was 29 July 1991; however, late submissions were accepted and considered. The Committee received 38 submissions in response to the advertisement. The names of organisations and individuals who forwarded submissions are listed in Appendix B.

Public hearings specific to this topic were held in Brisbane on 4 and 7 October 1991; in Townsville on 14 October 1991; and in Mackay on 16 October 1991. Earlier public hearings held for other matters but which identified safety factors associated with the road environment and traffic engineering were held in Roma on 15 October 1990; in Charleville on 16 October 1990; and in Longreach on 17 October 1990. Witnesses who appeared at all these hearings are listed in Appendix C.

Traditionally, road users have very little input into the development of strategies aimed at reducing the road toll. The Committee strongly believes that one of its prime roles is to be a mechanism through which the average motorist can have his or her say. The process adopted by the Committee to date of calling for public submissions and conducting public hearings and inspections, has been one which has encouraged this to occur. The Committee recognises that detailed, technical research is extremely valuable in developing and evaluating road safety countermeasures, particularly in the areas of road design and traffic engineering. Many organisations, both Government and non-Government, exist solely for this purpose and the Committee does not attempt to replicate their work. However, the Committee contends that motorists who travel thousands of kilometres each week, month or year can provide valuable input. It is the views of people such as these that the Committee has sought, as well as the views of established road safety and transport organisations.
Many suggestions put forward are unworkable or would be difficult to implement and administer. The Committee has attempted to combine feasible suggestions with established measures and standards by adopting a "common sense" approach to its use of information gathered.
2. **THE ISSUES**

The Committee understood from the early stages of the investigations that the topic encompassed a wide range of issues. Many of these issues related to relatively simple remedies which are available and proven, yet which have not been implemented. In many instances, the reason cited for not implementing known road design and traffic engineering road safety counter-measures, was insufficient finance. In other words, road designers and engineers generally have the answers; road design and traffic engineering standards are generally road safety oriented; but insufficient funds was blamed for a situation of less than full compliance with established standards and safety measures.

The Committee has deliberately refrained from making detailed, technical recommendations. Where further technical evaluation of possible traffic engineering solutions is required, the Committee has recommended accordingly.

The broad issues which will be dealt with in this report are as follows:

- Road Design Standards;
- Road Design around Schools;
- Overtaking Lanes and Road Widening;
- Fatigue;
- Roadside Power Poles;
- Traffic and Road Signs;
- Traffic Light Co-ordination;
- Level Crossings;
- Road Maintenance;
- Road Trains;
- Roundabouts; and
- Reflective Cats Eyes.
3. ROAD DESIGN STANDARDS

3.1 Adherence to Standards

AUSTROADS (previously known as NAASRA) is the national association established to develop standards for use by road authorities throughout Australia. Its membership consists of representatives from the road authorities in each of the 6 states, the 2 territories and the Federal Government. In its submission to the Committee, the Department of Transport (1991, p.3) identifies the mission of AUSTROADS to be:

"To pursue the effective management and use of the nation's roads as part of the Australian transport system by the development and promotion of national policies and practices."

The Department of Transport (1991, p.2) further states:

"Standards are used in the road design, construction and maintenance and operational activities as an aid to achieving consistent and operationally effective solutions to the Community's needs."

The Department also raises doubts as to the appropriateness of adopting standards in all situations. These doubts have two aspects (1991, p.3):

"Technical - rigid adherence to the standards may not always ensure a safe, operationally efficient road.

Financial - given our financial limitations, any increase in standards and resultant costs produces greater deficiencies on the balance of the road network with respect to present traffic."

As a result, standards are not blindly applied in all situations. Guidelines are used where standards are inappropriate so that the characteristics of each situation are taken into account. The Department's submission (1991, p.3) uses these words to describe the application of guidelines and standards:

"This concern has encouraged the use of Guides where what actually happens on the road networks is adopted as the basis rather than the other approach of adopting rigidly a predetermined standard. These Guides require more interpretation and engineering judgement than the mechanistic application of standards."

Mr John Hill, District Engineer with the Department of Transport in Mackay was asked whether standards or guidelines gave him any flexibility in designing and constructing roads for local conditions:

"I think the whole of our design process is geared towards that, in that we take account of the traffic on the road and the anticipated traffic, the type of traffic, the volume of heavy traffic, for example, and the size of vehicles. I guess they are the two key things. The geometry and, the vertical and horizontal alignment - likewise, we have got a choice in those things. We have got guidelines which would dictate that there are certain bounds within which to work. But I do believe that, overall, while
still satisfying those guidelines and good design practice, we can come up with designs locally that suit the situation required, and that is done."

At its Brisbane public hearing on 4 October 1991, the Committee heard evidence from one of the Department of Transport representatives, Mr Geoff Haigh, Principal Manager of the Design and Survey Branch of the Transport Technology Division:

"I think our design standards, in fact, follow very closely to Austroads standards. That is the body which represents all the State road authorities. It used to be called NAASRA, in case there is any confusion about that. That body does produce standards in almost all the areas of activity in road design and construction. Largely we follow those standards. There are particular examples like a guide to geometric design of rural roads and in the urban situation. There is a guide to the design of intersections, and so on. So largely we follow those. We do in fact incorporate our own manuals at times and we do have our own road design manual and urban road manual. Those manuals are based largely on the Austroads standards and approaches but address specific local issues and in particular look at warrants at which measures should be applied. I think it is probably fair to say that that is something the Austroads standards don't do because they are a national road standard."

When asked if the standards applied to embankments, Mr Haigh replied:

"We set a minimum standard, so you will get a variation in standards but it is normally above that minimum ... The standard we are aiming for is that generally if it is up to a metre high we would aim for flatter batters which obviously are safer and allow, as I think we put in the document, for a forgiving situation - a forgiving road. So up to about one metre high, one on four batters so that the vehicle can run off and recover itself without a lot of danger."

In one of his submissions to the Committee, Mr Tom Waters (1990, p.1) stated:

"In the last few years there has been a proliferation of high embankment roads. Often these embankments are steep, loosely compacted, erosion prone and without guardrails. Now, if you have an accident, it is more likely that the car will run over the embankment and roll."

Mr Waters cited the Bruce Highway between the Beerburrum and Caloundra turn-off and the Warrego Highway at the Gatton by-pass as examples of "hazardous embankments" (1990, p.1). He also showed the Committee photographs of steep, badly eroded embankments. The Committee generally agreed that several more examples of hazardous embankments existed. However, as Mr Haigh stated, environmental and financial constraints made strict adherence to design standards difficult to adopt in all cases.

Mr Waters cited research done by Zegeer, Reinfurt, Hunter, Hummer, Stewart and Herf in 1988 as determining that "flattening the batter slopes from 1:2 to 1:7 results in a 27 per cent decrease in single vehicle accidents" (1991, p.3). This has other implications. Waters (1991, p.3) states:

"Flattening of the batter slopes also has a beneficial effect on the stability of the road structure. The flatter batter slopes means that less moisture changes occur under the road surface since the moisture fronts have further to travel. In addition, flat batter
slopes can be better compacted resulting in more erosion resistant slopes and therefore lower maintenance costs”.

According to Mr Waters (1990, p.2) guidelines published by NAASRA (now AUSTROADS) in 1987, recommended that safety barriers be erected on steep embankments (1:1.5) where height is greater than 1.2m. While research done by Glennon and Tamburri in 1966 may be somewhat dated, its findings are still significant in terms of adopting a safe embankment height. The research found that by increasing the embankment height, the percentage of fatalities resulting from accidents increased substantially.

Mr John Hill from the Department of Transport in Mackay, while noting that departmental standards are being reviewed, indicated that funding levels can inhibit adherence to standards:

“I think particular problems have arisen in the past where we have had relatively narrow shoulders in conjunction with relatively steep batters. There is this perception that you have not got anywhere to pull off onto the side in the event of a blow-out or an accident. Moves are being made to review that situation. It seems that the combination of those two things is not good. In many cases, we are forced to have narrow shoulders. The reality is for the dollars that are available, in many cases we rehabilitate pavements on the basis of existing drainage widths and formation widths, and generally that narrows down the shoulder outside the true pavement. What is being recognised is that you need a flatter batter in that situation - flatten off the batter so that even though it is a narrow shoulder there is still this ability to move a wheel off the actual shoulder in the case of needing to seek refuge if the vehicle has a blow-out.”

The Committee accepts that financial and environmental factors must always be a consideration when designing and constructing roads. However, it seems clear to the Committee that greater use must be made of safety barriers (e.g. Armco rail), particularly on outside curves where there is an embankment falling way. This is also the case in situations where steep embankments are, for environmental reasons, unavoidable or preferable.

The Committee is also concerned about the role that unexpected changes in road conditions or road curvature play in accident causation. Mr Geoff McDonald, who gave evidence at the Brisbane public hearing of 4 October 1991, cited several examples of how non-standard treatment of road conditions or non-standard use of warning signs resulted in serious accidents. One example given by Mr McDonald in evidence is the road to Gatton:

"Very frequently we identify very clear visual factors which have made it difficult for the driver to perform satisfactorily in the existing situations. I have mentioned some of them here, but we have others. For example, I will relate one which comes to mind. Going up towards Gatton you come off a divided highway onto a single-lane highway, and the driver overtook a car and stayed sitting on the outside lane and collided head-on with a car coming the other way. The visual indications that he was going from divided highway to single highway were not very clear, and the existence of a truck on the inside of him would have removed that signal. The corner round which he was going, according to the code of uniform traffic control devices, should have had double white line markings, and did not have.”

Mr McDonald's submission to the Committee contained several photographs in support of his claims about unexpected and inappropriate changes to the road environment. In Mr McDonald's opinion, the subsequent visual illusion created in these cases, can cause accidents.
3.2 Local Authorities

Local Authorities also have a significant role to play in the adoption and enforcement of standards in road design. This is particularly so in the case of new sub-divisions where the local authority can exercise considerable control over the design and construction of the road system. This early control is vital, as decisions made at this stage have long-term ramifications in terms of impact on road safety when new developments become heavily urbanised.

Loder & Bayly Consulting Group submitted a report with their submission which summarises the findings of several studies. These studies found "that there are significant numbers of road accidents occurring in new residential estates which need not happen" (1990, p.1). The report offers several "acceptable options for road network design and the detailed design of non-access Local Traffic Routes in future sub-divisions ..." (1990, p.1).

In his evidence before the Committee at the Brisbane hearing on 4 October 1991, Mr Malcolm Daff, a representative of Loder & Bayly Consulting Group, said:

"The major change that has taken place over the last two years has been the Australian Model Code for Residential Development (AMCORD) and they have published two editions of a model code which has directly looked at the issue of speed in local streets. They have adopted the view that you must slow vehicles down, so therefore they have adopted a view that every local street must be below about 50k maximum. Therefore, this Australian code which is gradually being adopted by the States and instrumentalities and is certainly very well known in Queensland has taken the first steps to implementing better design for new subdivisions which relate to safety. It relates to a whole lot of other things as well. Obviously new subdivisions are very complex but it relates to safety and the approach they have taken is to make sure that every street which has got houses fronting onto it is a slow-speed street."

With respect to widespread adoption of the AMCORD code, Mr Daff stated:

"At this stage, the model code is purely advisory. It is just a model, but a number of municipalities have adopted it and given it statutory force."

The summary report of Loder & Bayly (1990, p.10) states that:

"In order to control vehicle speed to the 40-50 kph level it is desirable that lengths of free travel be limited to about 200m, with 120-150m desirable. Effective street length can be reduced by roundabouts, slow points, or T-intersections if most vehicles turn."

Mr Martin, also from Loder & Bayly Consulting Group, supported the incorporation of narrower pavements and narrower road reservations into safety design for new developments. However, factors such as capacity for underground pipes would need to be considered when designing for specific locations.

The question of how best to accommodate bicycle traffic on residential and arterial roads was also addressed. Mr Daff stated in evidence that:

"People will still use arterial roads for cycling. Although some people would say they should not be on arterial roads there is no way of stopping them and they will be there
whether we like it or not. Arterial roads are attractive to cyclists for the same reason they are attractive to motorists. They go where you want to; they are direct; they are well lit at night; they have generally a smooth surface; they are popular for cyclists. On the other hand they are a very poor environment if conditions are not right for them."

Mr Daff's relatively simple solution was to have a wide kerbside lane so that bicycle riders may use this lane in relative safety. During its public hearings and inspections in Townsville, the Committee observed considerable use of wide kerbside lanes for bicycle traffic. Mr Stanton, the Townsville City Council Director of Engineering Services, provided further explanation of this when he said in evidence:

"In a recreational sense, there are certain stand-alone bikeways, for example along the Rowes Bay foreshore to Pallarenda. That is discretely assigned, although I ride my bike along it and walk along it periodically and I find that the competition is real. So the pedestrians and the cyclists are increasingly sharing those facilities. Where it is possible and socially sound - and I mean in terms of sight lines and security for the user - we don't mind putting in a separate cycleway, if we can afford to. For example, we recently serviced the new William Ross High School out at Wulguru with a discrete bitumen network of cycleways. I must admit that was only after the State Government agreed to contribute towards the cost of it. But in the main, the council's philosophy, if you like, has been that cyclists are a part of the traffic envelope, and it is not in the interests of the cyclists to be completely divorced Canberra-style, if I can put it that way, from the road network, and we have actually integrated them where possible within the geometrical space restraints onto the road pavements.

In fact if you pull up at our intersections, you will see a 1.2 metre wide standing area at a set of signals set aside for the cyclists. The reason behind that philosophy is that it allows both the motorist and the cyclist to live together. It also means that if a cyclist has been in a position where they have been on a discrete or stand-alone cycleway and they get away from that precinct or area and move into another part of the city where we haven't got it and they have to ride on the road, they are at least accustomed to that process. As they age, of course, the area they ride is further, so we believe strongly in the integrated solution. There have only been a couple of cases where we have put cycleways in parks. We are aware of the propensity for schoolkids to form their little groups and prepare to own a section of cycleway if it is in a fairly remote location. The Townsville kids are no different to the kids anywhere else. We try to avoid setting those circumstances up."

Any discussion on design standards for local streets would not be complete without mention of Local Area Traffic Management (LATM). The Committee believes this initiative to be very important in reducing the incidence and severity of accidents in residential areas. However, care must be taken to ensure that accidents are not merely removed from residential streets to adjacent major roads, particularly if the major roads are not capable of supporting increased traffic flows.

The Committee heard evidence in Brisbane on 7 October 1991 from Mr Jim Evanson, Traffic Engineer, Research and Planning, Brisbane City Council regarding a wide range of topics dealing with standards used by local authorities. He generally supports the integration of bicycle traffic with other forms of traffic as long as it is practical to do so. He admitted that this philosophy works well in places like Townsville with wide road reserves and relatively flat terrain. However, in places like Brisbane where traffic volumes are much higher and the topography is less accommodating, a case
may exist for the development of an extensive off-road network. In essence, Mr Evanson is saying that situational factors must be considered when applying design standards.

He qualifies this by saying:

"NAASRA guidelines, for example, are fairly well utilised and adhered to. I would say that most practising engineers with any experience would stick fairly closely to those types of standards and guidelines although it is like most guidelines. There are always holes in the sentences and there are always lines between the sentences, so there is some room for interpretation and we were talking about the traffic sign situation. I think in some instances it is a matter of professional and other interpretations as to what is good practice and what is not so good practice."

While this represents a flexible approach to the use of standards and/or guidelines, the Committee believes that widespread deviations from standards causes a certain degree of confusion for road users. When considering variations to standards, road authorities need to remember that mistakes made in the past have proven very expensive, sometimes too expensive, to rectify. Consequently, the road system is "stuck with" an incorrect procedure or device for a long period.

The Committee noted the design of the mall, or Shopping Park as it is more correctly called, in Mackay whilst on its visit to the city to conduct public hearings and inspections. Of particular concern was the use of non-standard, non-approved (i.e. by the Department of Transport) signs which require the pedestrian to "Give Way to Traffic". Most other locations in Queensland which have this style of development use signs warning motorists that pedestrians are likely to cross.

### 3.3 Consultation Between Authorities

Several witnesses commented on the level of consultation between road authorities during the all-important design stage. In evidence, Mr Martin from Loder & Bayly commented that on a particular project in Queensland:

"... (the) question of the left hand and the right hand - with the best will in the world, probably - not coordinating, came up repeatedly".

He further commented on the need to set up structures:

"... where there is coordination between people of different disciplines and with different statutory responsibilities to work together on a project basis."

When asked to comment on the relationship between State and Local Government when it comes to planning and designing roads, Mr Evanson had this to say:

"There is a great degree of compartmentalism built into our systems, that is for sure. That not only cuts across the boundaries of road authorities but also cuts across the boundaries of just about any authorities that have to deal with any other authorities. An example of that is - I guess if I state it in economic terms, everybody tries to externalise the costs that they do not want and internalise the benefits that they do want. Consequently, you can have decisions being made by a State authority, for example, an Education Department about the location of a school, or about the size of a school, which affects the catchment and hence where the children are to come from to attend that school. That has implications then for the road and traffic authorities..."
as to how best those children might be gotten to school. Those sorts of problems do exist. They have existed and, to some extent, still exist between the State and local authorities in terms of the road-planning.

I feel presently that there is a great deal of optimism about the sorts of collaboration we are now seeing in terms of planning. We have a number of studies running at the moment - for example, the SEPTS study - which is a regional study for the south-east Queensland area for public passenger transport. There are a number of other studies in which the State authorities and the local authorities and various other authorities are collaborating. That is very much to the better.

At the local level, I think there are still some problems with the colloquial and the compartmentalisation of portfolios or responsibilities, if you like ... I must admit that it would be much better when the decisions are being made in the first place to work out what all the problems were and how they were going to be solved at the front end of the problem rather than to say, "Well, there's a line", and after the event, "You look after that and we'll look after this."

During public hearings in Townsville on 14 October 1991, the Committee heard evidence from Mr Ted Lawler, a senior engineer employed by a firm of consulting engineers, McIntyre and Associates. This firm is based in Townsville but also has branch offices in Brisbane, Cairns and Mackay. Mr Lawler believed that a greater amount of consultation, particularly between Police and road designers, would be beneficial. Furthermore, some sort of an advisory committee with an open, ongoing brief to facilitate and enhance consultation, received his support.

3.4 Conclusion

As stated earlier, the Committee accepts that road design standards cannot be blindly applied in all situations. However, the Committee is concerned that deviations from the standard can create dangerous situations which might otherwise have been avoided. Insufficient funding was cited as one reason why safety considerations are compromised. That is, engineers, road designers, and road authorities have to strike a balance between strict adherence to proven standards and making available funds go as far as possible.

**Recommendation 1**

The Committee recommends that the AUSTROADS (formerly NAASRA) standards on embankment design and construction, particularly with regard to embankment slope and guard rail protection where specified, be observed by road building authorities as a minimum.
Recommendation 2

The Committee recommends that greater emphasis be placed on setting road design and construction standards for state-wide use, and on observation of those standards by local authorities. This should also include LATM (Local Area Traffic Management) standards.

Recommendation 3

The Committee recommends that all Queensland traffic authorities meet annually at a conference dedicated to establishing and reviewing road design standards. The first of these conferences shall establish road design standards which should be adhered to by all traffic authorities in Queensland. Subsequent conferences shall review the standards for effectiveness and suitability. Any recommendations to create or modify standards, which emanate from such conferences should be directed to the organisation/s responsible for establishing the standards originally adopted.

Recommendation 4

The Committee recommends that the proportion of State funding to local authorities in the TETF (Traffic Engineering Trust Fund) scheme for traffic facilities, be increased.

Recommendation 5

The Committee recommends that unexpected changes in road conditions or road curvature be discouraged through adherence to AUSTROADS (road design) standards.
4. **ROAD DESIGN AROUND SCHOOLS**

In earlier reports, the Committee has recommended improvements to the road environment around schools. A specific example refers to the use of flashing lights during peak school hours to warn motorists of the likely presence of large numbers of children. The lights would also warn motorists that a change to the speed limit in the vicinity of the school is in force while the lights are flashing.

The Department of Transport has developed a program called "Schoolsafe" which considers a range of issues with regard to road safety around schools. Most notably, the program evaluates the need for lowering speed limits during peak school hours and posts appropriate signs indicating changes to speed limits at certain times of the day. A drive around some schools in Brisbane, particularly those on busy roads, will reveal an increasing use of these signs.

During the public hearings for this investigation, the Committee heard evidence that road design around schools could be improved. In particular, references were made to the need to make provision for set-down areas, safe crossing of busy roads, and areas for the safe clearing of vehicles. Mr Wease, Assistant Manager for the RACQ in their North Zone, commented at the public hearing in Townsville on 14 October 1991, on how important forward planning is when sites for new schools are selected:

"I really believe that it is the initial planning, the initial research in looking at the problem, or where you are going to put a school in particular. I will just pick up on that point of what sort of road system you are going to need with that school in 10 years' time. The State Government does a lot of research when they put a school into place. They do not plan it for one or two years, they plan it for 10 or 25 years on a grade pattern so they know that in 15 years' time a school that started with 300 pupils will have 1,500 pupils. They have allowed for that in their expansion of the schoolgrounds and the building area. They have also got to allow for that in the road system. They have got to allow run-off areas and pick-up and put-down areas."

Whilst better forward planning is necessary to allow for increased traffic volumes as well as increased population, Mr Wease, as evidenced by the following exchange, suggests that other problems exist around schools:

"The CHAIRMAN: Another matter I was going to ask you about - all of these are supplementary to the answers that you gave: talking about design at schools and outside schools, you mentioned the fact that there should be provision made for proper set-down areas and that sort of thing. Are you familiar with the circulatory design which allows the traffic to turn into a school set-down area and then come out again at 90 degrees to give drivers visibility in both directions and also to allow for the inevitable U-turns that occur when kids are dropped off at school? Would you care to comment on that sort of design as opposed to just having a set-back of the school fence to allow a parking bay?"

**Mr Wease:** I believe that you have to have a dedicated area like that, a run-off and then a re-entry area that allows for two things: clear vision and enough speed to be gained on re-entry. That is the ideal situation for any school, I think. The major problem with a schooling area in the run-off and pick-up areas at the moment is non-obeyance of traffic rules by the parents, and I think that probably every parent at some
stage of the game who picks up and puts down their children is at fault. They double park and triple park in some areas, do U-turns in front of multilane traffic and do U-turns across double lines ... There are two reasons. There is pure ignorance of the traffic rules and insufficient provision for them to put down and pick up.

The CHAIRMAN: Of course, that is a problem in ... old, established areas. But there is no excuse for that occurring in new developing areas, with the technical knowledge that is available today.

Mr Wease: Exactly; none whatsoever. As I said, they plan for the growth of the school; they should be able to plan for the traffic.”

Mr Don Pickard, Department of Transport Regional Director for North Queensland, in evidence at the Townsville public hearing on 14 October 1991, related to the Committee an example of poor siting of schools:

"We've had two situations here where the Education Department and Administrative Services have bought school sites adjacent to some of the major highway systems. Because of access from those major highway systems, not only are the sites inappropriate but there was no prior consultation at all. We salvaged the last situation by making them provide some facilities like bikeways and things of that nature. My concern is that we are exposing kids particularly to very dangerous situations. This is going to be a main arterial road through Townsville. It will probably carry 40 000 to 50 000 vehicles a day in 10 years' time. Inappropriate location of schools is a big issue. Often the access to schools is abysmal. Kirwan State School has terrible access. No consideration was given to those sorts of issues."

It is evident that appropriate road user behaviour is important when it comes to accident avoidance. However, it is obvious to the Committee that initial planning and design of individual roads and road systems can provide conditions which enhance accident avoidance. The Department of Transport is be commended for their "Schoolsafe" program which seeks to make the school environs safer for our children. However, greater emphasis on road safety (as discussed) in the initial site selection and design phases would obviate the need for such programs.

Recommendation 6

The Committee recommends that future school developments make full provision for suitable areas for set-down, pick-up, and waiting, and for turning or clearing of vehicles, including public transport, as is the case with all other types of new urban developments.
5. OVERTAKING LANES AND ROAD WIDENING

5.1 Overtaking Lanes

Throughout the investigations undertaken for this report, the Committee was repeatedly told that overtaking lanes should be more widely adopted. Several witnesses stated that an increased use of overtaking lanes would alleviate some of the frustration felt by motorists who, for any number of reasons, are unable to overtake slower vehicles. Furthermore, signs which tell motorists that they are approaching an overtaking lane, (e.g. "Overtaking lane - 5km Ahead") are considered by the Committee to be extremely valuable in further reducing frustration levels. Motorists would be persuaded to wait a little longer to overtake in safety rather than attempt what might otherwise be a risky and unsafe overtaking manoeuvre. Committee members who have travelled the coast highway in northern New South Wales have noted the use of overtaking lanes and associated signs and found them to be conducive to safe, frustration-free, driving.

In its submission to the Committee, the RACQ (1991, p. 15) in Brisbane state:

"Driver frustration increases and unsafe manoeuvres are encouraged when long lines of vehicles are held up behind slower vehicles, especially in undulating terrain where safe and legal overtaking opportunities are limited. Construction of adequate lengths of overtaking and climbing lanes at regular intervals increases traffic flow and reduces the need for dangerous driver practices, thus reducing accidents by 25%. In Queensland construction of passing lanes on the Bruce Highway has resulted in a reduction of 50% in road crashes at those locations.

It is preferable to provide several short climbing lanes, closely spaced, rather than one longer lane spaced further apart for both mountainous and level grade situations. Even the provision of short pull-over bays on long sections of narrow winding ranges eg. Gillies Highway, Atherton Tableland, would help to relieve driver frustration."

In evidence at the Brisbane public hearing on 7 October 1991, Mr Joe Kenny elaborated on the wisdom of overtaking lanes:

"More climbing lanes on the coastal road would be a great advantage, that is, the road between here and Cairns. The Gold Coast road is now four lanes. The Sunshine Coast road is four lanes. The road to Toowoomba is now virtually four lanes. However, on the Bruce Highway, more and better-engineered and better-signed climbing lanes would be a tremendous advantage. New South Wales has done it very well. Down there, they sign for the next lane. They say, "Overtaking lane 10 kilometres ahead". Then the signs say that the lane is 5 kilometres and then 2 kilometres ahead. A couple of years ago, I was down near Eden. I got stuck behind a big semitrailer that had big steel girders on its back. He was travelling at 60 kilometres an hour. It was a windy road, and I must admit that there was a tendency to think, "I am sick and tired on this.", but then you saw a sign that says, "Overtaking lane 5 kilometres ahead." At 60 kilometres an hour, which is slow by highway speeds, you are doing one kilometre in a minute so you have only to say to yourself, "In five minutes, there will be an overtaking lane."

This view was supported by other witnesses. Mr Peter Moore, North Zone Manager for the RACQ,
said in evidence at the public hearing in Townsville on 14 October 1991:

“The classic example of that (overtaking lanes) is the Greenvale Road from Charters Towers to Greenvale. Every 10 kilometres there is an overtaking section. Now, if that was advertised or somehow the public were made aware of it - our road maps are now coming out with those on them. I'm not sure about the Department of Transport maps, I can't remember, but I think they might be too. If people were to know that those sections were available to them, they would be happy to sit behind one until they came to the widened section of the road. That's a very good idea.”

Mr Lawler also stated that more overtaking lanes would be beneficial:

“The spacing of overtaking lanes needs to be closer; say a few kilometres, possibly even as much as 5 kilometres. There is a law of diminishing returns applying to it. With that, the alternative is to put the overtaking lanes in the easier country where it is much cheaper to build them and where the small car does have that edge in performance over the heavy vehicle.”

Mr Pickard and Mr Ian Rose (District Engineer, Department of Transport, Townsville) both commented in evidence on the effectiveness of overtaking lanes:

"Mr Pickard: We have used overtaking lanes quite extensively, probably not as extensively as we should, but on the range sections throughout north Queensland. I heard you ask Mr Lawler the same question. There are two sections of overtaking lanes on a flat area out on the Bruce Highway north of the city. We put those in because the traffic volumes were quite high, yet not high enough for four-laning. We were getting queues and people were being impatient and trying to overtake. There were a number of accidents. That seems to have corrected the road safety issue, but it is only a temporary measure until such time as the traffic volume reaches a level where we must construct four lanes. So they are very successful on flat areas, to get rid of the queues behind slow-moving vehicles in flat areas where the traffic volumes are, at that period, up to the level when you need to construct four lanes, and we have also used them successfully on hilly sections where you have slow-moving road trains and things of that nature. This is in the western area between Cloncurry and Mount Isa.

Mr Rose: If I can comment, I think there is no doubt about the fact that the use of passing lanes is a necessary and an interim measure between the volumes that Don has been talking about - the two-lane to the four-lane situation. I think the main factor controlling the progression of installation of passing lanes is basically funding - largely funding. The principle of providing the passing lanes to improve road safety and reduce frustration is quite sound and is recognised.”

Mr Roddick, in his submission (1991, p.1) supported wider use of overtaking lanes, particularly before inclines and better use of advance warning signs. In his submission he says:

"It is not only the fast and dangerous drivers who cause accidents, but the drivers who travel slowly and obstruct other drivers, thus causing a normally law abiding and safe prudent driver to take risks not normally appropriate to their behaviour.”

In his evidence on 7 October 1991 in Brisbane, he stated:

"I feel that the overtaking lanes could be much longer and start approximately
With regard to the signage, there are signs which indicate that there are overtaking lanes several kilometres ahead. If they could be put at 5 and 10 kilometres ahead, people would then happily wait the few minutes to get to that position or I postulate many people would be happy to wait. It would stop what I call the frustrated drivers - the ones who are predominantly law abiding and happily following along and they are frustrated because they cannot pass ... the point I am making there is that they will then just take a chance or risk which they normally would not have."

Of course, associated with the use of overtaking lanes is the issue of drivers being required to use the left lane unless overtaking. This is particularly evident on four-lane highways such as the road to the Gold Coast where long lines of traffic can be held up by inconsiderate drivers who persist in driving slowly in the right hand lane. The problem is exacerbated when, quite rightly, a slower driver is in the left hand lane. The net result is that both lanes are slowed and traffic backs-up unnecessarily. Bad driving habits such as this reduce the opportunity for overtaking; reduce the capacity of the road; and leads to higher levels of driver frustration.

In his evidence at the Mackay public hearing on 16 October 1991, Acting Superintendent Neil Healy suggested lack of resources as a reason why highway patrolling for these types of offences, and others, is not more successful:

"The Department of Transport has a very small number of people who conduct highway patrol operations in Queensland. I believe that should be massively extended and there should be a highway patrol section as there is in New South Wales at perhaps every major district in Queensland, properly staffed and resourced with proper resources to adequately patrol roads. That responsibility would be their responsibility only. The way it is now, those patrols are done ad hoc by divisional police or traffic police who are attached to divisions in the various big cities. There is no constant surveillance of major highways throughout Queensland by a dedicated highway patrol unit. The major problems with highway patrols, we believe, seem to occur at night and in the early hours of the morning when there is no surveillance. Major heavy vehicle accidents occur late at night and in the early hours of the morning when there is no monitoring of the behaviour of those people. Perhaps they well know that there is no monitoring at that time. What we are suggesting here - again, it is a matter of resources, of course - is that major highway patrol units should be set up in each district headquarters in Queensland to monitor those sections of the major highways on a constant basis.

5.2 Road Widening

With respect to road widening as both a safety measure and as a measure to reduce damage to roads, the Committee has seen many examples where insufficient pavement widths have resulted in dangerous shoulders forming as a result of erosion. This problem is particularly apparent when passenger vehicles must pass or overtake heavy transport. Mr Moore from the RACQ in Townsville stated in evidence:

"You get these southern visitors who are not used to driving in the west. They try to overtake them (road trains) and underestimate. They get on the bad shoulders and blow tyres. The stories go on and on. I think narrow roads, bad shoulders and the poor condition of the paved surface that is there now all add up to these accidents."
When asked to suggest some of the more cost-effective engineering solutions which could be used to reduce the number of accidents, Mr Lawler stated:

"In the rural roads, one particular one is width. It has been found here. We have a high proportion of heavy vehicles now, including road trains and B-double trucks on the highways. With the eight to nine metres of total roadway with total formation width, it has been accepted for quite a long time that there is not quite enough. Ten metres is far safer. It does permit passing a vehicle that is a bit overwidth or passing a vehicle that is a bit errant. I think on roads that carry heavy commercial vehicle traffic, width is probably the best one."

5.3 Conclusion

In view of the evidence heard by the Committee at hearings, in submissions, and from their own experiences in travelling many kilometres of highways and major roads, it is believed by the Committee that overtaking lanes and wider roads have significant road safety benefits.

**Recommendation 7**

The Committee recommends that widespread construction of overtaking lanes be planned and implemented, on both new and existing roads, as a means of reducing accidents. Appropriate signs giving advance warning to motorists that an overtaking lane is approaching are essential on existing and new overtaking lanes.

**Recommendation 8**

The Committee recommends that the bitumen surface of many roads be widened to facilitate safe overtaking of slow vehicles as well as improving the safety of two-way traffic. It will also reduce damage to bitumen edges.

**Recommendation 9**

The Committee recommends that detection and policing of so-called minor offences, such as slow driving in overtaking lanes and motorists failing to keep left unless overtaking, be given a higher, more urgent priority. This will increase the benefits associated with proven road safety traffic engineering facilities. This action is necessary to reduce the frustration and congestion which leads to accidents.
6. **FATIGUE**

Fatigue is suspected of being a largely understated cause of single vehicle accidents, particularly over Queensland's long distances. In his report for the Committee, titled "Achieving High Levels of Compliance with Road Safety Laws - a review of road user behaviour modification" Elliott (1992, p. 39) says:

"Car drivers need to voluntarily adopt specific behaviours to avoid fatigue prior to departing (or at the onset of any initial sign of fatigue) or else technology has to be used to protect them from themselves".

Elliott (p.39) further states:

"Fatigue represents a major area for road safety gains to be achieved. If fatigue-related crashes are to be substantially reduced then either:

- drivers need to plan ahead to avoid fatigue rather than relying on attempting fatigue-fighting behaviours at the commencement of the onset of fatigue; or

- drivers need to be protected from the possibility of fatigue. Technology may provide the solution by the use of fatigue bio-feedback devices and with it some control over the operation of the car itself. Monash University Accident Research Unit (MUARC) is doing research and development on such devices. Engineering methods such as audible edge-linings are available and are highly effective; albeit costly across a large network; or

- crash reduction can be achieved by long term low intensity enforcement as occurred in Tasmania (Leggett, 1988)."

At the Brisbane public hearing on 4 October 1991, Mr Geoff Middleton, Principal Manager of the Road and Vehicle Safety Branch of the Road Safety Division of the Department of Transport, told the Committee of various initiatives undertaken by the Department in relation to a reduction in the number of fatigue-related accidents:

"Under traffic management, we were thinking of things like signing procedures that have been trialled in New South Wales where they are using say fatigue zones. They identify areas where fatigue accidents are a problem and are signing those to let motorists know to raise their awareness. Other matters like the use of audible edge-linings which is a measure of advising the motorist before he actually runs off the road that he is starting to get drowsy. I suppose the use of rumble strips on the road on suitable locations. Fatigue - we use that as an expression of a single vehicle run-off-the-road-type accident which is basically or usually evidence of fatigue. Rumble strips appropriately located could aid in that area too if it is a recognised fatigue problem. In the area of construction, probably things like curve linear alignment or the avoidance of long straights in alignment and making the alignment more interesting and less boring, I suppose, is one technique in construction. The removal of roadside hazards, I think we have addressed that in our submission, but that is another technique; making sure that they are either placed far enough away from the road or if they have to be tolerated within the road then protected or signed or whatever. Probably the last one - I am not quite sure if it is a construction technique but it is the provision of resting facilities for motorists; rest areas. Traditionally we
have tended to place those in areas where we have property. We are now looking at strategically locating those to try to get people to pull up in those locations where fatigue is a significant problem. They are the types of issues we are talking about."

Association Professor Lal Wadhwa at the Townsville hearing supported the concept that improved road design impacts on the reduction in the level of fatigue experienced by motorists:

"Good roads cause less fatigue. If you have good sight distances, passing lanes, the curves are not very tight and so on, this reduces fatigue. Sometimes when driving 20 kilometres you feel more fatigued than driving 200 kilometres on the interstate system in the US, for example. So fatigue is related not only to the number of hours that you drive but also the conditions in which you drive. I believe that improving road conditions would certainly reduce fatigue."

Mr Moore from the RACQ in Townsville also believes that rumble strips are a useful warning device for the fatigued driver:

"If you were half asleep or you were dozing off and you hit (rumble strip) that on that western road, that would soon wake you up. I feel that that is a very good idea."

Mr McDonald at the Brisbane hearings also supported the use of rumble strips provided they could be shown to be effective:

"The problem we have with our long, straight roads, of course, is the arousal level when the driver drops off. I think those (rumble) strips would often pull the person back and sort of say, "It is time to take a spell and not continue." My own personal opinion is that, yes, they are good and should be encouraged. But whenever I say that, I make it very clear that I believe fact is far more important than opinion and it is necessary to always try to evaluate these things. Again, I think science often does not give enough recognition to the value of interviewing and recall and anecdotal information in getting that together."

The problem of fatigue was also brought to the Committee's attention during its public hearings and general discussions in Charleville and Longreach in 1990. Most comments referred to the need to provide more and better roadside facilities for fatigued drivers.

At this stage, the Committee is not in a position to be able to fully investigate the value of fatigue bio-feedback devices as suggested by Elliott. Perhaps the research being done by the Monash University Accident Research Centre (MUARC) may shed more light on the matter so that governments and road safety authorities can more closely consider their benefits and problems. However, the Committee does regard fatigue as an increasingly significant road safety issue and believes that programs already underway which combat the effects of fatigue, should be expanded.

**Recommendation 10**

The Committee recommends that, as roads are built or improved, greater use be made of traffic engineering warning devices; such as rumble strips, to warn drivers that they may be fatigued and that they should pull over and rest.
**Recommendation 11**

The Committee recommends that more specialist attention be given to planning roadside rest areas and encouraging motorists to make greater use of these facilities to avoid the onset of fatigue.
7. **ROADSIDE POWER POLES**

The Committee is concerned about the number of accidents which occur as a result of a motorist leaving the road and hitting a power pole. In general terms, little damage is done to the pole, but massive damage is done to the vehicle and its occupants. Obviously, power poles must be strong enough to withstand severe impacts without causing high voltage power lines to fall to the ground. However, their placement, particularly in urban areas and beside the travelling lanes on major roads, leaves much to be desired.

Research done by Fox, Good and Joubert in the late 1970's considered data gathered from "879 pole accidents ... obtained over an eight-month survey period from 7 July 1976 to 7 March 1977" (1979, p.31). The survey data referred to accidents recorded in the Melbourne metropolitan area. The results of the survey, when combined with other data, led Fox, Good and Joubert to estimate that "collisions with power poles in Melbourne account for 45 fatalities and 785 injured persons annually" (p.i).

The authors go into some detail in Chapter 5 of their research report, on the various methods used to calculate the cost of these accidents to society. In general terms, Fox, Good and Joubert (p.ii) stated that:

"When loss of societal welfare is measured in terms of consumption of current resources and foregone production, pole accidents in Melbourne cost at least $23 million annually."

The Committee recognises that methods used to calculate the cost of road accidents can vary significantly and that considerable debate arises whenever attempts are made to quantify the cost of road accidents upon the community. The Committee also is aware that the research by Fox, Good and Joubert is based on data which is some 16 years old. The environmental conditions as well as economic, road design, and vehicle characteristics are also dated. However, the Committee believes that the research still has relevance for road safety authorities today. Quite clearly, power poles represented a real threat to urban traffic in the mid-1970's and this threat does not appear to have abated.

In assessing methods by which the societal cost of pole accidents could be reduced, Fox, Good and Joubert (p.352) say:

"the most effective method ... is pole removal. As with other methods, of course the benefits must be weighed against the costs."

A later study by Epstein and Hunter (1984) which concentrates on the legal implications of frangible poles, but also comments on power poles, discusses the design of utility poles and the available alternatives. In summary, the report says that modified breakaway utility poles are only feasible where undergrounding of cables or relocation of the pole is not possible (p.92). The authors further state (p. 92):

"At the present time modification of the design of utility poles does not offer the motorist adequate protection; therefore the prudent road authority must alter the location of hazardous poles, underground the cables, or use impact attenuators."
The Committee heard a number of witnesses who stated a belief that a lesser number of power poles (or none at all) in urban areas, or moving power poles further back from the kerb would significantly reduce the number of accidents and associated injuries and costs. Mr Daff from Loder & Bayly, whilst not claiming to be an expert in location of utility poles, stated in evidence:

"Certainly there is a major study in Victoria in the late seventies which indicated that a very high proportion of accidents involved vehicles running off the road into utility poles. There are many people who would say that is a very cost-effective way of reducing accidents - by removing utility poles further back from the kerb. I am not an expert in that area, but I understand that is a very cost-effective way of reducing accidents."

When asked about the rules and regulations in relation to the placement of power poles, Mr Haigh, from the Department of Transport in Brisbane, replied:

"In fact we have been trying to get a code of practice with the service authorities, and the electricity industry is an area where we have been working on a code of practice for some time. We have an agreement at the moment, but we do want to take it further. That determines sort of how far back in a normal residential situation the power lines should be. It identifies positions for those in a residential situation. In a rural situation where you are talking about major power lines possibly, certainly by the planning process between the electricity authority and ourselves we try to keep them well removed, normally over to one side of the road reserve. When we are looking for that distance it is those criteria that Nev was talking about that apply, and I think we could spell those out. In a rural situation with a 100 kilometres per hour speed limit, generally we are looking for at least 9 metres' clearance free of hazardous objects. In other words, anything within that 9 metres alternatively must be treated, have some protection work. Normally we would be aiming to have those electricity lines, power lines, outside the 9 metre distance. In closer urban areas, certainly if there is any new design being done in a 60k area the distance is 3 metres. Obviously in a lot of residential areas these days underground power is preferred, so the danger is even less ... I think it is fair to say that the Electricity Act does give the electricity authorities what they believe is an overriding power, but I think it is a matter of cooperation at the time of planning these facilities. Also our code tries to apply to the electricity authority the cost of moving it. If we are in a situation of planning new roadworks and we are saying, "We want to put a new road there in the future, so we want you to move it out of the way", we are trying to apply the cost to them of either moving it later or protecting it later when the new roadworks go in. Their legislation does put them in a fairly powerful position, but I think through negotiation and cooperation we generally get what we need as far as offsets are concerned."

Mr Kenny from the RACQ told the Committee at the hearing in Brisbane on 7 October 1991 about a CURE (Clean Up Roadside Environment) program conducted in California some 25-30 years ago. Whilst it looked at all aspects of the roadside environment, not just power poles, the decrease in the number of fatalities resulting from road accidents was significant. Mr Kenny also had this to say about power poles:

"A tremendous study was done in Australia by Fox and Joubert on collisions with utility poles. In that, they developed a predictor model so that you could go around
Brisbane or anywhere and apply factors to that pole. You can say: how many cars a day go past it? Is it on the inside or the outside of a bend? How far is it from the kerb? You would go around with a bit of chalk, if necessary, and put Xs on those poles and replace them. The technology and the theory are there but it has not been done because the electrical authorities who own most of the poles say, "Who is going to provide the money?" ... the authorities cannot find the money until someone is killed, and then they can find the money to replace the pole and shift the wires within days. That is the problem."

In their submission to the Committee, the RACQ (1991, p.13) state:

"About 20% of road fatalities result from a collision with a power pole or tree. 45% of the fixed objects hit in fatal collisions were utility poles. On major roads in urban areas it is recommended that utility poles be set back 3m, and 2m on minor roads. The risk of hitting a utility pole would be reduced by locating the pole on the outside of the curve for minor roads and on the inside of the curve for major roads.

The RACQ supports a program for identifying utility pole sites with a high accident risk and adopting remedial treatment as required eg. installing underground services."

Despite suggesting that greater consideration could be given to the placement of power poles, particularly in recognised danger locations, Mr Lawler had reservations about placing power poles near a road at all:

"I find them very frightening. There can be consideration as to where a vehicle is likely to leave the through lane, particularly on the outside of a curve, for instance. The obvious danger spots can be avoided, but still I would prefer that they not be beside the through road."

Senior Constable John Ruller of the Traffic Accident Investigation squad gave evidence before the Committee in Brisbane on Monday, 7 October 1991. He was asked whether he attended many accidents in which power poles were involved:

"They do feature quite regularly in our investigations. Going on my own experience, night-time seems to be the time when a single vehicle will run off the road and collide either with trees or power poles or some sort of furniture on the side of the roadway. They are the most difficult, of course, because usually the person either does not remember or is killed in the crash."

The Committee recognises that there is a cost involved in placing utility services underground. Many years ago the difference in cost of using power poles as opposed to underground services was substantial. However, the Committee has noted that the cost gap has closed markedly in recent years. One of the reasons is the increasing scarcity of suitable poles. Initiatives by many of Queensland's electricity boards in reducing costs to land developers, are hoped to encourage an increasing use of underground services in new subdivisions.

Obviously, replacement of all existing power poles, en masse, would be extremely costly. Fox, Good and Joubert recommend using an accident predictor model to "rank sites in order of accident probability" (1979, p.354). These poles can then be targeted for immediate replacement with the cost of replacing all other poles being spread over a number of years. The cost of any
replacement program should be evaluated against savings likely to be obtained from a reduction in the number of road accidents. However, on the evidence presented by Fox, Good and Joubert it seems highly likely that a power pole replacement program would have a positive benefit:cost ratio.

**Recommendation 12**

The Committee recommends that:

- kerb-side power poles in urban areas be prohibited;
- undergrounding of reticulation lines in urban areas be made compulsory;
- electricity authorities be required to implement a program to replace all existing power poles and lines with underground services, over a period of years;
- poles currently carrying high voltage lines be provided with safety barrier protection; and
- new lines in new locations be placed well away from travelling lanes on roads, and at least in accordance with established standards.
8. **TRAFFIC AND ROAD SIGNS**

In general terms, the Committee believes the design and placement standards for the vast number of traffic and road signs, are largely adhered to. However, road authorities should be aware that deviation from these standards may result in serious and fatal accidents. Motorists today must deal with a large number and variety of signs, particularly in heavily populated areas, and it is important that the signs relate a consistent message. Signs using universal symbols have helped reduce some of the confusion experienced by motorists who are travelling in unfamiliar locations.

Mr McDonald told the Committee at the Brisbane public hearing on 4 October 1991, about how the correct use of signs can help motorists overcome visual illusions created by the lack of perceptual information available to the motorist. Examples of these illusions are curves appearing to be gentler than they really are, and the outside line of a curve appearing higher than the inside curve. In evidence, Mr McDonald stated:

"You come across the same thing in a number of places where there are advisory speed signs. They are absolutely necessary where the perceptual information on corners is not strong ..."

In its submission, the RACQ (1991, p.9) states:

"On many city streets drivers are bombarded by an overwhelming presence of advertising signs intermixed with traffic signs."

The submission also suggests that sign maintenance is important with regular inspections to determine the condition and continued effectiveness of the sign. In evidence, Mr Kenny referred to "information overload" as a problem motorists have when too many signs are located in specific areas. Several submissions received by the Committee (Preston, Turner, Mason, Mackiewicz, and Brown) referred to how signs can be confusing, misleading, poorly placed, and ambiguous.

Associate Professor Lal Wadhwa in Townsville believes that more consideration needs to be given to the older drivers on the roads with regard to sign design and location. In evidence, he stated:

"I think there is something that I have not mentioned specifically and that is the consideration for older drivers on our roads. That is a program that I found was being pursued very actively in the United States, and I believe that we have to grasp that fairly soon as well. Because the proportion of older drivers is increasing, and it is going to be increasing quite substantially, I think we need measures like improved advanced road signing, larger street name signs, larger, wider edge striping and pavement markings. There are a number of solutions that could be looked at in terms of the list of engineering solutions especially designed to make driving much easier for the older drivers."

Mr Stanton in Townsville raised the issue of whether authorities in Queensland use too many signs when other parts of Australia appear to use them less frequently. He also spoke of the difficulties and cost involved in maintaining road signs in local streets:

"... when you move out of Queensland and you look at New South Wales - I use New South Wales as probably the best "other end of the spectrum" example - there is very little signage. There is very little white paint on the roads. Yet is seems to function ..."
when you go to other places and you look at the level of signing, probably the most obvious comparison would be with Canberra, where there are very few signs. But then again the road routes are so obvious ... It would seem to me that there is a propensity for us to sign anything that might be of possible concern. My staff have the unenviable task of, under ultraviolet light, keeping all these reflectorised signs in reasonable condition. That is a substantial cost."

Mr Evanson, a traffic engineer with the Brisbane City Council, also believes that traffic and road signs are overused. In evidence at Brisbane on 7 October 1991, he stated:

"One of the areas that concerns me most I think is the abuse, if I could use that strong a word, of traffic signs. I think we are cleaning up our act as a profession quite considerably but I think just for the casual observer, if you drove along any stretch of road or around any city, you would find a plethora of warning signs of various types. I think there is some research that would indicate that most motorists do not have a good appreciation of what a lot of those signs mean in the first place ... Most of them do not see them because there are probably far too many and there may be an information overload. In addition to that, you get rather weary of seeing the signs which do not seem to relate to any particular hazard that is there at the time, so that the motorists becomes rather blase about the existence or presence of the sign. I think those types of signs are used in excess to try to correct deficiencies in a rather cheap way that we probably should be addressing in other ways …"

Also of concern to the Committee is the number of four-way intersections in urban areas that do not have "Stop" or "Give Way" signs. This type of intersection is not common, (or not used) in new developments and effective treatments such as roundabouts, are now used to overcome the safety concerns of some intersections. However, there is a considerable number of existing un-signed four-way intersections, many of which are not suited to roundabout treatment (or other treatments) which should be signed to clearly identify who has right of way.

**Recommendation 13**

The Committee recommends that local authorities be required to pay strict attention to traffic sign standards and to erecting clear, prominent signs; including street name signs and roadworks signs.

**Recommendation 14**

The Committee recommends that all four-way intersections in urban areas be controlled by "Stop" or "Give Way" signs, or some other appropriate intersection control device, as a matter of urgency. The "give way to the right rule" which is the default rule at intersections without an appropriate intersection control device, has long been discredited as an adequate road safety measure.
9. **TRAFFIC LIGHT CO-ORDINATION**

The Committee has a general concern that traffic lights are not being properly co-ordinated in many areas of the State, but particularly in Brisbane. The Committee inspected the traffic co-ordination facilities in Sydney and found that, given Sydney's problem with short distances between intersections, the system worked very well. Similarly, inspection of the system used in Melbourne showed that, although the road network and environment provides for a greater flow of traffic, the control system works very well.

Lack of proper co-ordination, particularly in areas where traffic lights are widely used, can result in inappropriate behaviour by motorists. This is usually in the form of speeding between sets of lights to avoid red lights. Better co-ordination can also increase capacity of major roads, reduce the number of "nose to tail" accidents resulting from sudden stops, and reduce the wastage of fuel which results from continual stopping and starting.

Mr Terry Roddick, who gave evidence at the Brisbane public hearing on 7 October 1991, suggested that traffic flow on main roads would be greatly assisted by proper co-ordination and control of traffic lights. He stated:

"...coordinated in time for both north and southbound traffic to have an area of green and rather than continually coming to another intersection which is tripped when a vehicle which is travelling, for example, on a cross road or east or west hits that light which then immediately changes. Those cross lights are changed in a cycle. The car coming on the cross road may trip the computer and, depending on the time left, they have to wait up to a specific period of time. So this, I feel, would enhance the flow of the traffic... Also I do not believe it is just a matter of putting up the red-light cameras at all the intersections. They are a great deterrent, but my point is: make the traffic lights flow."

Mr Evanson also referred to co-ordination of traffic lights. When asked by Mr Ardill, MLA, Chairman of the Committee, about why traffic lights are not better co-ordinated, Mr Evanson replied:

"I think the increase in computational power of digital computers in recent years has made a big difference to our ability to be able to provide that control and coordination much more cost effectively and efficiently. There is a perception that if you took just about every other cab in Sydney, they would tell you that the signals are not coordinated. In fact Sydney has probably got one of the best coordination systems available called SCATS. The signal system in Brisbane is by and large coordinated although it may not be evident. It is coordinated in such a way that not all components of the system are coordinated with each other. It depends on which movements are the major movements, and consequently at different times of the day you have different programs running which would provide different levels of coordination among the components. If I could say a further thing about signal coordination. There is some debate as to whether a system that is adaptive - that system in Sydney; it actually monitors itself by sensing the traffic flows in the streets. That feeds back into the central computer and from that it can select what activity level it needs, which program it needs to run virtually automatically. With the systems we have operating in Queensland, as far as I am aware, the systems are based on a number of plans that are worked out more or less independently of the signal control..."
system and they are implemented by time of day. Obviously that has some shortcomings and the pro-adaptive system lobby would argue that it is much better to have a system that looks after itself than a system that you have to do some analysis on the traffic system to come up with a set of plans ... If you adopt a system that requires analysis of fair amounts of data for each intersection that is finalised and for the development of numbers of different plans for different days of the week, that has to be done every two or three years, because with the traffic growth and the changes in the road network, you get changes in traffic demands ... With that type of - what you might call - tweaking of the system, it probably should be done every two years and it probably is not done until every five years simply because of manpower."

Mr Stanton in Townsville said that his council works closely with the Department of Transport in:

"... all manners of urban arterial work, four-lane road development, a widespread network of traffic signals coordinated under a computer coordination program called TRACS."

The Committee believes that better co-ordination of traffic lights, particularly in areas of high traffic volumes, would result in improved traffic flow on major roads.

**Recommendation 15**

The Committee recommends that local and state authorities place greater emphasis on the co-ordination of traffic lights on sections of road in which traffic lights appear at regular intervals. This would discourage motorists from accelerating between traffic lights in order to "catch" the green light and avoid stopping at a series of red lights.

The Committee further recommends that safer pedestrian crossings over multi-lane roads be provided by using pedestrian actuated traffic lights, and where applicable, pedestrian refuges in the median strip.
10. **RAILWAY LEVEL CROSSINGS**

Unsignalised railway level crossings on major roads are a dangerous, unwelcome, and unnecessary hazard. During the car journey from Townsville to Mackay to conduct public hearings, members of the Committee noted a number of unlit, poorly signed, sugar cane train level crossings. They were particularly dangerous late in the day when shadows were long and light was fading.

Mr David Ruhle, cane railway engineer employed by Mackay Sugar, gave evidence at the Mackay public hearing on 16 October 1991. When asked if sugar cane railway carriages had reflective devices attached to them, he stated:

"Individual mills do put reflective material on their wagons, as do Queensland Railways or any other State railway. There is a fair bit of research going on about the matter."

He further commented that these reflective signs would probably get caked with mud when sugar trains collected sugar cane from cane fields. Unless properly maintained, the effectiveness of the reflective devices would appear to be limited.

Mr Ruhle informed the Committee about an Australian Road Research Board (ARRB) conference, called "Improving Safety at Railway Level Crossings" which was held in Adelaide in September 1991. In an address to the conference during the official opening, the Honourable Frank Blevins, South Australian Minister for Transport, commented on the low number of fatalities caused by rail-vehicle crashes in South Australia. He quoted figures of nine fatalities over the last five years (Conference Proceedings 1991, p.1). However, he cautioned (1991, p.1):

"There is the potential for a major catastrophe if a bus or vehicle carrying dangerous goods is involved."

The cost of installing warning devices, such as flashing light installations, is usually cited as the main reason against treating more of the estimated 7,000 level crossings in Australia which don't have flashing lights and/or boom gates (1991, p.1). In his paper delivered at the conference, Mr Peter Cairney (1991, p.85) said it was difficult to obtain "meaningful costs for flashing light installations". Cairney's paper, titled "Some Possible Low-Cost Treatments for Railway Level Crossings", considers a number of alternative treatments. One of the conclusions Cairney (p. 91) came to as a result of his research, was:

"Much of this has been said before. Many of these issues were discussed at a Workshop organised by ARRB 17 years ago. It is time to set up some demonstration projects incorporating the more promising of these ideas."

Dr Stephen Richards, Director of the Transportation Centre at the University of Tennessee, also presented a paper at the ARRB conference. He provided an overview of the proceedings from an International Symposium on Rail-Highway Grade Crossing Safety and Research. A large part of his paper focused on innovative devices being used in the United States. Dr Richards says (1991, p. 6):

"Many of these devices are very low-cost, and they all could be applicable to the Australian situation."
It would seem that much research is available, both in Australia and overseas, and that many alternative low-cost treatments are being trialled, tested and evaluated. A matter of grave concern is Cairney’s statement that many of these issues were identified some 17 years ago and it appears as if very little has been done to evaluate the more promising of these low-cost treatments.

From the Committee’s experience, many railway level crossings are inadequately signed, particularly for night driving. In sugar cane producing areas like North Queensland, the problem is amplified with the presence of numerous, smaller, slow-moving sugar cane trains which are also difficult to see. The Committee has its own ideas on a suitable, low-cost solution. These ideas were gained mainly from discussion with David Rhule at the Mackay public hearings. However, it is obvious that many alternative solutions already exist.

Given the unfavourable benefit:cost ratio of installing flashing light systems and boom gates on a system-wide basis, the thorough evaluation of low-cost treatments appears warranted and long overdue. Ideally, a selection of suitable treatments could be selected after evaluation so that railway and road authorities are able to implement the system best suited in a given location.

The conference made 18 recommendations (1991, p.135) covering a number of issues under various headings. One of the key recommendations related to adopting a national approach to railway level crossing safety by establishing an arrangement between AUSTROADS, Railways of Australia, and ARRB. Additional research of low-cost treatments was amongst the recommendations. The full recommendations are contained in Appendix E.

**Recommendation 16**

The Committee recommends that a thorough evaluation of suitable low-cost treatments for railway level crossings be conducted in accordance with the recommendations of the September 1991 Australian Road Research Board Conference on Railway Level Crossings. Any standards, procedures, or treatments accepted and adopted as a result of the evaluation, should apply to private railway operators (eg. sugar cane rail systems), as well as State Railway Authorities. These standards should also apply to those railway level crossings in urban areas which are not treated with flashing light and/or boom gate devices, so that motorists and pedestrians are adequately protected.

The Committee further recommends that another alternative low-cost treatment be included in the evaluation program. This treatment requires the installation of a series of reflectors beyond level crossings which would give a visual effect of a moving vehicle crossing the road when lit by headlights of an approaching vehicle.
11. **ROAD MAINTENANCE**

A fundamental component of having a safe road network is a comprehensive, system-wide, road maintenance program. Such programs exist under the control of the Department of Transport and local authorities. However, the vast areas covered by Queensland's road network and the diverse, and usually harsh, nature of climatic conditions makes road maintenance a difficult task. It is estimated that 41% of our state and national highway system is overdue for pavement replacement, with 6% almost beyond redemption. In recent times, road rehabilitation has occurred at a third of the necessary rate.

The Australian Roads Outlook Report (TAROR), prepared for the National Association of Australian State Road Authorities (NAASRA), revealed that 60 per cent of expenditure on roads throughout Australia for the three years from 1983/84 to 1985/86, was on "upkeep" (1987, p.22). The report defined "upkeep" as preserving and restoring the physical condition of existing road networks with minor improvement in some cases to current engineering standards (p.22). In addition, the report stated (p.26):

"At present, there is an imbalance between our use of road systems and the rate at which they are being restored. This means that the present level of resources diverted to upkeep works will need to be increased in the next ten years."

Further information provided by the State Road authorities was used to forecast the demand for pavement reconstruction. It was predicted that by the year 2000 pavement reconstruction will need to be about double the levels they were at the time of reporting.

Witnesses at the public hearings in Roma, Charleville, and Longreach spoke of sections of roads sinking in wet conditions due to the unstable nature of the soil in these areas. These areas are particularly affected during wet weather and regular maintenance is required to repair sections of roads affected.

In its submission, the Department of Transport gave details of programs (1991, p.8) being used to achieve a safer road network. They included:

- Traffic Accident Remedial Program (TARP);
- Federal Black Spot Program;
- Safety Audits; and
- Mass Action Program (MAP).

Under these programs, treatments with a proven high benefit:cost ratio are implemented on those sections of roads identified as requiring remedial or maintenance work.

During the public hearing in Townsville on 14 October 1991, Associate Professor Lal Wadhwa suggested that while black spot programs were effective, mass action programs were better for two main reasons. Firstly, they treated all like conditions in the same manner so that motorists are not faced with non-standard situations. Secondly, they tended to be pro-active rather than re-active in
that they treated potential hazards as well as known hazards.

Mr John Hill, the District Engineer with the Department of Transport in Mackay, commented on the level of funding for new roadworks and road maintenance:

"I think a lot of things we may have thought possible five years ago are looking very much less likely to occur now with the funding levels that we have. In other words, I think we have to come up with maybe cheaper, shorter-term answers to stave off the problem because we have not got the big dollars that are required to fix up the problems.

We are talking about doing things that are adequate rather than projecting ahead in time. In otherwords, doing something that can last, say, 20 years for projected growth; that is the way we like to operate; that is the normal design function. But where we are forced by funding limitations, we just have to do things on a shorter time-frame - in other words, do something that will last for five years and we know we are going to have to come back because there just is not the finance. It may not be an economical best solution, but because of finance constraints we are being forced more and more to do that."

The whole question of funding for roads appears, to the Committee, to be circular. Simply put, more money spent at the time of construction results in less money being spent on maintenance. Road authorities recognise this but if the money is not available initially, they are forced to make compromises which can increase the costs of road maintenance. The only solution appears to be a greater level of funding. In its submission, the Department of Transport (1991, p. 11) summed up their on-going predicament:

"The management of existing infrastructure and of the traffic operations upon it to maximise road safety is restricted because of funding limitations and competing requirements."

Associate Professor Rod Troutbeck from the School of Civil Engineering at the Queensland University of Technology, in his submission (1991, p.3) to the Committee suggested that insurance companies consider:

"... funding roadworks or road improvements if they can demonstrate that it would save life or property"

One aspect of road maintenance which is of particular concern to the Committee is the number of low level creek crossings that are regularly damaged through minor flooding. Putting in culverts to drain excess water would help alleviate this problem, reduce maintenance costs, and make these crossings safer.

Mr Lawler supported the use of culverts to help overcome this problem, particularly on rural roads:

"I think possibly, on an ad hoc basis, fix up things like low-level creek crossings that are frequently flooded, areas that are old roads on very low formations where pavement flooding is frequent - fix those."

Another area of concern to the Committee is the increasing role that animals play in road accidents on rural roads. While it is impossible to keep native fauna off public roads, domestic stock should never be given the opportunity to venture, uncontrolled, onto our highways. Fencing all property
boundaries on the major roads is not practical or cost-effective. However, selectively fencing areas where, for example, native and domestic animals gather to feed or drink, could reduce the number of animals on the road in that area. During discussions on the pros and cons of fencing major roads, Mr Pickard agreed with the principle of selective fencing:

"In terms of road safety, we should be fencing in certain areas."

There are a number of issues with regard to fencing. The land owner has responsibility for fencing land which adjoins state highways. According to Mr Pickard, authority exists under the Local Government Act for land owners to be forced to fence their property. Where existing roads with existing fences are being relocated, the road authority is required to fence the new road. Fencing sections of road can create problems for access to water for both domestic and native animals. Native animals also need to be able to roam freely so they can obtain food and shelter where it is available. The various sizes of animals involved also creates problems on the optimum type of fencing to be used. Signs warning of the likely presence of animals in known congregation locations are currently used but with limited success. These areas of congregation are generally easily identified by the number of carcasses on the road or at its edges.

The Committee believes that increased funding levels for road maintenance programs is necessary to ensure our roads are maintained in a safe condition. Treatment of low level creek crossings and fencing of roads where animals are a hazard to motorists, will also contribute to safer road travel.

**Recommendation 17**

The Committee recommends that maintenance programs for Queensland roads receive greater funding, in order to reduce the number of accidents caused by poor road conditions.

**Recommendation 18**

The Committee recommends that a program be undertaken to reduce the number of low level creek crossings and to insert culverts in floodways.

**Recommendation 19**

The Committee recommends that sections of roads near watering points and in areas of poor visibility be suitably fenced, over a period of time, as a means of reducing accidents involving stock.
12. **ROAD TRAINS**

Many areas of Queensland rely on road transport for the supply of essential goods and services. In addition, the economies of many of these areas receive a welcome boost from residents whose incomes are derived from the road freight industry. It follows that any change to the status quo will impact on the road freight industry as well as on those regional areas or townships which rely on the industry to maintain a certain level of economic activity. Depending on the nature and extent of the change experienced, it could have a multiplier effect on the state and national economy in terms of the cost of getting export products to their markets.

Mr William Bonthrone, President of the United Graziers Association of Queensland gave some hint of the importance of road transport to rural economies during the hearing in Roma on 15 October 1990:

"Most of our produce is carried by the types of vehicles you are talking about. Most of the goods that come in come on those sorts of vehicles. We have got to live with them. They have given us some rather remarkable service. All the markets we are trying to get now in the cattle industry, for instance, are markets that require a very efficient carrier to produce a high-class product when it hits the coast, and motor lorries and the small and medium sized carriers have really become very expert with livestock."

The Committee is concerned about a number of issues which relate to the use of road trains for large volume freight movements. Of prime concern is the safety of motorists who encounter road trains on the highway. Their size, both in bulk and length, causes many problems for drivers who must either pass or overtake them. Invariably, the trailer/s of a road train sways and moves around on the road considerably, thereby creating a dangerous hazard for motorists. Dust thrown up by road trains (on narrow roads) make it virtually impossible to safely get around them as visibility is drastically reduced.

The road trains cause considerable damage to road edges and shoulders, particularly in the many areas where road pavements are narrow; and particularly when road trains are overloaded. In some instances, the entry of road trains into built-up areas causes further concern.

Evidence heard at the hearings in Roma and Charleville suggest that road trains are a matter of concern for some residents of those areas. When asked whether road trains create a specific problem with regard to road maintenance, Mr Haigh in Roma stated:

"Certainly I would say the road trains put a particular pressure on the road. You have got extensive scrubbing movements with trailers being pulled around, particularly on curves and corners. In fact, corners in our area require special treatment. We can go to treatment with bitumen impregnated with rubber to try to give us some more resilience for the bitumen. The loads that they carry are a particular problem.

A volume-loaded road train can be up to 20 tonnes over the allowable load. I know there is some good argument for volume loading because of the ease of loading and determining what is there. I do feel that the operators are very aware of how much load they have on. They have to make the thing work and get the vehicle to the other
end, so they are aware of what they have got. We have seen it in the design of trailers. Because of the volume loading, the design of trailers in Queensland is significantly stronger than the ones that you see in New South Wales. I believe that the overloading that we are talking about with road trains and their effect on our roads are a significant factor because of the volume loading allowance we have."

The concept of volume loading was explained to the Committee by Mr Haigh:

"Volume loading means they can put as many stock into each deck as they can fit. As long as they fit comfortably, they are allowed to take it. In a semitrailer with a maximum load of 42 tonnes - you can get up to 55, close to 60 tonnes in that unit instead of the restricted amount."

Mr Douglas Head, Senior Engineer for the Department of Transport in the South-West District (based in Roma) also told the Committee of the damage caused by road trains:

"It is very apparent when you go west of here and see some of these road trains coming towards you on the narrow sections of road, that they do not track extremely well. The second trailer does not track extremely well, which gives you a problem as you approach them as to what that fishtail effect will have on you. Not only that, it has an effect on the road because every time those rear wheels come off the edge of the bitumen, it usually knocks a bit more off the edge and it leaves a bigger hole. The shoulders get eroded away. So it is a continuing process."

At the Roma public hearing, Mr Peter Evans, a Department of Transport Executive Engineer based in Roma, and Mr Head and Mr Haigh, each commented on different aspects of coping with road trains on our roads:

"Mr Head: I think on the older road where road trains are in use, yes. It is very apparent on the narrower sections of road. For example, if we have an old 18-foot pavement, that is quite adequate for two normal vehicles to pass and manoeuvre with no degree of difficulty. But as soon as you put a road train on that and they start to move, yes, it is apparent that the edges fray away very readily."

"Mr Haigh: In wet whether you certainly notice because the shoulders will cut straight away because of the road trains passing and the loads involved."

"Mr Evans: Yesterday I returned from Rockhampton. I followed a B-double, 23 metres long, a refrigerated van, for about half an hour before I got a chance to pass him, and the cloud of dust behind that was quite amazing. I was not aware of it to such an extent before that."

"Mr Haigh: We have shown that by sealing out that extra half metre or metre, depending on the traffic, it has a significant effect on the maintenance of the shoulder. That is why I said earlier that on the arterial roads that is our design standard, to give us that extra cover and to hold the material there because it blows away otherwise."

As can be seen, these comments highlight some of the very real problems associated with road trains and a solution to the problem of road damage. Obviously, the solution has significance for the previous section on road maintenance, but it is included here as it relates directly to damage caused by road trains on major highways.
Acting Inspector (at the time) Ron O'Brien of the Roma Police stated in evidence that he didn't consider road trains to be a hazard to other road users:

"I think the people of the west are used to seeing them on the road and they just take the necessary precautions."

At the public hearing in Charleville on 16 October 1990, Mr John Lutvey, Shire Engineer (since 1970), was asked to tell the Committee what, in his opinion, are the major road safety issues encountered by him:

"Narrow bitumen roads, which are mainly 18 feet wide between here and Morven, and road trains. When you get two road trains coming to pass one another, the width of the bitumen is too narrow for them."

Mr Lutvey also stated a belief that overloading of heavy vehicles makes effective road maintenance difficult.

Mr Lawler in Townsville was asked whether he thought overloaded road trains were a major factor contributing to the amount of damage done to roads on which they travel:

"So long as they are not running off the edge of bitumen and off the edge of pavement and they are moving from side to side within the pavement, it would probably have no effect on the life of the pavement at all."

The Committee believes that road trains are a hazard to other motorists on major state and national highways. This is due to a number of reasons, for example; narrow roads, high shoulders, motorists unfamiliarity with road trains, and damage caused by overloading (or volume loading). A possible solution is to further restrict the roads upon which road trains are allowed to travel. However, the impact on the economy (local, state and national) and on the road freight industry, of implementing further restrictions needs to be compared with the additional cost of maintaining roads damaged by road trains (and other heavy vehicles).

**Recommendation 20**

The Committee recommends that an investigation be undertaken into the need to restrict the use of road trains on major national highways, especially where other means of transport is available. The investigation should consider the socio-economic impact of further restrictions on road train travel as well the road safety and road maintenance aspects.
13. **ROUNDABOUTS**

Roundabouts are widely used by road authorities throughout Queensland as cost-effective, safe traffic control devices. The benefit:cost ratio of roundabouts is in the order of 15:1 thus making it a very safe, relatively inexpensive option for the treatment of dangerous intersections. In general terms, roundabouts keep traffic flowing and significantly reduce the chances of fatal and/or serious accidents occurring.

A feature of roundabouts is the variation in their size and design, and on two lane or multi-laned roundabouts, the method of lane-marking. The gateway arterial road has very large roundabouts which control fairly high volumes of fast moving traffic. Other roundabouts in Brisbane which are smaller also handle high traffic volumes. In Townsville, the Committee inspected a large roundabout which controls the main turn-off to the University. The Committee also observed a series of small roundabouts on Thuringowa Drive. A submission (1991, p.1) from R J Kruckow described small roundabouts as "dinner plates". Observations by the Committee has confirmed that roundabouts with more than one lane are not lane-marked in a consistent manner.

The design of approaches to roundabouts also differ. Approaches are important in controlling the speed at which vehicles enter the roundabout. In his submission to the Committee, Associate Professor Rod Troutbeck commented on how properly designed entries to roundabouts can make them safer:

"Roundabouts give effective service when drivers enter them at a slow speed. This is usually achieved by requiring drivers to travel through curves, either at the roundabout or on the approach roads. Another requirement for all intersections is that they be conspicuous.

Many large roundabouts have been designed with flowing entries and circulating roadways that encourage faster speeds. These will generally have a poorer safety record. It is possible to design large roundabouts that encourage slower negotiation speeds if curves are used on the approaches."

The variation in the design of roundabouts has evolved partly as a result of the need to design roundabouts for specific locations. In the Committee's opinion, the development of a single, standard design for all roundabouts in all locations is not feasible. However, the Committee believes that a single standard design, incorporating standardised lane-marking for roundabouts with more than one lane, can be developed for use in most roundabouts. Road authorities need to retain some degree of flexibility when constructing roundabouts so as to take account of local conditions, traffic flows, types of traffic (eg. passenger or heavy vehicles), and the local road network, but variations from the standard should be avoided wherever possible.

The Committee has noted that considerable confusion and difference of opinion exists within the community regarding the rules which govern the use of roundabouts. This is despite the efforts of road authorities in explaining how roundabouts should be used. Such explanations have tended to emphasise their simplicity and ease of use yet, in the Committee's experience, many people find them daunting. As stated earlier, the Committee accepts that roundabouts are very effective in reducing fatal and serious accidents at those intersections where they are used. However, the confusion which exists regarding the rules, has caused problems when apportioning blame in minor accidents.
Mr Kenny from the RACQ gave a comprehensive presentation on roundabouts to the Committee at the Brisbane public hearing on 7 October 1991. The presentation included slides, videos and diagrams of current rules and usage of roundabouts. It focused on the problems associated with using two lane roundabouts. The thrust of Mr Kenny's presentation was that standard lane-marking of two lane roundabouts, together with a well organised publicity campaign on how to use roundabouts with these lane-markings, would greatly reduce the number of minor accidents and, consequently, the level of confusion within the community. In introducing his presentation, Mr Kenny stated:

"I have mentioned that there are four alternative treatments of two-lane roundabouts. I have already said there are no problems with the one-lane roundabouts. We have a standard facility - a two-lane roundabout - and there are four different treatments throughout Queensland: fully lane marked with the concentric circle going all the way round the central island; completely unlaned; partially lane marked, which has been referred to here today by Dr Pretty; and pavements marked in a special or unorthodox manner. How confusing is this? ...

Here (pointing) are two identical roundabouts up in the Sunshine Coast area - Wises Road and Sugar Road intersection on that one, and Glenkyle Drive and Sugar Road there. This one was built before the northern one. The circulating lanes are marked fully. Two hundred metres away, subsequently this one was built and it was left unlaned. Within 200 metres you have two identical roundabouts, both treated differently and both with different orders of priorities for people using them. We think that is putting too much of an onus on drivers."

Mr Kenny spoke of the confusion which apparently also exists within the authorities:

"We got a lot of inquiries from people who had been involved in collisions, who had been breached by the police, who were having big hassles with insurance companies, and we thought okay, we will consult the experts. We went first to the Queensland Police Department Traffic Branch and their adjudication section, because they are the people who review the traffic offence notices. We went to senior traffic engineers in the Main Roads Department as it then was - now the DOT. We went to senior traffic engineers of Brisbane City Council, Gold Coast City Council, Rockhampton, Bundaberg, Mackay, Cairns and Townsville. They are the people who put the things in and decide whether to put lane lines on them. We went to private consulting engineers of firms that specialise in traffic engineering. We still could not get any consensus or agreement. We went further - practising members of the legal profession, including two barristers; claims managers employed in various insurance companies. They have all got different opinions. We even consulted a couple of stipendiary magistrates."

Insurance companies also benefit from this confusion and ambiguity as illustrated by Mr Kenny in this case study:

"Two cars collided on the Toowong roundabout driven by two young university students. Both of the young people were under 21. Their cars were fully comprehensively insured - they were their parents' cars - but those insurance policies carry a $500 age excess and a $200 property excess. So, you get that $700 back if the other person is at fault. So, the girl on the inside lane put a claim on the fellow - it is unlaned, remember - saying that because he was overtaking illegally on the left, she should be reimbursed her $700. He passes it on to this insurance company, who
rejected it. They said, "No, you are not driving as near as practicable to the left-hand side of the carriageway." So, she saw him at the university, told him what happened, he put a claim on her, quoting his insurance company, to say, "Because you were not driving as near as practicable to the left-hand side of the carriageway, I request my $700." It went up to the insurance company, who rejected it because he was illegally overtaking. So, neither of them got their $700."

Mr Kenny also commented on the variation in brochures produced by each state which explain the rules and regulation surrounding the use of roundabouts. In summary, the brochures differ in some respects and highlight the differences both within states and across states. In particular, Mr Kenny said in evidence that information about the exit rules for roundabouts was only addressed by one authority:

As to leaving the roundabouts, I said that not one of them identified the problem and gave you the order of priority. There was one exception, and that is the ACT, because it hit the bullet. They said, "We are going to lane-mark the circulating roadway and we are going to rule that the person on the inside lane who wants to get out has to cross a lane line. The regulations throughout Australia say that you shall drive wholly within a marked lane and only change lanes when it is safe to do so. They said, "We will mark them." It says down the bottom that the red car must give way to the green car because he is changing lanes. That was the only authority in Australia that designated an order of priorities.

Mr Kenny's suggested solution is to use a lane marking system used in Alberta, Canada. This system uses lane markings which clearly identify right of way when exiting the roundabout. The Committee believes the "Alberta" system would clearly indicate who is at fault if a collision occurs. However, the Committee also believes that, under the "Alberta" system, the capacity of roundabouts, especially those with a predominant flow of right-turning traffic on a major road, would be reduced.

At the Brisbane public hearing on 4 October 1991, Mr Middleton, from the Department of Transport, was asked how the confusion surrounding the application and interpretation of roundabout is being tackled:

"First of all, I suppose I should say that roundabouts - while they cause a lot of I won't say public concern, but there is certainly a lot of discussion in the public arena about them. They are a very important safety device that has been introduced into Australia in the last 10-20 years and have been responsible for a tremendous improvement in the safety situation at particular urban intersections. But they do not come without a price. There are some problems associated with them. Quite often there is an increase in accidents at roundabouts as opposed to signalised intersections. Not always, but sometimes there is. Usually it is the nature of the accident that is the important characteristic of roundabouts. They tend to be minor accidents. They tend not to cause any personal injury at all and vehicles in fact tend to be driven away rather than towed away from accidents at roundabouts. So if you are going to have an accident, a roundabout is a good place to have one because you do not usually get hurt and the vehicle does not usually get too damaged. With that as a preface, I think the issues that are being raised in the local or the public arena at the moment have to do with a very small number of roundabouts and particularly those larger roundabouts in urban areas that have got multi-lane or more than a one-lane circulating roadway. It is a problem at the exit from those facilities. This has been highlighted by the Royal Automobile Club in a recent article in their journal in fact and we have been discussing that with the RACQ and with other people for quite some time before that journal article came out, of course. The problem is that there is no
legislation regulating the exists from multi-lane roundabouts and bearing in mind we are talking about a very small portion of roundabouts and roundabouts being a very small portion of our intersections, so it is not a world-shattering problem. But it is a very serious problem in that when an accident occurs, the police have very great difficulty in establishing blame and the way they do establish blame is they go back to the traffic regulations and they find what regulations are nearest or sort of fit the situation and then they hang a ticket on perhaps one person or perhaps both people - quite often both people because both people have done something wrong albeit unwittingly or unknowingly because they way the rules are written. They are not written for roundabouts. They are written for ordinary intersections or for that matter, ordinary merge situations, lane changes, and people are not aware that that applies in a roundabout. So there is a problem there and the Department is quite determined to solve that problem. We have been determined to solve it for quite a long time. About two years ago we tried to come into line with the rest of the nation. The Austroads policy was -

The Chairman: It would be pretty difficult when they all seem to be different.

Mr Middleton: That's right, although there is an expressed Austroads policy which in fact says no marking on the circulating roadway; that is, of multilane roundabouts. We have generally adopted that. We have trialled it and we have found it operates quite well but there is still a significant problem. They operate as well as or better than marked roundabouts but there is a problem at the exit and quite often the pressure comes on the Department or on the local authority to in fact mark the pavements - pressure by the Police Department who are frustrated with the situation and think that that is a solution. That has been found not to be the solution. It is a partial solution. It maybe takes away five to 10 per cent of the problem. We admit it, we thought that might be a solution but in fact it is not. The problem is still there. So we are looking at it now with a view to changing the markings of multilane roundabouts and also of introducing new specific regulations which absolutely control, I should say, unambiguously control the exit for multilane roundabouts. If an accident occurs then we all know who is in the right and who is in the wrong, and that is important so that people can then behave in the right way. It is not as simple as that because it is a national issue. Being a tourist State we have a lot of interstate drivers here and it would be a matter of great concern if we were to unilaterally change our policy in Queensland without having some sort of agreement interstate or having a similar situation occurring down there because their drivers would be unfamiliar with our system.

So we are more or less sure of what we need to do. We are considering adopting the Alberta system which is one that the RACQ have been pushing. We are considering introducing legislation. I understand Victoria is also considering similar legislation but without the pavement markings. They are considering it. They may actually change their minds when they are further down the track but that is my understanding of their current thought. I don't believe there is very much discussion on it in New South Wales at this stage.

I suppose to sum up: we understand there is a problem; we are determined to solve that problem; there is a right of way of doing it and perhaps a wrong way of doing it and we are determined to do it the right way to try and end up with a solution that is right for Australia and not just Queensland."
The Committee supports the development of a standard or policy which can be applied nationally so that all states have essentially the same lane-marking system and associated rules.

The matter of roundabout design has been discussed in various forums. A workshop was held at the Queensland University of Technology (QUT) in February 1991 to consider the design of roundabouts and unsignalised intersections. A series of papers, mainly technical in nature, were presented. A paper prepared by Mr Gordon Lee from the Road and Vehicle Safety Branch of the Department of Transport, directly addressed the issue of lane markings and the operation of roundabouts. Current practice of Australian road authorities, including the Department of Transport and the Brisbane City Council, with regard to lane-marking of roundabouts was discussed. The information shown supported Mr Kenny's claim that different systems are used in different states.

Mr Lee considered the "Alberta" system, a "Tracked" system (designed by Mr Allan Walker, a South African engineer), and roundabouts without any markings at all. His comments (1991, p.6 of Mr Lee's paper) on the effectiveness of the "Alberta" system were:

"In the event of an accident on the roundabout, it would be relatively easy to apportion blame, as the give way rule would be defined clearly and consistently for installations with this form of line marking.

However, roundabouts with Alberta markings would probably have a marginally lower traffic capacity as some of the non-left turning drivers would be discouraged from using the kerb lane due to the give way obligation when passing an exit."

Mr Lee further stated that "all three systems require further consideration and trials before being adopted for general use in Queensland" (1991, p.7). The Committee wholeheartedly supports this concept. However, Mr Lee warns of the need for extensive driver education in the use of different roundabouts:

"To explore the advantages and disadvantages between different forms of roundabouts, it would be desirable to carry out trials on them using different marking systems. As the Canadian and the "tracked" systems are so different from what Australian motorists have been exposed to, any trials on such systems would need extensive driver education."

Furthermore, Mr Lee provided these closing comments:

"Despite occasional adverse publicity, well designed roundabouts are safe and efficient forms of intersection control. They are gaining in popularity and acceptance. However, the lack of uniformity in the pavement markings and traffic operations on such facilities has led to some confusion for the general motoring public.

A simple, logical and uniform system of line marking and operating rules for roundabouts is required. Perhaps these could be achieved through the co-operation of the various State Road Authorities and the Standards Association of Australia."

A diagram showing the "Alberta" system of lane-markings is included as Appendix F.

Roundabouts have also been the subject of much discussion overseas. An international workshop on "Intersections without Traffic Signals II" was held in Germany in July 1991. Roundabouts were the subject of several papers discussed at the workshop, and included a paper by Associate Professor Rod Troutbeck from Queensland. The proceedings were edited by Professor Dr -Ing. Werner
Brilon from Germany who commented in his preface (p.v) that:

"Roundabouts are on the advance worldwide. Many countries like Australia, France, Norway, Sweden, Switzerland and Germany are increasingly using roundabout as an intersection design which bears comparison with other solutions or which is even more advantageous."

Before concluding on the topic of roundabouts, the Committee would like to state that it is aware of an on-going project being co-ordinated by the Department of Transport (Mr Middleton is the Project Leader). The objective of the project, titled "Roundabout Policy Review", is "to review the policies controlling the operation of roundabouts to improve operations and safety" (National Road Safety Research Project Database, 1991, keyword search - Roundabouts). In addition, recent television reports concerning a Department of Transport review of the "Alberta" system has been noted. Finally, Associate Professor Rod Troutbeck from the School of Civil Engineering at the Queensland University of Technology is reviewing the AUSTROADS standard on roundabouts titled "AUSTROADS Guide to Traffic Engineering, Part 6 - Roundabouts".

The matter is obviously complex and, at times, confusing. The Committee entered into considerable discussion on an appropriate course of action with regard to lane-markings and design. As previously stated, roundabouts have a very good safety record and the Committee readily accepts that. However, apportionment of blame in minor accidents is not clear under the present lane-marking system. Furthermore, the rules governing driver rights and responsibilities on roundabouts are subject to various interpretations. The Committee notes with interest that much activity has occurred in recent years on the very issues discussed in this report. The time has come for action to be taken to clearly establish the lane-marking system to be used and for the road rules to be modified so that they are appropriate to that system.
**Recommendation 21**

The Committee recommends that the Queensland Department of Transport implement a pilot program whereby the Canadian lane-marking system for two-lane roundabouts known as the "Alberta" system is evaluated. The pilot should also trial other lane-marking systems including the system shown in Appendix G. The aim of the pilot should be to develop a standard system of lane-marking for use on the majority of two-lane roundabouts throughout Queensland. The pilot should be adequately signed and well publicised. As a minimum, the pilot program should establish:

- the impact on the volume of traffic able to be sustained by the roundabout;
- the impact on the number of minor accidents (i.e. no fatalities and no serious injuries);
- the impact on the ability and consistency of Police to apportion blame in the cases of accidents;
- the impact on the ability of the motorist to understand the road rules associated with the lane-markings being trialled; and
- the optimum design standard for approaches to, and exits from, roundabouts.

Upon completion of the pilot program, a standard lane-marking system for two-lane roundabouts should be developed and implemented. Appropriate regulations governing the rules for using roundabouts should then be introduced as a matter of urgency. Such regulations, while essential to inform motorists of the correct rules and procedures, should also facilitate unambiguous apportionment of blame in minor accidents.
The investigations conducted by the Committee for this report did not specifically address the value of raised reflective pavement markers (cats eyes) as a road safety measure.

However, in discussing the other issues contained in this report, the Committee considered the value of using different coloured raised reflective pavement markers in locations where white ones are "lost" in the glare of street lights or are indistinguishable amongst other pavement markings. The problem is highlighted in wet weather. An example discussed by the Committee was Bowen Bridge Road near the Royal Brisbane Hospital. This is an undivided, multilane road which carries large volumes of traffic.

The white raised reflective pavement markers which are located in the middle of this road are difficult to see for the reasons mentioned above. Also, as stated, they are harder to see in wet weather. If this is the case, the safety value of raised reflective pavement markers in clearly delineating the middle or edge of the road, is severely reduced. On face value, it would appear that different coloured raised reflective pavement markers would solve the problem.

A similar concept was contained in a submission received from W.J. Small who referred to some roads in the United States which are distinctly marked:

"Lanes separating traffic going in the same direction are always marked with white paint, and roads that are used for two way traffic are marked with a yellow line in the centre, but with white lines either side of the centre".

The Committee recognises that it is not in a position to unilaterally recommend using different coloured raised reflective pavement markers without further investigation. However, such further investigation into the benefit of using different coloured raised reflective pavement markers in specific locations appears warranted.

**Recommendation 22**

The Committee recommends that an assessment of the safety value of using different coloured (other than white) raised reflective pavement markers (cats eyes) to clearly indicate the difference between the lane marking and the centre line on multi-lane, undivided, roads, be undertaken by the Queensland Department of Transport.
**SUMMARY OF RECOMMENDATIONS**

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Recommendation Text</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The Committee recommends that the AUSTROADS (formerly NAASRA) standards on embankment design and construction, particularly with regard to embankment slope and guard rail protection where specified, be observed by road building authorities as a minimum.</td>
</tr>
<tr>
<td>2</td>
<td>The Committee recommends that greater emphasis be placed on setting road design and construction standards for state-wide use, and on observation of those standards by local authorities. This should also include LATM (Local Area Traffic Management) standards.</td>
</tr>
<tr>
<td>3</td>
<td>The Committee recommends that all Queensland traffic authorities meet annually at a conference dedicated to establishing and reviewing road design standards. The first of these conferences shall establish road design standards which should be adhered to by all traffic authorities in Queensland. Subsequent conferences shall review the standards for effectiveness and suitability. Any recommendations to create or modify standards, which emanate from such conferences should be directed to the organisation/s responsible for establishing the standards originally adopted.</td>
</tr>
<tr>
<td>4</td>
<td>The Committee recommends that the proportion of State funding to local authorities in the TETF (Traffic Engineering Trust Fund) scheme for traffic facilities, be increased.</td>
</tr>
<tr>
<td>5</td>
<td>The Committee recommends that unexpected changes in road conditions or road curvature be discouraged through adherence to AUSTROADS (road design) standards.</td>
</tr>
<tr>
<td>6</td>
<td>The Committee recommends that future school developments make full provision for suitable areas for set-down, pick-up, and waiting, and for turning or clearing of vehicles, including public transport, as is the case with all other types of new urban developments.</td>
</tr>
</tbody>
</table>
Recommendation 7

The Committee recommends that widespread construction of overtaking lanes be planned and implemented, on both new and existing roads, as a means of reducing accidents. Appropriate signs giving advance warning to motorists that an overtaking lane is approaching are essential on existing and new overtaking lanes.

Recommendation 8

The Committee recommends that the bitumen surface of many roads be widened to facilitate safe overtaking of slow vehicles as well as improving the safety of two-way traffic. It will also reduce damage to bitumen edges.

Recommendation 9

The Committee recommends that detection and policing of so-called minor offences, such as slow driving in overtaking lanes and motorists failing to keep left unless overtaking, be given a higher, more urgent priority. This will increase the benefits associated with proven road safety traffic engineering facilities. This action is necessary to reduce the frustration and congestion which leads to accidents.

Recommendation 10

The Committee recommends that, as roads are built or improved, greater use be made of traffic engineering warning devices; such as rumble strips, to warn drivers that they may be fatigued and that they should pull over and rest.

Recommendation 11

The Committee recommends that more specialist attention be given to planning roadside rest areas and encouraging motorists to make greater use of these facilities to avoid the onset of fatigue.

Recommendation 12

The Committee recommends that:

- kerb-side power poles in urban areas be prohibited;
- undergrounding of reticulation lines in urban areas be made compulsory;
- electricity authorities be required to implement a program to replace all existing power poles and lines with underground services, over a period of years;
- poles currently carrying high voltage lines be provided with safety barrier protection; and
- new lines in new locations be placed well away from travelling lanes on roads, and at least in accordance with established standards.
**Recommendation 13**

The Committee recommends that local authorities be required to pay strict attention to traffic sign standards and to erecting clear, prominent signs; including street name signs and roadworks signs.

**Recommendation 14**

The Committee recommends that all four-way intersections in urban areas be controlled by "Stop" or "Give Way" signs, or some other appropriate intersection control device, as a matter of urgency. The "give way to the right rule" which is the default rule at intersections without an appropriate intersection control device, has long been discredited as an adequate road safety measure.

**Recommendation 15**

The Committee recommends that local and state authorities place greater emphasis on the co-ordination of traffic lights on sections of road in which traffic lights appear at regular intervals. This would discourage motorists from accelerating between traffic lights in order to "catch" the green light and avoid stopping at a series of red lights.

The Committee further recommends that safer pedestrian crossings over multi-lane roads be provided by using pedestrian actuated traffic lights, and where applicable, pedestrian refuges in the median strip.

**Recommendation 16**

The Committee recommends that a thorough evaluation of suitable low-cost treatments for railway level crossings be conducted in accordance with the recommendations of the September 1991 Australian Road Research Board Conference on Railway Level Crossings. Any standards, procedures, or treatments accepted and adopted as a result of the evaluation, should apply to private railway operators (eg. sugar cane rail systems), as well as State Railway Authorities. These standards should also apply to those railway level crossings in urban areas which are not treated with flashing light and/or boom gate devices, so that motorists and pedestrians are adequately protected.

The Committee further recommends that another alternative low-cost treatment be included in the evaluation program. This treatment requires the installation of a series of reflectors beyond level crossings which would give a visual effect of a moving vehicle crossing the road when lit by headlights of an approaching vehicle.

**Recommendation 17**

The Committee recommends that maintenance programs for Queensland roads receive greater funding, in order to reduce the number of accidents caused by poor road conditions.
**Recommendation 18**

The Committee recommends that a program be undertaken to reduce the number of low level creek crossings and to insert culverts in floodways.

**Recommendation 19**

The Committee recommends that sections of roads near watering points and in areas of poor visibility be suitably fenced, over a period of time, as a means of reducing accidents involving stock.

**Recommendation 20**

The Committee recommends that an investigation be undertaken into the need to restrict the use of road trains on major national highways, especially where other means of transport is available. The investigation should consider the socio-economic impact of further restrictions on road train travel as well the road safety and road maintenance aspects.

**Recommendation 21**

The Committee recommends that the Queensland Department of Transport implement a pilot program whereby the Canadian lane-marking system for two-lane roundabouts known as the "Alberta" system is evaluated. The pilot should also trial other lane-marking systems including the system shown in Appendix G. The aim of the pilot should be to develop a standard system of lane-marking for use on the majority of two-lane roundabouts throughout Queensland. The pilot should be adequately signed and well publicised. As a minimum, the pilot program should establish:

- the impact on the volume of traffic able to be sustained by the roundabout;
- the impact on the number of minor accidents (i.e. no fatalities and no serious injuries);
- the impact on the ability and consistency of Police to apportion blame in the cases of accidents;
- the impact on the ability of the motorist to understand the road rules associated with the lane-markings being trialled; and
- the optimum design standard for approaches to, and exits from, roundabouts.

Upon completion of the pilot program, a standard lane-marking system for two-lane roundabouts should be developed and implemented. Appropriate regulations governing the rules for using roundabouts should then be introduced as a matter of urgency. Such regulations, while essential to inform motorists of the correct rules and procedures, should also facilitate unambiguous apportionment of blame in minor accidents.
**Recommendation 22**

The Committee recommends that an assessment of the safety value of using different coloured (other than white) raised reflective pavement markers (cats eyes) to clearly indicate the difference between the lane marking and the centre line on multi-lane, undivided, roads, be undertaken by the Queensland Department of Transport.
REFERENCES


Fox, J.C., Good, M.C., & Joubert, P.N., (1979) "Collisions With Utility Poles" Report CR1, Department of Transport, Office of Road Safety, Canberra, A.C.T.


Queensland University of Technology, Proceedings of Roundabout and Unsignalised Intersection Workshop, Brisbane, Queensland, February 1991.


Evidence heard at public hearings conducted by the Committee was recorded by Hansard. Written submissions received by the Committee are listed in Appendix B.

OTHER REFERENCES FOUND USEFUL


APPENDIX A - Newspaper Advertisement
### APPENDIX B - Submissions Received

<table>
<thead>
<tr>
<th>Name</th>
<th>Address</th>
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<th>Postcode</th>
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<tr>
<td>P A Burger</td>
<td>30 Harlin Road</td>
<td>COALFalls</td>
<td>Q</td>
<td>4305</td>
</tr>
<tr>
<td>R S L Jones</td>
<td>Environmental Youth Alliance</td>
<td>GPO Box 1587</td>
<td>BRISBANE</td>
<td>Q</td>
</tr>
<tr>
<td>Mr G N Goddard</td>
<td>106 Sylvan Road</td>
<td>TOOWONG</td>
<td>Q</td>
<td>4066</td>
</tr>
<tr>
<td>T Roddick</td>
<td></td>
<td>EIGHT MILE PLAINS</td>
<td>Q</td>
<td>4123</td>
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<tr>
<td>Ms K Mackiewicz</td>
<td>392 Tooronga Road</td>
<td>EAST HAWTHORN</td>
<td>VIC</td>
<td>3123</td>
</tr>
<tr>
<td>Mr Brian Connor</td>
<td></td>
<td>C/- 145 Faulkner Street</td>
<td>ARMIDALE</td>
<td>NSW</td>
</tr>
<tr>
<td>R J Kruckow</td>
<td>Lot 108</td>
<td>MINDEN</td>
<td>Q</td>
<td>4340</td>
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<tr>
<td>Mr Ian Nixon</td>
<td>&quot;Remuda&quot;</td>
<td>Hillcrest Road</td>
<td>WARRANWOOD</td>
<td>VIC</td>
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<tr>
<td>Mr G Soltan</td>
<td>1/126 Cottesloe Drive</td>
<td>ROBINA</td>
<td>Q</td>
<td>4226</td>
</tr>
<tr>
<td>Mr W J Preston</td>
<td>34 Wongara Street</td>
<td>CLAYFIELD</td>
<td>Q</td>
<td>4011</td>
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<tr>
<td>W J Small</td>
<td>Mountain view Drive</td>
<td>MINDEN</td>
<td>Q</td>
<td>4340</td>
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<tr>
<td>Mr H Johnson</td>
<td>Aspley Special School Recycling Station</td>
<td>PO Box 467</td>
<td>ZILLMERE</td>
<td>Q</td>
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<tr>
<td>Mr P Hanson</td>
<td>62 Ormonde Road</td>
<td>YERONGA</td>
<td>Q</td>
<td>4104</td>
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<tr>
<td>Mr N J Clark</td>
<td>177 Park Road</td>
<td>WOOLLOONGABBA</td>
<td>Q</td>
<td>4102</td>
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<tr>
<td>Mrs R Turner</td>
<td>62 Thomas Street</td>
<td>TORWOOD</td>
<td>Q</td>
<td>4066</td>
</tr>
<tr>
<td>G H Savage</td>
<td>President</td>
<td>The Outdoor Advertising Assoc. of Australia (Inc.)</td>
<td>MANLY</td>
<td>Q</td>
</tr>
<tr>
<td>Mr T J Waters</td>
<td>33 Oxley Street</td>
<td>DECEPTION BAY</td>
<td>Q</td>
<td>4508</td>
</tr>
<tr>
<td>Mr P O'Connell</td>
<td></td>
<td>VICTORIA POINT</td>
<td>Q</td>
<td>4165</td>
</tr>
</tbody>
</table>
M F Fisher
Director
Department of Geography and Environmental Science
Graduate School of Environmental Science
Monash University
CLAYTON VIC 3168

Associate Professor R J Troutbeck
School of Civil Engineering
QUT
2 George Street
BRISBANE Q 4000
APPENDIX C - Witnesses Who Presented Evidence at Public Hearings

Brisbane - Friday 4 October 1991

Mr T Waters
Mr G McDonald Geoff McDonald and Associates
Mr M Daff Loder and Bayly Consulting Group
Mr J Martin Loder and Bayly Consulting Group
Mr G Middleton Department of Transport
Mr G Haigh Department of Transport
Mr N Patterson Department of Transport

Brisbane - Monday 7 October 1991

Mr J Evanson Brisbane City Council
Mr G Graham Institution of Engineers Australia
Mr R Mogg Institution of Engineers Australia
Dr R Pretty Institution of Engineers Australia
Mr J Carlisle Institution of Engineers Australia
Mr B Fitts Institution of Engineers Australia
Mr T Roddick

Mr V Mathieson RACQ
Mr J Kenny RACQ
Senior Constable J Ruller Queensland Police Service - Traffic Accident Investigation Squad

Townsville - Monday 14 October 1991

Associate Professor L Wadhwa James Cook University

Mr P Moore RACQ
Mr G Wease RACQ
Mr B Stanton Townsville City Council
Mr T Lawler McIntyre and Associates
Mr D Pickard  Department of Transport
Mr I Rose  Department of Transport
Mr B Prideaux  Department of Transport

Townsville Police were scheduled to appear but were unable to attend due to two fatal car accidents occurring that morning.

**Mackay - Wednesday 16 October 1991**

A/Superintendent N Healy  Mackay Police
Mr D Zarb  Zarb Transport
Mr B Jackson  Zarb Transport
Mr J Hill  Department of Transport
Mr S McGrath  Department of Transport
Mr J Martin  Mackay City Council
Mr D Ruhle  Mackay Sugar Co-op Association

A representative from Mackay Transit Coaches was invited but failed to appear.

**Roma - Monday 15 October 1990**

Mr P M West  Department of Transport
Mr G B Haigh  Department of Transport
Mr P A Evans  Department of Transport
Mr D K Head  Department of Transport
Mr D M Wass  Department of Transport

Acting Inspector R O'Brien  Roma Police
Mr J Lewis  School Bus Operator
Superintendent R J Mackney  Roma Ambulance

Mr H A T Dawes  Amor Motors
Mr P Ladbrook  Amor Motors
Mr K Busiko  K N Busiko and Co.
Mr W N Bonthrone  United Graziers Association
Charleville - Tuesday 16 October 1990

Superintendent I Halliwell  Charleville Ambulance
Acting Inspector W Haupt  Charleville Police
Mr B Webster  Bert's Body Shop
Mr J Lutvey  Murweh Shire Council
Mrs J Akers  Queensland Country Women's Association (Warrego Division)

Longreach - Wednesday 17 October 1990

Mr S Janas  Department of Transport
Mr M Ross  Department of Transport
Senior Sergeant J Howell  Longreach Police
Mr J T Themsen  Longreach Shire Council
Mr G N Hannah  Department of Transport
APPENDIX D - Extract from Epstein and Hunter


7.7 STATE OF THE ART - THE STANDARD OF CARE (CHAPTER 3)

The investigators were required to assemble engineering and technical information about road construction and roadside objects. These data are necessary in order to determine whether an action in negligence would lie against a road authority as an essential element of any negligence action is whether there has been a breach of the standard of care owed by a road authority to a road user.

The standard of care is determined by reference to technological development and change, practices and methods currently in use, i.e. the state of the art. This is not to say that a road authority is necessarily required to adopt the latest safety devices irrespective of other factors. What is required is that an authority in the performance of its duty in the placement and design of the devices located along the road, must act in a manner which is reasonable taking into account such other factors as cost, accident rates, etc. Resolution of the question of the standard of care applicable is determined by reference to what a reasonable road engineer fully apprised of the circumstances, would do. It is therefore necessary to describe the state of the art which currently applies in the area of the design and location of fixed objects along the road. In order to accomplish this the investigators canvassed practices in all the Australian States as well as the Northern Territory and the Australian Capital Territory. Additionally, questionnaires were sent to the Highway Departments of each of the American States, the Canadian Federal Highway Authority, each of the Canadian Provincial Highway Departments and to the New Zealand Road Authority. Information was received from the road safety bodies of Sweden and the Netherlands. Current literature in the field was surveyed and researchers both in Australia and overseas were contacted about the latest developments.

7.7.1 Utility Poles

7.7.1.1 Design. During the last five years, researchers both in Australia and overseas have experimented with designs for a utility pole which will minimise the severity of an impact by a vehicle. The feature which distinguishes the design of utility poles from that of poles which provide only street lighting is the difficulty of ensuring that overhead electric cables are kept aloft when the pole is impacted. The researchers in the field have experimented with a breakaway design whereby on impact, the pole yields at the base while the cross beam detaches and remains aloft, thus preventing the cables from falling. It has been suggested that this procedure could be used to modify timber utility poles which pose a particular hazard to motorists because of their location although a modified pole will still pose some degree of danger to the motorist. A device to guard and prevent the pole from falling on the road surface by means of supporting cables attached to neighbouring poles has also been suggested. The investigators' Australian and overseas enquiries have not revealed any jurisdiction which currently regularly uses a modified breakaway utility pole although one American State does use such poles as
temporary poles. The Australian research in this area has indicated that the modified pole would only be feasible where other alternatives such as undergrounding of cables or relocation of the pole are not possible.

7.7.1.2 Alternatives: Location of Poles and Undergrounding of Cables. Strictly speaking the present study is limited to the legal implications of the use of poles of alternative design. The matter of location presents further legal issues which are briefly dealt with in this report. The matter of location is important as the legal characterisation of negligence requires an appreciation of the alternatives available to traffic engineers and the feasibility of the use of such alternatives. The investigators' survey of Australian practises has revealed that there is no uniformity amongst the Australian States regarding the placing of utility poles along the road. The location of poles along the roadside is a primary factor affecting the frequency and severity of pole collisions. The Melbourne University Study concluded that such factors as the horizontal curvature of the road, the traffic flow rate, the skid resistance of the surface, road width, super-elevation of the road, placement on the inside or outside of a bend and the lateral offset of the pole from the kerb all influence whether a pole is likely to be impacted and also the resulting severity of such an accident. The authors of the Melbourne University Study noted the particular importance of the lateral offset of the pole:

The results indicate that the probability of an accident involving poles at the pavement edge is 3.5 times higher than for poles which are set 3 metres back from the road edge. They also show that little further reduction in accident probability is achieved by moving the pole back from 3 metres to 12 metres offset.

Despite the clear evidence that pole location is a central factor in collisions, none of the Australian States appears to prescribe any general restriction or policy on the placement of utility poles in the area adjacent to the road. Although electricity authorities in some States are required to obtain the consent of the local Council for the placement of utility poles along the road, more attention is usually given to aesthetics than to road safety. The only area where there is some uniformity amongst the States regarding the placement of utility poles is in respect of freeways. Practically every state has legislated to prohibit utility poles along this category of road unless the responsible road authority has consented in writing. The situation in the United States is quite different in this respect. The American Association of State Highways and Transportation Officials has recommended that utility poles be not permitted within 30 feet (9.14m) of the road. Most of the American States' Highway Departments observe this restriction, authorising the placement of a pole within this area only if it is shielded from motorists by a guardrail placed behind a non-mountable kerb or on the upslope of a ditch.

7.7.1.3 Legal Implications of Hazardous Utility Poles. Utility poles constitute one of the greatest hazards to motorists both in terms of the frequency of accidents and in severity. In the opinion of the investigators, it would breach the standard of care owed to a motorist to leave unaltered a hazardous utility pole or to place a new utility pole in a hazardous location. Utility poles can be identified as hazardous either because they have been involved in a collision or because they have a high accident probability according to the model designed by the Melbourne University Department of Mechanical Engineering. At the present time modification of the design of utility poles does not offer the motorists adequate protection; therefore the prudent road authority must alter the location of hazardous poles, underground the cables, or use impact attenuators. It is recognised that, in part, the present hazardous position of certain utility poles has resulted from changing patterns in vehicular traffic, widening of road surfaces, increased speed limits and other factors beyond the control of the authority which originally constructed or which now owns or controls a particular pole. These factors can affect legal liability.
Although the common law does not demand, and cannot expect, that hundreds of thousands of utility poles will be relocated overnight or otherwise modified, it does, however, require that when a given pole becomes especially hazardous or has been knocked down and needs to be replaced, that the responsible institution will act with prudence to eliminate undue risks which threaten a motorist's safety. An authority may face the imposition of legal liability for the damages which ensue from its failure to take such steps.
CONFERENCE RECOMMENDATIONS

These recommendations were developed from the syndicate meetings reported above, discussion of the syndicate reports at a final plenary session of the conference, delegate response to a set of draft recommendations mailed to them shortly after the conference, and discussion of the conference and draft recommendations at a meeting of the Working Group of the Standards Australia MS/12 Committee which has responsibility for traffic control devices at railway level crossings.

KEY RECOMMENDATIONS

1. **National Approach**

There is a clear need to develop a national approach to railway level crossing safety. An arrangement involving AUSTROADS, Railways of Australia and the Australian Road Research Board is the most appropriate way of ensuring this.

2. **Cost of active protection**

Active protection is presently expensive in relation to its benefits in terms of accident reduction. There is therefore an urgent need to find ways of reducing the cost of active protection. Cost reductions through improved work practices and adopting new technologies should both be explored.

3. **Decide priorities**

There is a major need to identify priorities for action and research on railway level crossing safety. While the priorities on action are likely to be decided at the State level, AUSTROADS/Railways of Australia should have a role in shaping these priorities and in determining research priorities.
OTHER RECOMMENDATIONS

BASIC ISSUES

4. **Consolidating knowledge and experience**

A comprehensive listing of all Australian material on railway level crossing safety and treatments should be compiled.

5. **Standardisation**

Railways would benefit from greater standardisation of hardware and procedures. Standards Australia may be the most appropriate organisation to achieve this. Standards Australia, together with railway and professional organisations, should investigate the need for Australian Standards to cover railway signalling equipment.

6. **Education and training**

There is a need to ensure that drivers are better informed about the meaning of different sign arrays on the approaches to railway crossings. The driver licensing authority in each State should ensure that this material, together with correct procedures, is included in basic driver instruction and testing and associated handbooks.

7. **Data on level crossing accidents**

National statistics on railway level crossing accidents should be reported at regular intervals. (Note - the Federal Office of Road Safety's National Fatal Accident File could readily be used to generate such reports for fatal accidents.)

IMPLEMENTING CHANGES TO EQUIPMENT AND PROCEDURES

8. **Australian Standard for traffic control devices**

The following issues should be considered by Standards Australia Committee MS/12, responsible for AS 1742, Manual of Uniform Traffic Control Devices:

- the most appropriate applications for the proposed revised railway crossing position sign (crossbucks on a rectangular sign with a red background), and the likely benefits it will generate;

- the most appropriate form for a backing board to improve the visibility of flashing light signals, and the circumstances in which it should be provided;

- the most appropriate form of pavement marking, having regard to cost and data on public understanding of the various forms of marking.
9. **Reflectorised markings on rolling stock**

Where programs of providing reflectorised markings on rolling stock have been undertaken, the effects on accidents and the performance of the reflectorised markings in practice should be monitored by the rail and road authorities.

10. **Whistle code**

It is considered that the present two-blast whistle signals may be inadequate, the first blast happening too far away from and the second too close to the crossing. This arrangement should be reconsidered by rail authorities.

11. **Locomotive lights**

Speedy resolution should be sought on the issue of lights for locomotives which give motor vehicle drivers sufficient warning of the approach of a train. In particular, a full evaluation should be made of how visible the ditch lights fitted to new locomotives in NSW and Victoria are to drivers of motor vehicles, as they would appear to have at least some of the desirable features (separated lights, mounted at coupling height) advocated by researchers.

12. **Identification of railway crossings**

When an accident or other problem occurs, train crews have no way of identifying the precise location of the crossing. Wrong identification of the crossing can mean lengthy delays in emergency services getting to the scene. This could be rectified by labelling such crossing and displaying the label on the back of the existing signs, using either the road name or a numerical system as the identifier. A system of identification labelling for railway level crossings should be implemented.

**RESEARCH ISSUES**

13. **Advisory speeds**

At present, at sign controlled crossings where there is insufficient sight distance to permit safe passage at the prevailing traffic speed, a stop sign should be erected. This may lead to very widespread use of the stop sign at crossings, with adverse effects on the credibility of the sign and compliance with it. An alternative may be to post advisory speeds at crossings which would have adequate sight distance if crossed at speeds lower than normal traffic speeds. The feasibility of advisory speeds for railway level crossings, the likely extent of their use and their effect on driver behaviour should be investigated.

14. **Traffic signal control**

Unlike railway level crossing signals, conventional traffic signals normally display a green light to indicate safe passage, while signals which have failed display flashing yellow or no light at all. No such distinction between the safe passage and failed state is available with current flashing light signals. Traffic signals have been successfully trialled in this application in the US, although improving low levels of compliance with the stop signal was the primary reason for the trial. It is recommended that traffic
signals be trialled at one or more level crossing locations, and that the results be carefully monitored and evaluated.

15. **Lower-cost active treatments**

It was made clear at the conference that the law requires that the relevant authorities provide reasonable warning of the presence of crossings and of the approach of trains. It does not require that railway crossing signalling devices necessarily be designed along fail-safe principles. System designs incorporating multiple detectors, self-monitoring and telecommunications links are capable of delivering a very high degree of reliability, and may be appropriate at crossings which are remote from existing track circuits. It is recommended that alternative forms of active protection which may result in lower costs, and the associated legal and policy issues, be vigorously pursued.

16. **Examination of costs of flashing light installations**

Financial and other records relating to some recent flashing light installations should be examined to determine whether there are opportunities for reducing these costs.

17. **A systematic risk management plan**

If the benefits of active protection and boom barriers are to be maximised, it is important they be installed at crossings where there is the highest risk of a crash. At present, it is not clear to what extent various factors contribute to crash risk, nor whether any more complex model would provide better prediction than traffic and train volumes or past numbers of accidents. If lower cost active protection does prove to be viable, and a more pro-active approach to level crossing treatments becomes possible as a result, then it will be essential to have an objective means of deciding which crossings to treat. It is recommended that the authorities responsible for railway level crossing protection should develop crossing protection plans based upon technically sound risk assessments, and that the criteria adopted by the different authorities in developing their plans should be consistent.

**OTHER ISSUES**

18. **Pavement Condition**

Uneven surfaces tend to develop at railway crossings and may distract the motorist, increasing the probability that an approaching train will not be observed. Better co-operation between road and rail authorities and clear demarcation of responsibility for road condition on the crossing are required.
APPENDIX F - "Alberta" System Roundabout

APPENDIX G - Roundabout Lane-Marking System