University of Southern Queensland
Faculty of Engineering and Surveying

Evaluation of Funding Justification of Low Volume Roads in North Queensland

A dissertation submitted by

Christopher Frank Mackenzie

In fulfilment of the requirements of

Courses ENG4111 and 4112 Research Project

towards the degree of

Bachelor of Engineering (Civil)

Submitted: October, 2004

Abstract

The limited funding of low volume roads is a common problem faced by commuters in the North Queensland region. These roads are commonly narrow in seal and formation width and provide limited overtaking opportunities. In the future, improvements to their asset condition can be achieved by aligning their standards with the goals of the Rural Regional Implementation Scheme.

These improvements would provide increased safety on these developmental roads, and ensure that funds were appropriately distributed throughout the link. In general, low volume roads are prioritised by treating the 'critical' sections, which are typically defined as containing poor asset conditions and high accident frequencies.

The processes followed to compile this project were:

- Conduct a literature review of the current practices employed on low volume roads.
- Review the current strategy.
- Review the practices employed by Main Roads.
- Gather accident data for low volume roads in North Queensland.
- Analyse the data collected.
- Conduct an economic appraisal to support the improvements to the low volume roads.

The data indicates that a high proportion of accidents have occurred on narrow sections of the pavement during the study period. The challenge in the future, is to establish suitable funding prioritisation procedures for these low volume roads with consideration being made to the social, environmental and economic factors of the community.

University of Southern Queensland

Faculty of Engineering and Surveying

ENG4111 & ENG4112 *Research Project*

Limitations of Use

CERTIFICATION

I certify that the ideas, designs and experimental work, results, analyses and conclusions set out in this dissertation are entirely my own effort, except where otherwise indicated and acknowledged.

I further certify that the work is original and has not been previously submitted for assessment in any other course or institution, except where specifically stated.

Christopher Mackenzie

Student Number: Q10207830

Signature

Date

ACKNOWLEDGMENTS

I would like to sincerely thank the people who have provided advice and support during the completion of this research. Specifically, I wish to thank my supervisor, Dr David Thorpe for his knowledge and guidance.

Special thanks to my vacation employment supervisor, Richard Barrett, who provided regular advice and the inspiration to undertake this project. Thanks to my computer expert, Mr Anthony Dooley.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

Chapter 1 INTRODUCTION

Society is becoming increasingly more demanding with regard to improved asset condition on low volume roads. At present, only limited funding is provided to maintain and upgrade current low volume road networks. The United States describes a low volume road as a road which experiences fewer than 400 vehicles per day (Hough and Smadi 1999). In Australia, low volume roads are considered to have a lower number of vehicles than this. It is estimated that approximately 90% of the roads world wide are low volume roads. It is therefore essential that people recognise the importance of maintaining suitable asset conditions. The challenge in the future is to provide acceptable planning, design, construction and maintenance of these roads using limited funding.

Low volume roads are common in North Queensland and, as a result of low traffic volumes, they often remain as only single lane carriage ways with minimal passing opportunities. Future funding for these roads can be justified by the volume of traffic, predicted traffic growth, flood immunity and accident frequency.

The Department of Main Roads currently uses a Rural Road Implementation Strategy (RRIS) to establish the function of the road and the asset improvements needed. In addition, the Road Implementation Program (RIP) identifies the road construction projects and their priority on these low volume roads. Furthermore, the RRIS details a specific twenty year investment strategy vision for the link, with the primary outcome of improved pavement width, surface roughness, overtaking opportunities and flood immunity. These strategies will be evaluated using low volume roads in North Queensland and a focus on accident rates will be identified to justify their funding in the future.

1.1 Aim

The aim of this dissertation to investigate and evaluate the justification for funding of low volume roads in North Queensland using accident data supplied by the Queensland Department of Main Roads database, *Road Crash II*.

1.2 Dissertation Structure

This dissertation is structured in the following format.

- Chapter 2 provides a summary of the current asset and traffic conditions experienced on the Gregory Developmental Road (GDR). It also includes the current strategy employed by Main Roads as designed by the consultants, Maunsell Australia.

- Chapter 3 discusses low volume road issues experienced globally, nationally, state wide and at the local level. Topics include planning, management, finance, best practice, pertinent safety issues and a past project undertaken by James Cook University in 1991.

- Chapter 4 presents the current practices employed by Main Roads and local councils for funding and management of low volume roads.

- Chapter 5 introduces the concept of road crashes, the components of the traffic system and the Main Roads database *Road Crash II*.

- Chapter 6 presents the research methodology employed for *Road Crash II* data.

- Chapter 7 describes the results from Chapter 6 using the Austroads publication *Treatment of Crash Locations* (2004).

- Chapter 8 discusses the results from chapter 7.

- Chapter 9 presents the conclusion and recommendations to the project work.

Chapter 2 The Gregory Developmental Road

2.1 Introduction

The Gregory Developmental Road (GDR) is situated in far North Queensland, linking the Charters Towers region with the lower tablelands region of Herberton and Atherton. This route forms a suitable inland north / south alternative route in the event of road closures on coastal routes. The GDR intersects with the Flinders Highway at Charters Towers and continues northwest to intersect with the KDR at the Lynd. Appendix B shows the study area. The road is approximately 260 kilometres long, and has pavement widths ranging from four to eight metres wide.

The construction of the road was undertaken in the 1960s, 70s and 80s as a 'beef' road. The majority of the road was one lane on an eight metre wide formation with natural soil shoulders. Over time, improvements and maintenance to pavement width have been employed on the GDR. The Department of Main Roads has been working in conjunction with an engineering consultancy, Maunsell Australia, since mid 2001. Maunsell has developed strategies to improve the geometric and performance standard for the GDR with an investment strategy aimed at a time horizon of twenty years.

2.2 Existing Asset Condition of the GDR

Analysis of the existing asset conditions of the GDR in 2002 identified the standards that needed to be met to improve the overall safety of the road (Maunsell Australia 2002).

1. Due to a large majority of the link having a pavement width smaller than eight metres, overtaking is difficult for vehicles, especially with road trains and multi-combination vehicles using the road. This can be supported by accident data. Figure 2.1 shows the pavement conditions.

Figure 2.1 Narrow pavement width on the GDR

2. There are areas of insufficient fencing adjacent to the road, which have led to a number of accidents involving livestock on the road.

3. Low lying areas have low flood immunity which results in road closures in excess of two days and causes disruption to residential, commercial and tourist vehicles. These flooded sections of road also contribute to vehicles damaging unsealed shoulders when pulling off the narrow pavement.

4. There are several sections of road with horizontal and vertical curves designed for low speeds but the overall speed environment is 110 kilometres per hour.

Figure 2.2 Horizontal and vertical alignment of the GDR

2.3 Existing Traffic Conditions

Further analysis was undertaken to determine important features of the existing traffic conditions of the GDR and to allow sufficient planning for the future (Maunsell Australia 2002).

1. Originally the road was designed as a single lane road for traffic flows of 150 vehicles per day. Traffic flows are now generally exceeding 150 vehicles per day. An Austroads publication on the design of rural roads outlines capacities greater than 200 cars per day should have a minimum

pavement width of eight metres (Rural Road Design 1999). The impact of possible traffic increase should necessitate the implementation of eight metre pavement width along the entire link.

2. The road experiences a high proportion of commercial vehicles, approximately 30%. Due to the width of these vehicles and the pavement, difficulties with overtaking are often experienced. These vehicles often have to pull off the road to allow satisfactory passing which damages the asset condition. These large vehicles also have a large Equivalent Standard Axles (ESAs), which also contribute to deterioration of the asset and need to be considered in design improvements.

3. Details from the Main Roads Database *Road Crash II* indicate narrow bitumen / formation width sections are contributing to accidents.

The current asset and traffic conditions experienced on the GDR were used by the consultants, Maunsell, to develop a link strategy which is to be employed over a 20 year design life. Main Roads envisages that improvements to the asset condition would provide an attractive route for Freight Efficient Vehicles (FEVs) and alternate north south route for tourists in the future. The current asset condition is sealed for the entire length but has varying seal widths which make it difficult to judge overtaking opportunities. In addition, the current overtaking opportunities are only one kilometre in length and are insufficient for FEVs. The consultant states that the main priority “involves widening the road to achieve a two-lane seal” and that improvement to sections along the link need to prioritised (Maunsell Australia 2004). The consultant also expresses that ‘the aim is to provide a flexible strategy for the upgrade of this section of the GDR, which is compatible with the Regional Roads Investment Strategy (RRIS)’ (Maunsell Australia 2002, p. 7). Below, I have summarised the details of the investment strategy which are relevant to accident analysis.

2.4 Project Priorities

The development of the strategy priorities required an investigation into the current expenditure in the Road Implementation Program (RIP) and its alliance with the Rural Road Implementation Scheme (RRIS). Stakeholders along the link were surveyed in September / October 2002 and February / March 2003 to establish their concerns for the current road conditions. A questionnaire was given to all stakeholders and this was used to identify and prioritise the issues as they see them impacting on the performance of the Link. A list of perceived issues was provided to the stakeholders and this allowed them to outline the most pertinent issues to improve the function of the GDR.

The 12 issues raised were ranked from 1 (being the highest) to 12 (being the lowest priority). A summary of the results received are shown below:

Road Condition Criterion	Priority Rating
Higher Priority Issues	
Seal Width	1
Formation Width	2
Overtaking Opportunity	3
Medium Priority Issues	
Seal Conditions	4
Fencing and Grids	5
Lower Priority Issues	
Roadside Amenities	6
Flood Immunity	7
Bridge Width	8
Horizontal Alignment	9
Soil Erosion	10
Vertical Alignment	11
Property Accesses/Intersections	12

The Maunsell reports states that 'Stakeholders were unanimous in their prioritisation of the top 3 issues (all relating to road width)' (Maunsell Australia 2004, p. 5).

2.5 Seal Width and Overtaking Opportunities

The review of the current Main Roads' policies and the consultation with the stakeholders have further emphasised the importance of widening the narrow single lane sections to a desirable pavement width of 8 metres. The Austroads publication *Rural Road Design* (1999) outlines that pavement with average annual daily traffic (AADT) of 150 – 500 vehicles per day need to be two lanes each, three metres in width (Rural Road Design 1999). This manual also recommends shoulder widths of 1 – 1.5 metres for this traffic volume. These Austroad recommendations can be found in Appendix C. Any sections on the link, greater than seven metres wide, were given lowest priority. Exceptions were only considered where significant asset conditions justified their importance for immediate rehabilitation. The consultant expresses that the aims of the strategy are:

- Achieving a safe route for the operation of freight efficient vehicles (FEVs) up to and including 53.5 metre combinations.

- Establishing suitable overtaking opportunities, particularly for passing FEVs.

The consultant also outlines that 'the desirable length for overtaking opportunities is between 2 and 2.5 kilometres' and, where suitable, extension of the current overtaking opportunities of 1 km to the desired 2 – 2.5 kilometres (Maunsell Australia 2004, p. 7). This recommendation is further supported by the Austroads publication *Rural Road Design* (1999) and is illustrated in Appendix D**.** Maunsell also emphasised that the 'staging of widening works needs to be planned to strategically distribute overtaking opportunities along the link initially' (Maunsell Australia 2004, p. 25). These planned upgrades can be seen in Appendix E.

2.6 Narrow Seal and Accidents

The consultant's investigation into the justification of upgrading the GDR included analysis of accidents north of chainage 5.76 kilometres on the link between February 1992 and January 2002. The contributing factors are outlined below:

Major Contributing Factor	**No. of Accidents**
Narrow single lane bitumen seal	31 accidents (1 fatal)
Stock on road	11 accidents
Driver fatigue/undue care	9 accidents (2 fatal)
Vehicle malfunction (e.g. blow out)	4 accidents

These results indicated that a high proportion of accidents were occurring due to narrow pavement width and that 'accidents typically involve vehicles getting into trouble on loose or soft shoulders when pulling off the single lane seal to allow another vehicle to pass' (Maunsell Australia 2004, p. 8). Appendix E illustrates the current asset conditions and overtaking opportunities on the GDR. These results were the motive behind the undertaking of this project.

2.7 Investment Strategies

Three investment strategies were proposed by Maunsell and these represented the priorities determined earlier in the report. The basic concept behind this strategy is to improve the 'critical' sections first and improve the overall asset condition. This method is commonly used on low volume roads in North Queensland as it 'stretches' the limited funding available for asset improvements. Three strategies were considered and evaluated quantitatively and qualitatively. Strategy 3 was the most expensive strategy to be proposed over the design life of 20 years but was chosen on its superiority in lower maintenance costs and ease of access to construction materials. Appendix E illustrates the strategy which is currently being employed on the GDR. This strategy involved 'upgrading of the link in line with a conventional 'widen and overlay' 20 year design life approach' (Maunsell Australia 2004, p. 31). Another point outlined by the consultant is 'sections of the road width less than seven metres would be widened to eight metres and overlaying of extensive sections of the road would be necessary at depths of 100mm to 150mm thick' (Maunsell Australia 2004, p. 41).

2.8 Funding of Investment Strategy

An estimate of the total cost of Investment Strategy 3 has been provided in Appendix F. The consultant has estimated that this equates to $2,800,000 (2004 dollars) for a single financial year and would be sufficient funding to complete the strategy over a 20 year design life.

2.9 Conclusion

The consultants' strategy aims to be aligned with RRIS and has considered the stakeholder priorities for the current works planned to be undertaken along the link. The pertinent final vision standards for the RRIS are as follows:

- Increased seal width, reduced roughness and improved overtaking opportunities within the 20 year horizon.

- Seal width: eight metres

- Roughness counts: < 140

It is anticipated that the investment will provide benefits ‘to economic trade and regional development through efficiency gains for many industries by reducing transport costs and improving safety’ (Maunsell Australia 2004, p. 38 , through:

- Improved flood immunity.
- Reducing commuter delays.
- Providing alternate north/south route when Bruce Highway is flooded.
- Increased road width.
- Improved surface condition.
- Reducing road user costs, particularly FEVs.

Finally, the investment of $2,800,000 per financial year would allow the strategy to be fully implemented over the design life and provide social and economic benefit to the community.

Chapter 3 Low Volume Road Issues

Asset management, road safety and planning methods have been researched from international and state transport engineering professionals. I have concentrated my research on the Seventh and Eighth Low Volume Roads Conference journals as these provide the latest innovative methods in all facets of low volume road engineering. I have separated my findings into four general headings. Firstly, planning, management and financial resources. Secondly, a section which describes the needs for technology transfer to local government authorities. Thirdly, the methods employed by agencies to improve the safety standards of roadway systems. Finally, I have summarised the findings of a thesis completed in 1991 on a similar topic.

3.1 Planning, Management and Finance

Throughout the world, the field of traffic engineering is exploring alternative methods for maintaining the condition of low volume roads. Economic decision models are common in developed countries and use asset and traffic information to prioritise the planning, management and financing of low volume roads. Developing countries are also seeking to implement these models.

Kumar and Kumar (1999) outline the pressures of inadequate funding to maintain road networks in India. The current practices of ad hoc planning are not suitable for such funding constraints, so they have developed a road planning model. This model is used to determine the need for new construction, upgrading of additional assets, selecting appropriate design standards and determining priority maintenance strategies.

In Queensland, Main Roads uses a Road Implementation Program (RIP) to identify projects it plans to complete over the next five years. Project funding is provided for the first two years and further allocations are provided for planning during the final three years.

In addition, Archondo-Callao (1999) presents a road economic decision model (RED) which is being used in Africa. This tool is used to identify the most critical maintenance sections of low volume roads. The model performs an economic evaluation of asset management options and considers the road length, condition, geometry and types of accidents.

In Queensland, a maintenance strategy has been developed by the Department of Main Roads for low volume roads. This provides some strategic guidance for appropriate maintenance of unsealed sections of developmental roads in North Queensland. The method seeks to improve the asset condition through a staged approach whereby an acceptable standard is achieved with the available funding. In general, the link is separated into different pavement / alignment types and suitable construction solutions are determined. The staged construction ensures the pavement is built in the most economic way possible, whilst maintaining consideration for road safety. This strategy has been employed on the Peninsula Developmental Road, Kennedy Developmental Road, Wills Developmental Road and the Gregory Developmental Road in North Queensland. This strategy employed on the GDR will be evaluated and other suitable options will be proposed.

Veeraragavan and Reddy (2003) demonstrate the Highway Developments Tool (HDM-4) can be used to budget and program road works with the data of the road content, structure and condition. Using the roads traffic and asset condition data, the tool allows the forecast of budget requirements and road network performance by applying strategy analysis of HDM-4. This tool is suitable for use on low volume roads as it allows determination of future budget requirements and suitability of alternative investment options.

In Australia, Main Roads have developed SCENARIO for Queensland use as HDM-4 was considered too difficult for the untrained operator. SCENARIO allows the user to predict future road conditions, make recommendations for road works and is considered far more relevant for project use.

In addition, Zimmerman and Peshking (2003) explain the advantages and disadvantages of pavement management tools. This tool allows quick analysis of the effect of improvement to worst condition, first repair. This allows local authorities to efficiently distribute funds to these regions of road network. Furthermore, pavement management tools are used to evaluate the future funding impacts, the cost effectiveness of maintenance programs and cost analysis for road management.

Hough and Smadi (1999) report that there are increased budget constraints on the federal, state and local levels of government and that the transportation industry is facing changes in demand due to population shifts, changes in travel patterns and changes in economic activity. This results in the ever increasing pressure to maintain road networks in regions of low population density but where there is not sufficient funding because of a limited tax base.

Four financing methods have been described. These are sales tax, special ownership tax, wheel tax and rural improvement districts. The use of increased county sales tax can provide a means to finance road budgets. Special ownership tax is a fee imposed on the owners or operators of specific items. An annual wheel tax is used to generate road revenue by charging a per tyre fee. Finally, rural road improvement districts charge newly constructed subdivisions a fee to finance the demand for road improvements in the area.

Giumarra (2003) describes a hierarchy system which ensures that funds are allocated to most needy roadways and which costs are better justified. The system uses five road classifications, which include the road and its functional characteristics. The road classifications include primary, secondary, minor, access and tracks. Within each road classification existing standards are used to ensure suitable upgrading is applied to the roadway.

A journal from Ivarsson and Malmber Calvo (2003) has proposed the Swedish option of private ownership and financing of low volume roads. Two thirds of roads are managed by private road associations at less than half the cost of local government road authorities. The journal proposes a model that includes a law on private roads and financial and technical incentives. The aim is to establish a private-public partnership whereby the government provides the finances and legal incentives for local property owners to take responsibility for their roads. In summary, this model allows the government to provide the finances and the private roads' authorities to increase their efficiency and effectiveness on low volume roads. This concept is in widespread use in Scandinavia but has not been readily adopted in Australia and is not considered within the scope of my project.

3.2 Best Practice

To ensure improved asset management in the future, local authorities need to be provided with up to date information.

This journal from Giumarra (2003) describes the importance of ARRB working with local governments by providing them with the latest research and developments to allow them to better manage their assets with limited resources. This is further supported by the *Highway Maintenance Code of Good Practice* (LAA 1989) which outlines that the strategy for highway maintenance management and maintenance road hierarchy should deal with urban and rural roads separately. The manual also recommends that maintenance procedures should be further broken down by considering the roads' traffic flow and composition. Efficiencies will result if maintenance and safety scheme programmes can work together.

Keller and Sherar (2003) concentrated on the concept and application of best management practices (BMPs) of low volume roads. A Low-Volume Roads Engineering Best Management Practices Field guide has been developed. The guidelines specify that:

- 'Roads must serve the needs of the user through good transportation planning.'

- 'Long Term cost effectiveness and minimised impacts are then achieved through application of good design and maintenance practices.'

(Keller and Sherar 2003, p. 174)

Therefore, low volume roads in Australia should adhere to these management practices to ensure better conditions on low volume roads.

3.3 Safety

Safety on road networks is of significant importance to road users around the world. Authorities perform road safety audits and maintain accident databases in order to prioritise improvements to road sections.

In the United States a road safety tool called the Road Safety Audit (RSA) has been used to identify and reduce roadway crashes by analysing the safety aspects of project plans before completion (Wilson and Lapinski 2003). It is also particularly useful in local rural areas where safety issues are commonly related to existing roadway networks. In practice, a Road Safety Audit Review (RSAR) is a tool used to identify the functionality and safety of a road and allows the identification of improvements needed to attain a suitable standard.

The United Kingdom Department for Transport (2004) supports this tool and it is used to prevent accidents on their road networks. The road safety auditors are involved in all stages of the project with the view to considering all potential road users, the possible varying conditions and the likely impact of the surrounding areas.

Austroads publication Road Safety Audit (2002) is used by Australian and New Zealand and provides state highway authorities, local government authorities and consulting practices with methods to deal with road safety issues. This has been followed on from its UK origins. It is regularly implemented in Australia and New Zealand and is currently up-to-date with the world best practice standard.

Achwan and Rujito (1999) report more than 10,000 road fatalities over the past 10 years in Indonesia. This has motivated them to conduct further study into road safety and develop the Microcomputer Accident Analysis Program (MAAP). This system is being used to identify contributory factors at dangerous locations. The journal concludes that the majority of its accidents are caused by poor shoulder condition which causes a rollover of vehicles. Finally, the report outlines that due to low accident numbers on individual links, it is difficult to identify the priority routes to be upgraded. However, it is planned that future study will allow this remedial treatment to be implemented.

The United Kingdom Department for Transport (2004) employs a system for identifying and prioritising road improvements based on accident information. Firstly you consider accident data, accident location and most probable causes for insufficient road safety. Secondly, you consider how the traffic composition has changed and whether this will have further effect in the future. Finally, you rank the problems by the severity of accident rate, number of accidents and severity of injuries sustained. Worst case problems are then attended to as top priority.

Australia employs a similar system for data capture of its road networks. *Road Crash II* is a database maintained by the Department of Main Roads and contains detailed descriptions of accidents, the number of vehicles involved and the severity and location of each accident. Police provide descriptions of the most likely cause of the accident and any obvious conditions or circumstances that may contribute to the accident.

However Stamtiadis, Jones & Aultman-Hall (1999) believe that due to high crash frequencies in low volume roads in the US we need to examine casual factors and determine whether crash characteristics are similar on other low volume highways. This study examines the relationship between the driver, roadway and environmental conditions causing crashes on a low volume road linking Kentucky and North Carolina. Some important results show that low volume roads present similar road crashes to other roads and large vehicles have the highest percentage of two vehicle crashes on low volumes roads.

The United Kingdom Department for Transport (2004) indicates that even though only 31% of its road crashes occur on rural roads, 44% account for the total cost of injuries due to severity of injuries compared to urban roads. The website also describes its justification for funding based on economic return for its safety improvements; that is, they compare the benefits gained over the year following the improvement and correlate this with the cost of the scheme.

Another important issue was raised by Calvert and Wilson (1999) who describe that the increasing need to improve geometric deficient rural roads cannot be funded to attain the road authority guidelines. A solution was suggested that incremental road improvements were to be completed on the worst case horizontal alignment and this would allow sufficient improvement to roadway safety. This view is supported by manuals generated by the Department of Main Roads in Townsville for the use on low volume roads in North Queensland.

3.4 Previous Project

In 1991 Associate Professor Lal Wadhwa and BHP engineer Brian Handy undertook a project titled *Identification and Evaluation of Engineering Solutions to Accident Reduction in North Queensland* through James Cook University (Wadha and Handy 1991). The project aim was to establish the most significant factors causing accidents on rural roads in North Queensland and to determine economical engineering solutions to reduce accident frequency.

An accident database called PHYLAK was used to identify accident frequency, severity and circumstances for rural roads in the districts of Townsville, Cairns and Mackay. Sections of these roads were analysed with the view to determine above average accident concentrations by using a measure of accidents per kilometre. Each accident had a Road User Movement (RUM) number assigned to allow a description of the accident type.

The location of above average accident concentrations was examined and the PHYLAK database provided information on the most likely factors contributing to accidents which was represented by RUM numbers.

Engineering solutions were proposed to improve the road condition and to reduce the likelihood of accidents. A cost benefit analysis was performed on each engineering solution and the order of priority determined by the highest accident per kilometre and the correlating cost benefit.

A similar strategy has been employed to the Gregory Developmental Road. The current Main Roads database, *Road Crash II*, was used for data collection and analysed to establish black spots on the link. This project uses cost of crashes by 'accident type' to establish 'critical' sections. This analysis has enabled the identification of contributing factors to these accidents and allows evaluation to possible engineering solutions with the assistance of the Austroads publication *Treatment of Crash Locations* (2004). Furthermore, the results for the GDR have been compared with two sections of the KDR. This has allowed identification to benefits gained from improved asset conditions and increased funding.

Chapter 4 Current Main Roads Practices

4.1 Regional Roads Investment Strategy

4.1.1 Introduction

The Regional Roads Investment Strategy (RRIS) aim is to provide a strong long term plan for the regional road network in Queensland. The Queensland Department of Main Roads seeks to achieve this by providing:

- An endorsed road user driven strategy to maximise benefits across the whole road network within realistic funding levels, taking account of external impacts on the wider community.

- A strong, consistent approach to standards and equity of investment across the State, and stretch the road dollar to its greatest potential.

- A network solution, and not simply an aggregation of one-off projects

(*Draft Regional Roads Investment Strategy* 2000, p. ii)

It is envisaged that compliance with these visions will produce broader consistency of roadway standard for roads categorised within its function. The goal is to improve road assets to acceptable standards and to coordinate suitable road maintenance procedures in the investment process.

4.1.2 Planning Process

The investment strategies provide the first step towards the planning process. Detailed link strategies are developed and plans for a suitable Road Implementation Program (RIP) completed.

The overall planning process is summarised below:

- The Road Network Strategy (RNS) is used to interpret community and government objectives.

- The long term (20 year) visions and objectives are defined through investment strategies.

- The prioritisation and refinement of works on individual link sections through link strategies (up to 20 years).

- Finally, a short term (1 to 5 years) program of road works projects identified in the RIP.

(Draft Regional Roads Investment Strategy 2000, p. ii*)*

Figure 4.1 shows the relationship between the above stages in the planning process.

Figure 4.1 Planning Process

4.1.3 Strategy for Rural Regional Roads

The draft of the current RRIS recommends that $3670 million over 20 years be invested into 11432 kilometres of rural regional roads in Queensland. This length of road is estimated at 35% of the total state controlled network.

- $1990 million in capital works and rehabilitation, consisting of:

  - $430 million in shoulder resealing.
  - $210 million in widening.
  - $420 million in rehabilitation.
  - $500 million in additional enhancement projects such as duplications, bridges, realignments and intersection improvements.
  - $150 million for initial construction to sealed standard.
  - $160 million for initial construction to form and pave.
  - $120 million for overtaking lanes and overtaking opportunities including the provision of sealed sections on unsealed roads.

- $770 million in routine maintenance.
- $230 million for contingency and minor works.
- $680 million in programmed maintenance.

(*Draft Regional Roads Investment Strategy* 2000, p. ii).

This funding of $3670 million will improve vision widths and surface condition across the network over a 20 year design life. Furthermore, the strategy seeks to increase overtaking opportunities and flood immunity on these road networks.

The strategy aims for all rural regional roads with traffic volumes greater than 250 vehicles per day to be sealed, with only 16% remaining below two lane width (< 6 metres) over a 20 year design life. In order to achieve this goal, more shoulder resealing is planned for 'interim seal widths' within existing formation and alignment. Main Roads' vision maintains $210 million over 20 years of formation widening to vision seal widths greater than seven metres. Interim seal widths can be defined as seal widths which are close to vision widths.

In addition, the strategy strives to increase the emphasis on programmed maintenance on these rural roads. It is planned that rehabilitation will be increased to an annual rate of 1.25% of sealed network length per year over the next 20 years to address the current backlog of poorly maintained asset conditions.

For rural regional roads with traffic volumes less than 250 vehicles per day, the aim is to provide new formation and running coarse, providing sealed sections (20% or 5 kilometres out of 25 kilometres) to enable overtaking opportunities and to implement sufficient maintenance practice to maintain improved roadway conditions. For existing single lane roads, widening is planned (10% or 2 kilometres out of 20 kilometres) to allow increased overtaking opportunities *(Draft Regional Roads Investment Strategy* 2000, p. iv*)*.

In summary, the primary aims for the regional road investment for a 20 year design period is improvements to vision widths, surface condition (roughness), overtaking opportunities and flood immunity.

4.1.4 Application of Strategy

The RRIS seeks to ensure that all significant attributes such as formation width, seal width, overtaking opportunities and roughness condition of the overall standard across the links of the network that should be achieved over the next 20 years.

It is important to note that the RRIS is strategic in nature and does not identify detailed design elements or suitable programme of works to improve asset conditions. Best use of available funding is through innovative 'engineering' solutions by utilising and improving existing asset conditions. For the GDR, the strategy uses shoulder resealing on a strengthened outer pavement to achieve eight metre seal width on an existing eight metre wide formation. This strategy can then be implemented to treat the 'critical' sections first and improve the overall asset condition.

The design detail and programme of works is formulated within the link strategies phase of the planning process. Possible asset management strategies for individual links within overall investment strategies are proposed and evaluated as well *(Draft Regional Roads Investment Strategy* 2000, p. v*)*.

4.1.5 Higher Levels of Funding

The vision assumes that future funding levels for regional roads remain constrained at current funding levels. Main Roads' philosophy is to concentrate its resources on basic improvements to achieve minimum standard across the whole network. In the event of any increased funding, this may affect the programming of works but not the standards to be achieved *(Draft Regional Roads Investment Strategy* 2000, pg vi*).*

The following issues should be considered in the event of increased funding:

- Completing the sealing program earlier on a priority basis.
- Improving vision standards on unsealed roads.
- Targeting particular deficiencies.
- Performing accelerate rehabilitation of the network.
- Attainment of medium vision on priority routes.

(*Draft Regional Roads Investment Strategy* 2000, p. vi)

Any increase in funding needs to consider the economic, social and environmental impacts that this has on the surrounding community.

4.1.6 Consultation with the Stakeholders

The Regions and Districts discuss specific link issues with stakeholders in light of the funding of investment strategies. Workshops are often held with the local community as these allow the determination of link investment factors and their relative weights for analysis of both rural and urban roads.

External stakeholders describe factors such as safety, access to essential services and industry access as the highest order priority across the state. These factors are all considered strategic in nature. Emergency access, freight efficient vehicles and environmental sustainability are considered to be satisfied by strategic factors. Stakeholders also expressed that the most common issue raised in relation to safety was the traffic composition involving heavy vehicles and tourists on narrow and poorly maintained rural roads. Finally, Benefit Cost analysis should only be considered when all the above conditions are met, only then can a decision on the investment be made *(Draft Regional Roads Investment Strategy* 2000, p. 6*).*

For rural communities who are likely to be exposed to low volume roads, suitable road width was considered more important than roughness and flood immunity. In far north Queensland, people have come to accept flooding in tropical regions and therefore believe increased road width services the community with increased safety and overtaking opportunities.

4.2 Road Implementation Program

The RIP is a budgeting and planning tool employed by the Department of Main Roads. This tool identifies projects which need to be completed over the next five years and ensures that the goals of Roads Connecting Queenslanders are met. Project funding is approved on the basis that years one and two are firm, with indicative allocations for planning purposes in years three to five (QDMR 2004). There is continual consultation with stakeholders as future RIP's are produced to attend to the most critical work for the next five year vision.

The main priority for the GDR is the widening of this link to achieve a two lane seal width as this is expected to improve the overall safety of the road. The current RIP 2003/04-2007/08 plans to establish sections of two lane overtaking opportunity at regular intervals of approximately 20 kilometres. These overtaking opportunities are only relatively short (approximately 1 kilometre in length) and are not sufficient to allow passing of road trains. Individual improvement projects to the current asset condition have been identified and prioritised to ensure an alliance with the RRIS. These projects are summarised in Appendix E. In addition, the estimated costs of these improvements have been determined using quantitative and qualitative information of the proposed strategy improvements.

4.2.1 Existing Projects (RIP 2003/04 – 2007/08)

The current RIP 2003/04–2007/08 for the GDR can be seen in Table 4.1

.

Project Number	Description Work	Chainage	Indicative Timing	Estimated Cost
42/98C/306	Widening sections of existing pavement at Gray Creek (1.9km length) and East Paddy Creek (3.9km length).	201.2km - 203.1km and 220.2km – 224.1km	Early 2004	$ 1,500,000
42/98C/900	Miscellaneous works allowance, unspecified. Dalrymple Shire Boundary to Urdera Road (2.1km length).	6.8km - 8.9km	2003 - 2004	$ 40,000
42/98C/310	Widening and sealing variousm sections between Charters Towers and Hervey's Range Developmental Road.	Various unspecified	2004 – 2006	$ 2,737,000
42/98C/311	Widening and sealing various sections between Hervey's Range Developmental Road and the District boundary.	Various unspecified	2005 - 2007	$ 7,000,000
		TOTAL		**$11,277,000**

Table 4.1 RIP 2003/04 – 2007/08 Planned Projects

4.3 The Gregory Developmental Road and the RRIS

The aim of the strategy employed by the consultant is to link with the visions of the RRIS. The current emphasis has been directed at increasing pavement width to a Main Roads vision standard, reducing roughness and providing suitable overtaking opportunities. As the GDR is located in the tropics, flood immunity has been considered in the Maunsell strategy but with a view to only reducing its impact. The three primary goals of increased seal width, formation width and overtaking outlined by the RRIS and stakeholders will most likely be achieved by implementation of the consultant's strategy.

Chapter 5 Road Crash Background

5.1 What is a Road Crash?

The road traffic system is described as containing the interaction of three components, namely:

- the human;
- the vehicle; and
- the road.

A break down in the traffic system by one of these components can lead to a crash or accident. The UK Department of Transport (1986) defines an accident as 'rare, random, multifactor event always preceded by a situation in which one or more persons have failed to cope with their environment' (Treatment of Crash Locations 2004, p. 10).

The Venn diagram (RTANSW 1996) shown in Figure 5.1 illustrates the interaction and importance of these factors which contribute to road crashes:

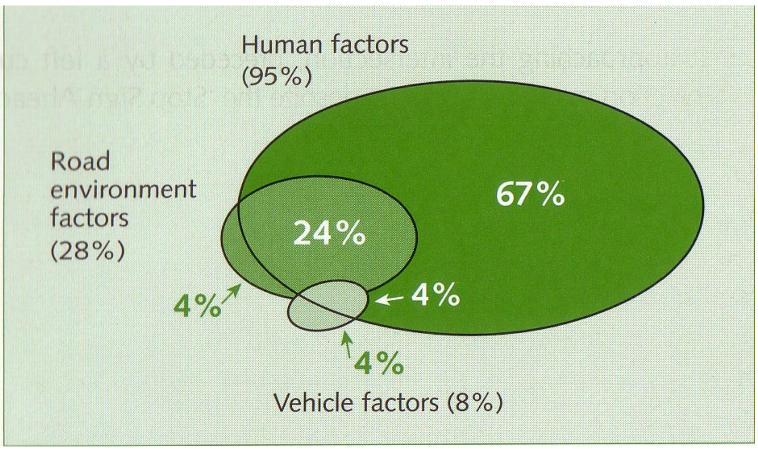


Figure 5.1 Three Factors Which Contribute to Road Crashes

It can be seen that human factors have the highest contribution to accidents. Austroads expresses that even if this is the case, ‘it is very often more effective to apply road safety engineering treatments to the road environment, so that the interaction of human factors and road environment factors is modified than address human factors directly’ (Treatment of Crash Locations 2004, p.10). This is because it is considered easier to change road environment which affects human behaviour, rather than attempting to change the behaviour of drivers.

5.2 Components of the Traffic System

5.2.1 The Road User

When designing roads engineers need to have an understanding of the human performance, capabilities and behaviour of the road user. The aim is to provide a network environment for the road user which allows good decisions to be made in the traffic system.

Information processing is essential in allowing the road user to make correct decisions whilst on the network. Austroads describes driving as having three essential tasks:

- **navigation:** trip planning and route following;
- **guidance:** following the road and maintaining a safe path in response to traffic conditions; and
- **control:** steering and speed control.

These tasks require the driver to:

- receive inputs (most of which are visual);
- process the inputs;
- make predictions about alternative actions;
- decide which is the most appropriate alternative actions;
- execute the actions; and
- observe their effects through the reception and processing of new information.

(Treatment of Crash Locations 2004, p. 13).

Engineers need to design roads which allow visual information to be processed by the driver easily. This can be achieved by providing a ‘suitable layout of the road and the features which are designed into the road’ (Treatment of Crash Locations 2004, p. 15).

Austroads describes ‘about 90 percent of the information used by the driver is visual (Lay 1986, p. 321) and ‘vision is the only way information from traffic signs, signals, pavement markings and delineation devices gets to the driver’ (Treatment of Crash Locations 2004, p. 16).

5.2.2 The Vehicle

When designing rural roads it is important to consider the likely traffic composition, as this can affect manoeuvrability, visibility, cornering and braking. Manoeuvrability considers the vehicle's dimensions and mass. Visibility of the road is 'dependent on the vehicle design as well as the road design, positioning of road furniture etc' (Gardner 1996, p. 22).

5.2.3 The Road Environment

To provide a safe road environment the design needs to consider the limitations of human decision making. The road environment must be suitable for users of all driving abilities and not place greater demands than expected on the driver.

Austroads describes a safe road as one which is designed and managed so that it:

- warns the driver of any substandard or unusual feature;
- informs the driver of conditions to be encountered;
- guides the driver through unusual sections;
- controls the driver's passage through conflict points or conflict sections; and
- forgives a driver's errant or inappropriate behaviour.

It should:

- provide no surprises in road design or traffic control (the design matches expectation);

- provide controlled release of relevant information (the design matches information processing abilities); and

- provide repeated information, where pertinent, to emphasise danger.

(Treatment of Crash Locations 2004, p. 19)

It is important to understand that if a road is ‘built to standard’ it does not necessarily provide a safe road environment. Therefore, it is essential that the design and safety standards for a road environment are integrated to establish a safe route for traffic.

5.3 What is Road Crash II?

Road Crash II is an information database maintained by the Queensland Department of Main Roads. Information of the current asset and traffic conditions is regularly updated. Asset condition data includes rutting, roughness, cracking, seal width and construction performed along sections of road. Traffic data provides the average annual daily traffic (AADT), trends in traffic flow and traffic composition.

For this project, *Road Crash II* provides information of accidents on low volume roads in North Queensland. An accident number is assigned to each accident location along the link.

For Example:

Road Crash: 20010026545
The first four digits indicate the year: 2001
The last 5 digits show the accident number: 26545

Detailed Crash Summary reports can be used to provide more extensive information of the road crash in interest. In particular these reports show:

- The vehicles involved and their direction of travel.
- The current road conditions.
- The time and location of the crash.
- Police reports detailing the contributing factors and violations.
- A DCA Code for the accident location.

An accident DCA Code represents the road user movement which most likely contributed to the road accident. It can be seen in Appendix G that the codes are grouped according to similar factors. For example, first ‘00’ column shows accidents involving pedestrians, whilst column ‘80’ shows accidents caused by vehicles moving off the path on curve. These DCA codes were used in my project to identify any patterns in accident types and their likely contributing factors.

Chapter 6 Research Methodology

6.1 Step 1 – Gather Accident Data from Road Crash II Database.

The Northern, Peninsula and North Western Main Roads District Offices were contacted and road crash data was requested for three low volume roads in North Queensland. These roads were the Gregory (98C) and the Kennedy (99B, 99C) Developmental Roads. I have chosen these roads as they have similar asset and traffic attributes. In particular, the Gregory (98C) and Kennedy (99C) roads have low volumes of traffic with varying bitumen seal width along the link. The Kennedy (99B) is also a low volume road but has very limited sections of bitumen seal. 99B has been useful in comparing accident rates and their corresponding severities with the varying seal widths of links 98C and 99C.

The output received from *Road Crash II* database provided a graphical comparison from 1991 to 2003 of:

- Construction performed;
- Accident number and location;
- Seal width; and
- AADT.

I have chosen to analyse the period of 1991 – 2003 as there were only records / data of limited quantities of crash details for low volume roads in North Queensland.

6.2 Step 2 – Identify the Crash Locations

6.2.1 Define the Locations

Only sections with low volume traffic and narrow pavement width were considered for crash location treatment of each link. For the GDR (98C), analysis was only considered between chainage 8 to 259 kilometres as the first eight kilometres from Charters Towers was interpreted as high traffic volume with constant pavement width of eight metres. For the KDR, 99B and 99C were analysed for the entire link (chainage 0 to – 214 kilometres) and between chainage 1.5 to 260 kilometres respectively.

6.2.2 Decide on the Time Period

Austroads recommends a time period of five years as this usually provides statistically reliable accident data for the link being considered. Due to low volumes of accident data available for all three links, I have made the assumption to use accident data for the past 13 years (1991 – 2003). I have also considered that due to minimal construction undertaken over the study period, traffic conditions would be reasonably consistent over the time period. The consultant's report outlines that traffic growth over the past five years has not steadily increased and that it is not anticipated to increase greatly even with the consideration of greater use by tourists in the future. Therefore, I have assumed that using the past 13 years will provide a suitable analysis period for these links.

6.2.3 Criteria for Selecting Locations to Investigate for Treatment

These narrow sections were then divided into 10 kilometre blocks in an attempt to identify black spot locations. This assumption was made as only low quantities of accident data were available for such long stretches of pavement for the GDR and KDR. This restricted more specific identification of critical sections. The following procedure was used to determine the most critical sections requiring remedial treatment:

- Apply the cost of crashes by 'accident type' to all accidents within the 10 kilometre block with low volume traffic and narrow pavement width.

- Calculate the accidents per kilometre within the 10 kilometre block.

'Critical' 10 kilometre sections were then established based on cost of crashes by 'accident type', followed by accidents per kilometre.

In addition, detailed crash summaries were requested from the *Road Crash II* database for critical sections along each link. This was used to consider the contributing factors causing these accidents and allow determination of suitable remedial works in the future. Copies of these crash summaries are provided in Appendix H.

6.3 Step 3 – Diagnosing the Crash Problems

6.3.1 The Process of Diagnosis

This step considers the possible road environment factors which may have led to the accident and, therefore, the design of suitable countermeasures for these incidents. All data obtained in Step 2 was then organised into a format which allowed analysis and comparisons between each of the 10 kilometre sections and each of the roads. In addition, a site inspection was conducted in January 2004 and pictures taken of current asset conditions and black spots along the GDR.

These pictures can be viewed in Appendix I. The KDR 99B and 99C were not inspected visually.

6.3.2 Analyse the Data for Clustering and Common Factors

To identify any clustering of accident-type or other common factors, Austroads recommends the following presentations:

- Construct a factor matrix for each ‘critical’ ten kilometre section.
- Draw collision diagram from the descriptions provided from *Road Crash II*.
- Produce a histogram of DCA Code sub-groups for the entire link.

6.3.2.1 Factor Matrix

The *Road Crash II* data was then placed into a format called a ‘factor matrix’. This table allows the combination of the DCA code and ‘key direction’ to be analysed in conjunction with accident attributes. Furthermore, this table allows a visual check for the following accident issues:

- The number of accidents in any particular year.
- The identification of common directions of vehicle travel.
- The particular types of road users involved in accidents.
- The condition of the road surface.

- The high frequency of accidents on any particular day.

Another table was then constructed outlining the common contributing factors for each accident identified in the road crash summary reports. These tables can be found in Appendix K, L and M. Trends within these factors were also considered for future remedial treatment.

6.3.2.2 Collision Diagram

A collision diagram has not been drawn for each accident as the detailed crash summary reports provide enough information for analysis of the 10 kilometre blocks along the links. No collision diagrams were available from authorities as the only ones available were of fatalities and therefore off limits.

6.3.2.3 Frequency Histogram of DCA Code sub-groups

As discussed earlier, DCA codes describe the vehicle movements which have been involved in accidents. Following the Austroads guidelines 'Dominant DCA types often provide the most reliable guide to the remedial action, since they are likely to be indicative of the future crash patterns at the site, if it is not treated' (Treatment of Crash Locations 2003, p. 51). Therefore, DCA codes were grouped according to their DCA Code Sub-groups as this will assist in identifying common contributing factors. Further reference was then made with the detailed crash report.

6.3.3 Finalise the Assessment and Draw Conclusions

Conclusions were then made about the most pertinent factors causing accidents for the given volume of traffic and pavement. These were used in the next section: Selecting the Countermeasures.

6.4 Step 4 – Selecting the Countermeasures

The aim of the countermeasure is to reduce the number of accidents at the black spot locations determined in Step 2. Countermeasures were selected based on the underlying contributing factors determined in Step 3. An Austroads publication, *Treatment of Road Crash Locations*, was used to identify suitable remedial measures for common contributing factors. Considerations were made from the following Austroads recommendations:

- Select a solution and ensure the adopted countermeasure is suitable for all aspects.

- Ensure the remedial treatment is economically viable.

6.5 Step 5 – Designing a Safe Remedial Treatment

Using Step 4, suggestions for remedial treatment were provided by the Austroads manual, *Treatment of Crash Locations*. These solutions aim to satisfy the goals of reducing accident rates and their severities.

6.6 Step 6 – Justifying the Expenditure

6.6.1 Conduct an Economic Appraisal

The following steps were undertaken to establish the justification for remedial works determined in Step 5:

- Identify and calculate all benefits and costs for the remedial treatment.

- ‘Reduce’ all future benefits and costs to their present day values using standard present value approaches based on compound interest.

- Compare the present day values of benefits and costs according to an explicit decision criterion (Austroads 2004).

It was assumed that all net present value calculations are calculated for the design life of 20 years for the Gregory Developmental Road.

6.6.2 Identify the Costs and Benefits

For this analysis the only costs considered were the initial capital cost only. Benefits were established for each remedial treatment. It was anticipated that the investment will provide savings in crash costs and a reduction in the number and severity of crashes. The assumed appraisal period is to be 20 years.

6.6.3 Determine value for Costs and Benefits

The next step applied the Austroads recommended method of ‘using information about percentage effectiveness of particular treatments in reducing particular accident types, to estimate the effect of the proposed treatment’ (Treatment of Crash Locations 2004, p. 89). The effectiveness of countermeasures can be found Appendix J. The reduction in crash costs by accident type for each included accident was then calculated. This allows the calculation of the crash reduction benefit per year for the treatment.

Estimation from consultant’s strategy for maintenance costs were deducted from the annual benefit to give the net annual benefit. For the analysis, I made the assumption that maintenance and other agency (Main Roads cost) are similar for the other options. However, the analysis has not considered user costs other than cost of crashes.

6.6.4 Reducing all Future Benefits and Costs to their Present Day Value

To perform discounting, future dollar amounts are reduced to present day values. I have used a common discounting rate of 7 percent as this is recommended by Austroads and is commonly used in government analysis. I have also applied a discounting rate of 5 percent as I have assumed that this be more reasonable as it takes inflation into account. Using the net annual benefits, present worth factors were used to determine net present value over an appraisal period of 20 years.

6.6.5 Select a Decision Criterion

I have used the Net Present Value (NPV) and the Benefit/cost ratio (BCR) as a method for justifying expenditure for works along the link.

6.6.5.1 Net Present Value

The NPV was calculated by subtracting the present value of costs from the present value of benefits. A positive NPV indicates a treatment which is economic and beneficial to the community.

6.6.5.2 Benefit / Cost Ratio

This is calculated by dividing the benefits by the costs.

6.7 Step 7 – Conduct Sensitivity Tests

As there are many assumptions made during the accident analysis, Austroads recommends a range of accident reduction percentages be applied and assessed for each 10 kilometre section. By using accident reduction percentage values both higher and lower than original Austroads estimates, further assessment was can be undertaken into the likely benefits gained and the validity of corresponding assumptions. Due to the results of the original accident percentage savings indicating a BCR considerably less than 1 (<<1) and a negative NPV, this step was not undertaken.

6.8 Step 8- Present the Results

The above results are presented in Chapter 7 and include detailed summaries of the findings from the above procedure.

Chapter 7 Results

7.1 Introduction

This project concentrates on investigating accident data for sections of narrow pavement and low volume traffic. The following roads were investigated from the North Queensland Region:

- Gregory Developmental Road (98C)
- Kennedy Developmental Road (99B)
- Kennedy Developmental Road (99C)

The *Road Crash II* data for each of these roads can be viewed in Appendix L,M and N. The output from *Road Crash II* illustrates the job details and completion dates of all works. Accidents are shown with a coloured circle and their positions along the link can be located using chainages along the horizontal axis. All these accidents contain a corresponding crash number which is used to further analyse the crash situation. These graphs allow an easy interpretation of accident locations on narrow sections for 98C, 99B and 99C. Due to minimal works being completed on these roads, the accident were analysed over the whole data capture period of 13 years.

7.2 Establishing the Critical Sections for Treatment

All accidents occurring on narrow sections of pavement were then split up into 10 kilometre blocks. To achieve this, estimated costs per crash by 'accident type' were applied to each DCA Code Sub-group. These tables are tables are illustrated in Appendix K,L and M. The DCA Code Sub-group, the DCA codes, their descriptions and their corresponding estimated cost per crash can be seen in Appendix N.

Figure 7.1 shows the scatter graph for each cost of crash by 'accident type' that were plotted to allow establishment of the critical sections. The GDR (98C) is illustrated below:

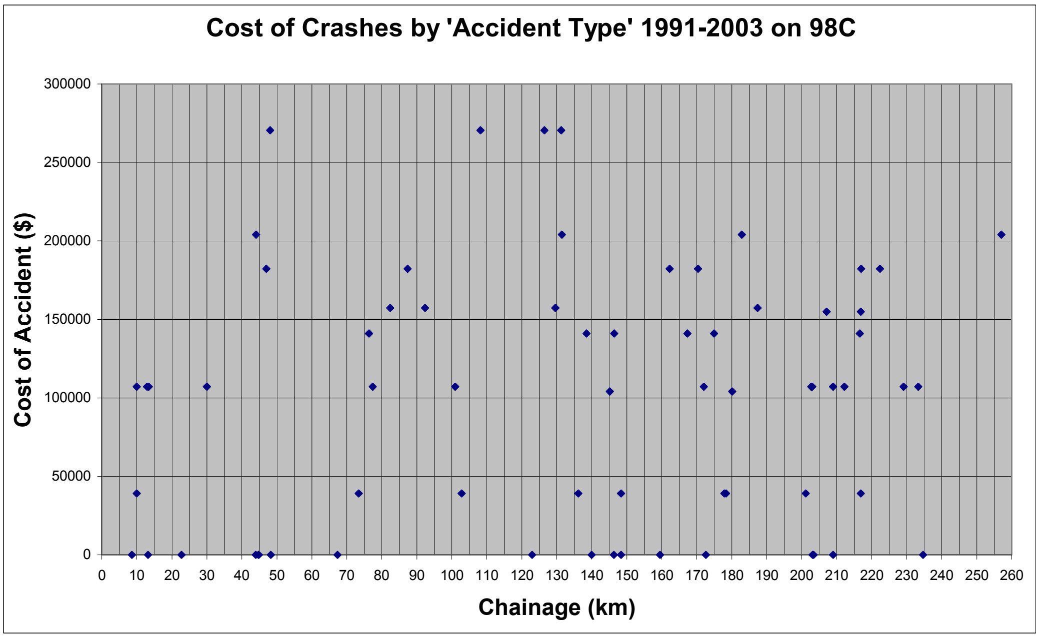


Figure 7.1 Cost of Crashes by 'accident type' (98C)

In addition, Figure 7.2 shows a cumulative cost of crashes for each 10 kilometre section. This bar graph allows easier interpretation for determining 'critical' sections on the GDR.

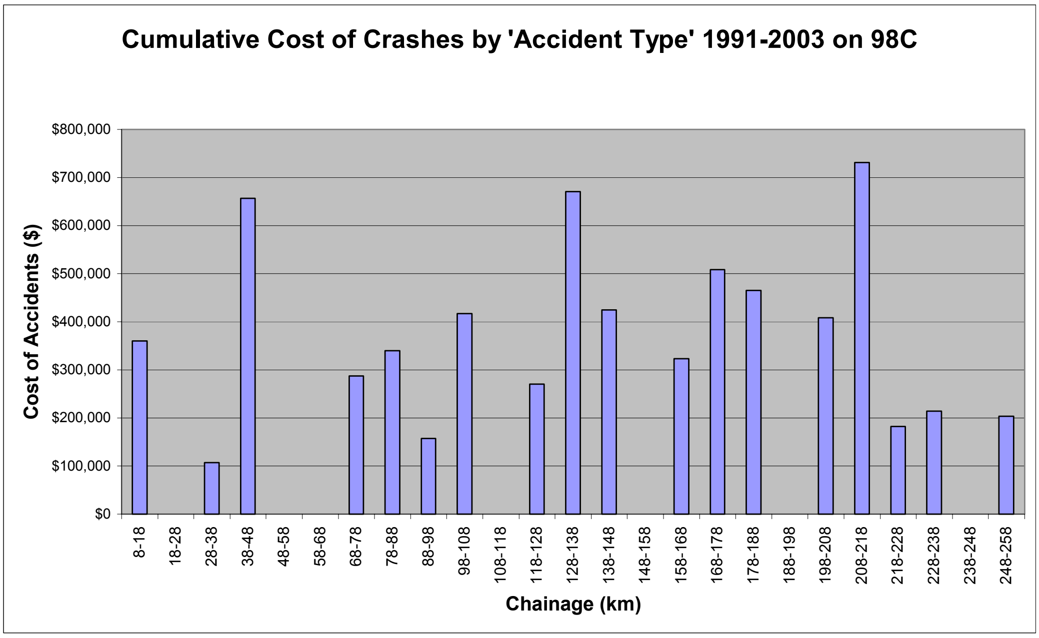


Figure 7.2 Cumulative Cost of Crashes by 'accident type' (98C)

Figure 7.3 portrays the scatter graph for each cost of crash by 'accident type' for the KDR (99B).

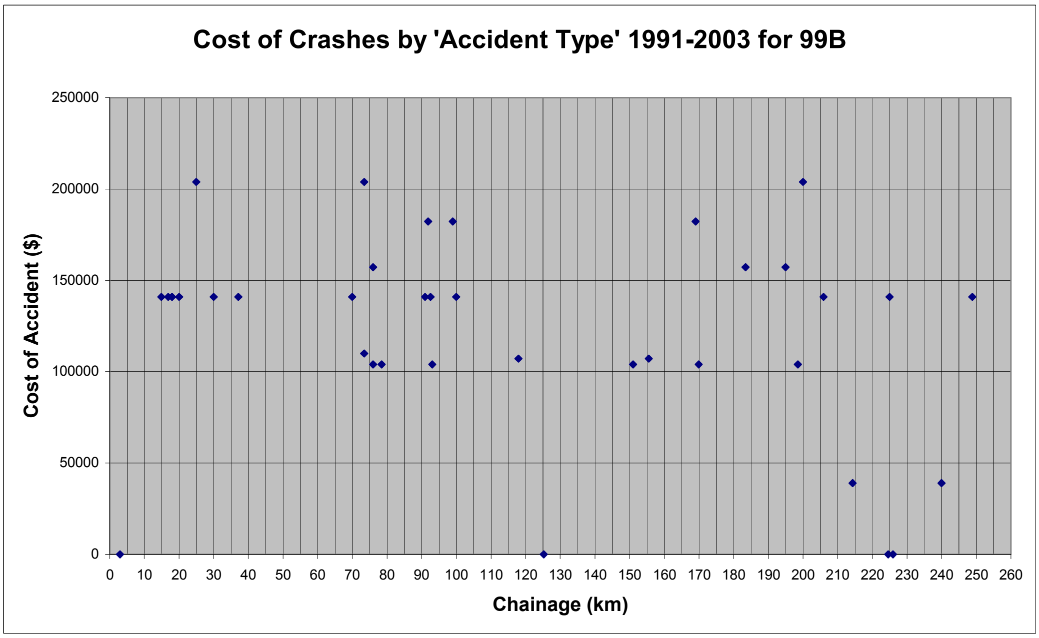


Figure 7.3 Cost of Crashes by 'accident type' (99B)

Figure 7.4 shows the cumulative cost of crashes for each 10 kilometre section on the KDR (99B).

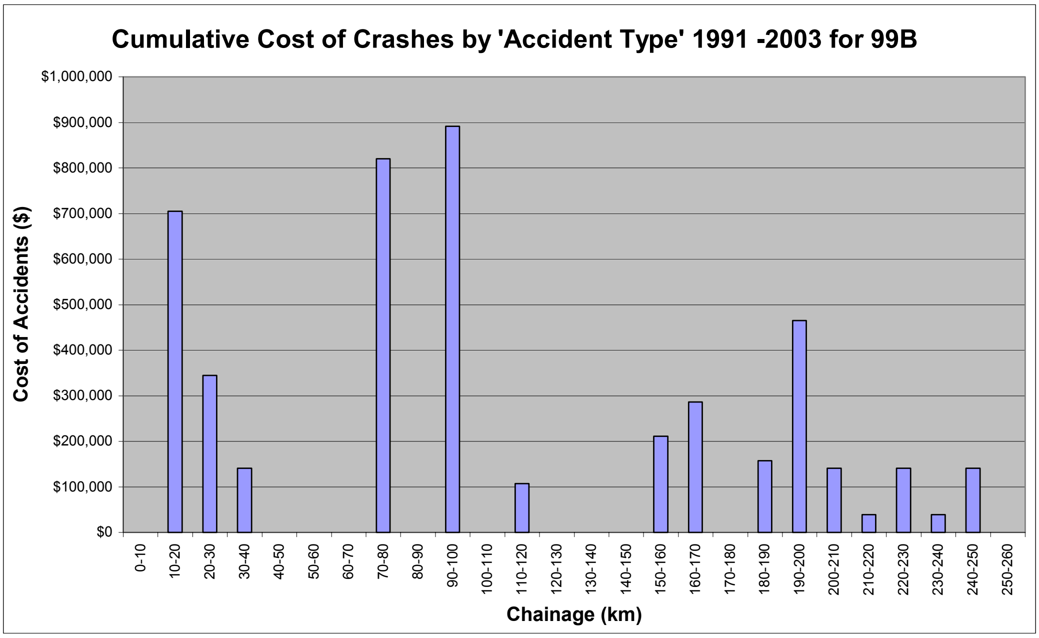


Figure 7.4 Cumulative Cost of Crashes by 'accident type' (99B)

Finally, a scatter graph for the cost of crash by 'accident type' was produced for another section of the Kennedy Developmental Road (99C). This graph can be seen in Figure 7.5.

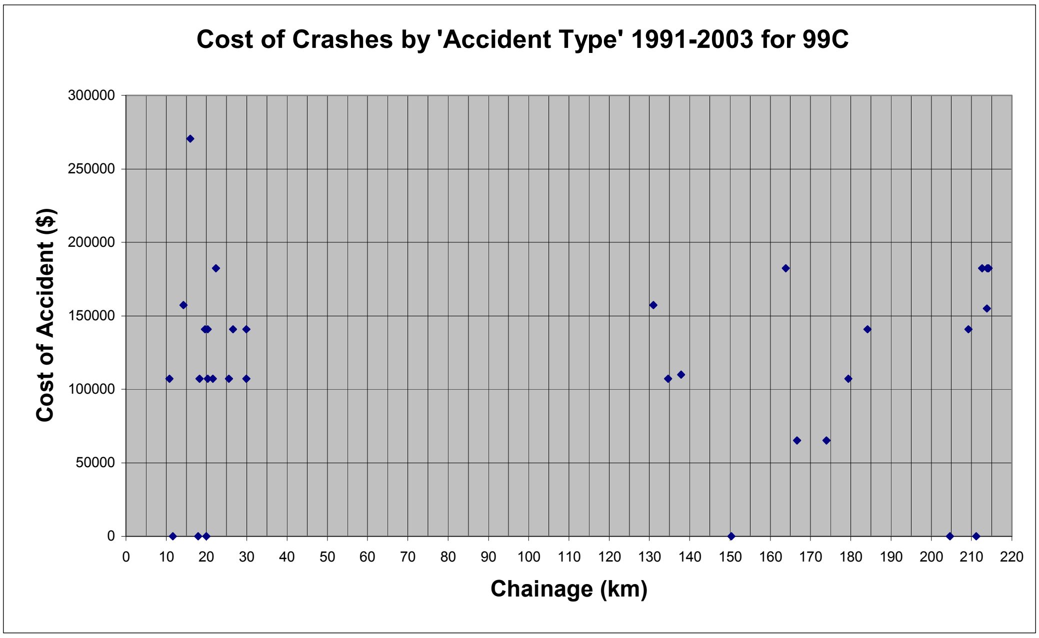


Figure 7.5 Cost of Crashes by 'accident type' (99C)

Figure 7.6 shows the cumulative cost of crashes for each ten kilometre section for the KDR (99C).

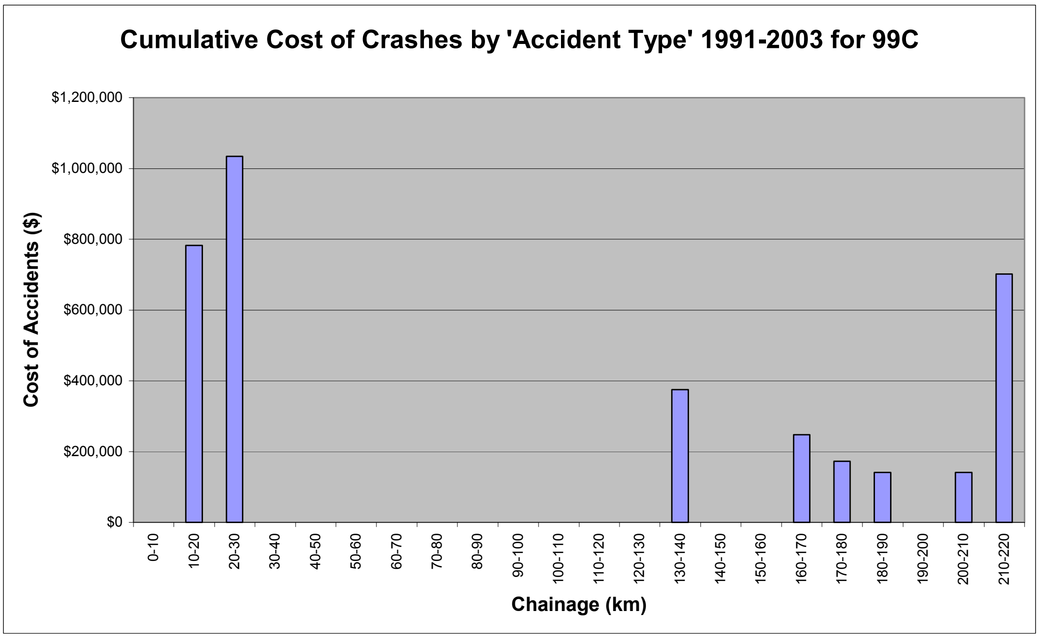


Figure 7.6 Cumulative Cost of Crashes by 'accident type' (99C)

A detailed summary of the cumulative cost of crashes by 'accident type' for each developmental road can be found in Appendix K, L and M. In addition, these summaries calculated the accidents per kilometre for both the entire 10 kilometre section and for the proportion of narrow lengths within the 10 kilometre section. This has provided an indication for sections with the highest accident per kilometre ratio. The highest accidents per kilometre sections correlated directly with the highest cumulative cost of crashes for each 'critical' 10 kilometre section. The following sections were termed 'critical' and considered highest priority for upgrades in the future:

Gregory Developmental Road (98C)

- Section 1: CH 38 – 48
- Section 2: CH 128 – 138
- Section 3: CH 208 – 218

Kennedy Developmental Road (99B)

- Section 1: CH 10 – 20
- Section 2: CH 70 – 80
- Section 3: CH 90 – 100

Kennedy Developmental Road (99C)

- Section 1: CH 10 – 20

7.3 Determining the Contributing Factors

To establish the most common contributing factors for causes of accidents on both the GDR and KDR, the following two presentations were made:

1. Construction of a factor matrix for each ‘critical’ 10 kilometre section.

2. Creation of a DCA Code Sub-group histogram for all accidents occurring on narrow pavements for the entire length.

The factor matrixes for each 10 kilometre section deemed ‘critical’ and of highest priority for the GDR and KDR can be found in Appendix K, L and M.

A brief summary of the results obtained from these factor matrixes are as follows:

Road: Gregory Developmental Road (98C)

Section 1: CH 38 – 48

- The accidents are scattered over numerous years.

- Crashes involve a variety of vehicles.

- Accidents which are related to the road environment are primarily single vehicle accidents, ‘run off the road’ type crashes.

- More than half of the accidents occurred in the day time with 87% occurring on a weekday.

- There was no correlation between the contributing factors for this section.

Section 2: CH 118 – 128

- All accidents have occurred over the past eight years.
- Three out of five accidents were single vehicle, 'run of the road' type accidents.
- A wide variety of contributing factors influenced these accidents.
- MORE INFO TO GO IN HERE

Section 3: CH 208 – 218

- A majority of accidents were single vehicle, 'run off the road' type accidents.
- Half the road users involved in accidents were cars, whilst the other half, were a combination of road trains, trucks and vans.
- Accidents were scattered over the 13 year analysis period.
- A majority of accidents occurred during day time.
- All accidents occurred on a weekday.
- The factor matrix shows a wide variety of contributing factors which could be related to the driver itself, the road environment or the vehicle.

The histogram seen in Figure 7.7 indicates the distribution of DCA Code Sub-groups for the entire link of the Gregory Developmental Road (98C).

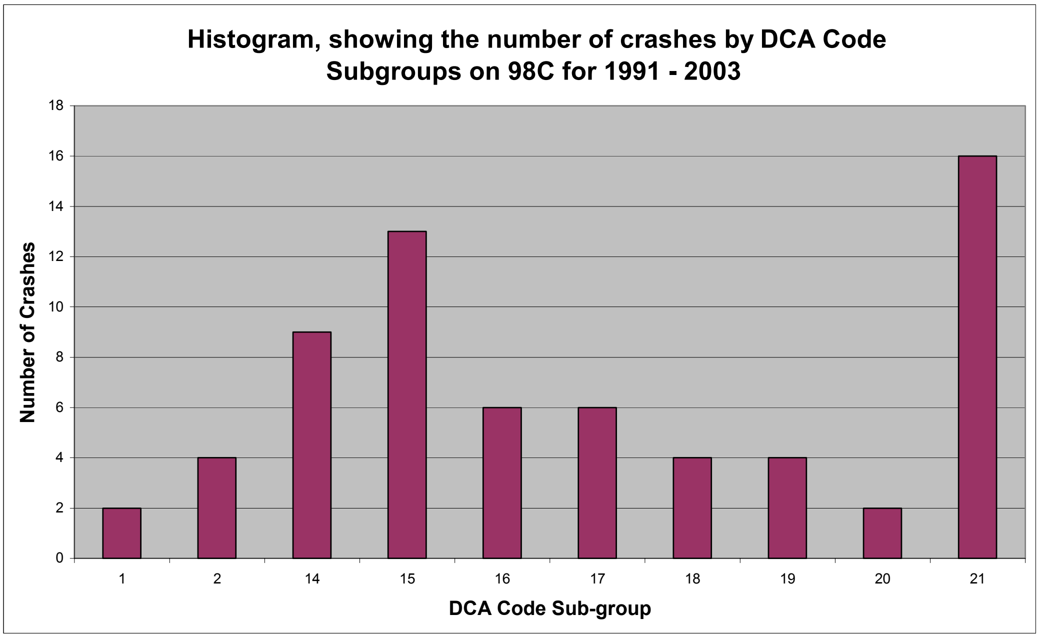


Figure 7.7 Gregory Developmental Road DCA Histogram

This distribution confirms that the highest proportion of accidents were 'run off the road' type accidents. Appendix G illustrates the DCA Code Diagram used to describe 'run off the road' type accidents. A description of the DCA Code Sub-groups 15, 16, 17, 18, 19 and 20 can be seen in Appendix N. For remedial treatment, the engineer needs to consider why such a high proportion of accidents are caused by vehicles 'running off the road' pavement. Furthermore, investigation into the contributing factors is needed as it allows an understanding of what road environment improvements are needed in the future.

Table 7.1 shows the number of accidents and percentage of DCA Code Sub-groups for the entire link of 98C over 13 years of analysis:

DCA Code Group	DCA Codes	Number of Accidents	Percentage (%)
1	100 - 109	2	3%
2	201, 501	4	6%
15	502, 701, 702,	13	20%
	706, 707		
14	609, 905	9	14%
16	703, 704	6	9%
17	705	6	9%
18	801, 802	4	6%
19	803, 804	4	6%
20	805	2	3%
21	400, 500, 607, 610,	16	24%
	700, 800, 900		
		66	100%

Table 7.1 DCA Code Sub-groups for GDR (98C)

This can be more easily interpreted with the pie graph shown in Figure 7.8:

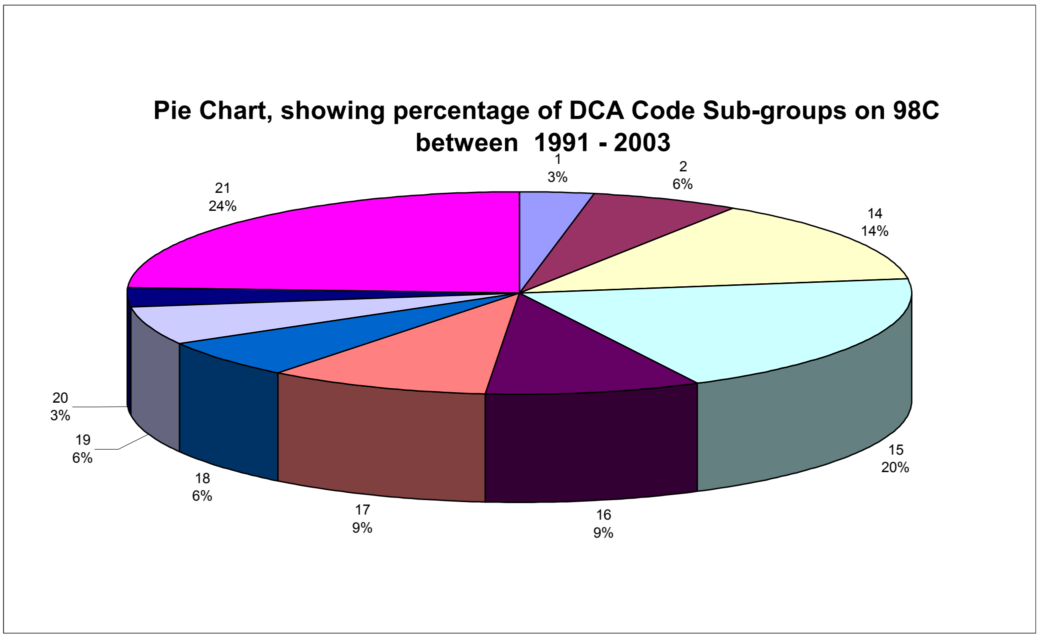


Figure 7.8 Percentages of DCA Code Sub-groups for GDR (98C)

Kennedy Developmental Road (99B)

Section 1: CH 10 – 20

- All accidents were related to ‘run off the road’ type crashes.
- All accidents have occurred over the past five years.
- The vehicles involved in accidents were road trains, vans and trucks.
- A high majority of accidents occurred in the day time and on a weekday.
- The most pertinent contributing factor was the wet / slippery road conditions.

Section 2: CH 70 – 80

- The majority of accidents were single vehicle, ‘run off the road’ type accidents.
- A high proportion of cars were involved in the accidents.
- All accidents occurred in day time and on a weekday.
- Half the accidents were related to gravel / dirt and rough surface on the unsealed road.

Section 3: CH 90 – 100

All accidents occurred over the past five years and were single vehicle crashes, with ‘run off the road’ type accidents being most common.

- Two thirds of the road users involved in accidents were vans. The remaining one third involved cars.

- All accidents occurred in day time and are evenly distributed between the week days and weekends.

- A wide variety of factors have contributed to these accidents. Half were caused by tyre blowouts.

The histogram in Figure 7.9 indicates the distribution of DCA Code Sub-groups for the KDR (99B).

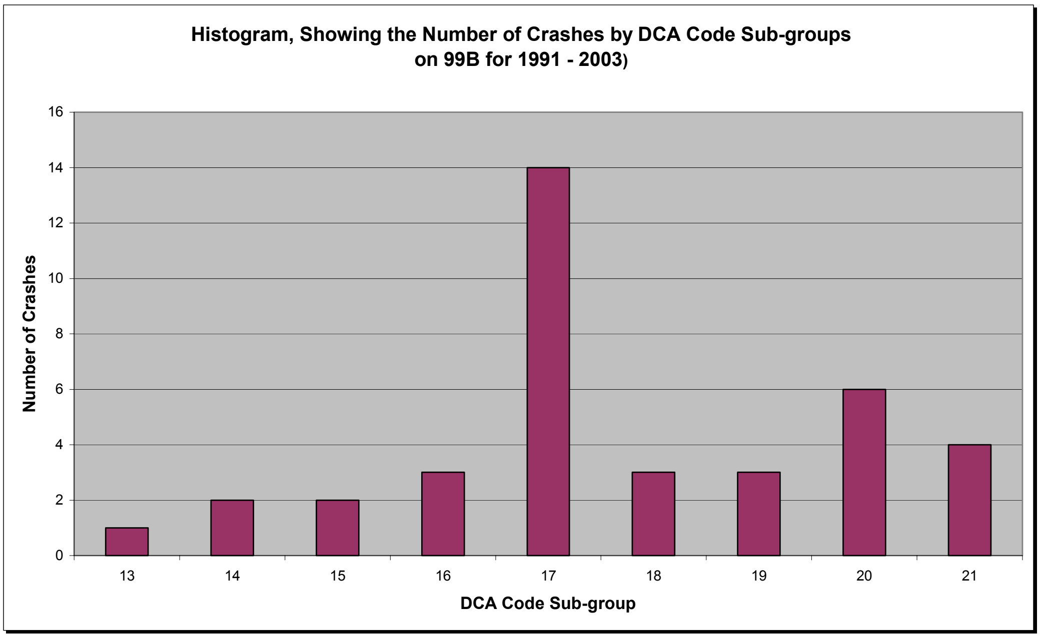


Figure 7.9 Kennedy Developmental Road DCA Histogram

The graph indicates that ‘run off the road’ type DCA Code Sub-groups were the highest proportion of accidents. DCA Code Sub-group 17 had the highest number of crashes. This accident is described as ‘out of control, on straight’.

Table 7.2 shows the number of accidents and percentage of DCA Code Sub-groups for the entire link of 99B over 13 years of analysis:

DCA Code Group	DCA Codes	Number of Accidents	Percentage
13	605	1	3%
14	609, 905	2	5%
15	502, 701, 702,	2	5%
	706, 707		
16	703, 704	3	8%
17	705	14	36%
18	801, 802	3	8%
19	803, 804	3	8%
20	805	6	16%
21	400, 500, 600, 607,	4	11%
	610, 700, 800, 900	38	100%

Table 7.2 DCA Code Sub-groups for KDR (99B)

This can be more easily interpreted with the pie shown in Figure 7.10.

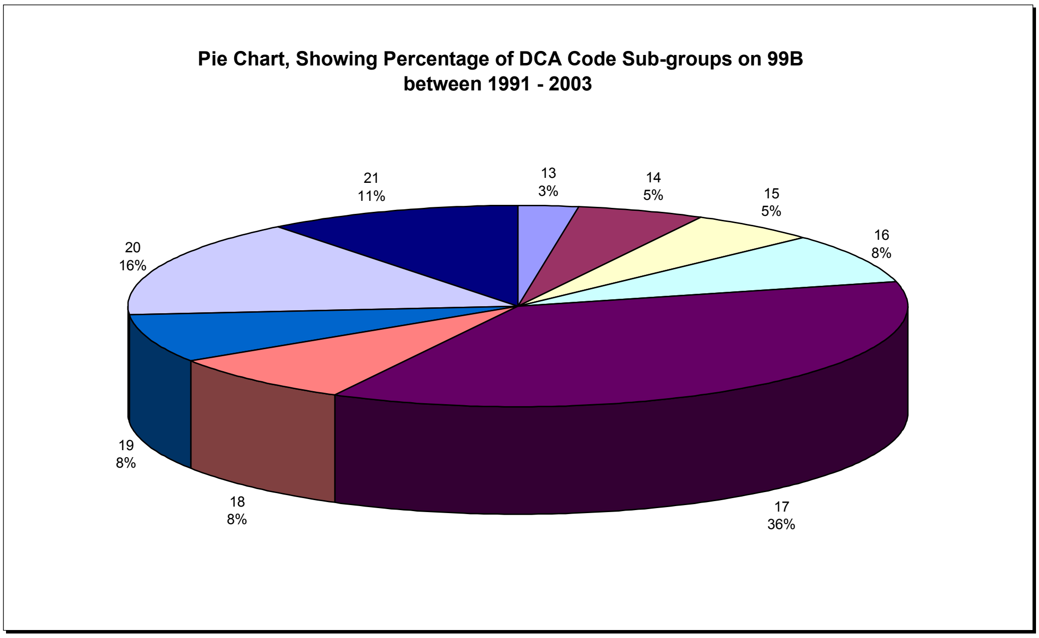


Figure 7.10 Percentages of DCA Code Sub-groups for KDR (99B)

The pie chart shows that 36% of accidents on the Kennedy Developmental Road (99B) were represented by DCA Code Sub-group 17. Appendix N shows that DCA Code 705 is the only vehicle movement represented within this Sub-group. These findings indicate that the most common accident movement on this unsealed pavement was ‘out of control on straight’.

Road: Kennedy Developmental Road (99C)

Section 1: CH 10 – 20

- Over half the accidents were involved in ‘run off the road’ type accidents.
- Accidents were spread over the 13 year analysis period.
- The most common road users involved in accidents were cars.
- All accidents occurred in the day time.
- Nearly half of the accidents occurred in wet conditions.
- Most accidents occurred on a weekday.
- The majority of contributing factors were related to road conditions such as roughness, gravel / dirt and wet / slippery pavements.

The histogram as seen in Figure 7.11 indicates the distribution of DCA Code Sub-groups for the entire link of the KDR (99C).

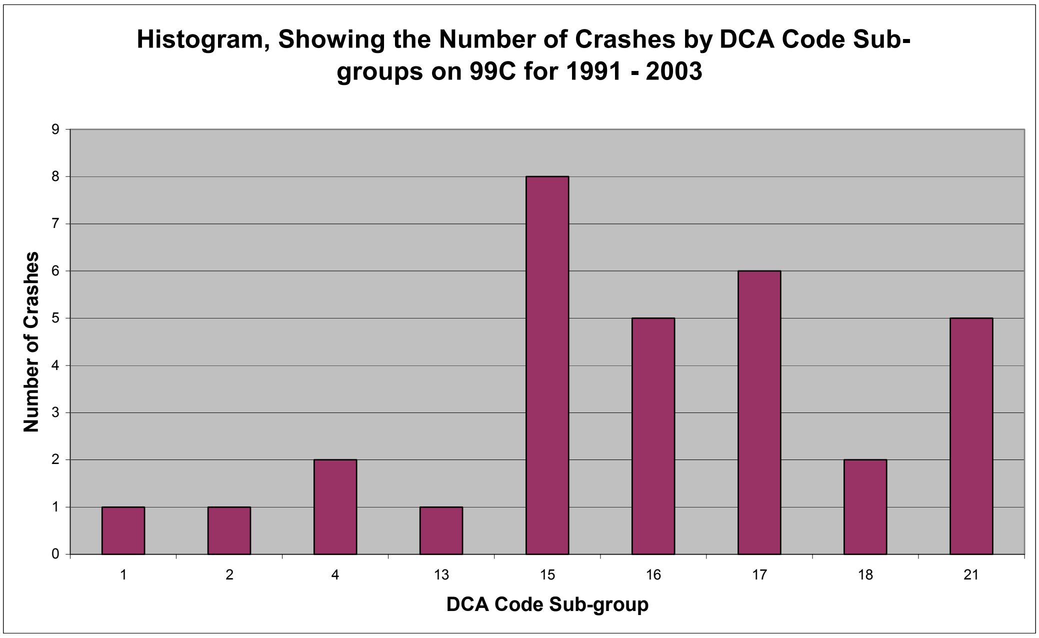


Figure 7.11 Kennedy Developmental Road DCA Histogram

The highest number of accidents correlated with DCA Code Sub-group 15. A high proportion of DCA codes within this Sub-group were described as vehicle 'off carriageway, on straight'.

Table 7.3 shows the number of accidents and percentage of DCA Code Groups for the entire link over a 13 year analysis period:

DCA Code Group	DCA Codes	Number of Accidents	Percentage (%)
1	100 - 109	1	3%
2	201, 501	1	3%
4	301 - 303	2	6%
13	605	1	3%
15	502, 701, 702,	8	26%
	706, 707		
16	703, 704	5	16%
17	705	6	19%
18	801, 802	2	6%
21	400, 500, 607, 610,	5	16%
	700, 800, 900		
		31	100%

Table 7.3 DCA Code Sub-groups for KDR (99C)

This can be more easily interpreted with the pie graph shown in Figure 7.12:

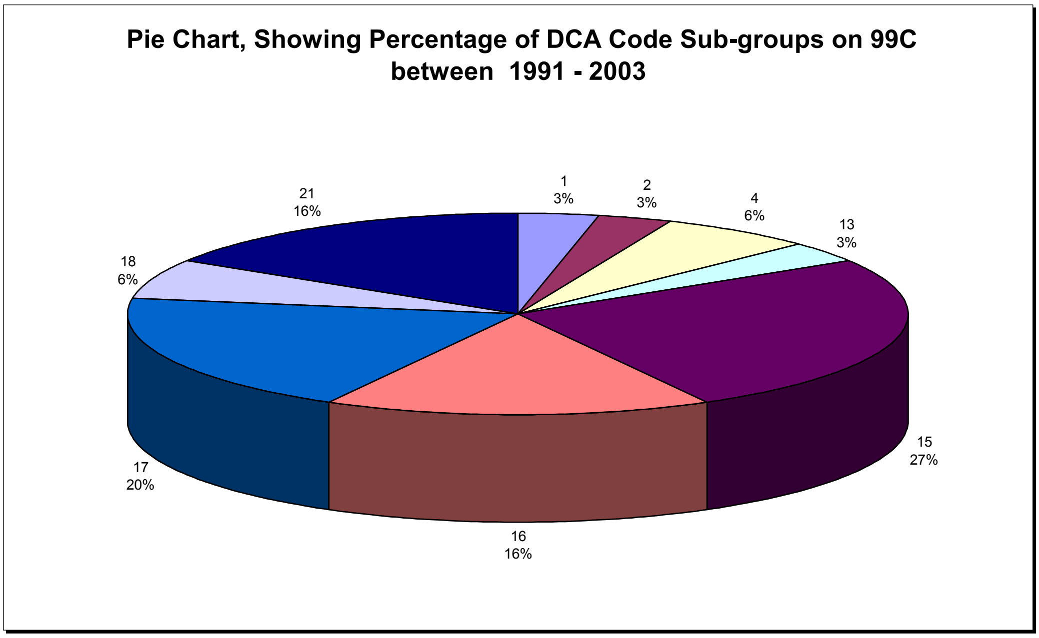


Figure 7.12 Percentages of DCA Code Sub-groups for KDR (99C)

The pie chart illustrates that 69% of DCA Code Sub-groups are related to 'run off the road' type accidents.

In summary, it can be seen that there are a high number of single vehicle crashes on these narrow sections. In general, the crash summaries describe single vehicles running off the carriageway on narrow pavements. All these incidents can be termed as 'run off the road' type accidents. The data indicates a high percentage of the road users involved in these accidents were cars. Only a low number of accidents occurred with road trains, trucks and vans within these critical sections. The contributing factors are difficult to assess, but it can be anticipated that these trends in driver violations will continue to occur in the future, but changes to the road environment could curb the accident potential caused by poor asset conditions.

The following points outlined by Austroads (Treatment of Crash Locations 2004) describe possible contributing factors for 'run off the road' type accidents:

- The current asset has narrow lanes or narrow seal.
- The severity of curve cannot be judged.
- The edge of road is not evident.
- The gravel shoulders do not allow recovery and control.
- The alignment of road is deceptive.
- The pavement has inadequate skid resistance or drainage.

In addition, the Austroads publication indicates that possible contributing factors for head-on collisions include:

- The lanes are too narrow (for traffic composition, speed or curvature of road).

- The centreline is not visible.

- The severity of curve cannot be judged.

- There are insufficient overtaking opportunities.

- The road surface has deficiencies.

All these suggestions were considered when deciding on the most suitable remedial treatments for each link.

7.4 Selecting the Solutions

This step took into consideration the findings that there were a high proportion of 'run off the road' type accidents and some high accident cost, head on collision type accidents. The following recommendations, as sited from the Austroads manual (Treatment of Crash Locations 2004, p. 67), were considered:

- Consider improved delineation, including post mounted delineators, RRPMs, edge lines, tactile edge lines and chevron alignment markers.

- If an isolated curve, consider adequacy of alignment design and superelevation.

- Widen the lanes or seal the shoulders.

- If at critical curves, consider warning signs and advisory curve speed signing.

- Widen the edgeline of curves.

- If there is a high incidence of wet weather crashes, check surface texture, skid resistance and pavement drainage.

- Check the speed limit is appropriate.

- Consider increasing the number of overtaking opportunities by duplication of overtaking lanes.

The Gregory and Kennedy Developmental Roads current pavement conditions strive to be aligned with the Regional Roads Implementation Strategy and are considered to have another five years of adequate performance remaining. The GDRs horizontal and vertical alignment abides by rural road standards except for the section between chainage 45.3 and 46.2 kilometres. This section has recently been realigned by the Queensland Department of Main Roads.

It was outlined in earlier analysis that the factor matrix indicates a high proportion of accidents occurring in the day time, and most commonly on a weekday. Therefore delineation through the use of post mounted markers was not considered a high priority. As the GDR and KDRs are low volume rural roads, the road users expect to travel safely at the current speed limit of 110 kilometres per hour. The analysis of the current asset condition demonstrates that the current horizontal and vertical alignment allows for this. The Austroads publication, *Treatment of Crash Locations* (2004) outlines the importance of choosing a countermeasure which is suitable for all aspects and which is economically viable for the funding available. Therefore, for the GDR (98C) and KDR (99C) the most suitable remedial treatment would be to increase the pavement seal. This treatment would allow improved overtaking opportunities, reduce the sections of unsealed shoulders and improve the overall standard of the road.

7.5 Design of Selected Countermeasures

It is anticipated that accident rates and their severity will be reduced by sealing the shoulders on these narrow sections with the highest accident cost. The treatment should be implemented on these ‘critical’ sections first, as they ensure improvement to the overall standard for the asset. In addition, the treatment makes use of the existing pavement as it is still in reasonable condition and can provide suitable running coarse. This treatment would also be most economically viable for the existing links condition.

7.6 Justification for Funding

Accident cost savings were determined using the accidents corresponding crash cost determined in Step 2. These costs had their estimated percentage of savings applied for the proposed remedial treatment on the GDR. This table can be found in Appendix O. Each accident cost was multiplied by its corresponding percentage for crash reduction or increase and all accident savings were combined to find the total crash savings.

Appendix F was used to estimate the cost of remedial treatment for existing pavement widths. The total cost for upgrading the ‘critical’ narrow sections of pavement were found by multiplying the cost per kilometre of remedial treatment with the length of narrow section. This table is shown in Appendix O.

The next step was to calculate the NPV for the total accident savings over a design year design life of 20 years. A discount rate of five, six, seven, eight and nine percent were applied to give a range of results. These results can be seen in Appendix O.

Finally, the Benefit Cost Ratio (BCR) and Net Present Value (NPV) for each discount rate were determined. These results are shown in Appendix O. The findings for all sections along the GDR indicated a BCR less than 1 (< 1) and a negative NPV. It is anticipated that other benefits such as social, community and environmental issues need to be considered further in this analysis to justify expenditure in the future.

Table 7.4 summarises the findings for the BCR for each proposed remedial treatment on the GDR (98C):

Critical Section	Savings $/year	Initial Capital Cost ($)	NPV 5%	BCR	NPV 7%	BCR
CH 38-48	-$20,206	$466,213	-$251,813	0.54	-$214,064	0.46
CH 128-138	-$19,437	$1,488,703	-$242,227	0.16	-$205,915	0.14
CH 208-218	-$16,265	$1,098,025	-$202,693	0.18	-$172,308	0.16

Table 7.4 Benefit Cost Analysis for the GDR (98C)

Furthermore, Table 7.5 illustrates the NPV for each proposed remedial treatment for the critical sections on the GDR.

Critical Section	Savings $/year	Initial Capital Cost ($)	NPV 0.05	NPV (NPV-Costs)	NPV 0.07	NPV (NPV-Costs)
CH 38-48	-$20,206	$466,213	-$251,813	-$214,399	-$214,064	-$252,148
CH 128-138	-$19,437	$1,488,703	-$242,227	-$1,246,476	-$205,915	-$1,282,788
CH 208-218	-$16,265	$1,098,025	-$202,693	-$895,332	-$172,308	-$925,718

Table 7.5 Net Present Value for the GDR (98C)

Chapter 8 Discussion of Results

8.1 Gregory Developmental Road

8.1.1 Section 1: Chainage 38 - 48

Section 1 had the second highest total accident cost along the link. Over the past 13 years, seven accidents were experienced on 3.1 kilometres of narrow pavement. These accidents can be seen in Appendix K. The total accident cost was $656,700 and the accident per kilometre ratio was 2.2 for narrow sections. Further analysis for this section indicates that four accidents corresponded to DCA Code Sub-group 21 and therefore do not contribute to crash savings, as causes for these accidents are unlikely to be related to the road environment. For the remaining three accidents, two were caused by ‘run off the road’ type vehicle movements and one by a ‘head on’ incident. These accidents attract high accident cost savings and therefore these critical sections should be treated as early as possible.

The factor matrix does not show any correlation for any particular make of the eight vehicles involved in these accidents. These incidents included three cars, one road train and four vans. Over half the accidents occurred during day time and seven out of eight accidents on a week day. The contributing factors were varied and the results from the factor matrix table indicate three were related to the driver, one to an uncontrolled animal, one to driver conditions, one to excessive speed, and four to road conditions. The description of the road and its condition indicated accidents were caused by wet, slippery and narrow pavement conditions. It is difficult to assess the most important contributing factors due to low correlation, but as the wet and narrow seals are the only factors relating to the asset, it is anticipated that road widening is a suitable remedial treatment.

Road widening over a 3.1 kilometre length would provide more overtaking opportunities and remove the dangers of the gravel shoulders.

8.1.2 Section 2: Chainage 128 - 138

Section 2 experienced four accidents over the past eight years. There was no correlation between the DCA codes involved in these accidents. Furthermore, the contributing factors were varied and did not provide any direct evidence that narrow pavement seal was the primary contributing factor for accidents.

8.1.3 Section 3: Chainage 208 - 218

This section contained the highest total cost of accidents for the link. A total of seven accidents have occurred during the 13 year analysis period with the total cost being $731,500. Two accidents were associated with DCA Code Group 15 which is described as a vehicle accident movement ‘off carriageway on straight’. There were also two other accidents which are related to vehicles running off the pavement which are described as ‘off carriageway, on straight hit object’ and ‘out of control on straight’. In addition there was also one accident which involved a hit animal and another ‘run off the road type’ accident. Both vehicle movements were deemed not related to the road environment. The seventh accident occurred at an intersection and is therefore not considered as suitable for use as justification for widening the road.

In summary, a high majority of the accidents were related to ‘run off the road’ type accidents which would confirm the importance of widening this section. The vehicles involved ranged from cars to road trains, vans and trucks, and it is therefore difficult to identify any relationship between the accident type and the vehicle. All accidents occurred on a week day and the majority were in the day time. Therefore, fatigue is not considered an influencing issue. For all ‘critical’ sections on the GDR, the factor matrix indicates a wide variety of the contributing factors for road accidents.

8.1.4 The Overall Link

The DCA Code Sub-group histogram illustrated in the results indicates the problems that the GDR is currently facing with regards to 'run off the road' type accidents. The critical sections established by cost of crashes by 'accident type' supports this. The accidents were described as DCA Code Sub-groups 15, 16, 17, 18, 19 and 20. These vehicle movements contribute to 67% of the total accidents for the entire link. Therefore the alliance with the Rural Roads Investment Strategy (RRIS) is of critical importance for the GDR. The RRIS visions include increasing pavement widths, providing sufficient overtaking opportunities and improving the level of surface condition.

Choosing the 'critical' sections based on cost of crashes by 'accident type' has provided a means for establishing the reasons for common accidents. In addition, it has attempted to determine the significant contributing issues. In regards to the main contributing factor, the analysis did not provide any direct evidence for poor road condition. However, analysis for the whole link outlines the major issue of reducing the number of 'run off the road' type accidents. It is anticipated that by providing wider pavements at regular intervals, drivers will not be forced to pull over onto gravel shoulders or be tempted to challenge passing manoeuvres on narrow sections of pavement. This remedial treatment would most likely reduce the chance of vehicles loosing control on the gravel, slipping in wet conditions or being motivated to attempt unsafe passing manoeuvres. The results from the methodology indicate 'run off the road' type accidents as the main focus for designing future remedial. However consideration into the funding for improvements and there likely benefits are required to justify their expenditure. Further analysis into the justification for this funding will now be described in the Benefit Cost analysis.

8.1.5 Benefit Cost Analysis

The summary for the accident cost savings and the cost for remedial treatment of the 10 kilometre sections were illustrated in the results and a detailed explanation can be found in Appendix O. All critical sections indicated a BCR less than one (<1) and a negative NPV. Due to the low volumes of traffic and a long analysis period, accident savings are much less than the investment required for widening the road.

For the ‘critical’ section between chainage 208 to 218 kilometres, on average, only one accident is occurring every two years. Therefore, for a low volume road, with an AADT of 200, a total of 292,000 vehicles are travelling over this section between accident incidents. It would be difficult to support the justification for funding for the GDR purely on an economic basis, or, by the current correlation between accidents and narrow pavements. Further considerations such as social and environmental issues need to be considered:

The anticipated social considerations are outlined below:

- Reducing the number and severity of accidents along the link.

- Removal of possible contributing factors to ‘run off the road’ type accidents.

- Users will make savings in travel time and have a better ability to access all services along the link.

- Rehabilitation along sections may enable the reduction of flooding along the link.

- The road would become more user friendly for tourists and would therefore provide an alternate means for tourist traffic.

- Savings in maintenance of vehicles would be experienced. Vehicles would not have to pull off onto the gravel shoulder which could reduce suspension damage, fuel consumption and tyre blow outs.

- The improved asset condition may reduce the number of violations experienced along the link.

- Issues such as driver impatience may be directly linked to violations such as undue care and attention.

- The link would provide a more comfortable journey for all commuters.

- User costs are typically several times those of agency costs, thus justifying the expenditure.

The environmental issues include:

- Reduction in pollution in rural areas of North Queensland. Vehicles will not have to pull off the sealed narrow sections, slow down and accelerate once they have passed another vehicle. This would reduce the quantities of carbon dioxide released into the atmosphere.

- The reduced need for maintenance by having a sealed pavement would reduce the demand on natural building materials.

How can we justify the economic costs for the investment of a low volume road with the visions of the RRIS and the social and environmental issues?

The most important consideration when dealing with limited funding is to treat the 'critical' sections first. This ensures that the overall asset condition is improved and that the funding is distributed evenly over the link. It is believed that accidents is one method of determining 'critical' sections, but further analysis into the above issues would need to considered when outlining a suitable strategy for the GDR.

8.2 Cost of Crashes and the Consultants Strategy

8.2.1 Introduction

The Maunsell strategy is outlined in Appendix E. These plans indicate the proposed project priorities which need to be treated. The following descriptions are provided on the plans:

- P1: Priority 1, treat this section as highest priority.
- P2: Priority 2, treat this section once P1 has been completed.
- P3: Priority 3, treat this section once P1 and P2 are completed.

In addition, the current asset condition is summarised in a tabular format below the proposed strategy. Furthermore, accidents and their severities are illustrated below this table. This strategy allows a comparison between the accident locations, current asset conditions and the corresponding sections that have been deemed as most important in the view of the consultant. Assessments of this strategy with the 'critical' sections established by cost of crashes were used to determine the effectiveness of the two strategies.

8.2.2 Agreements and Disagreements Between Strategies

The first critical section established by cost of crashes by 'accident type' correlates reasonably with the consultants' strategy. Since undertaking this study, chainages 38 to 45 kilometres, have been widened to a seal width of 7.5 metres. This section contained no accident history but provided an introduction into a horizontal curve which is located between chainages 45.3 and 46.2 kilometres. Previous studies conducted by the consultant established that this curve (chainage 45.3-46.2 kilometres) did not align with rural road standards and has since been denoted as priority one. The remaining section spanning from chainage 46.2 to 48 kilometres has been proposed as priority three. This is a little unexpected considering three accidents have occurred over these two kilometres. It could be presumed that the consultants have prioritised the road geometry as one and then considered accidents as a second consideration.

Chainages 128 through to 138 kilometres were deemed as priority two by the consultant strategy but were ranked one by cost of crashes. This section has endured five accidents over its 13 year history, and has provided the second highest total cost of crashes by 'accident type'. It was expected that the consultant strategy has taken into consideration the number of high cost accidents endured over this section. The possible reasons for denoting the remedial treatment as priority two could be due to the 10 kilometre section between chainage 118 to 128 currently having a pavement width of 7.9 metres and providing some overtaking opportunities. It is also suspected that the consultant has followed the visions of improving the worst sections first to improve the value of the overall asset.

The final critical section was compared with the consultants' strategy between road sections 208 to 218 kilometres. The consultants have proposed the section as priority three and they have only considered treatment between chainages 212 to 218 kilometres. This seems reasonable as five out of the seven accidents recorded were experienced over this section and contribute to the majority of the accident crash costs. The level of priority is seen to be a little low considering this section had the highest accident cost. However, it is expected that due to seven metre wide pavement leading into this section, the consultants considered and provided for sufficient overtaking opportunities.

8.2.3 Considerations in the Future

The establishment of prioritising 'critical' sections on low volume roads such as the GDR require full analysis of the current asset conditions, the funding available and the history of accident rates. Using cost of crashes by 'accident type' has identified the usefulness that road crash information can provide when determining 'critical' sections for remedial treatment.

8.3 Comparisons with Other Low Volume Roads

8.3.1 Low Volume Traffic with Variable Pavement Width

The KDR (99C) was chosen for comparison with the GDR (98C) as both links experience low volumes of traffic and sealed pavements of varying widths. The cost of crashes by 'accident type' was applied to the KDR and a 'critical' section was determined from chainage 10 to 20 kilometres. Analysis of this 'critical' section indicated over half of its accidents were related to 'run off the road' type vehicle movements. Details of the current asset and traffic conditions experienced on the GDR and KDR can be found in Appendix K and M.

The factor matrix illustrates six out of seven accidents were related to poor road asset conditions on the KDR. The factor matrix for KDR (99C) can be found in Appendix M. The *Road Crash II* summaries describe road surface factors such as gravel / dirt pavements, wet / slippery seal and rough surface conditions as being the primary causes to these accidents. Details of the crash summaries for 99C can be found in Appendix H.

The DCA Code Sub-group histogram outlines 70% of accidents were involved in 'run off the road' type vehicle movements. These findings reflect similar results for the GDR, emphasising the importance of widening these links in the future.

8.3.2 Sealed Vs Unsealed Roads

The KDR (99B) was another link used to investigate the relationship between accident types and road asset conditions. The current asset condition of the KDR (99B) consists predominately of unsealed pavement. The methodology, cost of crashes by 'accident type' was applied to the KDR (99C) The 'critical' sections determined, using this methodology, indicate sections 10 to 20, 70 to 80 and 90 to 100 kilometres were the highest priority for remedial treatment. Closer analysis indicated the first section, chainage 10 to 20 kilometres; involved accident movements described as 'Out of control, on straight'. The contributing factors from the factor matrix indicate that three out of five accidents were related to wet or slippery conditions on the pavement. This factor matrix can be seen in Appendix L. These factors emphasise unsafe driving conditions experienced on unsealed sections in wet conditions.

The next critical section, chainage 70 to 80 kilometres, describes five out of six accidents were related to 'run off the road' type accidents. In addition, the four out of the five contributing factors were related to asset condition, such as rough surface or gravel / dirt carriageways. For the final critical section, chainage 90 to 100 kilometres, all six accidents were related to 'run off the road' type vehicle movements. The contributing factors were varied and do not allow for identification of any predominate problem for this section.

For the overall link, 50% of DCA Code Sub-groups were related to ‘run off the road’ type accident movements. This low volume road illustrates the problems endured by users when the asset conditions are only narrow in width and remain as unsealed carriageways. Due to these high accident rates, caused by vehicles running off the road, a priority of providing sealed pavements and suitable overtaking opportunities is necessary in the future.

Is it better justified to use limited funding on unsealed links or sealed links with varying pavement widths?

Evidence needs to be provided to justify expenditure on unsealed roads such as 99B. Current traffic volumes, traffic composition and future use, all need to be assessed to determine which link has highest priority for asset improvements. The comparisons between sealed and unsealed low volume roads have identified the advantages in providing pavement seal and staging asset upgrades to a seal width of eight metres. The high proportion of accidents on 99B, relating to the vehicle movement ‘out of control, on straight” highlights the importance of providing a minimum single lane seal. The goal for future work on links such as 99B would be to provide single lane seal, with a vision for future upgrades to an eight metre seal width. It is expected that these improvements would reduce the number accidents and their severity on unsealed pavements. It will always be difficult to assess whether unsealed roads are more worthy of funding compared to a partly sealed roads. Engineers must ensure that all social, economic and environmental factors are taken into consideration as the decision process will most likely be open to conjecture.

Chapter 9 Conclusion

The project has shown that cost of crashes by 'accident type' is a suitable method for establishing critical sections for treatment on low volume roads in North Queensland. The methodology also provides a system whereby remedial treatment can be designed to countermeasure common accidents and ensure maximum crash savings are achieved. However, accidents and their predicted savings can not solely provide justification for funding of these roads. Some further considerations include the anticipated future traffic volume, traffic composition, desired asset conditions, vision for the link and the social and environmental impacts. Discussions with stakeholders should continue in the future as they provide valuable feedback on common issues for low volume roads. Strategies should also continue to strive to align with Regional Roads Investment Strategy and provide improved asset conditions. The limited funding available should continue to be 'stretched' by treating the 'critical' sections of the link first and therefore improving the overall asset condition.

9.1 Achievement of Objectives

An extensive literature review was conducted using journal articles from the Low Volume Roads Conferences held in 1999 and 2003. These papers provided up to date information on low volume road practices through global, national and local levels. Industry professionals provided detailed information on issues such as management, planning, finance, best practice and safety. These articles provide an excellent source of information, which could be explored in more detail if this project was to be undertaken at a later date.

The Main Roads website provided detailed descriptions of the current strategies employed for rural roads. A draft copy of the Regional Road Investment

Strategy was sourced through a contact at the Roma Main Roads office. This document outlines the visions, goals, funding and procedures used in rural Queensland.

The internet was accessed to source other international methods used to prioritise and treat rural roads of low volume. Previous research indicated that accident rates and improved safety was of high priority on all road networks and that this should apply to rural links where needed.

Using the contacts from Main Roads in the Toowoomba office, access to the *Road Crash II* database was obtained. This provided sufficient details of the current asset conditions, traffic volume and accidents along the GDR. A methodology from the publication *Treatment of Crash Locations* (2004) was applied to narrow sections of the link. A cost of crash by 'accident type' was applied to establish critical sections along the link. In addition, DCA Code Sub-groups were evaluated using a DCA Code Sub-group histogram and number of accidents per kilometre for each section was calculated. A factor matrix was produced for critical sections using crash summaries provided by the *Road Crash II* database. This allowed evaluation of similarities between accidents and the contributing factors. These factors were used to determine suitable remedial treatments. This tool is appropriate for use on all low volume roads and was successfully applied to the Gregory Developmental Road (98C), Kennedy Developmental Road (99B) and another section of the Kennedy Developmental Road (99C).

Analysis of the data showed that 'run off the road' type accidents were the most common accident endured on critical sections. Unsealed pavements had a higher quantity, of 'run of the road' type accidents compared to the sealed sections with varying pavements widths. This result indicates that a narrow seal with the potential for widening the sections of the road will provide suitable overtaking opportunities for vehicles. This will therefore reduce the 'run off the road' type accidents and their severities. It was established that widening the narrow sections is the most effective remedial treatment and should be employed at regular intervals along the link over the 20 year design life.

The methodology applied to Gregory Developmental Road shows a high correlation between the established ‘critical’ sections with the Maunsell strategy. This indicates that the cost of crashes by ‘accident type’ will allow a suitable method for establishing critical sections for rehabilitation. However, the highest priorities for the methodology did not directly correspond with the priorities of P1, P2 and P3 indicated by Maunsell. It is anticipated that the differences between strategies is a result of ensuring regular overtaking opportunities and implementation of remedial treatments carried out on the road during the undertaking of this project.

The benefit cost analysis did not provide suitable justification for funding for the Gregory Developmental Road. Nevertheless, it is critical that engineering designs prioritise rehabilitation to ensure funding is used adequately over the design life. It was also found that further investigations into other benefits were needed as these were not accounted for and this project only considered the percentage of accident cost savings. In addition, social and environmental issues need to be considered when justifying expenditure for low volume roads.

9.2 Recommendations

The following areas have been identified in which further work can be carried out with regards to the justification of funding of low volume roads:

- Analyse accidents, their crash costs and contributing factors for other low volume roads.

- Consider establishing justification for funding through the use of social impacts.

- Consider establishing justification for funding through the use of environmental impacts.

9.3 Further Work

- Use the current strategies for low volume roads to establish a new system for prioritising and justifying expenditure in the future

LIST OF REFERENCES

Achwan, N & Rudjito D, 1999, 'Accident Characteristics on Low-Volume Roads in Indonesia', *Seventh International Conference on Low Volume Roads*, May 23-26, pp. 103-110.

Archondo-Callao R, 1999, 'Economic Decision Model for Low-Volume Roads', *Seventh International Conference on Low Volume Roads*, May 23-26, pp. 18-30.

Austroads 1999, *Rural Road Design: Guide to the Geometric Design of Rural Roads*, Austroads, Sydney.

Austroads 2002, *Road Safety Audit*, Austroads, Sydney.

Austroads 2004, *Guide to Traffic Engineering Practice Series Part 4 – Treatment of Crash Locations*, Austroads, Canberra.

Calvert, E, Haiar, K & Wilson, E 1999, 'Development of Field Evaluation Guide for Unpaved Rural Roads', *Seventh International Conference on Low Volume Roads*, May 23-26, pp. 86-89

Department for Transport 2004, Road Safety, Department for Transport, viewed 12 May 2004, <http://www.dft.gov.uk>.

Gardner R, 1996, 'Vehicle Characteristics', in Orgden KW and Taylor SY (eds), *Traffic Engineering and Management'*, Monash University, Melbourne, pp. 21-32.

Giummarra, G 2003, 'Establishment of a Road Classification System and Geometric Design and Maintenance Standards for Low-Volume Roads', *Eighth International Conference on Low Volume Roads*, June 22-25, pp. 132-140.

Hough, J & Smadi A 1999, 'Innovative Financing Methods for Local Roads in Midwest and Mountain Plain States', *Seventh International Conference on Low Volume Roads*, May 23-26, pp. 7-12.

Ivarsson, S & Malmberg Calvo, C, 2003, 'Private-Public Ownership for Low-Volume Roads', *Eighth International Conference on Low Volume Roads*, June 22-25, pp. 39-45.

Keller, G & Sherar, J, 2003, 'Low Volume Roads Engineering: Best Management Practices', *Eighth International Conference on Low Volume Roads*, June 22-25, pp. 174-181.

Kumar, A & Kumar P, 1999, 'User-Friendly Model for Planning Rural Roads', Seventh International Conference on Low Volume Roads, May 23-26, pp. 31-39.

Main Roads 2003, Road Implementation Program 2003-2007, viewed 10 May 2004, <**http://www.mainroads.qld.gov.au**>.

Maunsell Australia 2002, 'Evaluation of Existing Links', pp. 2-20.

Maunsell Australia 2004, 'Link Development Report: Project and Staging Options', Vol 1, pp. 5-25.

Lay, MG 1986, 'Handbook of Road Technology', Vol 1 & 2, pp. 712-713.

Roads & Traffic Authority of New South Wales 1996, 'Road Environment Safety: A Practitioners Reference Guide to Safer Roads', pp. 119-120.

Stamaiadis, N, Jones, S & Aultman-Hall L 1999, ‘Causal Factors for Accidents on Southeastern Low-Volume Rural Roads’, *Seventh International Conference on Low Volume Roads*, May 23-26, pp. 111-117.

Veeraragavan, A & Rathnakara Reddy, KB 2003, ‘Application of Highway Development and Management Tool for Low-Volume Roads’, *Eighth International Conference on Low Volume Roads*, June 22-25, pp. 7-12.

Wison, E & Lapinski, M 2003, ‘Practical Safety Tool for Local Low-Volume Rural Roads: The Road Safety Audit Review’, *Eighth International Conference on Low Volume Roads*, June 22-25, pp. 225-230.

Wadhwa, L & Handy, B 1991, ‘Identification and Evaluation of Engineering Solutions to Accident Reduction in North Queensland’, *Australian Transport Research Forum*, September, pp. 279-295

Zimmerman, K & Peshkin, D 2003, ‘Applying Pavement Preservation Concepts to Low-Volume Roads’, *Eighth International Conference on Low Volume Roads*, June 22-25, pp. 81-87.

APPENDIX A

PROJECT SPECIFICATION

University of Southern Queensland
FACULTY OF ENGINEERING AND SURVEYING

ENG 4111/2 *Research Project*
PROJECT SPECIFICATION

FOR: **Chris MACKENZIE**

TOPIC: Evaluation of funding justification for low volume roads in North Queensland

SUPERVISORS: 1. Dr. David Thorpe (USQ)

PROJECT AIM: The aim of this project is to investigate and evaluate the justification for funding of low volume roads in North Queensland.

BACKGROUND: The Gregory Developmental Road is a developing route in North Queensland. The Queensland Department of Main Roads (Townsville) is interested in establishing the strategic function of the road, determining an appropriate geometric and performance standard and to establish an investment strategy.

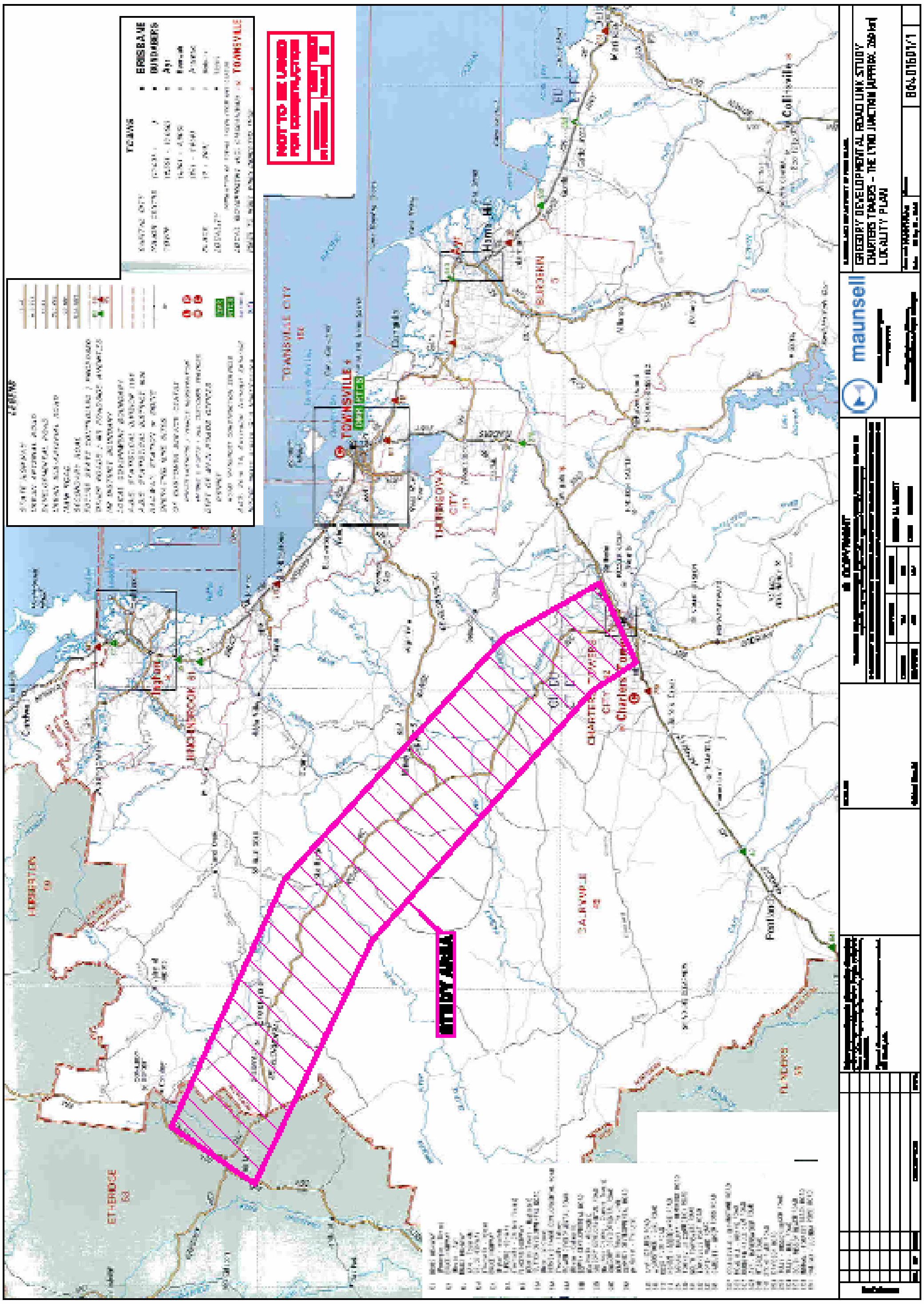
PROGRAMME: **Issue B, October 2004**

1. Undertake a literature review of low volume road funding and management practices in Australia and overseas.
2. Review the current practices of Main Roads and local councils for funding and management of low volume roads.
3. Investigate the accident, performance, condition and other relevant data provided by Queensland Main Roads databases.
4. Evaluate the proposed strategy for upgrading and managing the Gregory Developmental Road, using similar roads for comparison.
5. Undertake a cost – benefit analysis of the implementation of this strategy.
6. Report findings to peer group via oral presentations and in the required written format.

AGREED: ________________(Student) ________________(Supervisor)

APPENDIX B

MAP OF THE GREGORY DEVELOPMENTAL ROAD



APPENDIX C

RURAL ROAD DESIGN:

PAVEMENT WIDTH

Table 4.1 Traffic Lane Widths for Undivided Sealed Roads

Design Traffic Volumes (AADT) (veh/day)	1-150	150-500	500-1000	Over 1000
Normal Lane Widths (m)	1 Lane 3.5	2 Lanes 3.0	2 Lanes 3.0 - 3.5	2 Lanes 3.5

Notes

(a) Design traffic volume is that expected to be using the road at the end of the design period. This should be taken as a period in the range of 10 to 20 years. Where the construction of a road may lead to considerable commercial development, this must be taken into account in predicting traffic volumes.

(b) Where design speeds are over 80 km/h (mountainous country), or 100 km/h (undulating country), or where the heavy vehicle content is high, the adoption of a 3.5m traffic lane width is desirable (refer to Section 4.1.2).

(c) Refer to Section 4.5 for the adoption of standards in restricted areas.

(d) For low volume roads with single lane carriageways, refer to Section 4.3.

Table 4.2 Width of Shoulders on Undivided Sealed Roads

Design Traffic Volume AADT (veh/day)[a]	Normal Widths (m)
Single lane roads[a]	1.5 - 2.5
Two lane roads	
1-500	1.0[b] - 1.5
500-1000	1.0[b] - 2.0
Over 1000	1.0[b] - 3.0[c]

Notes

(a) See Note to Table 4.1.

(b) Where 1.0 m shoulders are used, provision should be made for vehicles to stop clear of the traffic lanes wherever possible on low fills and at transitions from cut to fill. This is more important for volumes above 500 vehicles/day.

(c) Shoulders of 2.5 m to 3.0 m allow commercial vehicles to stop clear of the traffic lanes. Where the route carries a high absolute volume of commercial vehicles, is a major trucking route, and the incidence of trucks stopping is high, 3.0 m shoulders should be considered

APPENDIX D

RURAL ROAD DESIGN:
OVERTAKING OPPORTUNITIES

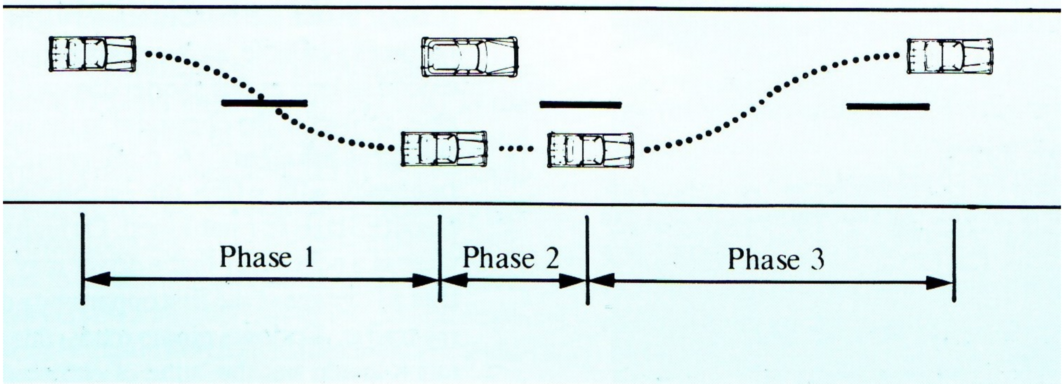


Figure 6.2 Overtaking Manoeuvre

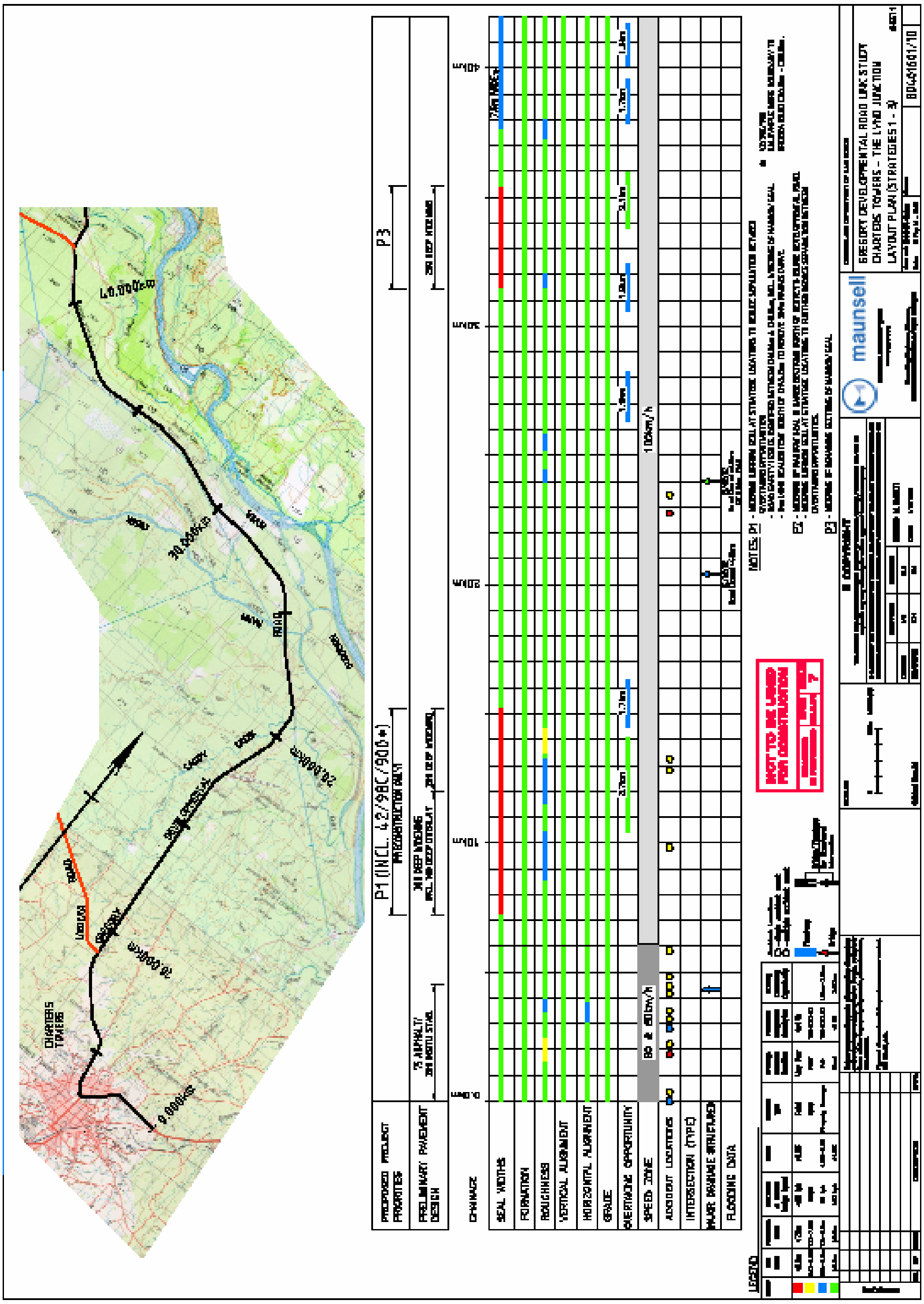
Table 6.4
Overtaking Sight Distances (1.15 m to 1.15 m) For Determination of Start and Finish of Overtaking Zones

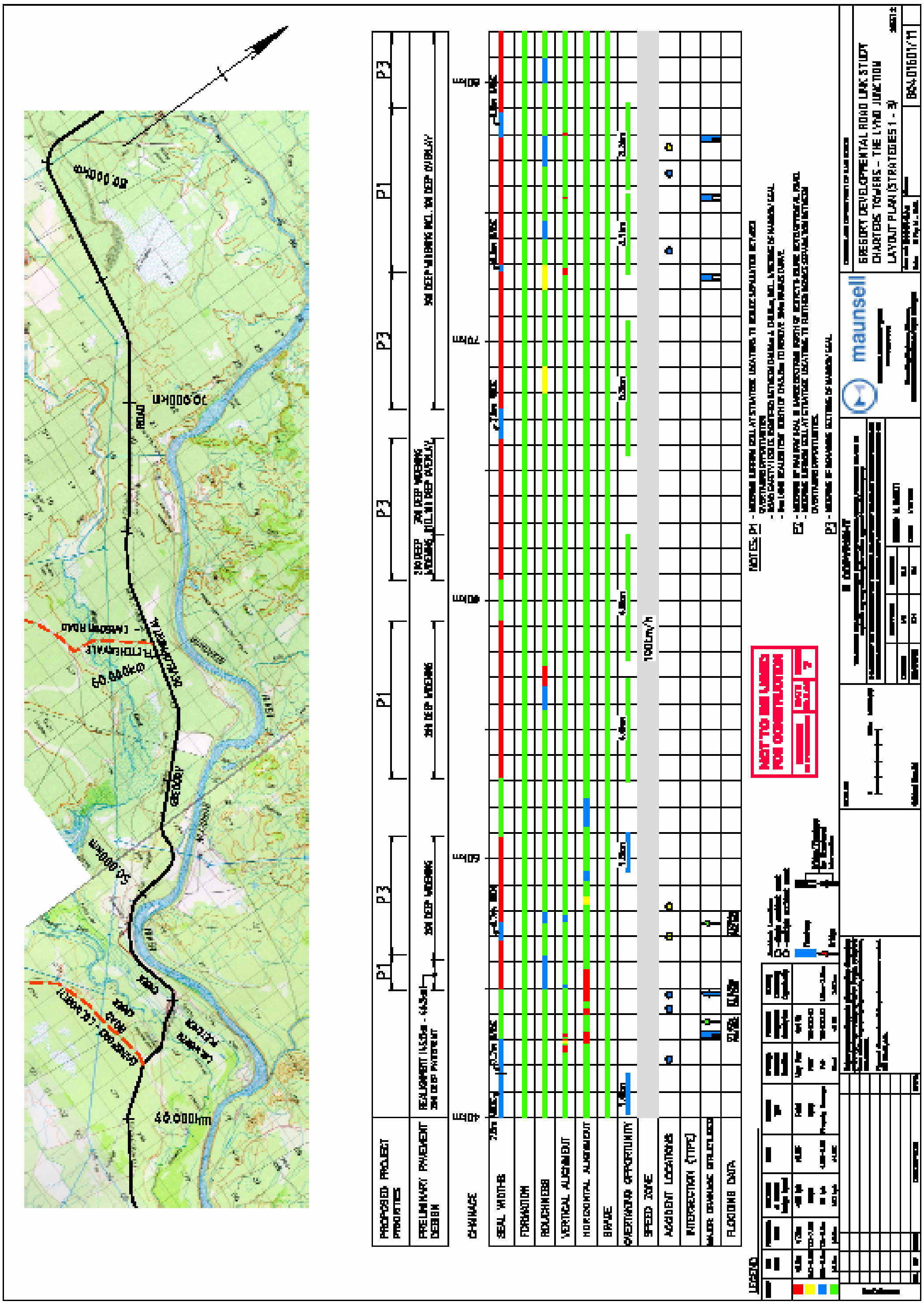
Design Speed (km/h)	Overtaken Vehicle Speed (km/h)	Establishment		Continuation	
		Time Gap (sec)	Sight Distance (m)	Time Gap (sec)	Sight Distance (m)*
50	43	12.8	330	4.5	165
60	51	13.6	420	5.0	205
70	60	14.4	520	5.4	245
80	69	15.5	640	6.0	300
90	77	16.6	770	6.5	360
100	86	17.8	920	7.2	430
110	94	19.4	1100	7.9	500
120	103	21.0	1300	8.7	600
130	111	22.4	1500	9.5	700

* Including 50 m to 60 m clearance at completion.
Note: Time gaps used in derivation of distances also shown.

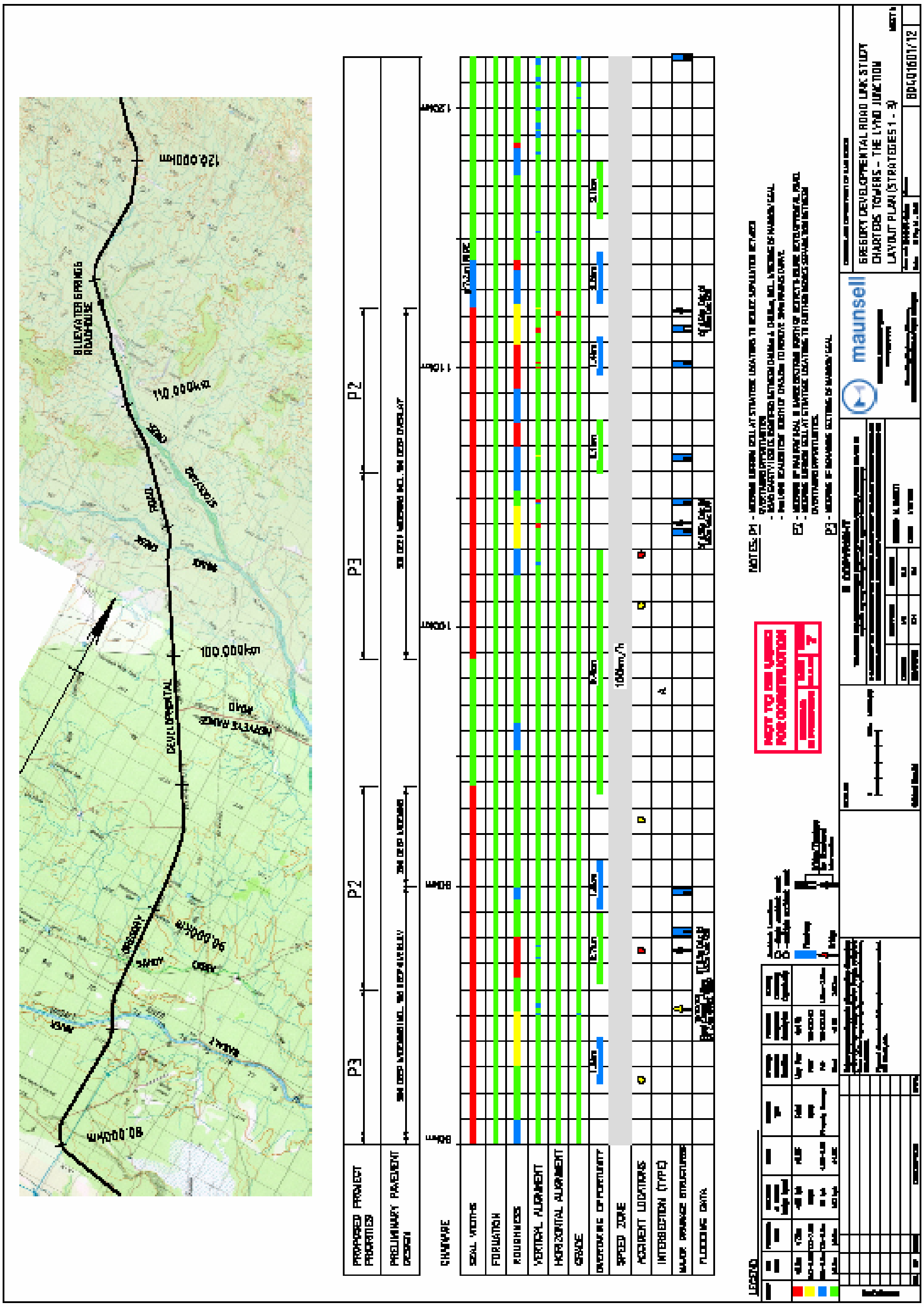
APPENDIX E

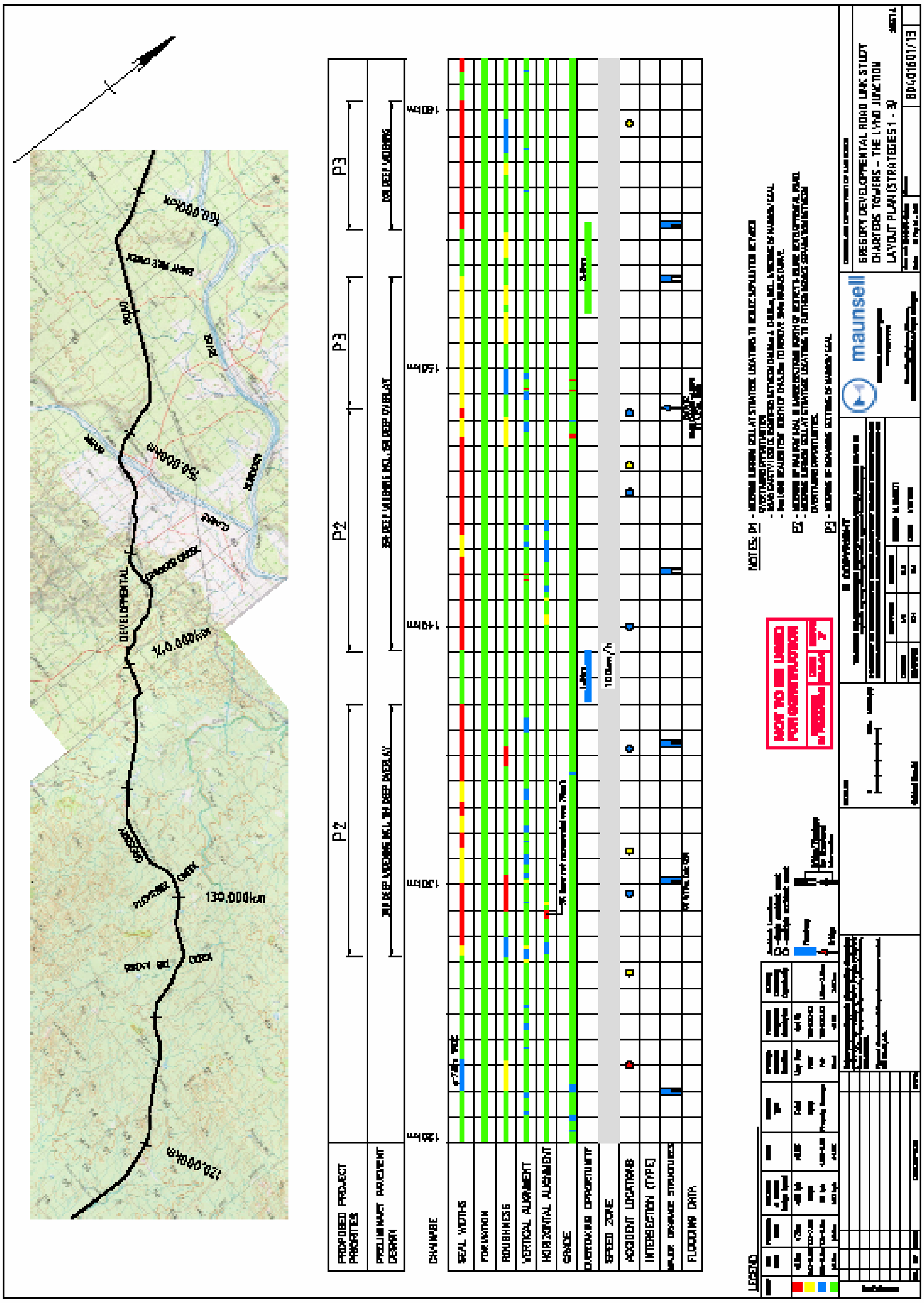
MAUNSELL STRATEGY

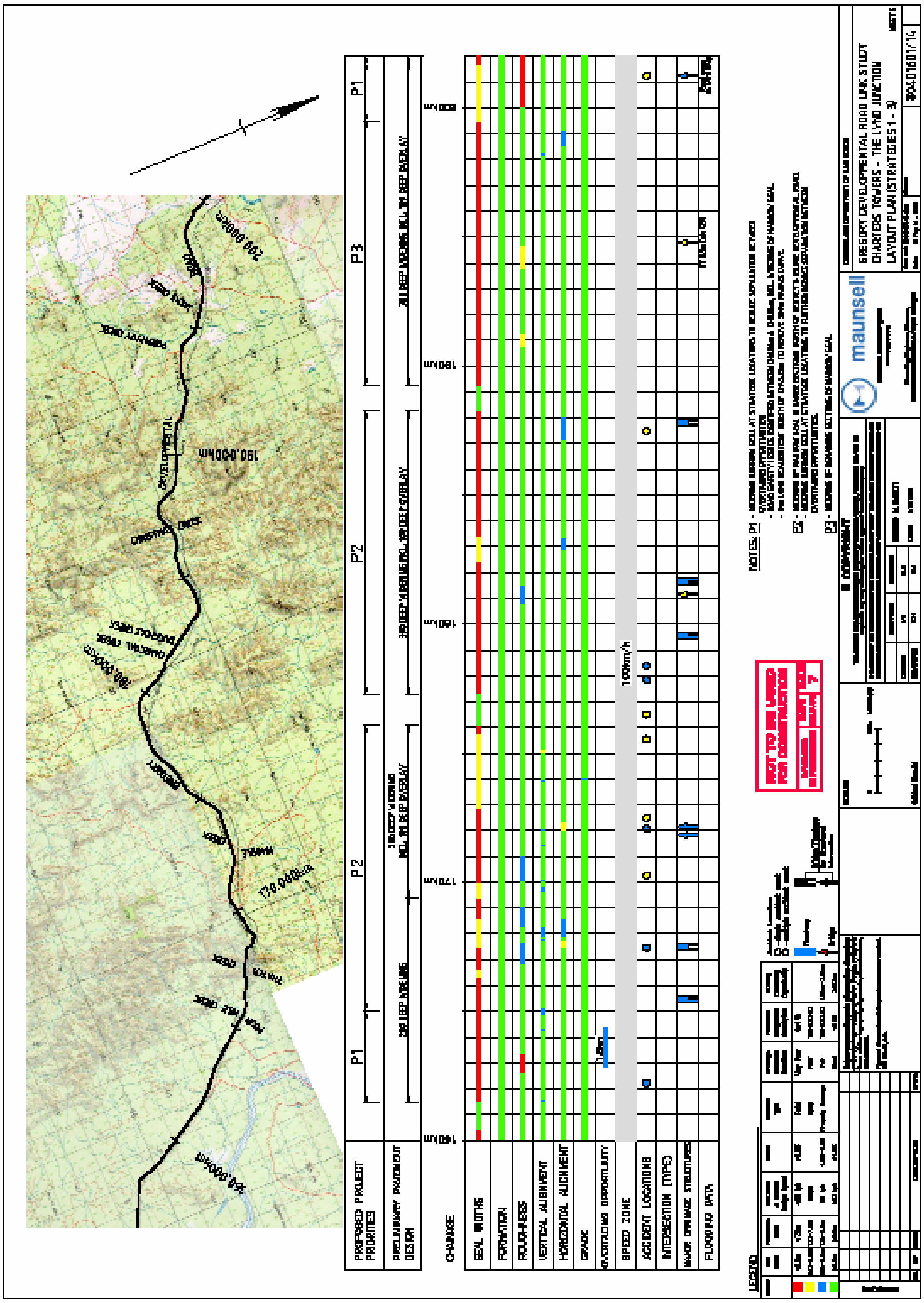

CHARTERS TOWERS
P1 (INCL. 42/98C/900+)
P3
PROPOSED PROJECT PRIORITIES
PRELIMINARY PAVEMENT DESIGN
CHAINAGE
SEAL WIDTHS
FORMATION
ROUGHNESS
VERTICAL ALIGNMENT
HORIZONTAL ALIGNMENT
GRADE
OVERTAKING OPPORTUNITY
SPEED ZONE
ACCIDENT LOCATIONS
INTERSECTION (TYPE)
MAJOR DRAINAGE STRUCTURES
FLOODING DATA
100km/h
LEGEND
NOTES:
NOT TO BE USED FOR CONSTRUCTION
maunsell
GREGORY DEVELOPMENTAL ROAD LINK STUDY
CHARTERS TOWERS - THE LYND JUNCTION
LAYOUT PLAN (STRATEGY 1 - 3)

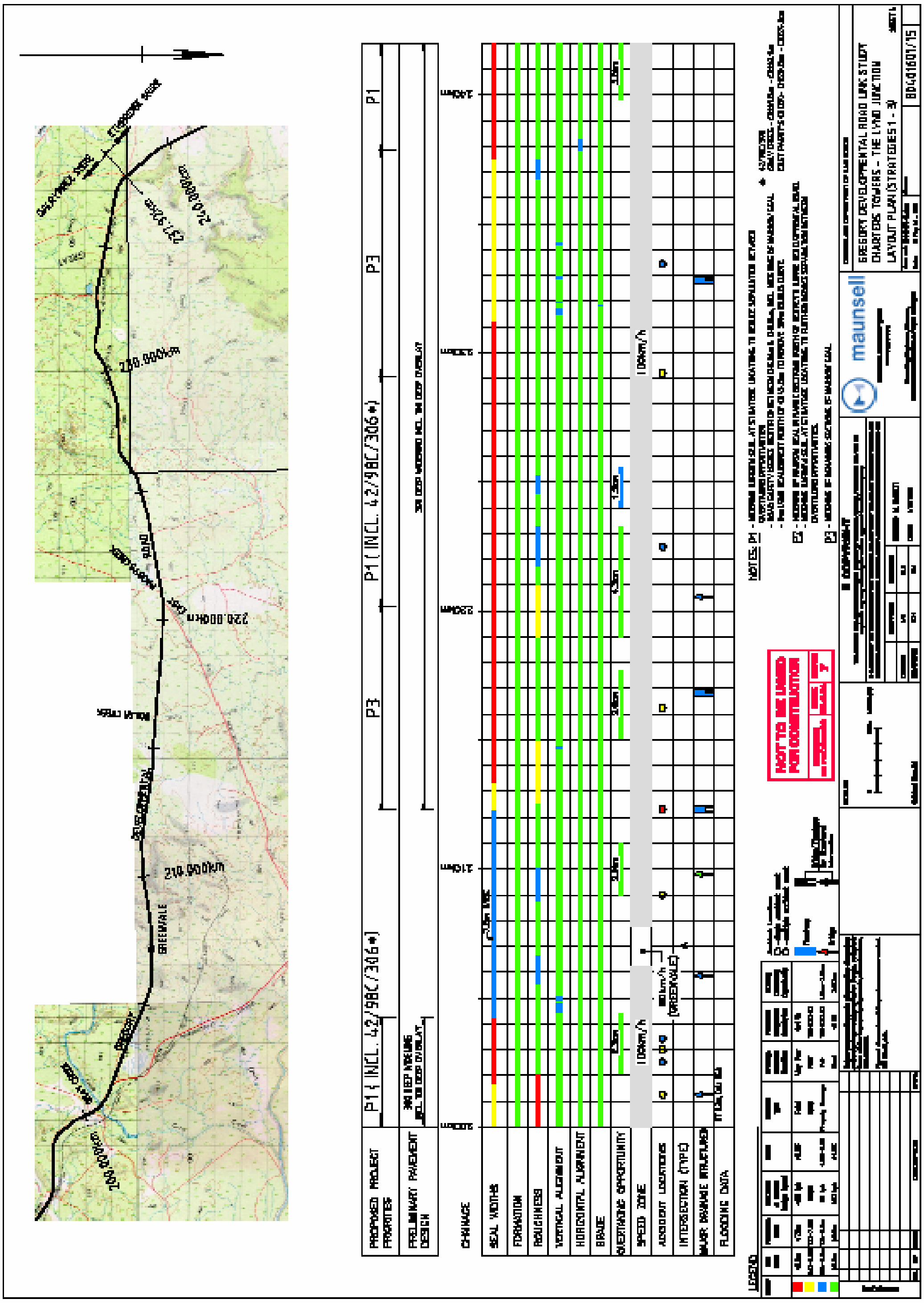


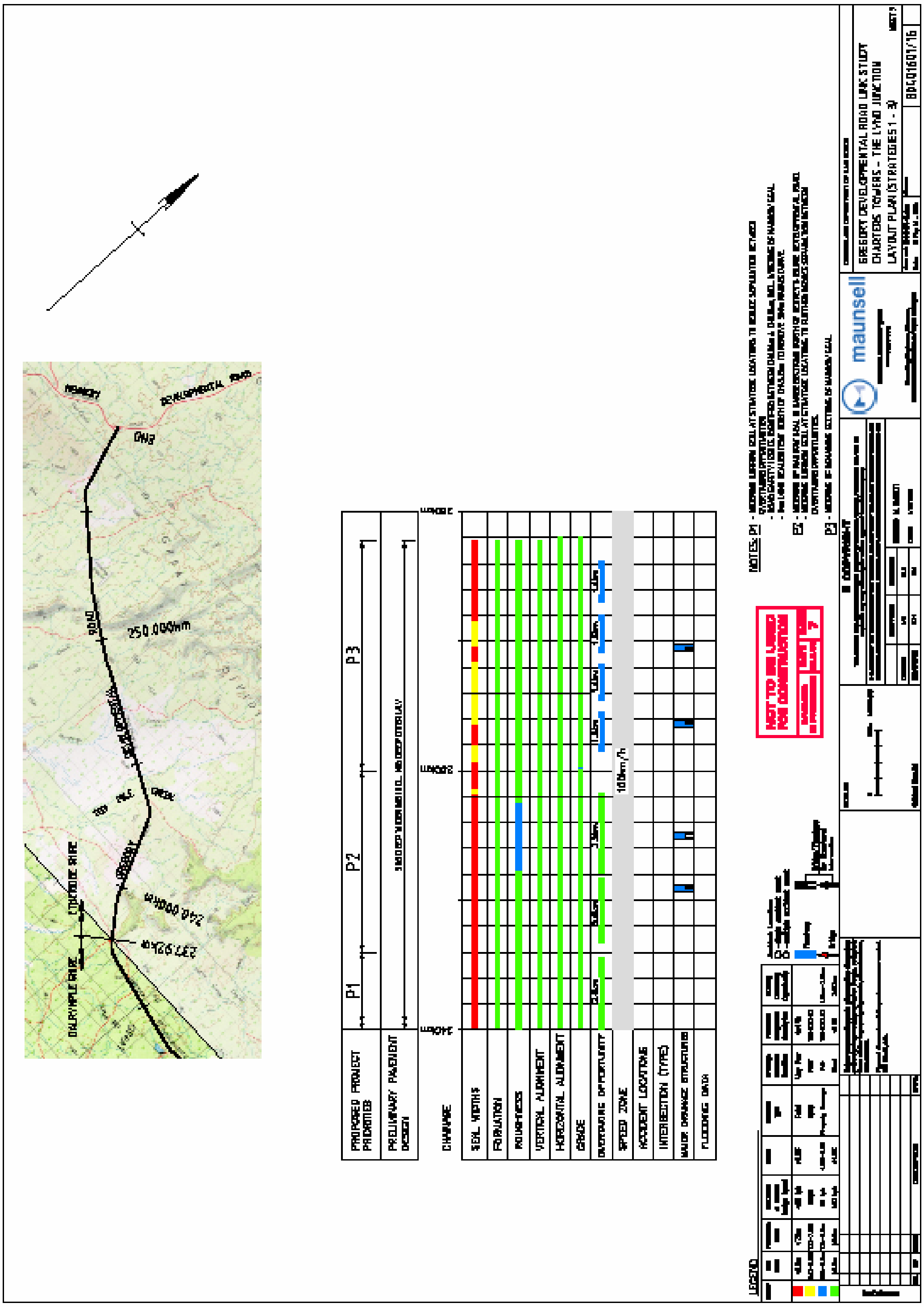
GREGORY DEVELOPMENTAL ROAD LINK STUDY
CHARTERS TOWERS - THE LYND JUNCTION
LAYOUT PLAN (STRATEGIES 1 - 3)
maunsell
NOT TO BE USED FOR CONSTRUCTION
40.000km
50.000km
60.000km
70.000km
80.000km
PROPOSED PROJECT PRIORITIES
PRELIMINARY PAVEMENT DESIGN
CHAINAGE
SEAL WIDTHS
FORMATION
ROUGHNESS
VERTICAL ALIGNMENT
HORIZONTAL ALIGNMENT
GRADE
OVERTAKING OPPORTUNITY
SPEED ZONE
ACCIDENT LOCATIONS
INTERSECTION (TYPE)
MAJOR DRAINAGE STRUCTURES
FLOODING DATA
100km/h
NOTES:
LEGEND




PROPOSED PROJECT PRIORITIES
PRELIMINARY PAVEMENT DESIGN
CHAINAGE
SEAL WIDTHS
FORMATION
ROUGHNESS
VERTICAL ALIGNMENT
HORIZONTAL ALIGNMENT
GRADE
OVERTAKING OPPORTUNITY
SPEED ZONE
ACCIDENT LOCATIONS
INTERSECTION (TYPE)
MAJOR DRAINAGE STRUCTURES
FLOODING DATA
LEGEND
NOTES
120.000km
130.000km
140.000km
150.000km
160.000km
DEVELOPMENTAL
P2
P3
maunsell
GREGORY DEVELOPMENTAL ROAD LINK STUDY
CHARTERS TOWERS - THE LYND JUNCTION
LAYOUT PLAN (STRATEGIES 1 - 3)


PROPOSED PROJECT PRIORITIES
PRELIMINARY PAVEMENT DESIGN
CHAINAGE
SEAL WIDTHS
FORMATION
ROUGHNESS
VERTICAL ALIGNMENT
HORIZONTAL ALIGNMENT
GRADE
OVERTAKING OPPORTUNITY
SPEED ZONE
ACCIDENT LOCATIONS
INTERSECTION (TYPE)
MAJOR DRAINAGE STRUCTURES
FLOODING DATA
P1
P2
P3
100km/h
160.000km
170.000km
180.000km
190.000km
200.000km
maunsell
GREGORY DEVELOPMENTAL ROAD LINK STUDY
CHARTERS TOWERS - THE LYND JUNCTION
LAYOUT PLAN (STRATEGIES 1 - 3)


PROPOSED PROJECT PRIORITIES
PRELIMINARY PAVEMENT DESIGN
CHAINAGE
SEAL WIDTHS
FORMATION
ROUGHNESS
VERTICAL ALIGNMENT
HORIZONTAL ALIGNMENT
GRADE
OVERTAKING OPPORTUNITY
SPEED ZONE
ACCIDENT LOCATIONS
INTERSECTION (TYPE)
MAJOR DRAINAGE STRUCTURES
FLOODING DATA
P1 (INCL. 42/98C/306*)
P3
P1
maunsell
NOT TO BE USED FOR CONSTRUCTION
GREGORY DEVELOPMENTAL ROAD LINK STUDY
CHARTERS TOWERS - THE LYND JUNCTION
LAYOUT PLAN (STRATEGIES 1 - 3)


END
250.000km
DALRYMPLE SHIRE
P1
P2
P3
PROPOSED PROJECT PRIORITIES
PRELIMINARY PAVEMENT DESIGN
CHAINAGE
SEAL WIDTHS
FORMATION
ROUGHNESS
VERTICAL ALIGNMENT
HORIZONTAL ALIGNMENT
GRADE
OVERTAKING OPPORTUNITY
SPEED ZONE
ACCIDENT LOCATIONS
INTERSECTION (TYPE)
MAJOR DRAINAGE STRUCTURES
FLOODING DATA
100km/h
NOTES:
LEGEND
NOT TO BE USED FOR CONSTRUCTION
maunsell
GREGORY DEVELOPMENTAL ROAD LINK STUDY
CHARTERS TOWERS - THE LYND JUNCTION
LAYOUT PLAN (STRATEGIES 1 - 3)

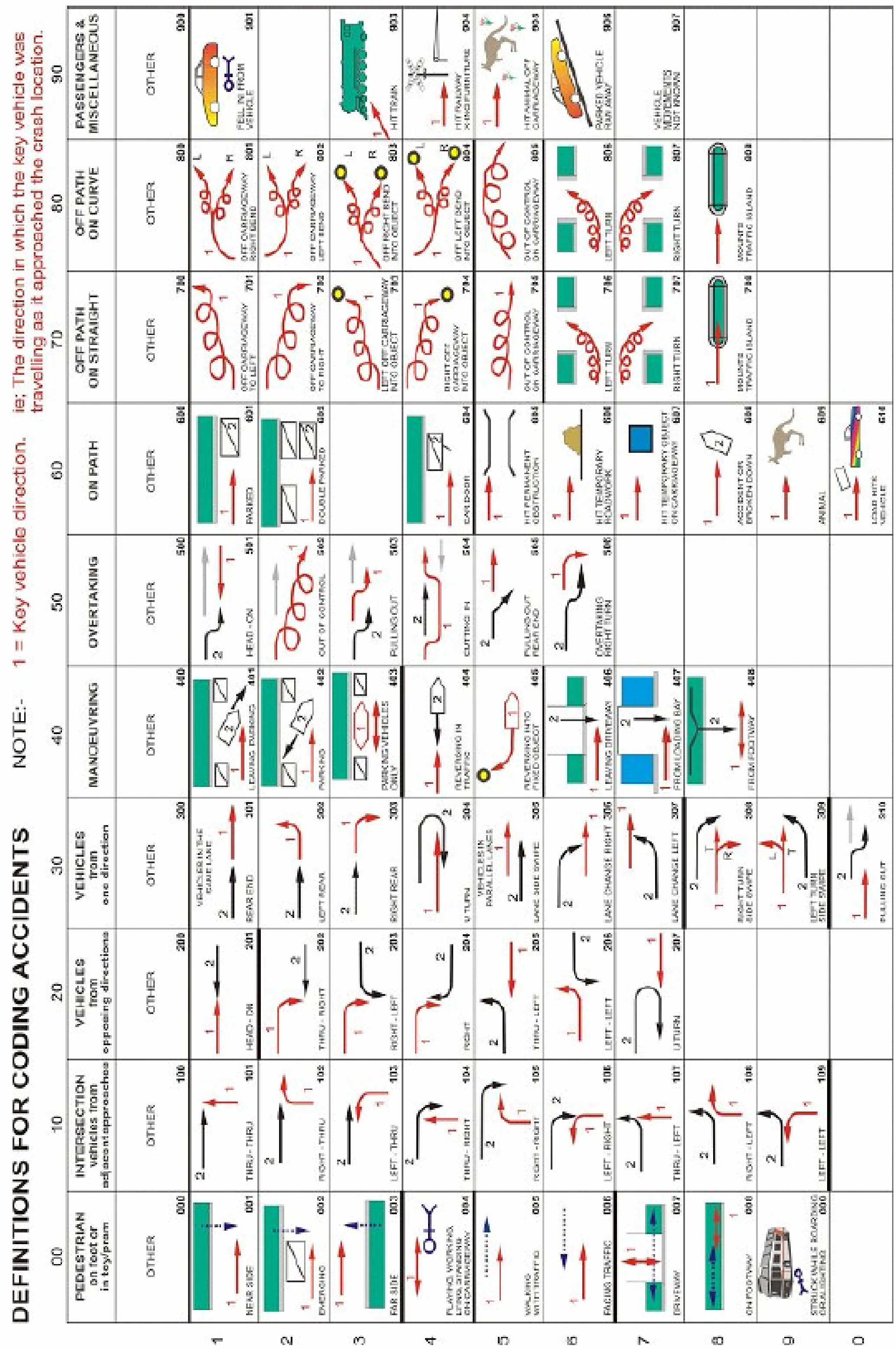
APPENDIX F

MAUNSELL ESTIMATE

ITEM	DESCRIPTION	UNIT	RATE ($)	TYPE 1 QUANTITY (PER KM)	TYPE 1 AMOUNT (PER KM)	TYPE 2 QUANTITY (PER KM)	TYPE 2 AMOUNT (PER KM)	TYPE 3 QUANTITY (PER KM)	TYPE 3 AMOUNT (PER KM)	Realignment QUANTITY (PER KM)	Realignment AMOUNT (PER KM)	
1	**Establishment**	km	10000	1	$10,000	1	$10,000	1	$10,000	1	$10,000	
2	**Provision for Traffic**	km	7000	1	$7,000	1	$7,000	1	$7,000	1	$7,000	
3	**Excavation**											
a)	Box out Shoulders	m^3	7	990	$6,930	610	$4,270	870	$6,090	2400	$16,800	
4	**Earthworks**											
a)	Subgrade Preparation	m^2	1.5	5730	$8,595	5140	$7,710	5730	$8,595	8000	$12,000	
b)	Embankment Type(cut)	m^3	9	860	$7,740	560	$5,040	760	$6,840	2400	$21,600	
c)	Embankment Type(impo)	m^3	12	470	$5,640	1760	$21,120	920	$11,040	0	$0	
5	**Gravel Pavements**											
a)	Type 3.4 gravel (subbase)(Ex Supply)	m^3	50	1010	$50,500	1080	$54,000	0	$0	0	$0	
b)	Type 3.2 gravel (base)(Ex Supply)	m^3	50	840	$42,000	1290	$64,500	970	$48,500	1760	$88,000	
6	**Bitumen Surfacing**											
a)	Primerseal Cl 170 + 5% Cutter 1.2L/m^2	L	0.95	9600	$9,120	9600	$9,120	5200	$4,940	9600	$9,120	
b)	10mm Agg @ 140m2/m^3	m^3	150	58	$8,700	58	$8,700	30	$4,500	58	$8,700	
c)	Seal - Cl 170 1.6 L/m^2	L	0.75	12800	$9,600	12800	$9,600	12800	$9,600	12800	$9,600	
d)	14mm Agg @ 110m2/m^3	m^3	110	73	$8,030	73	$8,030	73	$8,030	73	$8,030	
7	**Insitu Stablisation (All Type Sections)**		1		$57,000	1	$57,000	1	$57,000	1	$57,000	
8	**Sub Total - A**				$230,855		$256,090		$182,135		$247,850	
9	**Pre Construction & Adimin (20% of A) - B**				$27,702		$30,730		$21,856		$29,742	
10	**Contingency (20% of A & B)**				$51,711		$57,364		$40,798		$138,796	
	Total				$310,269		$344,184		$244,789		$416,388	
Northern District		Length (km)			112.9		14.4		36.9		1	
					$35,029,383		$4,956,263		$9,032,730		$416,388	$49,434,764
Peninsula District		Length (km)			21.1							
					$6,545,678							$6,545,678
												$55,980,442

APPENDIX G

DCA CODE TABLE


DEFINITIONS FOR CODING ACCIDENTS
NOTE:- 1 = Key vehicle direction. ie; The direction in which the key vehicle was travelling as it approached the crash location.
00 PEDESTRIAN on foot or in toy/pram
10 INTERSECTION vehicles from adjacent approaches
20 VEHICLES from opposing directions
30 VEHICLES from one direction
40 MANOEUVRING
50 OVERTAKING
60 ON PATH
70 OFF PATH ON STRAIGHT
80 OFF PATH ON CURVE
90 PASSENGERS & MISCELLANEOUS

APPENDIX H

DETAILED CRASH SUMMARIES

Queensland Government
Department of Main Roads

Road Crash 2
CRASH DETAIL REPORT

Crash No.	Date	Day	Hour	DCA	No. Units	Street/s
940014094	25-JUN-1994	Sat	09	701 OFF PATH-S	1	Gregory Development Rd

RSect: 98C Charters Twrs-The Lynd
RPC: 2
Cway: 1
Direction: S
Dist from RPC: 18.330
Inter.:
Tdist: 42.320

Nature: 07 Overturned
Severity: 5 PROPERTY DAMAGE ONLY
Alignment: Vertical: 1 Level
Horizontal: 1 Straight
Feature: 99 Not Applicable
Traffic Control: 99 No Traffic Control

Units	Age	Gender	Unit Type	Dirn.	Intended Action	BAC
1			02 Utility, Panel Van	S	01 Go Straight Ahead	N/A

Description

DRIVER TELEPHONED POLICE STATION TO REPORT INCIDENT. HE STATED THAT HE WAS TRAVELLING TOWARDS CHARTERS TOWERS WHEN A COW WALKED ONTO THE CARRIAGEWAY FROM HIS RIGHT. HE SWERVED TO HIS LEFT TO AVOID THE BEAST, BUT LOST CONTROL IN THE TABLE DRAIN, SUBSEQUENTLY ROLLING THE VEHICLE NEAR THE RED FALLS TURNOFF. NIL INJURIES; VEHICLE TOWED FROM SCENE BY DRIVER.

Contributing Circumstances

1 DRIVER - INEXPERIENCE/LACK OF EXPERTIS
1 DRIVER - TAKING AVOIDING ACTION TO A R
1 ANIMAL UNCONTROLLED - ON ROAD

Crash No.	Date	Day	Hour	DCA	No. Units	Street/s
20020013794	07-JUN-2002	Fri	04	800 OFF PATH-(	1	Gregory Development Rd

Nature	07 Overturned
Severity	5 PROPERTY DAMAGE ONLY
RSect	98C Charters Twrs-The Lynd
RPC	2
Alignment: Vertical	1 Level
Cway	1
Direction	S
Dist from RPC	20.010
Horizontal	3 Curved-View open
Inter.	
Tdist	44.000
Feature	99 Not Applicable
Traffic Control	99 No Traffic Control

Units	Age	Gender	Unit Type	Dirn.	Intended Action	BAC
1			40 Road Train/Bdouble/Triple	S	01 Go Straight Ahead	0

Description

Unit 1 was travelling in Southerly direction on Lynd Hwy towards Charters Towers coming from Oak Park Station. Unit 1 is a double trailer road train carrying 44 head cattle per trailer. Unit 1 has come to a slight bend and has misjudged the bend with one of the rear tyres leaving the roadsurface and come in contact wit h the unsealed shouler. This has caused the rear trailer to flip on its side. Th e cab of the truck and the trailer closest to it remained upright. The section o f road is completely unlit and is only one lane wide with soft unsealed shoulder s. There was no traffic direction at the time of the incident. Traffic Breach completed-T.I.N Issued for Drive with recently expired open licen ce s.78(1) TIN A0056678 - 11384

Contributing Circumstances

1 VIOLATION - UNDUE CARE AND ATTENTION

Crash No.	Date	Day	Hour	DCA	No. Units	Street/s
980023727	30-OCT-1998	Fri	15	803 OFF PATH-(	1	Gregory Development Rd

Nature	06 Hit fixed obstruction or temporar
Severity	5 PROPERTY DAMAGE ONLY
Alignment: Vertical	1 Level
Horizontal	3 Curved-View open
Feature	99 Not Applicable
Traffic Control	99 No Traffic Control

RSect	98C Charters Twrs-The Lynd	RPC	2
Cway	1	Direction	N
Dist from RPC	20.070	Tdist	44.060
Inter.			

Units	Age	Gender	Unit Type	Dirn.	Intended Action	BAC
1			01 Car, Station Wagon	N	01 Go Straight Ahead	0

Description

Driver of unit 1 states that he was heading north towards Greenvale along Dalrymple Road. He was travelling at about 110km/hr and fell asleep approx. 1 km south of Fletchers Creek. He states that he left the carriage way on the left hand side at the apex of a sweeping curve. The vehicle was extensively dam aged. He states that he worked from 7am to 7pm on Thrusday 29/10/98 and had approximately 6 hours sleep prior to the accident.

Contributing Circumstances

1 VIOLATION - EXCEEDING SPEED LIMIT
1 DRIVER - FATIGUE/FELL ASLEEP

Crash No.	Date	Day	Hour	DCA	No. Units	Street/s
960024368	27-SEP-1996	Fri	19	800 OFF PATH-(	1	Gregory Development Rd

RSect: 98C Charters Twrs-The Lynd

Cway: 1

Direction: S

Inter.:

RPC: 2

Dist from RPC: 20.750

Tdist: 44.740

Nature: 07 Overturned

Severity: 5 PROPERTY DAMAGE ONLY

Alignment: Vertical: 1 Level

Horizontal: 3 Curved-View open

Feature: 20 Bridge, Causeway

Traffic Control: 99 No Traffic Control

Units	Age	Gender	Unit Type	Dirn.	Intended Action	BAC
1			02 Utility, Panel Van	S	01 Go Straight Ahead	N/A

Description

Scene not visited by police. Reported at Counter on 15/10/96. Reported for insurance purposes. Unit 1 travelling south on Lynd Highway at speed of about 40kmh pulled over to l eft hand edge of causeway to allow oncoming vehicle to pass. Unit 1 veered over embankment and rolled onto roof.

Contributing Circumstances

1 DRIVER CONDITIONS - MISCELLANEOUS

Crash No.	Date	Day	Hour	DCA	No. Units	Street/s
20030017767	22-JUL-2003	Tue	11	400 VEH'S MAN(	1	Gregory Development Rd

RSect	98C Charters Twrs-The Lynd
Cway	1
Direction	W
Inter.	
RPC	3
Dist from RPC	0.105
Tdist	44.895

Nature	06 Hit fixed obstruction or temporai
Severity	2 ADMITTED TO HOSPITAL
Alignment: Vertical	1 Level
Horizontal	1 Straight
Feature	99 Not Applicable
Traffic Control	99 No Traffic Control

Units	Age	Gender	Unit Type	Dirn.	Intended Action	BAC
1			06 Motor Cycle	W	01 Go Straight Ahead	N/A

Description

At about 11.00am on tuesday 22nd July 2003 the rider of unit 1 was riding a frie nds motorbke at Fletcher Creek caravan park. The motorbike was a suzuki 185cc tr ail bike and the rider had never ridden a bike before. It appears that the ride r has been riding on council land at Fletcher Creek and has been travelling at s peeds in excess of 80km/h. Witnesses noticed that he was travelling to fast and yelled out to him to slow down, unfortunately the rider has wridden across the L ynd hwy at about 80 km/h and hit rocks on the other side of the road. this has f lipped the bike and the rider has fallen off and rolled approximately 30 meters over stones until he came to rest. As a result of this accident the rider receiv d injuries which included a broken right leg, as damaged left knee and a number of knocks to his head as his helmet cam off. The rider was subsequently airlifte d to townsville hospital.

Contributing Circumstances

1 DRIVER - UNDERAGE (INEXPERIENCE)
1 EXCESSIVE SPEED FOR CIRCUMSTANCES

Crash No.	Date	Day	Hour	DCA	No. Units	Street/s
970025461	20-NOV-1997	Thu	14	703 OFF PATH-S	1	Gregory Development Rd

RSect	98C Charters Twrs-The Lynd	RPC	3
Cway	1	Direction	S
Dist from RPC	2.270	Tdist	47.060
Inter.			

Nature	06 Hit fixed obstruction or temporar
Severity	2 ADMITTED TO HOSPITAL
Alignment: Vertical	1 Level
Horizontal	1 Straight
Feature	99 Not Applicable
Traffic Control	99 No Traffic Control

Units	Age	Gender	Unit Type	Dirn.	Intended Action	BAC
1			01 Car, Station Wagon	S	01 Go Straight Ahead	N/A

Description

The incident occured on the Lynd Hwy about 42 km north of Charters Towers and about 2km north of Fletcher Creek. The carriageway at this point consists of a narrow strip of bitumen. The unit went into a slide after skidding on the loose surface on the side of the road. The driver lost control of the vehicle and it left the carriageway. After leaving the carriageway vehicle struck a mound and was badly damaged.

Contributing Circumstances

1 ROAD - WET/SLIPPERY
1 ROAD - NARROW BITUMEN

Crash No.	Date	Day	Hour	DCA	No. Units	Street/s
970014985	11-JUL-1997	Fri	16	201 VEH'S OPP(	2	Gregory Development Rd

RSect: 98C Charters Twrs-The Lynd

Cway: 1 Direction: N

Inter.:

RPC: 3

Dist from RPC: 3.270

Tdist: 48.060

Nature: 04 Head-on

Severity: 2 ADMITTED TO HOSPITAL

Alignment: Vertical: 1 Level

Horizontal: 1 Straight

Feature: 99 Not Applicable

Traffic Control: 99 No Traffic Control

Units	Age	Gender	Unit Type	Dirn.	Intended Action	BAC
1			01 Car, Station Wagon	S	01 Go Straight Ahead	N/A
2			02 Utility, Panel Van	N	01 Go Straight Ahead	N/A

Description

THE TRAFFIC INCIDENT OCCURRED ON THE LYND HWY APPROX 47KMS NORTH OF CHARTERS TOWERS. THE LYND HWY IS A NARROW SEALED ROAD WITH UNSEALED SHOULDERS. U1 WAS TRAVELLING SOUTH FOLLOWING A SEMI TRAILER. U2 WAS TRAVELLING NORTH . U2 VEERED SLIGHTLY OFF TO THE LEFT SIDE OF THE ROAD TO LET THE ONCOMING SEMI TRAILER PASS. FOLLOWING THE TRUCK WAS A CLOUD OF DUST AND THEN U1. BEFORE U2 COULD VEER BACK ONTO THE ROAD U1 COLLIDED WITH U2.

Contributing Circumstances

2 NOT APPLICABLE
1 ROAD - NARROW
1 VIOLATION - FAIL TO KEEP LEFT

Crash No.	Date	Day	Hour	DCA	No. Units	Street/s
20020019224	05-AUG-2002	Mon	20	800 OFF PATH-(	1	Gregory Development Rd

Nature: 07 Overturned

Severity: 2 ADMITTED TO HOSPITAL

RSect: 98C Charters Twrs-The Lynd

RPC: 3

Alignment: Vertical: 1 Level

Cway: 1

Direction: N

Dist from RPC: 3.530

Horizontal: 3 Curved-View open

Inter.:

Tdist: 48.320

Feature: 99 Not Applicable

Traffic Control: 99 No Traffic Control

Units	Age	Gender	Unit Type	Dirn.	Intended Action	BAC
1			02 Utility, Panel Van	N	01 Go Straight Ahead	5

Description

UNIT 1 WAS TRAVELLING NORTH ON GREGORY DEVELOPMENTAL RD APPROXIMATELY 44 KM'S NO RTH OF CHARTERS TOWERS. UNIT 1 HAD JUST RECENTLY OVERTAKEN A LARGE TRUCK AND RET URNED TO THE LEFT SIDE OF THE ROAD. UNIT 1 HAS THEN CONTINUED ON FOR A TIME LOSI NG CONTROL ON A SOFT SHOULDER. UNIT 1 HAS THEN ROLLED APPROXIMATELY 3 OR 4 TIMES

Contributing Circumstances

1 ROAD CONDITIONS - MISCELLANEOUS

1 VIOLATION - OVER PRESCRIBED CONCENTF

Queensland Government
Department of Main Roads

Road Crash 2
CRASH DETAIL REPORT

Crash No.	Date	Day	Hour	DCA	No. Units	Street/s
950008495	16-APR-1995	Sun	11	801 OFF PATH-(	1	Gregory Development Rd

Nature: 07 Overturned
Severity: 5 PROPERTY DAMAGE ONLY

RSect: 98C Charters Twrs-The Lynd
RPC: 9
Alignment: Vertical: 2 Grade
Cway: 1
Direction: N
Dist from RPC: 2.630
Horizontal: 3 Curved-View open
Inter.:
Tdist: 129.650
Feature: 99 Not Applicable
Traffic Control: 99 No Traffic Control

Units	Age	Gender	Unit Type	Dirn.	Intended Action	BAC
1			01 Car, Station Wagon	N	01 Go Straight Ahead	N/A

Description

TRAVELLING NORTH AT ABOUT 80KM/H. MOVED OVER TO AVOID WIDE ROAD TRAIN APPROACHING FROM OPOSITE DIRECTION. LOST CONTROL IN LOOSE GRAVEL ON ROAD EDGES AND OVERTURNED. NON-INJURY INCIDENT INVOLVING SINGLE VEHICLE.

Contributing Circumstances

1 ROAD - NARROW BITUMEN
1 VIOLATION - UNDUE CARE AND ATTENTION

Crash No.	Date	Day	Hour	DCA	No. Units	Street/s
20040008912	07-APR-2004	Wed	14	705 OFF PATH-	1	Gregory Development Rd

RSect: 98C Charters Twrs-The Lynd
RPC: 9
Cway: 1
Direction: N
Dist from RPC: 3.980
Inter.:
Tdist: 131.000

Nature: 07 Overturned
Severity: 3 RECEIVED MEDICAL TREATME
Alignment: Vertical: 1 Level
Horizontal: 1 Straight
Feature: 99 Not Applicable
Traffic Control: 99 No Traffic Control

Units	Age	Gender	Unit Type	Dirn.	Intended Action	BAC
1			02 Utility, Panel Van	N	01 Go Straight Ahead	0

Description

Unit 1 was headed north along Grgeory Developemental Road when one of his tyres blew out. Driver has over corrected the steering. Driver has lost control of the vehicle. Vehicle has then rolled several times and then come to a holt.

Contributing Circumstances

1 VEHICLE - TYRES (I.E. LOW TREAD, PUNCTU
1 DRIVER - INEXPERIENCE/LACK OF EXPERTIS
1 DRIVER - FATIGUE RELATED BY DEFINITION

Crash No.	Date	Day	Hour	DCA	No. Units	Street/s
990005788	19-MAR-1999	Fri	14	201 VEH'S OPP(	3	Gregory Development Rd

RSect	98C Charters Twrs-The Lynd
Cway	1
Direction	S
Inter.	
RPC	9
Dist from RPC	4.250
Tdist	131.270
Nature	05 Sideswipe
Severity	3 RECEIVED MEDICAL TREATME
Alignment: Vertical	1 Level
Horizontal	1 Straight
Feature	99 Not Applicable
Traffic Control	99 No Traffic Control

Units	Age	Gender	Unit Type	Dirn.	Intended Action	BAC
1			01 Car, Station Wagon	S	01 Go Straight Ahead	0
2			04 Articulated Vehicle	N	01 Go Straight Ahead	0
3			02 Utility, Panel Van	S	01 Go Straight Ahead	0

Description

U1 TRAVELLING SOUTH BEHIND A TRUCK, THE TRUCK WENT TO PASS ANOTHER TRUCK (U2) HEADING NORTH. AS THE TRUCK PULLED OVER TO LET U2 PASS A LARGE CLOUD OF DUST WAS THROWN UP, U1 BECAME 'LOST' IN THIS DUST AND SIDESWIPED U2, IN THE OPPOSITE LANE AND THEN SPUN INTO U3 WHO WAS FOLLOWING U1. U3 COLLIDED WITH U1'S PASSENGER SIDE DOOR. road train

Contributing Circumstances

2 NOT APPLICABLE
3 NOT APPLICABLE
1 ATMOSPHERIC - DUST
1 VIOLATION - FOLLOW TOO CLOSELY

Crash No.	Date	Day	Hour	DCA	No. Units	Street/s
20020007976	04-APR-2002	Thu	16	803 OFF PATH-(	1	Gregory Development Rd

RSect: 98C Charters Twrs-The Lynd
RPC: 9
Cway: 1
Direction: N
Dist from RPC: 4.470
Inter.:
Tdist: 131.490

Nature: 06 Hit fixed obstruction or tempora
Severity: 1 FATAL
Alignment: Vertical: 2 Grade
Horizontal: 2 Curved-View obscured
Feature: 99 Not Applicable
Traffic Control: 99 No Traffic Control

Units	Age	Gender	Unit Type	Dirn.	Intended Action	BAC
1			03 Truck	N	01 Go Straight Ahead	N/A

Description

UNIT 1 TRAVELLED IN A MAINLY NORTH DIRECTION AT AN UNKNOWN SPEED WHEN ON APPROACHING A SLIGHT RIGHT HAND BEND THE FRONT OFFSIDE TYRE RUPTURED CAUSING THE VEHICLE TO SWERVE TO THE RIGHT AND TRAVEL INTO AN EMBANKMENT ON THE SIDE OF THE ROAD. THE VEHICLE THEN ROLLED OVER, LOSING ITS LOAD AND THEN ROLLED BACK ONTO ITS WHEELS BEFORE COMING TO A STOP. SUBSEQUENTLY THE PASSENGER WAS THROWN FROM THE VEHICLE AND DRIVER TRAPPED AFTER FRONT OF CABIN IMPACTED WITH THE EMBANKMENT CRUSHING THE CABIN. TO NOTE: UNIT 1 CURRENTLY UNREGISTERED AT TIME OF INCIDENT. CURRENT UNREGISTERED PERMIT IN EFFECT NO: C 126861. CTP RECEIPT NO: SUNCORP A1354090 APPLICABLE FOR 04/04/02.

Contributing Circumstances

1 VEHICLE - TYRES (I.E. LOW TREAD, PUNCTU

Crash No.	Date	Day	Hour	DCA	No. Units	Street/s
960015600	16-JUN-1996	Sun	18	609 PASS & MIS	2	Gregory Development Rd

RSect	98C Charters Twrs-The Lynd
Cway	1
Direction	N
Inter.	
RPC	10
Dist from RPC	0.370
Tdist	136.140

Nature	11 Hit animal incl. ridden horse or
Severity	5 PROPERTY DAMAGE ONLY
Alignment: Vertical	1 Level
Horizontal	1 Straight
Feature	99 Not Applicable
Traffic Control	99 No Traffic Control

Units	Age	Gender	Unit Type	Dirn.	Intended Action	BAC
1			01 Car, Station Wagon	N	01 Go Straight Ahead	N/A
2			13 Animal - Stock	E	99 Not Applicable	N/A

Description

Driver of Unit One was heading north at about 80kph. When passing through a cut ting, two cattle jumped off the cutting directly in the path of the unit, approx imately five metres in front of the vehicle. The Owner/Driver had no oppurtunit y to avoid colliding with beasts. Driver braked heavily, and collided with one beast, which rolled onto the bonnet of the vehicle. The driver then lost contro l of the vehicle, and the vehicle skidded to the right into a table drain before coming to rest on the vehicles passenger side. No injuries, unavoidable collision.x

Contributing Circumstances

2 NOT APPLICABLE

1 ANIMAL UNCONTROLLED - ON ROAD

Queensland Government
Department of Main Roads

Road Crash 2
CRASH DETAIL REPORT

Crash No.	Date	Day	Hour	DCA	No. Units	Street/s
920017994	07-AUG-1992	Fri	07	701 OFF PATH-S	1	Gregory Development Rd

RSect	98C Charters Twrs-The Lynd
Cway	1
Direction	S
Inter.	
RPC	15
Dist from RPC	8.110
Tdist	208.930

Nature	07 Overturned
Severity	4 MINOR INJURY - FIRST AID OR
Alignment: Vertical	1 Level
Horizontal	1 Straight
Feature	99 Not Applicable
Traffic Control	99 No Traffic Control

Units	Age	Gender	Unit Type	Dirn.	Intended Action	BAC
1			01 Car, Station Wagon	S	01 Go Straight Ahead	N/A

Description

Unit 1 was travelling south on the Gregory Developmental rd approximately 2km north of Greenvale at Redbank Creek. She swerved to avoid two kangaroos on the road. She subsequently lost control of her vehicle and rolled onto its side. The driver informed police she was not speeding but travelling at around 35-40km per hour. There was heavy fog and she didn't see where the edge of the roadway was subsequently rolling her vehicle of the side of the roadway.

Contributing Circumstances

1 ATMOSPHERIC - FOG
1 ANIMAL UNCONTROLLED - ON ROAD

Crash No.	Date	Day	Hour	DCA	No. Units	Street/s
980011108	27-MAY-1998	Wed	04	700 OFF PATH-S	1	Gregory Development Rd

Nature	06 Hit fixed obstruction or temporar
Severity	5 PROPERTY DAMAGE ONLY
RSect	98C Charters Twrs-The Lynd
RPC	15
Cway	1
Direction	S
Dist from RPC	8.180
Tdist	209.000
Inter.	
Alignment: Vertical	1 Level
Horizontal	1 Straight
Feature	99 Not Applicable
Traffic Control	99 No Traffic Control

Units	Age	Gender	Unit Type	Dirn.	Intended Action	BAC
1			04 Articulated Vehicle	S	01 Go Straight Ahead	N/A

Description

Unit one in this instance may not be responsible for this traffic incident. Unit one alleges a second vehicle namely a grn/wht triple stock truck was travelling along the wrong side of the roadway from Charters Towers. There is no way to identify this vehicle at this stage and further enquiries will be cond ucted to try and locate this vehicle. The Log Books of the Unit one have been seized and are being investigated.

Contributing Circumstances

1 VEHICLE - TYRES (I.E. LOW TREAD, PUNCTU
1 DRIVER - TAKING AVOIDING ACTION TO MIS

Crash No.	Date	Day	Hour	DCA	No. Units	Street/s
970022146	09-OCT-1997	Thu	13	702 OFF PATH-$	1	Gregory Development Rd

Nature	07 Overturned
Severity	1 FATAL
Alignment: Vertical	2 Grade
Horizontal	1 Straight
Feature	20 Bridge, Causeway
Traffic Control	99 No Traffic Control

RSect	98C Charters Twrs-The Lynd
Cway	1
Direction	S
Inter.	
RPC	16
Dist from RPC	2.570
Tdist	212.240

Units	Age	Gender	Unit Type	Dirn.	Intended Action	BAC
1			01 Car, Station Wagon	E	01 Go Straight Ahead	0

Description

U1 travelling in easterly direction towards Greenvale. U1 had been following a road train at some distance behind. U1 has veered onto the incorrect side of the roadway upon approaching Redbank Ck and has then veered sharply back onto the correct side of the road, where the left hand side wheels have left the bitumen and travelled on the gravel verge. The vehicle has then begun to skid and has then skidded sideways across the road and then left the roadway on the southern (incorrect side) of the road, overturned and has come to rest 5m from side of the road. The driver was trapped in the vehicle. The two other occupants have been assisted from the vehicle. The driver was later removed by Emergency workers, however, efforts to revive him were unsuccessful. Cause of accident unclear. Occupant passengers and other witnesses were unable to provide a cause for the accident.

Contributing Circumstances

1 DRIVER CONDITIONS - MISCELLANEOUS

Crash No.	Date	Day	Hour	DCA	No. Units	Street/s
20010016218	16-JUL-2001	Mon	11	705 OFF PATH-$	1	Gregory Development Rd

RSect	98C Charters Twrs-The Lynd	RPC	16
Cway	1	Direction	S
Dist from RPC	6.930	Tdist	216.600
Inter.			

Nature	07 Overturned
Severity	2 ADMITTED TO HOSPITAL
Alignment: Vertical	1 Level
Horizontal	1 Straight
Feature	99 Not Applicable
Traffic Control	99 No Traffic Control

Units	Age	Gender	Unit Type	Dirn.	Intended Action	BAC
1			07 Special Purpose Vehicle (Tractor Etc)	E	01 Go Straight Ahead	94

Description

UNIT 1 travelling towards Charters Towers. Observed vehicle coming other way along the single lane bituman road. UNIT 1 has started to break and move over t o left hand side of road and vehicle went past. UNIT 1 has tried to move back o nto bituman but righthand wheels have ended up off righthand side of bituman. UNIT 1 has swerved back onto road and loss control swerving again this time caus ing vehicle to slide sideways and roll. UNIT 1 describes that a lot of dust fro m vehicle passing in opposite direction made it difficult to see road.

Contributing Circumstances

1 ATMOSPHERIC CONDITIONS - MISCELLANE(
1 ROAD - NARROW BITUMEN
1 ROAD CONDITIONS - MISCELLANEOUS

Crash No.	Date	Day	Hour	DCA	No. Units	Street/s
920006891	25-MAR-1992	Wed	19	609 PASS & MIS	2	Gregory Development Rd

RSect: 98C Charters Twrs-The Lynd
RPC: 16
Cway: 1
Direction: S
Dist from RPC: 7.260
Inter.:
Tdist: 216.930

Nature: 11 Hit animal incl. ridden horse or d
Severity: 5 PROPERTY DAMAGE ONLY
Alignment: Vertical: 1 Level
Horizontal: 1 Straight
Feature: 99 Not Applicable
Traffic Control: 99 No Traffic Control

Units	Age	Gender	Unit Type	Dirn.	Intended Action	BAC
1			01 Car, Station Wagon	S	01 Go Straight Ahead	N/A
2			13 Animal - Stock	N	99 Not Applicable	N/A

Description

UNIT 1 travelling south-west on Gregory Development Road (Lynd Section), at a speed of approximately 90 km/h, after having conducted a mine security patrol. When at a point 10 kilometres north west of Greenvale, a large red Brahman cross cow ran from a clump of wattle scrub, through long grass on the road shoulder onto the bitumen surface of the road, turned and ran towards the approaching police vehicle, Unit 1. The driver of Unit 1 applied the brakes, leaving skid marks of 9.5 metres, before colliding with the animal. It would appear that the bolts which connect the bull-bar to the chassis rail elongated the holes in the chassis, on impact, allowing the bull-bar to come adrift at the near-side and crush the bonnet and near side of the vehicle. Vehicle towed to Greenvale police station by a passing motorist.

Contributing Circumstances

2 NOT APPLICABLE
1 ANIMAL UNCONTROLLED - ON ROAD

Crash No.	Date	Day	Hour	DCA	No. Units	Street/s
910006891	09-DEC-1991	Mon	06	101 VEH'S ADJA	2	Charles St Fitzroy St

Nature	02 Angle
Severity	5 PROPERTY DAMAGE ONLY
RSect	98C Charters Twrs-The Lynd
Cway	1
Direction	S
Inter.	
RPC	16
Dist from RPC	7.260
Tdist	216.930
Alignment: Vertical	1 Level
Horizontal	1 Straight
Feature	10 Cross
Traffic Control	08 Stop Sign

Units	Age	Gender	Unit Type	Dirn.	Intended Action	BAC
1			01 Car, Station Wagon	N	01 Go Straight Ahead	N/A
2			01 Car, Station Wagon	S	01 Go Straight Ahead	N/A

Description

UNIT 2 TRAVELLING DOWN CHARLES STREET TOWARDS THE INTERSECTION WITH FITZROY STREET. UNIT 1 TRAVELLING ALONG FITZROY STREET TOWARDS INTERSECTION WITH CHARLES STREET. AS UNIT 1 CAME UP TO THE INTERSECTION HE STOPPED AT THE STOP LINE AT THE STOP SIGN FACING HIM. AFTER HE ALLOWED A FEW CARS TO PASS HE LOOKED AND COULD NOT SEE ANYTHING TRAVELLING DOWN CHARLES STREET ON HIS LEFT OR RIGHT. AS HE ENTERED THE INTERSECTION A VEHICLE TRAVELLING DOWN CHARLES STREET ON HIS RIGHT APPEARED. UNIT 1 FAILED TO SEE UNIT 2 AND DROVE OUT STRAIGHT INTO HER PATH. BREACH UNIT 1 FOR FAIL TO GIVE WAY AT STOP SIGN - REG. 20(8))A)(ii)

Contributing Circumstances

2 NOT APPLICABLE

1 VIOLATION - DISOBEY STOP SIGN

Crash No.	Date	Day	Hour	DCA	No. Units	Street/s
970026931	09-DEC-1997	Tue	16	703 OFF PATH-S	1	Gregory Development Rd

Nature	06 Hit fixed obstruction or temporar
Severity	2 ADMITTED TO HOSPITAL
Alignment: Vertical	1 Level
Horizontal	1 Straight
Feature	99 Not Applicable
Traffic Control	99 No Traffic Control

RSect	98C Charters Twrs-The Lynd			RPC	16
Cway	1	Direction	S	Dist from RPC	7.290
Inter.				Tdist	216.960

Units	Age	Gender	Unit Type	Dirn.	Intended Action	BAC
1			01 Car, Station Wagon	S	01 Go Straight Ahead	94

Description

It would appear Unit 1 was travelling South/East along the Gregory Development Rd approaching Greenvale. Approximately 10km North/West of Greenvale Unit 1 sustained a blow out of the rear right tyre. The vehicle slowed to 80km/h before swerving sharply & uncontrollably to the left and into a drainage ditch causing the vehicle to roll. Major damage was sustained to the vehicle & moderate injuries to the passenger/Minor injuries to the driver.

Contributing Circumstances

1 VEHICLE - TYRES (I.E. LOW TREAD, PUNCTU

Queensland Government
Department of Main Roads

Road Crash 2
CRASH DETAIL REPORT

Crash No.	Date	Day	Hour	DCA	No. Units	Street/s
20030004319	21-FEB-2003	Fri	16	705 OFF PATH-S	1	Kennedy Developmental Rd

RSect: 99B The Lynd-Hughenden

RPC: 1

Cway: 1

Direction: S

Dist from RPC: 14.910

Inter.:

Tdist: 14.910

Nature: 07 Overturned

Severity: 5 PROPERTY DAMAGE ONLY

Alignment: Vertical: 1 Level

Horizontal: 1 Straight

Feature: 99 Not Applicable

Traffic Control: 99 No Traffic Control

Units	Age	Gender	Unit Type	Dirn.	Intended Action	BAC
1			20 4-Wheel Drive	S	01 Go Straight Ahead	N/A

Description

Unit 1 was travelling south on Kennedy Developmental Road. Unit 1 hit a sandy s ection of the road and due to his inexperience in driving in these circumstances has over corrected his steering causing the vehicle to roll over onto its roof.

Contributing Circumstances

1 ROAD - WET/SLIPPERY

1 DRIVER - INEXPERIENCE/LACK OF EXPERTIS

Crash No.	Date	Day	Hour	DCA	No. Units	Street/s
980009172	02-MAY-1998	Sat	07	705 OFF PATH-(	1	Kennedy Developmental Rd

RSect: 99B The Lynd-Hughenden
Cway: 1
Direction: S
Inter.:
RPC: 1
Dist from RPC: 16.920
Tdist: 16.920

Nature: 07 Overturned
Severity: 2 ADMITTED TO HOSPITAL
Alignment: Vertical: 1 Level
Horizontal: 1 Straight
Feature: 99 Not Applicable
Traffic Control: 99 No Traffic Control

Units	Age	Gender	Unit Type	Dirn.	Intended Action	BAC
1			02 Utility, Panel Van	S	01 Go Straight Ahead	N/A

Description

VEHICLE WAS BEING DRIVEN SOUTH ON AN UNSEALED WET ROAD. THE VEHICLE HIT A VERY SOFT SECTION OF ROAD AND THE DRIVER LOST CONTROL ROLLING THE VEHICLE TO THE RIGHT SIDE. BOTH OCCUPANTS WERE SERIOUSLY INJURED. BOTH ARE STILL IN HOSPITAL ONE IS A QUADRAPLEGIC.

Contributing Circumstances

1 ROAD - WET/SLIPPERY
1 ROAD CONDITIONS - MISCELLANEOUS

Crash No. 20030009123
Date 15-APR-2003
Day Tue
Hour 12
DCA 705 OFF PATH-
No. Units 1
Street/s Kennedy Developmental Rd

Nature 07 Overturned
Severity 3 RECEIVED MEDICAL TREATME

RSect 99B The Lynd-Hughenden
RPC 1
Alignment: Vertical 1 Level
Cway 1
Direction S
Dist from RPC 17.910
Horizontal 1 Straight
Inter.
Tdist 17.910
Feature 99 Not Applicable
Traffic Control 99 No Traffic Control

Units	Age	Gender	Unit Type	Dirn.	Intended Action	BAC
1			02 Utility, Panel Van	S	01 Go Straight Ahead	N/A

Description

Unit One was proceeding in a southerly direction on the Hann highway Einasleigh approximately 70-75 km from the Lynd Junction and heading to hughenden. For reas on unknown, the vehicle has suddenly swerved to the left and it is believed a ty re may have blown out on the vehicle. The driver has attempted to correct this b ut has ended up losing control of the vehicle, resulting in it rolling over twic e and coming to rest off the road, driver's side down. No other vehicles involve d or on the road at the time. The road surface is corrugated gravel / dirt and t he weather at the time was fine and clear. Minor neck and head injuries sustaine d by the driver, with no injuries sustainmed by any other vehicle occupant. The driver was subsequently flown to the Cairns Base Hospital by the Royal Flying Do ctor Service from Lyndhurst Station about 15km south of the incident scene. Medi cal treatment given but not admitted. The vehicle has been extensively damaged a nd will be written off by XXXXXXX XXXX. Towed from the scene to Charters Towers and to be conveyed to XXXXXXX XXXXXXX XXXXX XXXXXXXXXX 17/4/03.

Contributing Circumstances

1 VEHICLE - TYRES (I.E. LOW TREAD, PUNCTU

Crash No.	Date	Day	Hour	DCA	No. Units	Street/s
20020028147	08-NOV-2002	Fri	12	705 OFF PATH-S	1	Kennedy Developmental Rd

Nature	09 Motor cycle or pedal cycle overt
Severity	4 MINOR INJURY - FIRST AID OR
Alignment: Vertical	1 Level
Horizontal	1 Straight
Feature	99 Not Applicable
Traffic Control	99 No Traffic Control

RSect	99B The Lynd-Hughenden
Cway	1
Direction	N
Inter.	
RPC	1
Dist from RPC	17.910
Tdist	17.910

Units	Age	Gender	Unit Type	Dirn.	Intended Action	BAC
1			06 Motor Cycle	N	01 Go Straight Ahead	N/A

Description

The Kennedy Developmental Road runs from Hughenden towards the Kennedy Highway at the Lynd junction. It is all loose gravel with very little traffic. Unit 1 is motor cycle. Unit 1 has been travelling north about 25km hr when the motorcycle has slid out from underneath the rider on the loose gravel. The rider does not think he was going around a corner at the time.

Contributing Circumstances

1 ROAD - WET/SLIPPERY

Crash No.	Date	Day	Hour	DCA	No. Units	Street/s
20010015661	09-JUL-2001	Mon	12	705 OFF PATH-S	1	Kennedy Hwy

Nature: 07 Overturned
Severity: 3 RECEIVED MEDICAL TREATME

RSect: 99B The Lynd-Hughenden
RPC: 1
Cway: 1
Direction: S
Dist from RPC: 20.000
Inter.:
Tdist: 20.000

Alignment: Vertical: 1 Level
Horizontal: 1 Straight
Feature: 99 Not Applicable
Traffic Control: 99 No Traffic Control

Units	Age	Gender	Unit Type	Dirn.	Intended Action	BAC
1			07 Special Purpose Vehicle (Tractor Etc)	S	01 Go Straight Ahead	N/A

Description

Unit 1 was travelling south along Kennedy Developmental Road, when a rear tyre o n the vehicle has blown causing the back end of the vehicle to slide out. Unit 1 has then tried to correct the vehicles action. Unit 1 has overcorrected and t hen rolled onto the drivers side. Unit 1 has a rear blown tyre.

Contributing Circumstances

1 VEHICLE - TYRES (I.E. LOW TREAD, PUNCTU

Queensland Government
Department of Main Roads

Road Crash 2
CRASH DETAIL REPORT

Crash No.	Date	Day	Hour	DCA	No. Units	Street/s
20000020111	14-SEP-2000	Thu	11	705 OFF PATH-‹	1	Kennedy Developmental Rd

Nature: 07 Overturned
Severity: 4 MINOR INJURY - FIRST AID OR

RSect: 99B The Lynd-Hughenden
RPC: 4
Cway: 1
Direction: E
Dist from RPC: 2.460
Inter.:
Tdist: 70.000

Alignment: Vertical: 1 Level
Horizontal: 1 Straight
Feature: 99 Not Applicable
Traffic Control: 99 No Traffic Control

Units	Age	Gender	Unit Type	Dirn.	Intended Action	BAC
1			01 Car, Station Wagon	E	01 Go Straight Ahead	N/A

Description

The scene of the traffic accident was not attended as Police from Greenvale took up with the occupants of the vehicle at the Oasis Roadhouse, The Lynd. The scene is in the EINASLEIGH Police Division which is currently unattended. The only description available is that of the two versions obtained from the occupants. It would appears as the vehicle lost control which heading east, travelling at approx. 80-90km/hr. It was the size of the care, road conditions and driver experience which appears to have contributed to this accident

Contributing Circumstances

1 ROAD - ROUGH SURFACE

Crash No.	Date	Day	Hour	DCA	No. Units	Street/s
950011817	27-MAY-1995	Sat	14	803 OFF PATH-(	1	Kennedy Developmental Rd

RSect 99B The Lynd-Hughenden

Cway 1 Direction N

Inter.

RPC 4

Dist from RPC 5.900

Tdist 73.440

Nature 06 Hit fixed obstruction or temporar

Severity 4 MINOR INJURY - FIRST AID OR

Alignment: Vertical 1 Level

Horizontal 3 Curved-View open

Feature 99 Not Applicable

Traffic Control 99 No Traffic Control

Units	Age	Gender	Unit Type	Dirn.	Intended Action	BAC
1			02 Utility, Panel Van	N	01 Go Straight Ahead	N/A

Description

The driver of this Unit was travelling North along the Kennedy Development Road and as she was about to cross a grid she suddenly lost control of her vehicle in gravel and skidded accross the road and overturned coming to rest on the vehi cles roof. Both the driver and passenger received minor injuries as result. The vehicle had to be towed from the scene and is unrepairable.

Contributing Circumstances

1 ROAD - GRAVEL/DIRT

1 DRIVER - INEXPERIENCE/LACK OF EXPERTIS

Crash No.	Date	Day	Hour	DCA	No. Units	Street/s
960008368	04-APR-1996	Thu	16	605 VEH'S ON F	1	Kennedy Developmental Rd

RSect	99B The Lynd-Hughenden	RPC	4
Cway	1	Direction	N
Dist from RPC	5.910	Tdist	73.450
Inter.			

Nature	06 Hit fixed obstruction or temporar
Severity	2 ADMITTED TO HOSPITAL
Alignment: Vertical	1 Level
Horizontal	1 Straight
Feature	99 Not Applicable
Traffic Control	99 No Traffic Control

Units	Age	Gender	Unit Type	Dirn.	Intended Action	BAC
1			01 Car, Station Wagon	N	01 Go Straight Ahead	N/A

Description

The driver of Unit 1 was travelling north along the Kennedy development Road and as she came around a slight bend in the road she felt a front tyre go and the vehicle began to slid in a fishtail motion. The driver tried to correct the veh icle but lost control and the vehicle skidded out of control accross a grid cra shing into the guide post and then skidding for about 30metres before overturnin g twice and coming to rest on its wheels. All passengers received minor injuries, however two passenger were airlifted to cains base Hospital by RFDS with injuries for overnight treatment. vehicle extensively damaged and no Police action taken against driver.

Contributing Circumstances

1 ROAD - GRAVEL/DIRT

1 VEHICLE - TYRES (I.E. LOW TREAD, PUNCTU

Crash No.	Date	Day	Hour	DCA	No. Units	Street/s
20010017011	24-JUL-2001	Tue	13	805 OFF PATH-(	1	Kennedy Developmental Rd

RSect: 99B The Lynd-Hughenden

Cway: 1 Direction: S

Inter.:

RPC: 4

Dist from RPC: 8.410

Tdist: 75.950

Nature: 07 Overturned

Severity: 3 RECEIVED MEDICAL TREATME

Alignment: Vertical: 1 Level

Horizontal: 2 Curved-View obscured

Feature: 99 Not Applicable

Traffic Control: 99 No Traffic Control

Units	Age	Gender	Unit Type	Dirn.	Intended Action	BAC
1			20 4-Wheel Drive	S	01 Go Straight Ahead	N/A

Description:
UNIT 1 WAS TRAVELLING SOUTH ON THE DIRT KENNEDY DEVELOPMENTAL ROAD WHEN THE DRIV ER DROVE THROUGH A SECTION OF ROAD WITH SOFT EDGES AND LOOSE DIRT. VEHICLE BEGA N TO FISHTAIL RESULTING IN THE VEHICLE FLIPPING OVER AND ROLLING TWICE. NIL OTHER VEHICLES INVOLVED.

Contributing Circumstances:
1 ROAD CONDITIONS - MISCELLANEOUS

Crash No.	Date	Day	Hour	DCA	No. Units	Street/s
950015837	06-JUL-1995	Thu	15	801 OFF PATH-(	1	Kennedy Developmental Rd

RSect: 99B The Lynd-Hughenden
RPC: 4
Cway: 1
Direction: S
Dist from RPC: 8.410
Inter.:
Tdist: 75.950

Nature: 07 Overturned
Severity: 2 ADMITTED TO HOSPITAL
Alignment: Vertical: 1 Level
Horizontal: 3 Curved-View open
Feature: 99 Not Applicable
Traffic Control: 99 No Traffic Control

Units	Age	Gender	Unit Type	Dirn.	Intended Action	BAC
1			02 Utility, Panel Van	S	01 Go Straight Ahead	N/A

Description

UNIT 1 TRAVELLING STH ON HANN HIGHWAY APPROXIMATELY 180 KM NTH HUGHENDEN UNIT 1 APPROACHED RIGHT CURVE ON GRAVEL ROAD SURFACE AND LOST CONTROL OF VEHICLE. DRIVER OF VEHICLE UNABLE TO CONTROL VEHICLE RESULTING IN OVERTURN. ALTHOUGH IT IS THOUGHT THAT THE DRIVER HAD CONSUMED LIQUOR BLOOD WAS NOT TAKEN AS IT WAS SOME 5 HOURS BEFORE DRIVER ARRIVED AT MEDICAL FACILITY. DRIVER TRANSPORTED BY BES HELICOPTER. LARGE AMOUNT OF EMPTY BEER CANS AT SITE.

Contributing Circumstances

1 ROAD - GRAVEL/DIRT
1 CONDITION - UNDER INFLUENCE OF LIQOUR

Crash No.	Date	Day	Hour	DCA	No. Units	Street/s
970026767	07-DEC-1997	Sun	11	805 OFF PATH-(	1	Kennedy Developmental Rd

Nature: 07 Overturned
Severity: 4 MINOR INJURY - FIRST AID OR

RSect: 99B The Lynd-Hughenden
RPC: 4
Cway: 1
Direction: N
Dist from RPC: 10.910
Inter.:
Tdist: 78.450

Alignment: Vertical: 1 Level
Horizontal: 3 Curved-View open
Feature: 99 Not Applicable
Traffic Control: 99 No Traffic Control

Units	Age	Gender	Unit Type	Dirn.	Intended Action	BAC
1			01 Car, Station Wagon	N	01 Go Straight Ahead	N/A

Description

Unit 1 was travelling north on the Lynd/Hughenden Road at approximately 90 kilometres per hour. Unit 1 was travelling around a left hand bend when the vehicle commenced sliding. Unit 1 driver lost control and unit 1 continued sliding across roadway and overturned.

Contributing Circumstances

1 DRIVER CONDITIONS - MISCELLANEOUS

Queensland Government
Department of Main Roads

Road Crash 2
CRASH DETAIL REPORT

Crash No.	Date	Day	Hour	DCA	No. Units	Street/s
970024189	04-NOV-1997	Tue	15	705 OFF PATH-	1	Kennedy Developmental Rd

RSect: 99B The Lynd-Hughenden
RPC: 5
Cway: 1
Direction: S
Dist from RPC: 6.090
Inter.:
Tdist: 90.950

Nature: 07 Overturned
Severity: 2 ADMITTED TO HOSPITAL
Alignment: Vertical: 1 Level
Horizontal: 1 Straight
Feature: 99 Not Applicable
Traffic Control: 99 No Traffic Control

Units	Age	Gender	Unit Type	Dirn.	Intended Action	BAC
1			02 Utility, Panel Van	S	01 Go Straight Ahead	N/A

Description

UNIT 1 WAS PROCEEDING SOUTH ALONG THE KENNEDY DEV. RD.TOWARDS HUGHENDEN. UNIT 1 HAS SWERVED LEFT TO AVOID A POTHOLE OF WATER. UNIT 1 HAS THEN SLID IN THE SOFT EDGES OF THE ROADSIDE. UNIT 1 THEN SWERVED INTO THE MIDDLE OF THE ROAD AND OVERTURNED ENDING UPSIDE DOWN OFF THE RIGHT SIDE OF THE CARRIAGEWAY.

Contributing Circumstances

1 ROAD - POTHOLES
1 ROAD CONDITIONS - MISCELLANEOUS
1 DRIVER - TAKING AVOIDING ACTION TO A R

Crash No.	Date	Day	Hour	DCA	No. Units	Street/s
980026672	05-DEC-1998	Sat	13	704 OFF PATH-;	1	Kennedy Developmental Rd

RSect: 99B The Lynd-Hughenden
Cway: 1
Direction: S
Inter.:
RPC: 5
Dist from RPC: 7.050
Tdist: 91.910

Nature: 06 Hit fixed obstruction or temporar
Severity: 3 RECEIVED MEDICAL TREATME
Alignment: Vertical: 1 Level
Horizontal: 1 Straight
Feature: 99 Not Applicable
Traffic Control: 99 No Traffic Control

Units	Age	Gender	Unit Type	Dirn.	Intended Action	BAC
1			01 Car, Station Wagon	S	01 Go Straight Ahead	N/A

Description
UNIT 1 WAS PROCEEDING SOUTH ON THE KENNEDY DEV.RD WHEN ABOUT 100 KM SOUTH OF THE OASIS SERVICE STATION THE RIGHT REAR TYRE BLEW OUT CAUSING THE DRIVER TO LOOSE CONTROL TO THE RIGHT HIT THE TABLE DRAIN AND ROLL THE VEHICLE

Contributing Circumstances
1 VEHICLE - TYRES (I.E. LOW TREAD, PUNCTU

Crash No.	Date	Day	Hour	DCA	No. Units	Street/s
20010023629	06-OCT-2001	Sat	16	805 OFF PATH-(	1	Kennedy Developmental Rd

Nature: 07 Overturned

Severity: 3 RECEIVED MEDICAL TREATME

RSect: 99B The Lynd-Hughenden

RPC: 5A

Alignment: Vertical: 1 Level

Cway: 1

Direction: S

Dist from RPC: 0.490

Horizontal: 3 Curved-View open

Inter.:

Tdist: 93.000

Feature: 99 Not Applicable

Traffic Control: 99 No Traffic Control

Units	Age	Gender	Unit Type	Dirn.	Intended Action	BAC
1			02 Utility, Panel Van	S	01 Go Straight Ahead	0

Description

Unit 1 was being driven in a southerly direction on the Kennedy Dev Rd Hughenden The rear near side wheel suffered a blow out or it was snapped off at the axle. After the wheel came adrift the driver lost control and overturned. Minor injuries received by occupants.

Contributing Circumstances

1 VEHICLE - TYRES (I.E. LOW TREAD, PUNCTU

Crash No.	Date	Day	Hour	DCA	No. Units	Street/s
20030009823	25-APR-2003	Fri	13	703 OFF PATH-$	1	Kennedy Developmental Rd

RSect: 99B The Lynd-Hughenden

RPC: 5A

Cway: 1

Direction: N

Dist from RPC: 6.440

Inter.:

Tdist: 98.950

Nature: 06 Hit fixed obstruction or tempora

Severity: 1 FATAL

Alignment: Vertical: 1 Level

Horizontal: 1 Straight

Feature: 99 Not Applicable

Traffic Control: 99 No Traffic Control

Units	Age	Gender	Unit Type	Dirn.	Intended Action	BAC
1			20 4-Wheel Drive	N	01 Go Straight Ahead	N/A

Description

UNIT 1 HAS BEEN TRAVELLING NORTH WHEN IT HAS VEERED OFF THE ROAD AND INTO A LOOSE ROAD SHOULDER WITH SMALL GULLY. UNIT ONE HAS THE CLIPPED A TREE AND GONE ONTO ITS SIDE. NO INDERCATION OF TYRE DEFLATION OR EXCESSIVE SPEED. (GCL has no record of blood sample at time of pro- cessing, 30/7/03).

Contributing Circumstances

1 VIOLATION - UNDUE CARE AND ATTENTION

Crash No.	Date	Day	Hour	DCA	No. Units	Street/s
990017999	22-AUG-1999	Sun	10	705 OFF PATH-S	1	Kennedy Developmental Rd

RSect	99B The Lynd-Hughenden
Cway	1
Direction	N
Inter.	
RPC	5A
Dist from RPC	7.490
Tdist	100.000

Nature	07 Overturned
Severity	2 ADMITTED TO HOSPITAL
Alignment: Vertical	1 Level
Horizontal	1 Straight
Feature	99 Not Applicable
Traffic Control	99 No Traffic Control

Units	Age	Gender	Unit Type	Dirn.	Intended Action	BAC
1			02 Utility, Panel Van	N	01 Go Straight Ahead	0

Description

Unit 1 travelling north on Hann Highway burst a front passenger tyre sending the vehicle into a spin and causing unit 1 to over turn. Unit 1 driver and rear passenger seated at driver door injuried. speed of vehicle estimated only at info of driver.

Contributing Circumstances

1 VEHICLE - TYRES (I.E. LOW TREAD, PUNCTU

Queensland Government
Department of Main Roads

Road Crash 2
CRASH DETAIL REPORT

Crash No.	Date	Day	Hour	DCA	No. Units	Street/s
930003529	20-FEB-1993	Sat	16	701 OFF PATH-S	1	Kennedy Developmental Rd

Nature: 07 Overturned
Severity: 5 PROPERTY DAMAGE ONLY

RSect: 99C Hughenden - Winton
Cway: 1
Direction: S
Inter.:
RPC: 1
Dist from RPC: 10.750
Tdist: 10.750

Alignment: Vertical: 1 Level
Horizontal: 1 Straight
Feature: 99 Not Applicable
Traffic Control: 99 No Traffic Control

Units	Age	Gender	Unit Type	Dirn.	Intended Action	BAC
1			02 Utility, Panel Van	S	01 Go Straight Ahead	N/A

Description
Unit 1 was travelling south from Hughenden, on a gravel road surface, when he swerved to avoid a beast on the road. The driver of the unit lost control of the vehicle and the rear end of the vehicle slid into the tabledrain, causing the vehicle to roll over onto its right side.

Contributing Circumstances
1 ANIMAL UNCONTROLLED - ON ROAD

Crash No.	Date	Day	Hour	DCA	No. Units	Street/s
930015914	26-JUL-1993	Mon	14	600 VEH'S ON P	1	Kennedy Developmental Rd

RSect	99C Hughenden - Winton
Cway	1
Direction	N
Inter.	
RPC	1
Dist from RPC	11.596
Tdist	11.596
Nature	06 Hit fixed obstruction or tempora
Severity	5 PROPERTY DAMAGE ONLY
Alignment: Vertical	1 Level
Horizontal	1 Straight
Feature	99 Not Applicable
Traffic Control	99 No Traffic Control

Units	Age	Gender	Unit Type	Dirn.	Intended Action	BAC
1			01 Car, Station Wagon	N	01 Go Straight Ahead	N/A

Description

Unit 1 was travelling north along Winton Road heading towards Hughenden. Prior to the incident Unit 1 was travelling at approximately 80 km per hour. At about 12km south of Hughenden a cattle grid crosses the road. At the time of this incident this cattle grid had a section approximately 10cm long missing from the left side. As Unit 1 approached the grid the driver of the vehicle slowed down to approximately 30km per hour. As Unit 1 passed over the grid the driver heard a loud noise. The driver then stopped the vehicle and discovered that the rear wheel assembly had broken completely from the caravan leaving the caravan on its undercarriage. An inspection of the left wheel of the caravan revealed that the tyre was completely flat and a wedge had been formed in the rim of the tyre that was consistent with hitting the broken part of the cattle grid. Nil injuries were sustained. The caravan was then towed back to Hughenden by Close Autos. Reported for insurance (NRMA) purposes only. No further police action desired.

Contributing Circumstances

1 ROAD CONDITIONS - MISCELLANEOUS

Crash No.	Date	Day	Hour	DCA	No. Units	Street/s
20000001337	20-JAN-2000	Thu	15	802 OFF PATH-(	1	Kennedy Developmental Rd

RSect: 99C Hughenden - Winton

RPC: 2

Cway: 1

Direction: S

Dist from RPC: 2.000

Inter.:

Tdist: 14.280

Nature: 07 Overturned

Severity: 5 PROPERTY DAMAGE ONLY

Alignment: Vertical: 1 Level

Horizontal: 3 Curved-View open

Feature: 20 Bridge, Causeway

Traffic Control: 99 No Traffic Control

Units	Age	Gender	Unit Type	Dirn.	Intended Action	BAC
1			20 4-Wheel Drive	S	01 Go Straight Ahead	N/A

Description

Unit 1 was heading in a southerly direction from Hughenden towards Stamford on the Kennedy Development Rd (Hughenden-Winton Rd). As Unit 1 was near the end of the bitumen the driver stopped and engaged the 4WD locking hubs on the front wheels. Unit 1 then started to proceed again and was doing about 50 KPH as he approached an open curve going over a culvert. As Unit 1 approached the culvert, the car started to slide off the road onto the soft muddy shoulder of the road, losing control of the vehicle. The vehicle overturned ending up in th e culvert upside down causing extensive damage to the vehicle. 3/3/00 - crash validated (RS)

Contributing Circumstances

1 ATMOSPHERIC - HEAVY RAIN

1 ROAD - WET/SLIPPERY

Crash No.	Date	Day	Hour	DCA	No. Units	Street/s
20000012308	09-JUN-2000	Fri	11	201 VEH'S OPP	2	Kennedy Hwy

RSect: 99C Hughenden - Winton

Cway: 1

Direction: S

Inter.:

RPC: 2

Dist from RPC: 3.720

Tdist: 16.000

Nature: 04 Head-on

Severity: 5 PROPERTY DAMAGE ONLY

Alignment: Vertical: 1 Level

Horizontal: 1 Straight

Feature: 99 Not Applicable

Traffic Control: 99 No Traffic Control

Units	Age	Gender	Unit Type	Dirn.	Intended Action	BAC
1			01 Car, Station Wagon	S	01 Go Straight Ahead	0
2			01 Car, Station Wagon	N	01 Go Straight Ahead	0

Description

Unit 1 has rounded a corner and come onto a straight stretch in which Unit 2 was approaching him. U1 has possibly been travelling a little too fast for the conditions and has not been able to avoid stopping or hitting U2. Nil breach forcoming as wheel rutts very bad and Police vehicle had trouble stopping when approaching incident whilst travelling at very low speed.

Contributing Circumstances

2 NOT APPLICABLE

1 ROAD - ROUGH SURFACE

1 EXCESSIVE SPEED FOR CIRCUMSTANCES

Crash No.	Date	Day	Hour	DCA	No. Units	Street/s
970024533	06-NOV-1997	Thu	08	607 VEH'S ON F	1	Kennedy Developmental Rd

Nature: 06 Hit fixed obstruction or tempora

Severity: 4 MINOR INJURY - FIRST AID OF

RSect: 99C Hughenden - Winton

RPC: 2

Alignment: Vertical: 2 Grade

Cway: 1

Direction: N

Dist from RPC: 5.650

Horizontal: 1 Straight

Inter.:

Tdist: 17.930

Feature: 99 Not Applicable

Traffic Control: 99 No Traffic Control

Units	Age	Gender	Unit Type	Dirn.	Intended Action	BAC
1			01 Car, Station Wagon	N	01 Go Straight Ahead	N/A

Description

UNIT 1 WAS TRAVELLING NORTH ALONG THE WINTON RD AT APPROX. 90KMH. UNIT 1 HAS HIT A LARGE RUTT IN THE ROAD AND BLOWN A TYRE. UNIT 1 THEN SWERVED TO THE RIGHT AND OVERTURNED ENDING UP ON THE RIGHT SIDE OF THE CARRIAGEWAY

Contributing Circumstances

1 ROAD - ROUGH SURFACE

1 DRIVER - INEXPERIENCE/LACK OF EXPERTIS

Crash No.	Date	Day	Hour	DCA	No. Units	Street/s
990000804	12-JAN-1999	Tue	15	702 OFF PATH-S	1	Gregory Development Rd

RSect: 99C Hughenden - Winton
Cway: 1
Direction: N
Inter.:

RPC: 2
Dist from RPC: 6.000
Tdist: 18.280

Nature: 07 Overturned
Severity: 4 MINOR INJURY - FIRST AID OR
Alignment: Vertical: 1 Level
Horizontal: 1 Straight
Feature: 99 Not Applicable
Traffic Control: 99 No Traffic Control

Units	Age	Gender	Unit Type	Dirn.	Intended Action	BAC
1			01 Car, Station Wagon	N	01 Go Straight Ahead	N/A

Description

UNIT 1 WAS PROCEEDING NORTH ALONG THE WINTO OAD AT ABOUT 80KM'S PER HOUR. THE DRIVER OF UNIT 1 WAS ATTEMPTING TO STRADDLE THE 1 FOOT DEEP WHEEL STRUTTS MADE BY SOME LARGE TRUCKS THAT HAD BEEN ALONG THE ROAD PRIOR TO THEM. THE WEHEELS OF UNIT 1 SLIPPED OUTSIDE THE WHEEL STRUTTS AND WENT INTO A BROAD SLIDE. THE MOTOR OF UNIT 1 THEN CUT OUT AND THE DRIVER OF THAT UNIT LOST TOTAL CONTROL OF THE VEHICLE. THE VEHICLE SLID INTO THE TABLE DRAIN WHERE IT OVER TURNED ONTO ITS ROOF.

Contributing Circumstances

1 ROAD - ROUGH SURFACE

Crash No.	Date	Day	Hour	DCA	No. Units	Street/s
940020592	09-SEP-1994	Fri	15	705 OFF PATH-S	1	Kennedy Developmental Rd

RSect 99C Hughenden - Winton

Cway 1 Direction N

Inter.

RPC 2

Dist from RPC 7.320

Tdist 19.600

Nature 07 Overturned

Severity 4 MINOR INJURY - FIRST AID OF

Alignment: Vertical 2 Grade

Horizontal 1 Straight

Feature 99 Not Applicable

Traffic Control 99 No Traffic Control

Units	Age	Gender	Unit Type	Dirn.	Intended Action	BAC
1			01 Car, Station Wagon	N	01 Go Straight Ahead	N/A

Description

UNIT 1 WAS TRAVELLING AT ABOUT 100 KMS PER HOURON THE GRAVEL ROADWAY. A VEHICLE COMING IN THE OPPOSITE DIRECTION WAS COMING OVER A SLIGHT RISE. UNIT 1 MOVED TO THE LEFT SIDE OFTHE ROADWAY LOST CONTROL OF THE VEHICLE IN THE LOOSE GRAVEL. THE VEHICLE THEN SWERVED SIDEWAYS AND ROLLED OVER SEVERAL TIMES.

Contributing Circumstances

1 ROAD - WET/SLIPPERY

1 ROAD - GRAVEL/DIRT

Crash No.	Date	Day	Hour	DCA	No. Units	Street/s
20010010327	10-MAY-2001	Thu	13	607 VEH'S ON F	1	Kennedy Developmental Rd

RSect	99C Hughenden - Winton
Cway	1
Direction	N
Inter.	
RPC	2
Dist from RPC	7.720
Tdist	20.000

Nature	06 Hit fixed obstruction or tempora
Severity	2 ADMITTED TO HOSPITAL
Alignment: Vertical	2 Grade
Horizontal	2 Curved-View obscured
Feature	99 Not Applicable
Traffic Control	99 No Traffic Control

Units	Age	Gender	Unit Type	Dirn.	Intended Action	BAC
1			06 Motor Cycle	N	01 Go Straight Ahead	N/A

Description

The driver of unit 1 was driving in a northerly direction on Winton Road approx 20k's south of Hughenden. On appraoching a dirt detour the driver has slowed do wn due to an obscured view of the road. He has hit a small drop off and loose g ravel causing the motorcycle to slide out. The driver has put his foot down caus ing it to break.

Contributing Circumstances

1 ROAD - WET/SLIPPERY
1 ROAD - ROUGH SURFACE
1 ROAD CONDITIONS - MISCELLANEOUS

APPENDIX I

PICTURES OF GREGORY DEVELOPMENTAL ROAD


FLOODWAY


SANDY CREEK

APPENDIX J

PERCENTAGE EFFECTIVENESS
OF REMEDIAL TREATMENT

Table 9.5 Effectiveness of Countermeasures for Intersection Crashes

(based on the revised tables for FORS, 1996 - prepared by Dr David Andreassen for the Australian Transport Safety Bureau)

Accident-type [DCA Code]		101-109	201	202-206	301-304	305-307	308, 309	001-003	706, 707	601, 401, 402
Description		Adjacent approach	Head on	Opposing turns	Rear end	Lane change	Parallel lanes-turning	Vehicle hits pedestrian	Loss of control, L or R Turns	Hit parked/ parking vehicle
Treatment		**Estimated Percentage: Crash Reduction (-) or Increase (+)**								
Code	**Type**									
K 1	Roundabout	-70			**+20**		**+20**	**+30**	**+60**	
K 2	New traffic signals (no turn arrows)	-70		**+90**				-30		
K 3	New traffic signals with turn arrows	-70		-5				-30		
K 4	Remodel signals	-50		-60				-30		
K 5	Grade separation	-100		-50			-20	-70	-50	
K 6	Improve sight lines	-30		-30				-30	-20	
K 7	Street closure (one leg of cross int.)	-50		-50				-50	-10	
K 8	Street closure (close stem of Tee)	-100		-100				-50	-100	
K 9	Non-skid surface				-40				-10	
K 10	Stagger cross inter-section (right-left)	-50		-50	**+30**	**+10**				
K 11	Improve/reinforce priority (eg add a control sign]	-30								
K 12	Ban right turns			-50			-50		-50	
K 13	Ban left or U turns			Note 1	-50		-50		-50	
K 14	Improve lighting							-30		
K 15	Traffic islands on approaches		-20	-20	-20				-10	-10
K 16	Indented right turn island			-30	-40				-20	-20
K 17	Painted turn lane			-20	-20					-20
K 18	Ban parking adjacent to intersection	-10			-20	-20		-30		-50
K 19	Extend median through intersection	-100	-100	-100				-50		
K 20	Reduce radius on left turn slip lane				-50					
K 21	Protected left turn lane in crossing street				-10					
Cost per casualty crash ($1000)	**Metro**	**107.0**	**230.6**	**111.3**	**55.0**	**83.3**	**73.5**	**144.7**	**86.9**	**107.8**
	Rural	**227.0**	**408.3**	**187.4**	**128.9**	**209.5**	**165.2**	**253.9**	**181.4**	**183.8**

Note 1: For treatment code K13, banning U turns is a relevant treatment for accident-type 207, with an estimated 50% reduction [costs for 207: $104.8K (Metro) and $190.1K (Rural)]. Banning left turns is a relevant treatment for accident-types 203, 205 and 206 with a 50% reduction.

Table 9.6 (a) Effectiveness of Countermeasures for Non-Intersection Crashes, Part A

(based on the revised tables for FORS, 1996 - prepared by Dr David Andreassen for the Australian Transport Safety Bureau)

Accident-type [DCA Code]		201	202-206	301-304	305-307	001-003	601,401, 402
Description		Head-on	Opposing turns	Rear end	Lane change	Vehicle hits pedestrian	Hit parked/ parking vehicle
Treatment		**Estimated Percentage: Crash Reduction (-) or Increase (+)**					
Code	**Type**						
S 1	Median on existing carriageway	-90				-50	
S 2	Pedestrian refuge					-50	
S 3	Pedestrian (Zebra) crossing					-40	
S 4	Pedestrian overpass					-90	
S 5	Pedestrian signals					-70	
S 6	Pedestrian crossing lighting					-60	
S 7	Improved route lighting					-30	
S 8	Clearway, parking bans			-20		-30	-50
S 9	Indented right turn island		-30	-40			
S 10	Painted turn lanes		-20	-20			
S 11	Roadside hazards – remove	Note 2					
S 12	Roadside hazards – guard fence						
S 13	Non-skid surface			-40			
S 14	Seal shoulders	-40					
S 15	Advisory speed signs on curves	-30					
S 16	Delineation						
S 17	Edge lines						
S 18	Reconstruct superelevation on curve	-50					
S 19	Climbing/overtaking lanes	-30 Note 3			**+10**		
S 20	Signs (railway level crossing)						
S 21	Flashing lights (railway level crossing)						
S 22	Barriers or gates (railway level crossing)						
S 23	Bridge or overpass (railway level crossing)						
S 24	Frangible posts, poles						
Cost per casualty crash ($1000)	**Metro**	**230.6**	**111.3**	**55.0**	**83.3**	**144.7**	**107.8**
	Rural	**408.3**	**187.4**	**128.9**	**209.5**	**253.9**	**183.8**

Note 2: For treatment code S11, the effect of removing the objects which were hit after the vehicle left the carriageway is to reduce accidents that relate to hitting objects (i.e. accident types 703-704, 803-804), but the reduction in these accidents will be matched by an increase in accident types 701-702 and 801-802, as vehicles will continue to leave the carriageway but now will not be hitting objects (all else being equal). The net benefit will be a reduction in crash severity.

Note 3: For treatment code S19, accident type 501 (head on, overtaking) is also relevant [use DAC 201 cost].

Table 9.6 (b): Effectiveness of Countermeasures for Non-Intersection Crashes, Part B

(based on the revised tables for FORS, 1996 - prepared by Dr David Andreassen for the Australian Transport Safety Bureau)

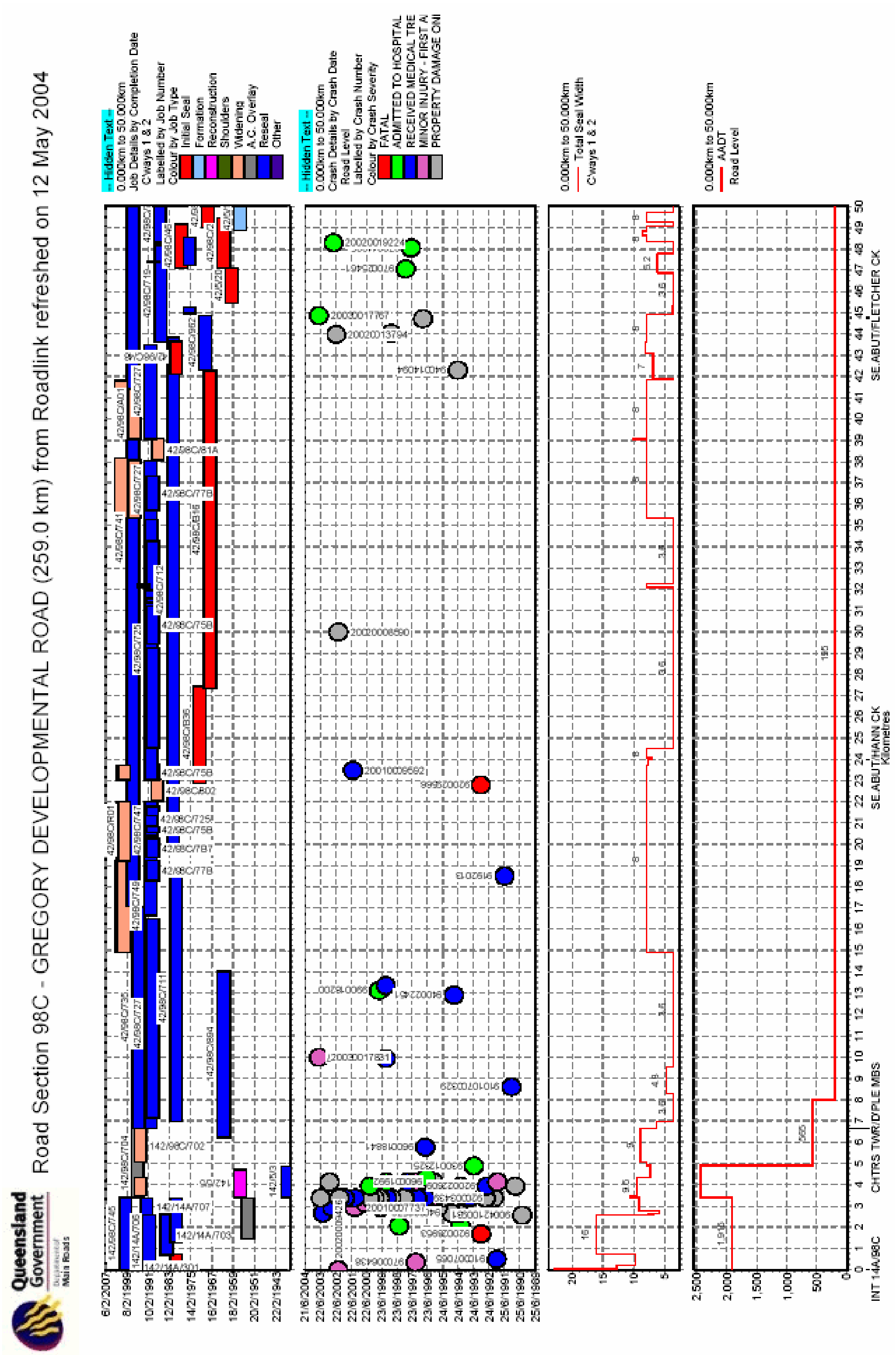
Accident-type [DCA Code]		On Straight			On Curve			
		701-702	703,704	705	801, 802	803, 804	805	903
Description		Off road	Off road, hit object	Loss of control, on road	Off road	Off road, hit object	Loss of control, on road	Hit train
Treatment		**Estimated Percentage: Crash Reduction (-) or Increase (+)**						
Code	**Type**							
S 1	Median on existing carriageway							
S 2	Pedestrian refuge							
S 3	Pedestrian (Zebra) crossing							
S 4	Pedestrian overpass							
S 5	Pedestrian signals							
S 6	Pedestrian crossing lighting							
S 7	Improved route lighting							
S 8	Clearway, parking bans							
S 9	Indented right turn island							
S 10	Painted turn lanes							
S 11	Roadside hazards – remove	**+80**	-80		**+80**	-80		
S 12	Roadside hazards – guard fence	-30	-30	**+30**	-30	-30	**+30**	
S 13	Non-skid surface	-10	-10	-10	-10	-10	-10	
S 14	Seal shoulders	-40	-40	-40	-40	-40	-40	
S 15	Advisory speed signs on curves				-30	-30	-30	
S 16	Delineation	-15	-15	-15	-15	-15	-15	
S 17	Edge lines	-30	-30		-30	-30		
S 18	Reconstruct superelevation on curve				-50	-50	-50	
S 19	Climbing/overtaking lanes							
S 20	Signs (railway level crossing)							-15
S 21	Flashing lights (railway level crossing)							-50
S 22	Barriers or gates (railway level crossing)							-80
S 23	Bridge or overpass (railway level crossing)							-100
S 24	Frangible posts, poles		Note 4			Note 4		
Cost per casualty crash ($1000)	**Metro**	**82.5**	**168.5**	**86.9**	**129.8**	**199.7**	**92.0**	**388.7**
	Rural	**161.2**	**279.3**	**181.4**	**250.0**	**310.9**	**165.6**	**573.8**

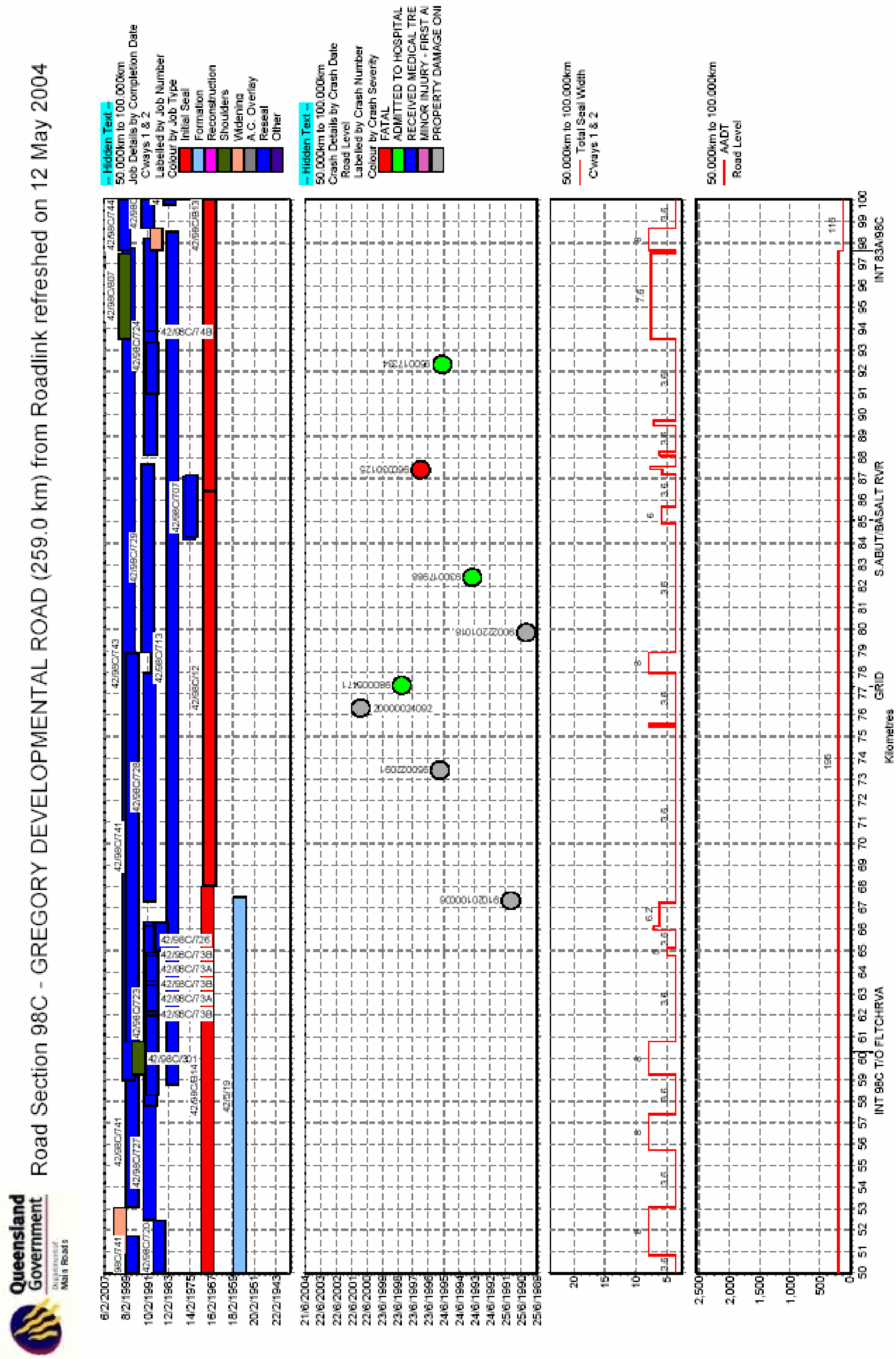
Note 4: For treatment code S 24, the number of "off road hit object" crashes is not expected to change, however, the severity outcome of these crashes will be reduced.

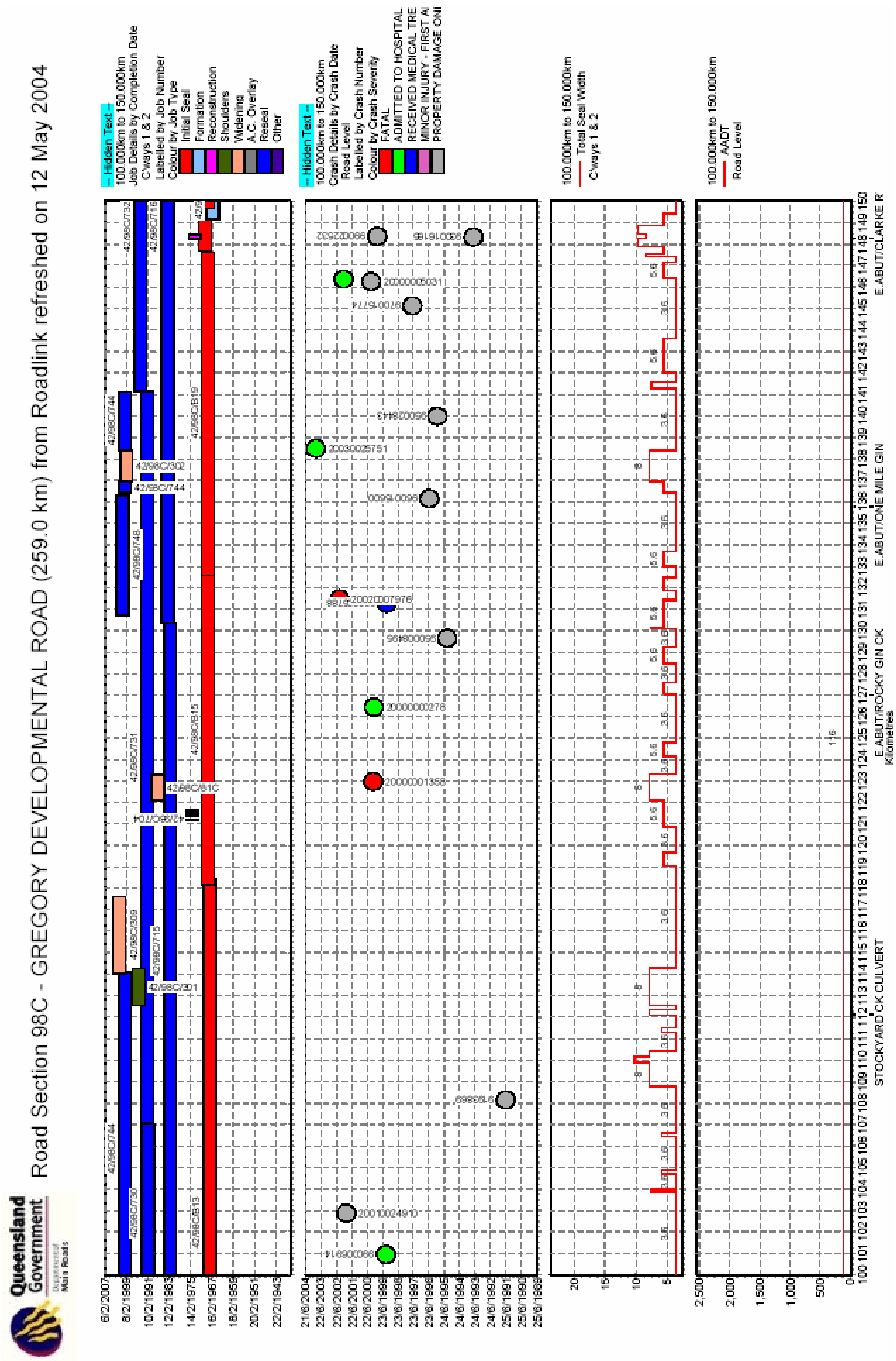
APPENDIX K

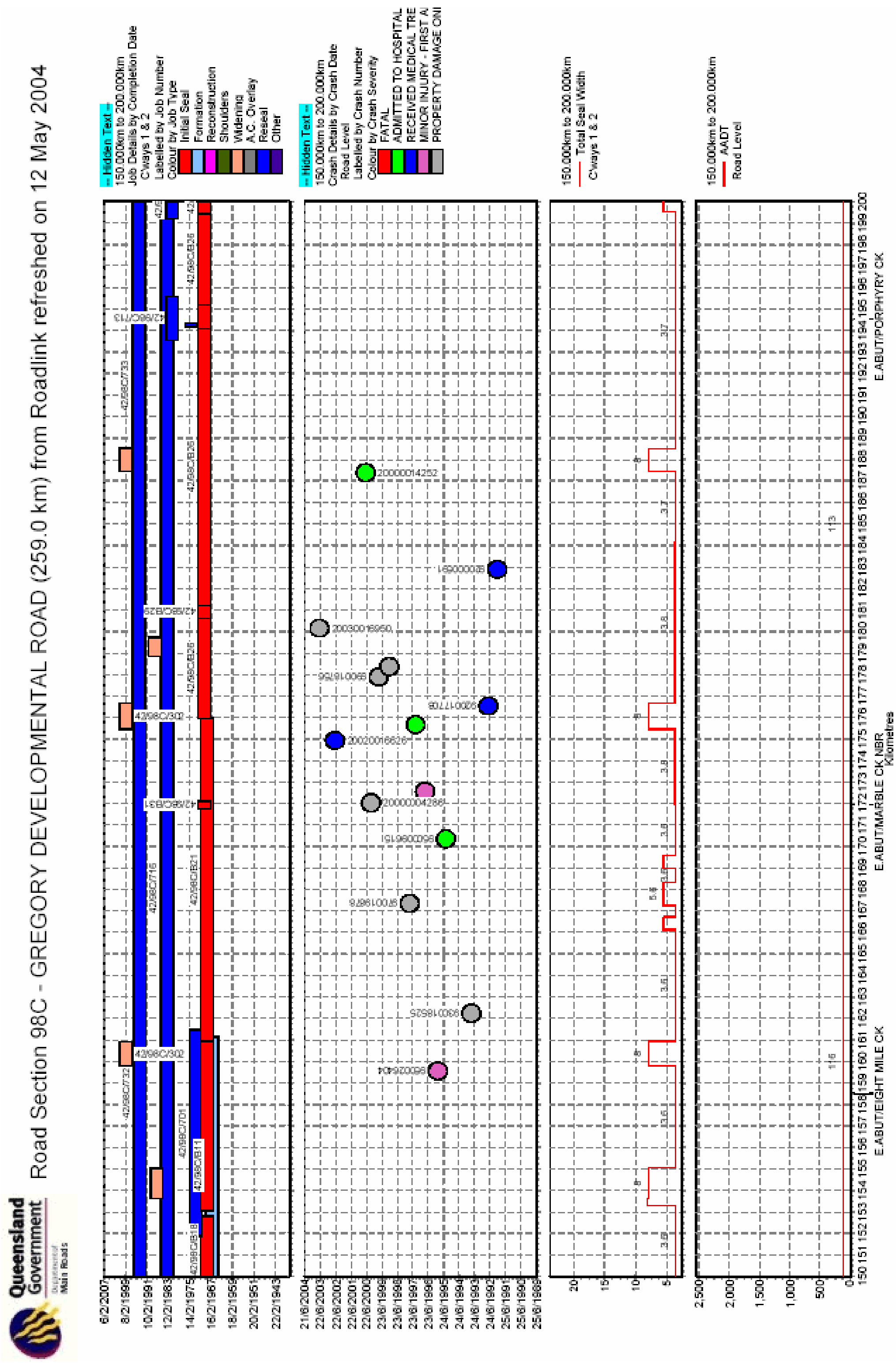
GREGORY DEVELOPMENTAL

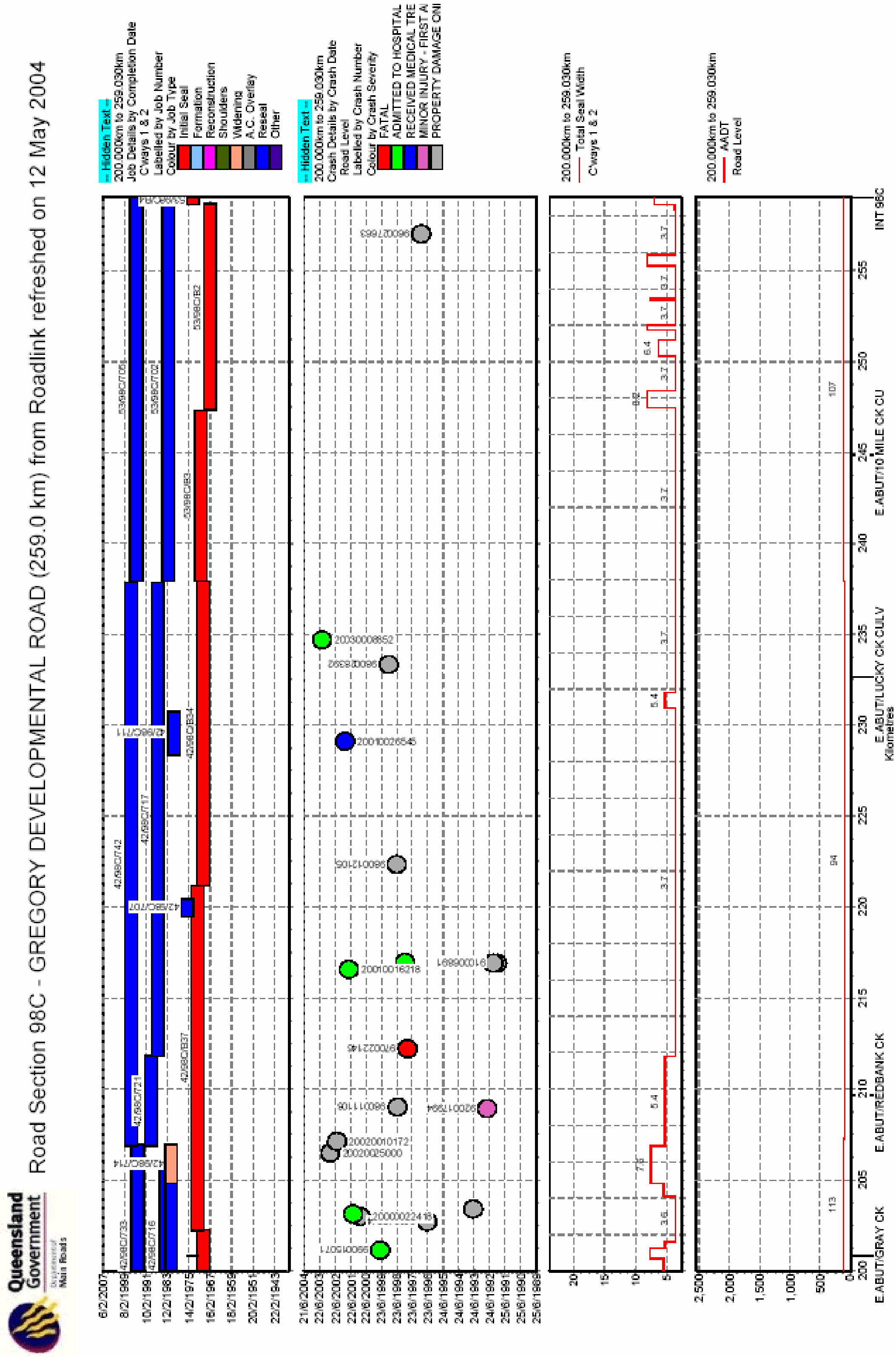
ROAD (98C) RESULTS


Road Section 98C - GREGORY DEVELOPMENTAL ROAD (259.0 km) from Roadlink refreshed on 12 May 2004
Queensland Government
Department of Main Roads
-- Hidden Text --
0.000km to 50.000km
Job Details by Completion Date
C'ways 1 & 2
Labelled by Job Number
Colour by Job Type
Initial Seal
Formation
Reconstruction
Shoulders
Widening
A.C. Overlay
Reseal
Other
-- Hidden Text --
0.000km to 50.000km
Crash Details by Crash Date
Road Level
Labelled by Crash Number
Colour by Crash Severity
FATAL
ADMITTED TO HOSPITAL
RECEIVED MEDICAL TRE
MINOR INJURY - FIRST A
PROPERTY DAMAGE ONI
0.000km to 50.000km
Total Seal Width
C'ways 1 & 2
0.000km to 50.000km
AADT
Road Level
INT 14A/98C
CHTRS TWR/DYPLE MBS
SE.ABUT/HANN CK
SE.ABUT/FLETCHER CK
Kilometres


Road Section 98C - GREGORY DEVELOPMENTAL ROAD (259.0 km) from Roadlink refreshed on 12 May 2004


Road Section 98C - GREGORY DEVELOPMENTAL ROAD (259.0 km) from Roadlink refreshed on 12 May 2004
Queensland Government
Main Roads
-- Hidden Text --
100.000km to 150.000km
Job Details by Completion Date
C'ways 1 & 2
Labelled by Job Number
Colour by Job Type
Initial Seal
Formation
Reconstruction
Shoulders
Widening
A.C. Overlay
Reseal
Other
Crash Details by Crash Date
Road Level
Labelled by Crash Number
Colour by Crash Severity
FATAL
ADMITTED TO HOSPITAL
Total Seal Width
AADT
Road Level
STOCKYARD CK CULVERT
E.ABUT/ROCKY GIN CK
E.ABUT/ONE MILE GIN
Kilometres


Road Section 98C - GREGORY DEVELOPMENTAL ROAD (259.0 km) from Roadlink refreshed on 12 May 2004
Queensland Government
Department of Main Roads
150.000km to 200.000km
Job Details by Completion Date
C'ways 1 & 2
Labelled by Job Number
Colour by Job Type
Initial Seal
Formation
Reconstruction
Shoulders
Widening
A.C. Overlay
Reseal
Other
Crash Details by Crash Date
Road Level
Labelled by Crash Number
Colour by Crash Severity
FATAL
ADMITTED TO HOSPITAL
Total Seal Width
AADT
Road Level
Kilometres
E.ABUT/EIGHT MILE CK
E.ABUT/MARBLE CK NBR
E.ABUT/PORPHYRY CK


Road Section 98C - GREGORY DEVELOPMENTAL ROAD (259.0 km) from Roadlink refreshed on 12 May 2004
Queensland Government
Department of Main Roads
Job Details by Completion Date
Initial Seal
Formation
Reconstruction
Shoulders
Widening
A.C. Overlay
Reseal
Other
Crash Details by Crash Date
FATAL
ADMITTED TO HOSPITAL
Total Seal Width
AADT
Kilometres
E.ABUT/GRAY CK
E.ABUT/REDBANK CK
E.ABUT/LUCKY CK CULV
E.ABUT/10 MILE CK CU
INT 98C

CRASH CH (km)	CRASH NUMBER	CRASH DATE	DCA CODE	CRASH COST	DCA CODE DESCRIPTION	DCA GROUP	DCA GROUP DESCRIPTION
8.6	91010700329	04-JAN-91		0			
9.9	990005157	12-MAR-99	502	107200	VEH'S OVERTAKING: OUT OF CONTROL	15	Off carriageway, on straight
10.0	20030017831	18-JUL-03	609	39000	PASS & MISC: HIT ANIMAL	14	Hit animal
12.9	940022451	03-OCT-94	702	107200	OFF PATH-STRAIGHT: RIGHT OFF CWAY	15	Off carriageway, on straight
13.2	990018200	25-AUG-99	500	0	VEH'S OVERTAKING: OTHER	21	Other
13.4	990005851	21-MAR-99	502	107200	VEH'S OVERTAKING: OUT OF CONTROL	15	Off carriageway, on straight
22.8	920029566	29-DEC-92	800	0	OFF PATH-CURVE: OTHER	21	Other
30.0	20020008590	11-APR-02	701	107200	OFF PATH-STRAIGHT: LEFT OFF CWAY	15	Off carriageway, on straight
44.0	20020013794	07-JUN-02	800	0	OFF PATH-CURVE: OTHER	21	Other
44.1	980023727	30-OCT-98	803	203900	OFF PATH-CURVE: OFF CWAY RT BEND HIT OBJ	19	Off carriageway on curve, hit object
44.7	960024368	27-SEP-96	800	0	OFF PATH-CURVE: OTHER	21	Other
44.9	20030017767	22-JUL-03	400	0	VEH'S MANOEUVRING: OTHER	21	Other
47.1	970025461	20-NOV-97	703	182300	OFF PATH-STRAIGHT: LEFT OFF CWAY HIT OBJ	16	Off carriageway on straight, hit object
48.1	970014985	11-JUL-97	201	270500	VEH'S OPPOSITE APPROACH: HEAD ON	2	Head-on
48.3	20020019224	05-AUG-02	800	0	OFF PATH-CURVE: OTHER	21	Other
67.4	91020100006	15-FEB-91		0			
73.4	950022091	21-SEP-95	609	39000	PASS & MISC: HIT ANIMAL	14	Hit animal
76.3	20000024092	08-NOV-00	705	140900	OFF PATH-STRAIGHT:OUT OF CONTROL ON CWAY	17	Out of control on straight
77.4	980005471	17-MAR-98	701	107200	OFF PATH-STRAIGHT: LEFT OFF CWAY	15	Off carriageway, on straight
82.4	930017988	20-AUG-93	801	157300	OFF PATH-CURVE: OFF CWAY RIGHT BEND	18	Off carriageway, on curve
87.4	960030125	21-DEC-96	704	182300	OFF PATH-STRAIGHT:RIGHT OFF CWAY HIT OBJ	16	Off carriageway on straight, hit object
92.3	950017334	30-JUL-95	802	157300	OFF PATH-CURVE: OFF CWAY LEFT BEND	18	Off carriageway, on curve
100.9	990006914	05-APR-99	702	107200	OFF PATH-STRAIGHT: RIGHT OFF CWAY	15	Off carriageway, on straight
102.9	20010024910	19-OCT-01	609	39000	PASS & MISC: HIT ANIMAL	14	Hit animal
108.2	9193869	21-JUN-91	201	270500	VEH'S OPPOSITE APPROACH: HEAD ON	2	Head-on
123.0	20000001358	21-JAN-00	800	0	OFF PATH-CURVE: OTHER	21	Other
126.5	20000000278	06-JAN-00	201	270500	VEH'S OPPOSITE APPROACH: HEAD ON	2	Head-on
129.7	950008495	16-APR-95	801	157300	OFF PATH-CURVE: OFF CWAY RIGHT BEND	18	Off carriageway, on curve
131.3	990005788	19-MAR-99	201	270500	VEH'S OPPOSITE APPROACH: HEAD ON	2	Head-on
131.5	20020007976	04-APR-02	803	203900	OFF PATH-CURVE: OFF CWAY RT BEND HIT OBJ	19	Off carriageway on curve, hit object
136.1	960015600	16-JUN-96	609	39000	PASS & MISC: HIT ANIMAL	14	Hit animal
138.5	20030025751	16-OCT-03	705	140900	OFF PATH-STRAIGHT:OUT OF CONTROL ON CWAY	17	Out of control on straight
140.0	950028443	07-DEC-95	900	0	PASS & MISC: OTHER	21	Other

CRASH CH (km)	CRASH NUMBER	CRASH DATE	DCA CODE	CRASH COST	DCA CODE DESCRIPTION	DCA GROUP	DCA GROUP DESCRIPTION
145.1	970015774	18-JUL-97	805	104000	OFF PATH-CURVE: OUT OF CONTROL ON CWAY	20	Out of control on curve
146.3	20000005031	09-MAR-00	607	0	VEH'S ON PATH: TEMPORARY OBJECT ON C'WAY	21	Other
146.4	20010031154	24-DEC-01	705	140900	OFF PATH-STRAIGHT:OUT OF CONTROL ON CWAY	17	Out of control on straight
148.3	930016165	26-JUL-93	609	39000	PASS & MISC: HIT ANIMAL	14	Hit animal
148.4	990022532	17-OCT-99	607	0	VEH'S ON PATH: TEMPORARY OBJECT ON C'WAY	21	Other
159.6	950026404	05-NOV-95	800	0	OFF PATH-CURVE: OTHER	21	Other
162.3	930018525	26-AUG-93	703	182300	OFF PATH-STRAIGHT: LEFT OFF CWAY HIT OBJ	16	Off carriageway on straight, hit object
167.4	970019878	08-SEP-97	705	140900	OFF PATH-STRAIGHT:OUT OF CONTROL ON CWAY	17	Out of control on straight
170.4	950009615	01-MAY-95	704	182300	OFF PATH-STRAIGHT:RIGHT OFF CWAY HIT OBJ	16	Off carriageway on straight, hit object
172.0	20000004286	29-FEB-00	701	107200	OFF PATH-STRAIGHT: LEFT OFF CWAY	15	Off carriageway, on straight
172.6	960020365	26-AUG-96	800	0	OFF PATH-CURVE: OTHER	21	Other
175.0	20020016626	09-JUL-02	705	140900	OFF PATH-STRAIGHT:OUT OF CONTROL ON CWAY	17	Out of control on straight
177.9	990018756	31-AUG-99	609	39000	PASS & MISC: HIT ANIMAL	14	Hit animal
178.4	980028261	24-DEC-98	609	39000	PASS & MISC: HIT ANIMAL	14	Hit animal
180.1	20030016950	12-JUL-03	805	104000	OFF PATH-CURVE: OUT OF CONTROL ON CWAY	20	Out of control on curve
182.9	920000591	08-JAN-92	804	203900	OFF PATH-CURVE: OFF CWAY LT BEND HIT OBJ	19	Off carriageway on curve, hit object
187.4	20000014252	03-JUL-00	801	157300	OFF PATH-CURVE: OFF CWAY RIGHT BEND	18	Off carriageway, on curve
201.2	990015071	17-JUL-99	609	39000	PASS & MISC: HIT ANIMAL	14	Hit animal
202.7	960015514	02-JUL-96	502	107200	VEH'S OVERTAKING: OUT OF CONTROL	15	Off carriageway, on straight
203.0	20000022418	16-OCT-00	702	107200	OFF PATH-STRAIGHT: RIGHT OFF CWAY	15	Off carriageway, on straight
203.2	20010008547	17-APR-01	800	0	OFF PATH-CURVE: OTHER	21	Other
203.4	930014066	05-JUL-93	700	0	OFF PATH-STRAIGHT: OTHER	21	Other
207.1	20020010172	29-APR-02	106	154900	VEH'S ADJACENT APPROACH: LEFT-RIGHT	1	Intersection, from adjacent approaches
208.9	920017994	07-AUG-92	701	107200	OFF PATH-STRAIGHT: LEFT OFF CWAY	15	Off carriageway, on straight
209.0	980011108	27-MAY-98	700	0	OFF PATH-STRAIGHT: OTHER	21	Other
212.2	970022146	09-OCT-97	702	107200	OFF PATH-STRAIGHT: RIGHT OFF CWAY	15	Off carriageway, on straight
216.6	20010016218	16-JUL-01	705	140900	OFF PATH-STRAIGHT:OUT OF CONTROL ON CWAY	17	Out of control on straight
216.9	920006891	25-MAR-92	609	39000	PASS & MISC: HIT ANIMAL	14	Hit animal
217.0	970026931	09-DEC-97	703	182300	OFF PATH-STRAIGHT: LEFT OFF CWAY HIT OBJ	16	Off carriageway on straight, hit object
216.9	910006891	09-DEC-91	101	154900	VEH'S ADJACENT APPROACH: THRU-THRU	1	Intersection, from adjacent approaches
222.4	980012105	08-JUN-98	703	182300	OFF PATH-STRAIGHT: LEFT OFF CWAY HIT OBJ	16	Off carriageway on straight, hit object
229.1	20010026545	19-OCT-01	502	107200	VEH'S OVERTAKING: OUT OF CONTROL	15	Off carriageway, on straight
233.4	980028392	27-DEC-98	702	107200	OFF PATH-STRAIGHT: RIGHT OFF CWAY	15	Off carriageway, on straight

CRASH CH (km)	CRASH NUMBER	CRASH DATE	DCA CODE	CRASH COST	DCA CODE DESCRIPTION	DCA GROUP	DCA GROUP DESCRIPTION
234.7	20030008852	14-APR-03	610	0	PASS & MISC: LOAD HIT VEHICLE	21	Other
257.0	960027663	23-NOV-96	804	203900	OFF PATH-CURVE: OFF CWAY LT BEND HIT OBJ	19	Off carriageway on curve, hit object

98C CUMULATIVE COST of CRASHES by "ACCIDENT TYPE" 1991 - 2003

CH Range (km)	Number of Accidents	Total Accident Cost ($)	Average Cost Per Year ($)	Accident Per (km)	Accident Per (km) Narrow Only - Quantities	Narrow (km)	Wide (km)
0-8	0	0	0	0	0.0	0.0	8.0
8-18	6	360600	30050	0.6	0.8	7.2	2.8
18-28	0	0	0	0	0.0	0.0	10.0
28-38	1	107200	8933	0.1	0.2	4.1	5.9
38-48	7	656700	54725	0.7	2.2	3.1	6.9
48-58	0	0	0	0	0.0	7.7	2.3
58-68	0	0	0	0	0.0	7.2	2.8
68-78	3	287100	23925	0.3	0.3	10.0	0.0
78-88	2	339600	28300	0.2	0.2	10.0	0.0
88-98	1	157300	13108	0.1	0.2	5.2	4.8
98-108	3	416700	34725	0.3	0.3	9.2	0.8
108-118	0	0	0	0	0.0	5.7	4.3
118-128	2	270500	22542	0.2	2.0	1.0	9.0
128-138	4	670700	55892	0.4	0.4	8.9	1.1
138-148	7	424800	35400	0.7	0.8	9.0	1.0
148-158	0	0	0	0	0.0	8.2	1.8
158-168	3	323200	26933	0.3	0.3	8.8	1.2
168-178	6	508400	42367	0.6	0.6	9.6	0.4
178-188	3	465200	38767	0.3	0.3	10.0	0.0
188-198	0	0	0	0	0.0	9.0	1.0
198-208	6	408300	34025	0.6	1.1	6.3	3.7
208-218	7	731500	60958	0.7	1.1	5.7	4.3
218-228	1	182300	15192	0.1	0.1	10.0	0.0
228-238	3	214400	17867	0.3	0.3	10.0	0.0
238-248	0	0	0	0	0.0	10.0	0.0
248-258	1	203900	16992	0.1	0.1	10.0	0.0
	66					186.0	72.0

Accidents Per km = (narrow sections)	0.33	Total No Accidents / Narrow Length	**Total Length**	**259**
Accident Per km = (entire link 1 year)	0.03	Divide by 13 Years		

Gregory Developmental Road 98C - Factor Matrix CH 38 - 48		Number of Accidents Each Year – Insert Years in Consecutive Order															Direction of the Other Vehicle				Types of Road Users								Surface		Light Condition				Type of Day			
Accident-Type DCA Code (Dominant ones first	Key Direction To	91'	92'	93'	94'	95	96'	97'	98'	99'	00'	01'	02'	03'	Total for this combination of DCA code & Key Direction		To North	To East	To South	To West	Cars or Similar	Road Train/ B Double/ Triple	Van, Lt Truck	Truck	Bus	Motorcycle	Pedal Cycle	Pedestrian	Dry	Wet	Dawn	Daylight	Dusk	Dark	Weekday	Saturday	Sunday	Most Common day (if any)
701-5 + 801-5	S				1			1							2						1		1									2			1	1		
800 Off Path	S						1						1		2							1	1											2	2			
701-5 + 801-5	N								1						1						1											1			1			
400	W													1	1											1						1			1			
201 Head On	S							1							1		1				1		1									1			1			
800 Off Path	N												1		1								1											1	1			
Totals		0	0	0	1	0	1	2	1	0	0	0	2	1	8	0	1	0	0	0	3	1	4	0	0	1	0	0	0	0	0	5	0	3	7	1	0	0

Gregory Developmental Road 98C - Contributing Factor Matrix CH 38 - 48		Driver				Animal Uncontrolled				Violation						Driver Conditions				Road		Road Conditions				Lighting			Condition			Vehicle		Atmospheric Conditions			
Accident-Type DCA Code (Dominant ones first	Key Direction To	Inexperience/Lack Experience	Taking Avoiding Action	Fatigue/Fell Asleep	Underage (Inxperience)		On Road			Undue Care & Attention	Fail to Keep Left	Over prescribed concentration	Disobey Stop Sign	Exceeding Speed Limit			Miscellaneous		Excessive Speed for Circumstances	Wet/Slippery	Narrow Bitumen		Miscellaneous				Sunlight Glare (Dawn/Dusk)			Under Influence of Liquor		Tyres (i.e Low tread, puncture)			Miscellaneous		
701-5 + 801-5	S	1	1				1													1	1																
800 Off Path	S									1							1																				
701-5 + 801-5	N			1										1																							
400	W				1														1																		
201 Head On	S										1										1																
800 Off Path	N											1											1														
Totals		1	1	1	1	0	1	0	0	1	1	1	0	1	0	0	1	0	1	1	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	

Gregory Developmental Road 98C - Factor Matrix CH 118 - 128

		Number of Accidents Each Year / Insert Years in Consecutive Order															Direction of the Other Vehicle				Types of Road Users								Surface		Light Condition				Type of Day			
Accident-Type DCA Code (Dominant ones first	Key Direction To	91'	92'	93'	94'	95	96'	97'	98'	99'	00'	01'	02'	03'	Total for this combination of DCA code & Key Direction		To North	To East	To South	To West	Cars or Similar	Road Train/ B Double/ Triple	Van, Lt Truck	Truck	Bus	Motorcycle	Pedal Cycle	Pedestrian	Dry	Wet	Dawn	Daylight	Dusk	Dark	Weekday	Saturday	Sunday	Most Common day (if any)
801 Off Path	N					1									1				1		1											1					1	
705 Off Path	N													1	1								1									1			1			
201 Head On	S									1					1		1				1	1										1			1			
803 Off Path	N												1		1									1								1			1			
609	N						1														1													1			1	
Totals		0	0	0	0	1	1	0	0	1	0	0	1	1	4	0	1	0	1	0	3	1	1	1	0	0	0	0	0	0	0	4	0	1	3	0	2	0

Gregory Developmental Road 98C - Contributing Factor Matrix CH 118 - 128

		Driver				Animal Uncontrolled				Violation						Driver Conditions				Road		Road Conditions				Lighting			Condition			Vehicle		Atmospheric Conditions			
Accident-Type DCA Code (Dominant ones first	Key Direction To	Inexperience/Lack Experience	Taking Avoiding Action	Fatigue/Fell Asleep	Underage (Inxperience)		On Road			Undue Care & Attention	Fail to Keep Left	Over prescribed concentration	Disobey Stop Sign	Exceeding Speed Limit			Miscellaneous		Excessive Speed for Circumstances	Wet/Slippery	Narrow Bitumen		Miscellaneous				Sunlight Glare (Dawn/Dusk)			Under Influence of Liquor		Tyres (i.e Low tread, puncture)			Miscellaneous	Dust	
801 Off Path	N									1											1																
705 Off Path	N	1		1																												1					
201 Head On	S																																			1	
803 Off Path	N																															1					
609	N						1																														
Totals		1	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2	0	0	0	1	

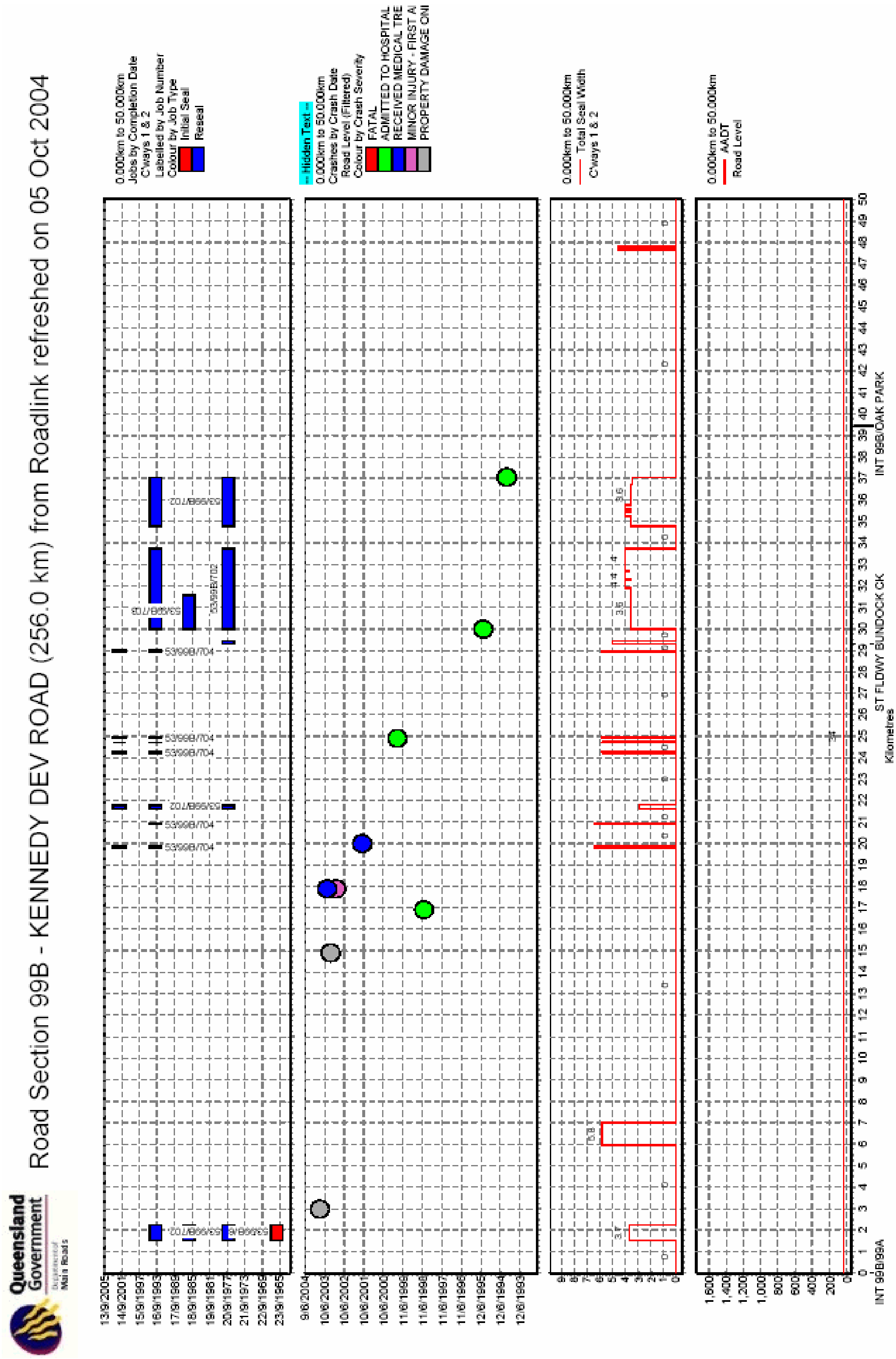
Gregory Developmental Road 98C - Factor Matrix CH 208 - 218		Number of Accidents Each Year — Insert Years in Consecutive Order														Direction of the Other Vehicle				Types of Road Users								Surface		Light Condition				Type of Day			
Accident-Type DCA Code (Dominant ones first	Key Direction To	91'	92'	93'	94'	95	96'	97'	98'	99'	00'	01'	02'	03'	Total for this combination of DCA code & Key Direction	To North	To East	To South	To West	Cars or Similar	Road Train/ B Double/ Triple	Van, Lt Truck	Truck	Bus	Motorcycle	Pedal Cycle	Pedestrian	Dry	Wet	Dawn	Daylight	Dusk	Dark	Weekday	Saturday	Sunday	Most Common day (if any)
701-5 + 801-5	S		1					1							2					2											2			2			
700, 800 Off Path	E												1		1						1										1			1			
701-5 + 801-5	E							1							1					1											1			1			
705	E											1			1								1								1			1			
609	S		1												1					1													1	1			
700, 800 Off Path	S								1						1							1								1				1			
101	N	1																		1										1				1			
Totals		1	2	0	0	0	0	2	1	0	0	1	1	0	7 0	0	0	0	0	5	1	1	1	0	0	0	0	0	0	2	5	0	1	8	0	0	0

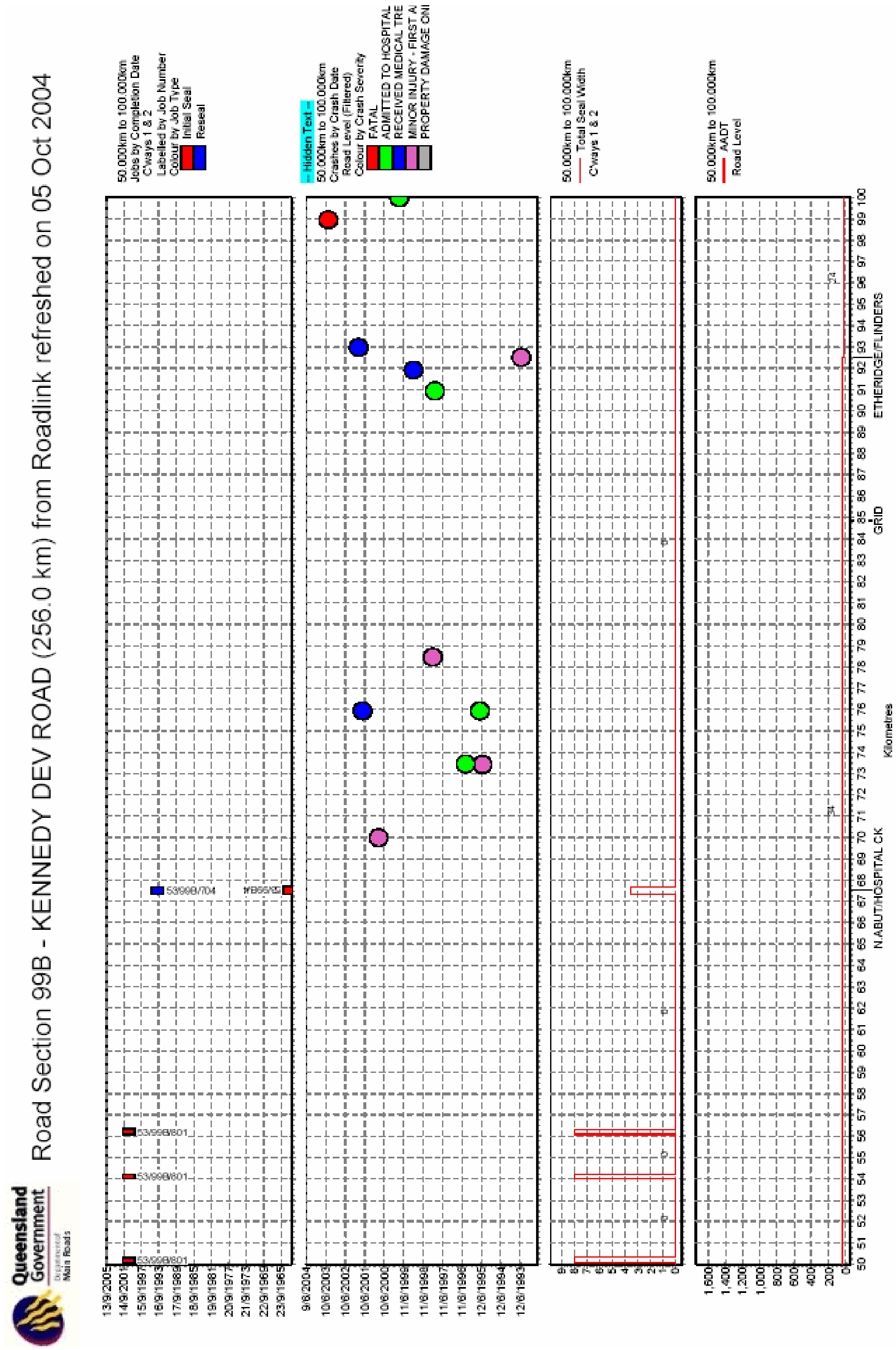
Gregory Developmental Road 98C - Contributing Factor Matrix CH 208 - 218

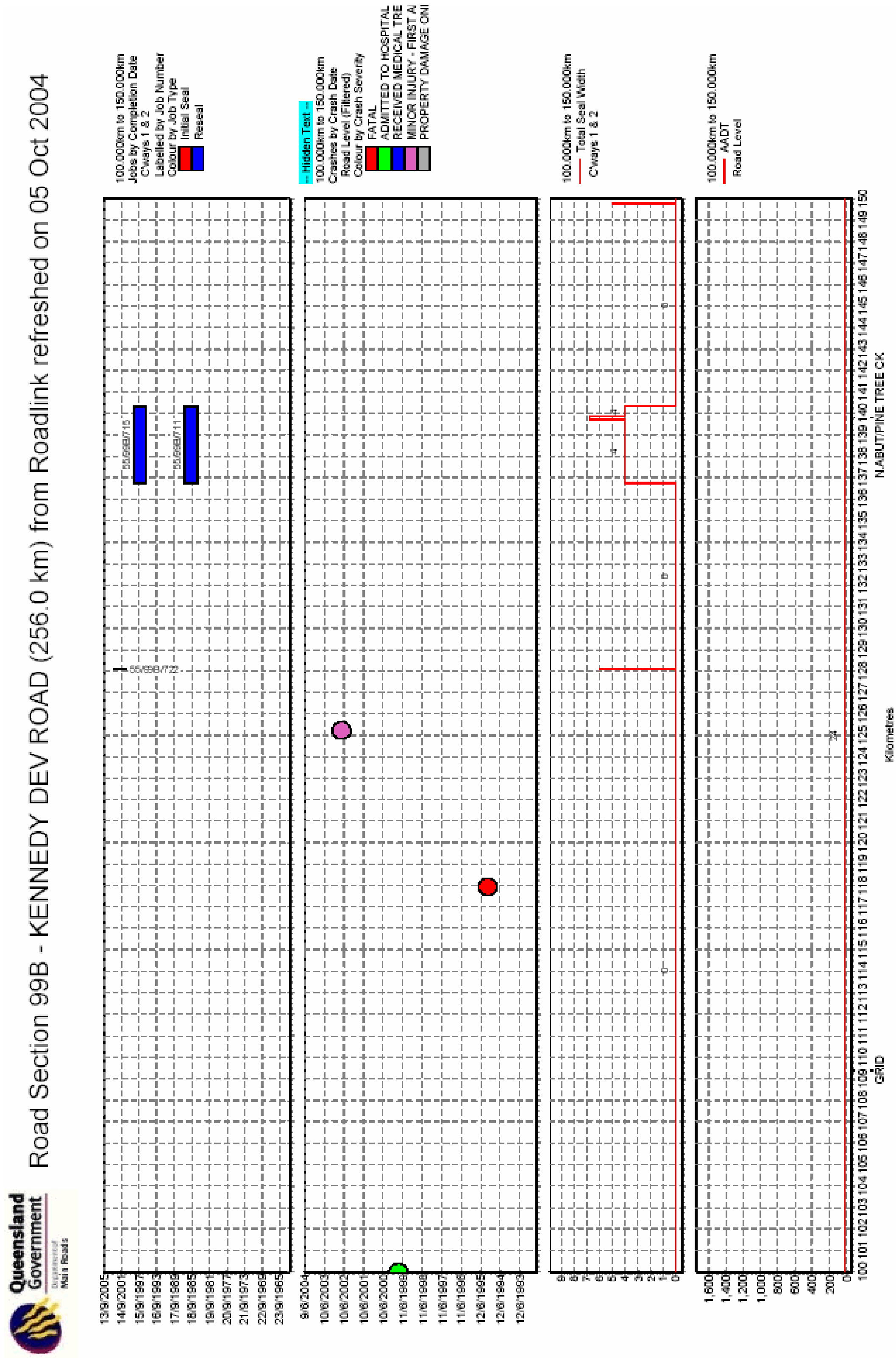
		Driver				Animal Uncontrolled				Violation						Driver Conditions				Road		Road Conditions				Lighting			Condition			Vehicle		Atmospheric Conditions			
Accident-Type DCA Code (Dominant ones first	Key Direction To	Inexperience/Lack Experience	Taking Avoiding Action	Fatigue/Fell Asleep	Underage (Inxperience)		On Road			Undue Care & Attention	Fail to Keep Left	Over prescribed concentration	Disobey Stop Sign	Exceeding Speed Limit			Miscellaneous		Excessive Speed for Circumstances	Wet/Slippery	Narrow Bitumen		Miscellaneous				Sunlight Glare (Dawn/Dusk)			Under Influence of Liquor		Tyres (i.e Low tread, puncture)		Fog	Miscellaneous		
701-5 + 801-5	S						1																									1		1			
700, 800 Off Path	E									1																											
101	N												1																								
705	E																				1		1												1		
609	S						1																														
700, 800 Off Path	S		1																														1				
701-5 + 801-5	E																1																				
Totals		0	1	0	0	0	2	0	0	1	0	0	1	0	0	0	1	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1	1	1	1	0	

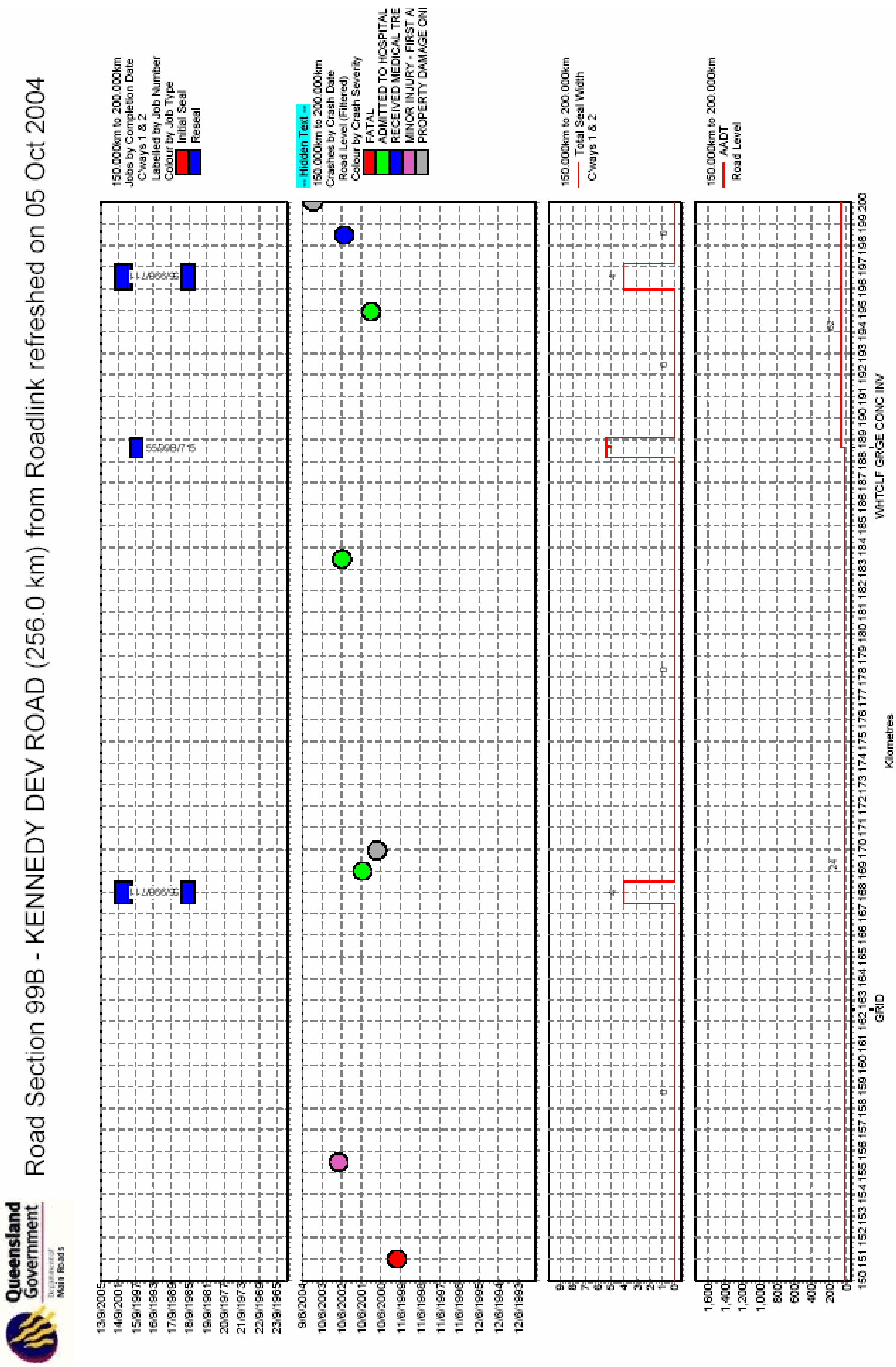
APPENDIX L

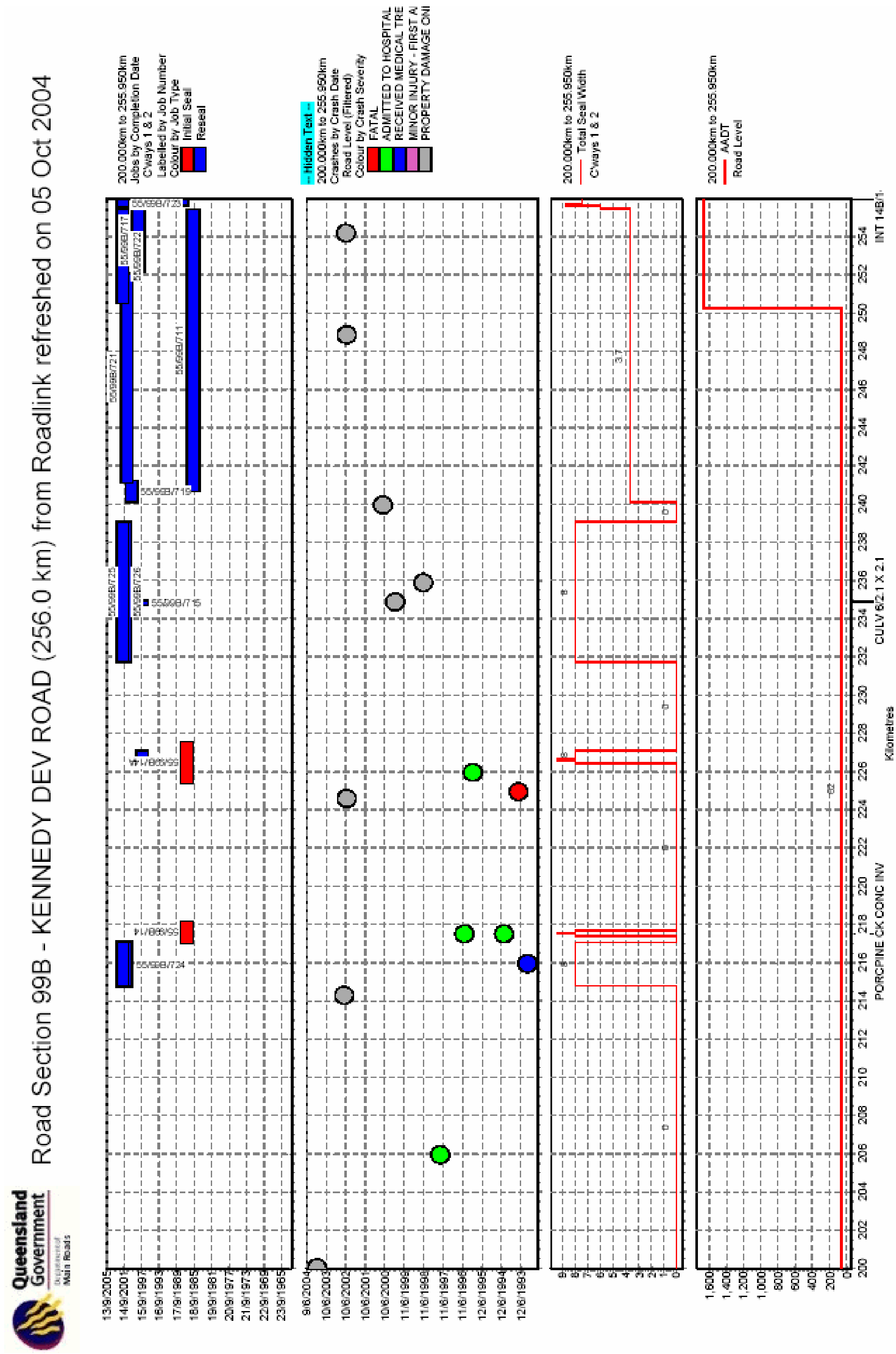
KENNEDY DEVELOPMENTAL
ROAD (99B) RESULTS


Road Section 99B - KENNEDY DEV ROAD (256.0 km) from Roadlink refreshed on 05 Oct 2004
Queensland Government
0.000km to 50.000km
Jobs by Completion Date
C'ways 1 & 2
Labelled by Job Number
Colour by Job Type
Initial Seal
Reseal
0.000km to 50.000km
Crashes by Crash Date
Road Level (Filtered)
Colour by Crash Severity
FATAL
ADMITTED TO HOSPITAL
0.000km to 50.000km
Total Seal Width
C'ways 1 & 2
0.000km to 50.000km
AADT
Road Level
INT 99B/99A
ST FLDWY BUNDOCK CK
INT 99B/OAK PARK
Kilometres


Road Section 99B - KENNEDY DEV ROAD (256.0 km) from Roadlink refreshed on 05 Oct 2004
Queensland Government
50.000km to 100.000km
Jobs by Completion Date
C'ways 1 & 2
Labelled by Job Number
Colour by Job Type
Initial Seal
Reseal
-- Hidden Text --
Crashes by Crash Date
Road Level (Filtered)
Colour by Crash Severity
FATAL
ADMITTED TO HOSPITAL
RECEIVED MEDICAL TRE
MINOR INJURY - FIRST A
PROPERTY DAMAGE ONL
Total Seal Width
AADT
Road Level
N.ABUT/HOSPITAL CK
GRID
ETHERIDGE/FLINDERS
Kilometres


Road Section 99B - KENNEDY DEV ROAD (256.0 km) from Roadlink refreshed on 05 Oct 2004
Queensland Government
100.000km to 150.000km
Jobs by Completion Date
C'ways 1 & 2
Labelled by Job Number
Colour by Job Type
Initial Seal
Reseal
55/99B/715
55/99B/711
55/99B/722
Crashes by Crash Date
Road Level (Filtered)
Colour by Crash Severity
FATAL
ADMITTED TO HOSPITAL
Total Seal Width
AADT
Road Level
GRID
Kilometres
N.ABUT/PINE TREE CK


Road Section 99B - KENNEDY DEV ROAD (256.0 km) from Roadlink refreshed on 05 Oct 2004
Queensland Government
150.000km to 200.000km
Jobs by Completion Date
C'ways 1 & 2
Labelled by Job Number
Colour by Job Type
Initial Seal
Reseal
150.000km to 200.000km
Crashes by Crash Date
Road Level (Filtered)
Colour by Crash Severity
FATAL
ADMITTED TO HOSPITAL
RECEIVED MEDICAL TRE
MINOR INJURY - FIRST AI
PROPERTY DAMAGE ONI
150.000km to 200.000km
Total Seal Width
C'ways 1 & 2
150.000km to 200.000km
AADT
Road Level
Kilometres
GRID
WHTCLF GRGE CONC INV


Road Section 99B - KENNEDY DEV ROAD (256.0 km) from Roadlink refreshed on 05 Oct 2004
Queensland Government
Department of Main Roads
200.000km to 255.950km
Jobs by Completion Date
C'ways 1 & 2
Labelled by Job Number
Colour by Job Type
Initial Seal
Reseal
- Hidden Text -
200.000km to 255.950km
Crashes by Crash Date
Road Level (Filtered)
Colour by Crash Severity
FATAL
ADMITTED TO HOSPITAL
RECEIVED MEDICAL TRE
MINOR INJURY - FIRST A
PROPERTY DAMAGE ONI
200.000km to 255.950km
Total Seal Width
C'ways 1 & 2
200.000km to 255.950km
AADT
Road Level
PORCPINE CK CONC INV
CULV 6/2.1 X 2.1
INT 14B/1
Kilometres

CRASH CH (km)	CRASH NUMBER	CRASH DATE	DCA CODE	CRASH COST	DCA CODE DESCRIPTION	DCA GROUP	DCA GROUP DESCRIPTION
3.0	20030022763	12-SEP-03	607	0	VEH'S ON PATH: TEMPORARY OBJECT ON C'WAY	21	Other
14.9	20030004319	21-FEB-03	705	140900	OFF PATH-STRAIGHT:OUT OF CONTROL ON CWAY	17	Out of control on straight
16.9	980009172	02-MAY-98	705	140900	OFF PATH-STRAIGHT:OUT OF CONTROL ON CWAY	17	Out of control on straight
17.9	20020028147	08-NOV-02	705	140900	OFF PATH-STRAIGHT:OUT OF CONTROL ON CWAY	17	Out of control on straight
17.9	20030009123	15-APR-03	705	140900	OFF PATH-STRAIGHT:OUT OF CONTROL ON CWAY	17	Out of control on straight
20.0	20010015661	09-JUL-01	705	140900	OFF PATH-STRAIGHT:OUT OF CONTROL ON CWAY	17	Out of control on straight
24.9	990020166	18-SEP-99	803	203900	OFF PATH-CURVE: OFF CWAY RT BEND HIT OBJ	19	Off carriageway on curve, hit object
30.0	950009278	22-APR-95	705	140900	OFF PATH-STRAIGHT:OUT OF CONTROL ON CWAY	17	Out of control on straight
37.1	940002585	04-FEB-94	705	140900	OFF PATH-STRAIGHT:OUT OF CONTROL ON CWAY	17	Out of control on straight
70.0	20000020111	14-SEP-00	705	140900	OFF PATH-STRAIGHT:OUT OF CONTROL ON CWAY	17	Out of control on straight
73.4	950011817	27-MAY-95	803	203900	OFF PATH-CURVE: OFF CWAY RT BEND HIT OBJ	19	Off carriageway on curve, hit object
73.5	960008368	04-APR-96	605	110000	VEH'S ON PATH: PERMANENT OBSTRUCTION	13	Permanent obstruction on carriageway
76.0	950015837	06-JUL-95	801	157300	OFF PATH-CURVE: OFF CWAY RIGHT BEND	18	Off carriageway, on curve
76.0	20010017011	24-JUL-01	805	104000	OFF PATH-CURVE: OUT OF CONTROL ON CWAY	20	Out of control on curve
78.5	970026767	07-DEC-97	805	104000	OFF PATH-CURVE: OUT OF CONTROL ON CWAY	20	Out of control on curve
91.0	970024189	04-NOV-97	705	140900	OFF PATH-STRAIGHT:OUT OF CONTROL ON CWAY	17	Out of control on straight
91.9	980026672	05-DEC-98	704	182300	OFF PATH-STRAIGHT:RIGHT OFF CWAY HIT OBJ	16	Off carriageway on straight, hit object
92.5	930011318	26-MAY-93	705	140900	OFF PATH-STRAIGHT:OUT OF CONTROL ON CWAY	17	Out of control on straight
93.0	20010023629	06-OCT-01	805	104000	OFF PATH-CURVE: OUT OF CONTROL ON CWAY	20	Out of control on curve
99.0	20030009823	25-APR-03	703	182300	OFF PATH-STRAIGHT: LEFT OFF CWAY HIT OBJ	16	Off carriageway on straight, hit object
100.0	990017999	22-AUG-99	705	140900	OFF PATH-STRAIGHT:OUT OF CONTROL ON CWAY	17	Out of control on straight
117.9	950002198	31-JAN-95	701	107200	OFF PATH-STRAIGHT: LEFT OFF CWAY	15	Off carriageway, on straight
125.2	20020024959	24-JUL-02	607	0	VEH'S ON PATH: TEMPORARY OBJECT ON C'WAY	21	Other
151.0	990017793	19-AUG-99	805	104000	OFF PATH-CURVE: OUT OF CONTROL ON CWAY	20	Out of control on curve
155.5	20020018788	01-AUG-02	702	107200	OFF PATH-STRAIGHT: RIGHT OFF CWAY	15	Off carriageway, on straight
169.0	20010011135	19-MAY-01	704	182300	OFF PATH-STRAIGHT:RIGHT OFF CWAY HIT OBJ	16	Off carriageway on straight, hit object
170.0	20000018175	16-AUG-00	805	104000	OFF PATH-CURVE: OUT OF CONTROL ON CWAY	20	Out of control on curve
183.5	20020012990	30-MAY-02	801	157300	OFF PATH-CURVE: OFF CWAY RIGHT BEND	18	Off carriageway, on curve
195.0	20000026147	04-DEC-00	801	157300	OFF PATH-CURVE: OFF CWAY RIGHT BEND	18	Off carriageway, on curve
198.5	20020009886	25-APR-02	805	104000	OFF PATH-CURVE: OUT OF CONTROL ON CWAY	20	Out of control on curve
200.0	20030029433	25-NOV-03	804	203900	OFF PATH-CURVE: OFF CWAY LT BEND HIT OBJ	19	Off carriageway on curve, hit object
206.0	970016785	02-AUG-97	705	140900	OFF PATH-STRAIGHT:OUT OF CONTROL ON CWAY	17	Out of control on straight
214.3	20020015859	01-JUL-02	609	39000	PASS & MISC: HIT ANIMAL	14	Hit animal

CRASH CH (km)	CRASH NUMBER	CRASH DATE	DCA CODE	CRASH COST	DCA CODE DESCRIPTION	DCA GROUP	DCA GROUP DESCRIPTION
224.6	20020011965	19-MAY-02	607	0	VEH'S ON PATH: TEMPORARY OBJECT ON C'WAY	21	Other
225.0	930015187	18-JUL-93	705	140900	OFF PATH-STRAIGHT:OUT OF CONTROL ON CWAY	17	Out of control on straight
226.0	950027882	30-NOV-95	600	0	VEH'S ON PATH: OTHER	21	Other
240.0	20000014914	03-JUL-00	609	39000	PASS & MISC: HIT ANIMAL	14	Hit animal
248.9	20020012002	19-MAY-02	705	140900	OFF PATH-STRAIGHT:OUT OF CONTROL ON CWAY	17	Out of control on straight

CUMULATIVE COST of CRASHES by "ACCIDENT TYPE" 1991 - 2003

CH Range (km)	Number of Accidents	Total Accident Cost ($)	Average Cost Per Year ($)	Accident Per (km)	Accident Per (km) Narrow Only - Quantities	Narrow (km)	Wide (km)
0-10	0	0	0	0	0.0	10.0	0.0
10-20	5	704500	58708	0.5	0.5	10.0	0.0
20-30	2	344800	28733	0.2	0.2	10.0	0.0
30-40	1	140900	11742	0.1	0.1	10.0	0.0
40-50	0	0	0	0	0.0	10.0	0.0
50-60	0	0	0	0	0.0	9.6	0.4
60-70	0	0	0	0	0.0	10.0	0.0
70-80	6	820100	68342	0.6	0.6	10.0	0.0
80-90	0	0	0	0	0.0	10.0	0.0
90-100	6	891300	74275	0.6	0.6	10.0	0.0
100-110	0	0	0	0	0.0	10.0	0.0
110-120	1	107200	8933	0.1	0.1	10.0	0.0
120-130	0	0	0	0	0.0	10.0	0.0
130-140	0	0	0	0	0.0	10.0	0.0
140-150	0	0	0	0	0.0	10.0	0.0
150-160	2	211200	17600	0.2	0.2	10.0	0.0
160-170	2	286300	23858	0.2	0.2	10.0	0.0
170-180	0	0	0	0	0.0	10.0	0.0
180-190	1	157300	13108	0.1	0.1	10.0	0.0
190-200	3	465200	38767	0.3	0.3	10.0	0.0
200-210	1	140900	11742	0.1	0.1	10.0	0.0
210-220	1	39000	3250	0.1	0.1	7.8	2.2
220-230	3	140900	11742	0.3	0.3	9.3	0.7
230-240	1	39000	3250	0.1	0.4	2.7	7.3
240-250	1	140900	11742	0.1	0.1	10.0	0.0
250-260	0	0	0	0	0.0	9.7	0.3
	36					249.1	10.9

Accidents Per km = (narrow sections)	0.15	Total No Accidents / Narrow Length	**Total Length**	260
Accident Per km = (entire link 1 year)	0.01	Divide by 5 Years		

Gregory Developmental Road 99B - Factor Matrix		Number of Accidents Each Year / Insert Years in Consecutive Order															Direction of the Other Vehicle				Types of Road Users								Surface		Light Condition				Type of Day			
Accident-Type DCA Code (Dominant ones first	Key Direction To	91'	92'	93'	94'	95'	96'	97'	98'	99'	00'	01'	02'	03'	Total for this combination of DCA code & Key Direction		To North	To East	To South	To West	Cars or Similar	Road Train/ B Double/ Triple	Van, Lt Truck	Truck (Special Purpose Vehicle	Bus	Motorcycle	Pedal Cycle	Pedestrian	Dry	Wet	Dawn	Daylight	Dusk	Dark	Weekday	Saturday	Sunday	Most Common day (if any)
705 Off Path	S								1			1		2	4						1		2	1							1	3			3	1		
705 Off Path	N												1		1											1						1			1			
Totals		0	0	0	0	0	0	0	1	0	0	1	1	2	5	0	0	0	0	0	1	0	2	1	0	1	0	0	0	0	1	4	0	0	4	1	0	0

Gregory Developmental Road 98C - Contributing Factor Matrix

		Driver				Animal Uncontrolled				Violation						Driver Conditions				Road		Road Conditions				Lighting			Condition			Vehicle		Atmospheric Conditions			
Accident-Type DCA Code (Dominant ones first	Key Direction To	Inexperience/Lack Experience	Taking Avoiding Action	Fatigue/Fell Asleep	Underage (Inxperience)		On Road			Undue Care & Attention	Fail to Keep Left	Over prescribed concentration	Disobey Stop Sign	Exceeding Speed Limit			Miscellaneous		Excessive Speed for Circumstances	Wet/Slippery	Narrow Bitumen		Miscellaneous				Sunlight Glare (Dawn/Dusk)			Under Influence of Liquor		Tyres (i.e Low tread, puncture)			Miscellaneous		
705 Off Path	S	1																		2			1									2					
705 Off Path	N																			1																	
Totals		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	1	0	0	0	0	0	0	0	0	2	0	0	0	0	

Gregory Developmental Road 99B - Factor Matrix

		Number of Accidents Each Year / Insert Years in Consecutive Order														Direction of the Other Vehicle				Types of Road Users								Surface		Light Condition				Type of Day			
Accident-Type DCA Code (Dominant ones first	Key Direction To	91'	92'	93'	94'	95'	96'	97'	98'	99'	00'	01'	02'	03'	Total for this combination of DCA code & Key Direction	To North	To East	To South	To West	Cars or Similar	Road Train/ B Double/ Triple	Van, Lt Truck	Truck	Bus	Motorcycle	Pedal Cycle	Pedestrian	Dry	Wet	Dawn	Daylight	Dusk	Dark	Weekday	Saturday	Sunday	Most Common day (if any)
															0																						
701-5 + 801-5	E										1				1					1											1			1			
605	N						1								1					1																	
701-5 + 801-5	N					1									1							1									1				1		
805	S											1			1					1											1			1			
701-5 + 801-5	S					1									1							1									1			1			
805	N							1												1											1					1	
Totals		0	0	0	0	2	1	1	0	0	1	1	0	0	5 0	0	0	0	0	4	0	2	0	0	0	0	0	0	0	0	5	0	0	3	1	1	0

Gregory Developmental Road 98C - Contributing Factor Matrix

		Driver				Animal Uncontrolled				Violation						Driver Conditions				Road			Road Conditions				Lighting			Condition			Vehicle		Atmospheric Conditions			
Accident-Type DCA Code (Dominant ones first	Key Direction To	Inexperience/Lack Experience	Taking Avoiding Action	Fatigue/Fell Asleep	Underage (Inxperience)		On Road			Undue Care & Attention	Fail to Keep Left	Over prescribed concentration	Disobey Stop Sign	Exceeding Speed Limit			Miscellaneous		Excessive Speed for Circumstances	Rough Surface	Gravel/Dirt	Narrow Bitumen		Miscellaneous				Sunlight Glare (Dawn/Dusk)			Under Influence of Liquor		Tyres (i.e Low tread, puncture)			Miscellaneous		
701-5 + 801-5	E																			1																		
605	N																				1												1					
701-5 + 801-5	N	1																			1																	
805	S																							1														
701-5 + 801-5	S																				1										1							
805	N																1																					
Totals		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	0	0	1	0	0	0	0	0	0	1	0	1	0	0	0	0	

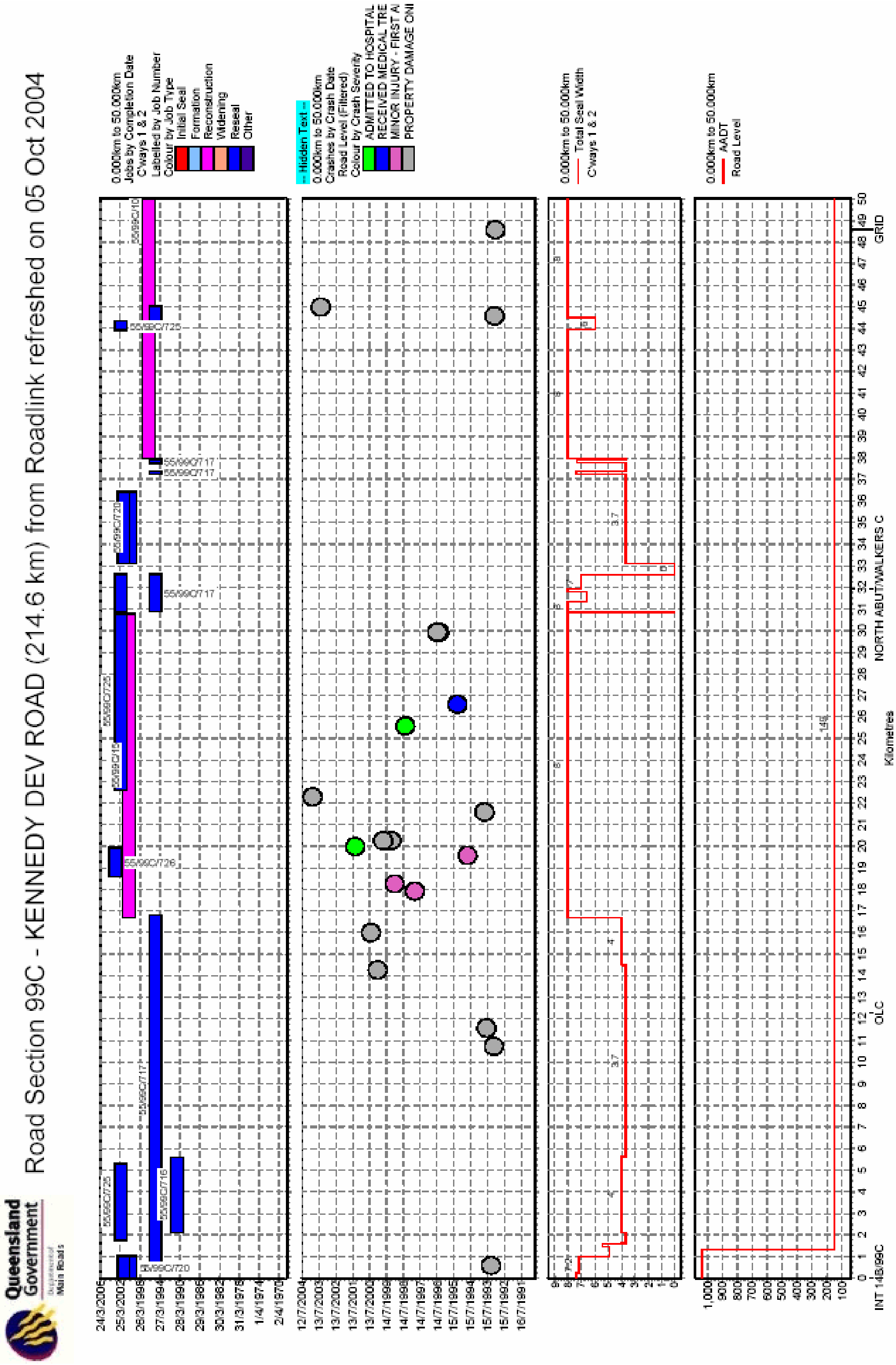
Gregory Developmental Road 98C - Factor Matrix		Number of Accidents Each Year / Insert Years in Consecutive Order															Direction of the Other Vehicle				Types of Road Users								Surface		Light Condition				Type of Day			
Accident-Type DCA Code (Dominant ones first	Key Direction To	91'	92'	93'	94'	95	96'	97'	98'	99'	00'	01'	02'	03'	Total for this combination of DCA code & Key Direction		To North	To East	To South	To West	Cars or Similar	Road Train/ B Double/ Triple	Van, Lt Truck	Truck	Bus	Motorcycle	Pedal Cycle	Pedestrian	Dry	Wet	Dawn	Daylight	Dusk	Dark	Weekday	Saturday	Sunday	Most Common day (if any)
502,701-5 + 801-5	S								1		1				2						1		1									2			1	1		
705	S							1							1								1									1			1			
502,701-5 + 801-5	N													1	1						1											1			1			
805	S											1			1								1									1				1		
705	N									1					1								1									1					1	
															0																							
															0																							
Totals		0	0	0	0	0	0	1	1	1	1	1	0	1	6	0	0	0	0	0	2	0	4	0	0	0	0	0	0	0	0	6	0	0	3	2	1	0

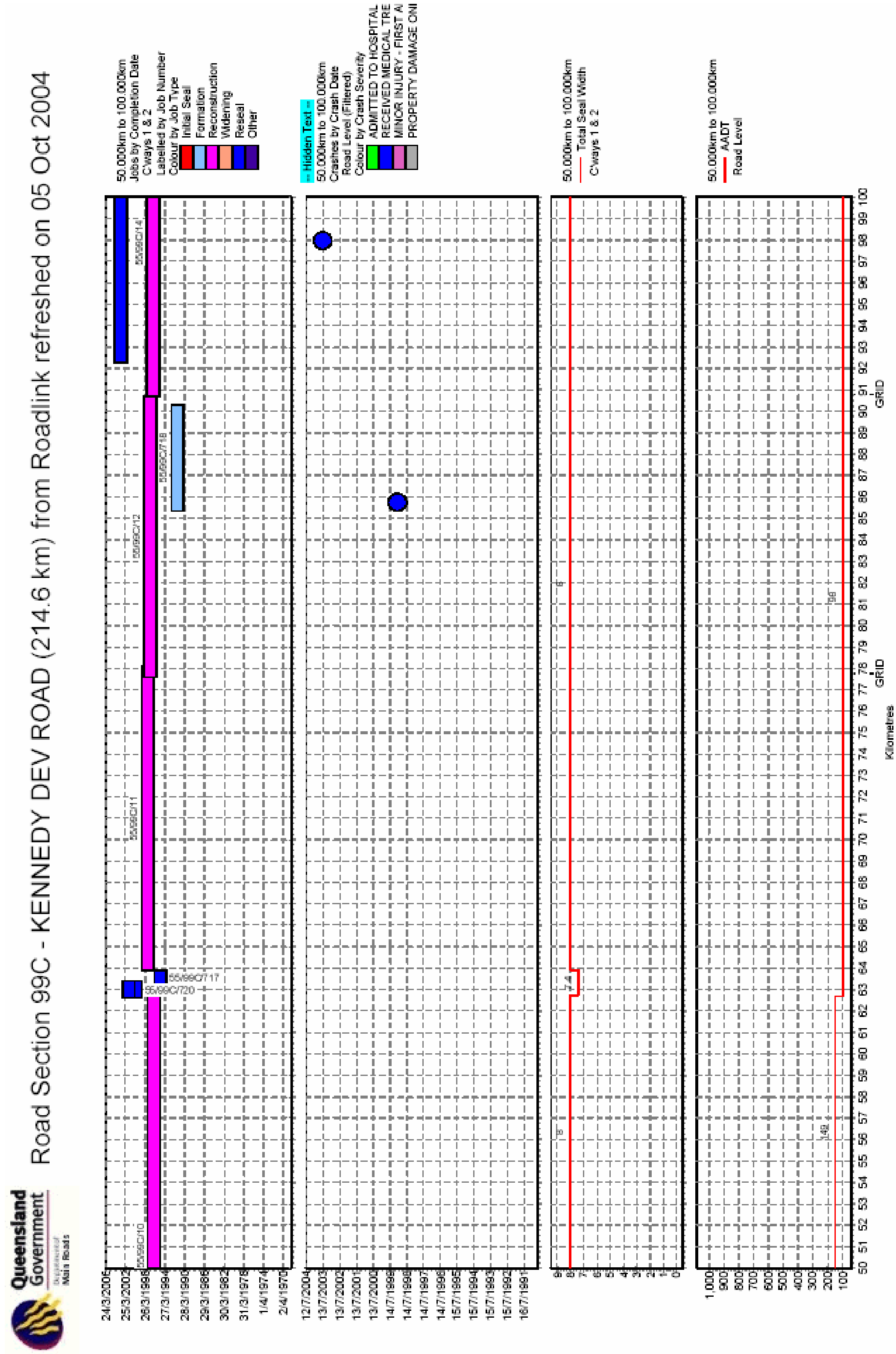
Gregory Developmental Road 98C - Contributing Factor Matrix

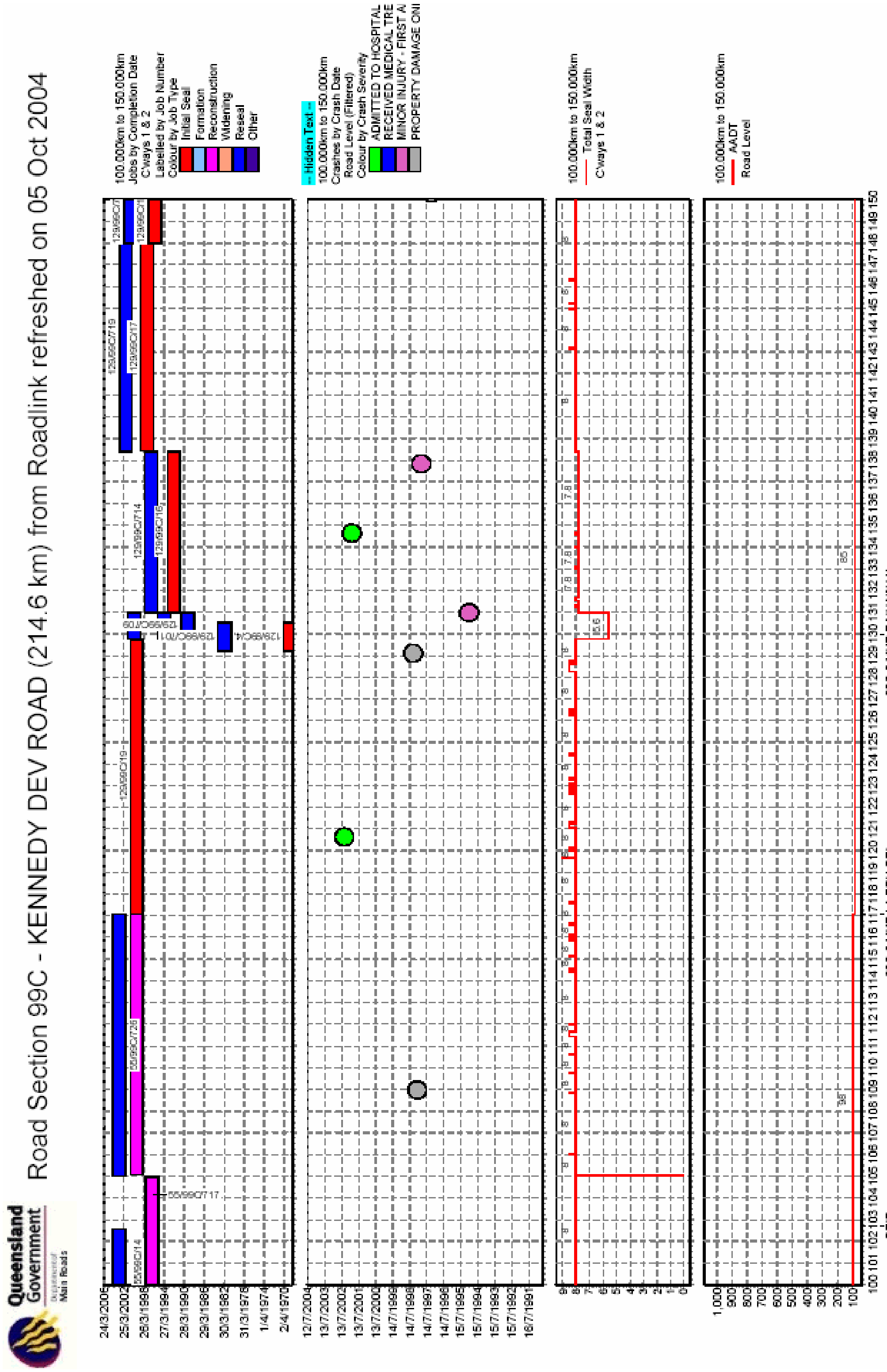
		Driver				Animal Uncontrolled				Violation						Driver Conditions				Road		Road Conditions				Lighting			Condition			Vehicle		Atmospheric Conditions			
Accident-Type DCA Code (Dominant ones first	Key Direction To	Inexperience/Lack Experience	Taking Avoiding Action	Fatigue/Fell Asleep	Underage (Inexperience)		On Road			Undue Care & Attention	Fail to Keep Left	Over prescribed concentration	Disobey Stop Sign	Exceeding Speed Limit			Miscellaneous		Excessive Speed for Circumstances	Potholes	Narrow Bitumen		Miscellaneous				Sunlight Glare (Dawn/Dusk)			Under Influence of Liquor		Tyres (i.e Low tread, puncture)			Miscellaneous		
502,701-5 + 801-5	S																															2					
705	S		1																	1			1														
502,701-5 + 801-5	N									1																											
805	S																															1					
705	N																															1					
Totals		0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	4	0	0	0	0	

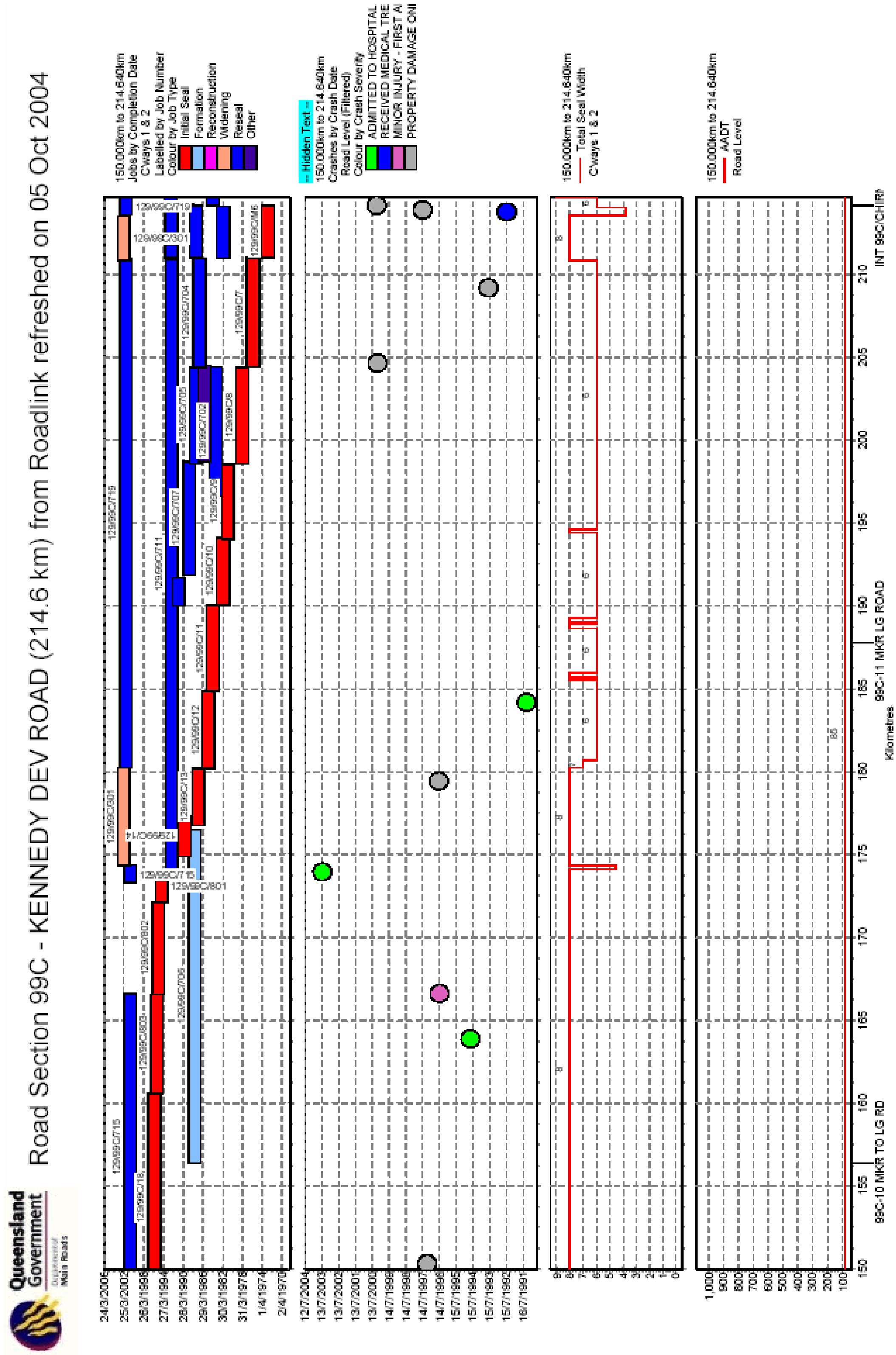
APPENDIX M

KENNEDY DEVELOPMENTAL ROAD (99C) RESULTS


Road Section 99C - KENNEDY DEV ROAD (214.6 km) from Roadlink refreshed on 05 Oct 2004
Queensland Government
Main Roads
0.000km to 50.000km
Jobs by Completion Date
C'ways 1 & 2
Labelled by Job Number
Colour by Job Type
Initial Seal
Formation
Reconstruction
Widening
Reseal
Other
0.000km to 50.000km
Crashes by Crash Date
Road Level (Filtered)
Colour by Crash Severity
0.000km to 50.000km
Total Seal Width
C'ways 1 & 2
0.000km to 50.000km
AADT
Road Level
Kilometres
GRID
NORTH ABUT/WALKERS C
OLC
INT 14B/99C


Road Section 99C - KENNEDY DEV ROAD (214.6 km) from Roadlink refreshed on 05 Oct 2004
Queensland Government
Main Roads
50.000km to 100.000km
Jobs by Completion Date
C'ways 1 & 2
Labelled by Job Number
Colour by Job Type
Initial Seal
Formation
Reconstruction
Widening
Reseal
Other
50.000km to 100.000km
Crashes by Crash Date
Road Level (Filtered)
Colour by Crash Severity
50.000km to 100.000km
Total Seal Width
C'ways 1 & 2
50.000km to 100.000km
AADT
Road Level
GRID
Kilometres


Road Section 99C - KENNEDY DEV ROAD (214.6 km) from Roadlink refreshed on 05 Oct 2004
Queensland Government
Department of Main Roads
100.000km to 150.000km
Jobs by Completion Date
C'ways 1 & 2
Labelled by Job Number
Colour by Job Type
Initial Seal
Formation
Reconstruction
Widening
Reseal
Other
-- Hidden Text --
100.000km to 150.000km
Crashes by Crash Date
Road Level (Filtered)
Colour by Crash Severity
ADMITTED TO HOSPITAL
RECEIVED MEDICAL TRE
MINOR INJURY - FIRST A
PROPERTY DAMAGE ONI
100.000km to 150.000km
Total Seal Width
C'ways 1 & 2
100.000km to 150.000km
AADT
Road Level
Kilometres
GRID
99C-8 MKR LA BDY GRI
99C-9 MKR RAILWAY X


Road Section 99C - KENNEDY DEV ROAD (214.6 km) from Roadlink refreshed on 05 Oct 2004
Queensland Government
Main Roads
150.000km to 214.640km
Jobs by Completion Date
CWays 1 & 2
Labelled by Job Number
Colour by Job Type
Initial Seal
Formation
Reconstruction
Widening
Reseal
Other
150.000km to 214.640km
Crashes by Crash Date
Road Level (Filtered)
Colour by Crash Severity
ADMITTED TO HOSPITAL
150.000km to 214.640km
Total Seal Width
CWays 1 & 2
150.000km to 214.640km
AADT
Road Level
Kilometres
99C-10 MKR TO LG RD
99C-11 MKR LG ROAD

CRASH CH (km)	CRASH NUMBER	CRASH DATE	DCA CODE	CRASH COST	DCA CODE DESCRIPTION	DCA GROUP	DCA GROUP DESCRIPTION
10.75	930003529	20-FEB-93	701	$107,200	OFF PATH-STRAIGHT: LEFT OFF CWAY	15	Off carriageway, on straight
11.596	930015914	26-JUL-93	600	$0	VEH'S ON PATH: OTHER	21	Other
14.28	20000001337	20-JAN-00	802	$157,300	OFF PATH-CURVE: OFF CWAY LEFT BEND	18	Off carriageway, on curve
16	20000012308	09-JUN-00	201	$270,500	VEH'S OPPOSITE APPROACH: HEAD ON	2	Head-on
17.93	970024533	06-NOV-97	607	$0	VEH'S ON PATH: TEMPORARY OBJECT ON C'WAY	21	Other
18.28	990000804	12-JAN-99	702	$107,200	OFF PATH-STRAIGHT: RIGHT OFF CWAY	15	Off carriageway, on straight
19.6	940020592	09-SEP-94	705	$140,900	OFF PATH-STRAIGHT:OUT OF CONTROL ON CWAY	17	Out of control on straight
20	20010010327	10-MAY-01	607	$0	VEH'S ON PATH: TEMPORARY OBJECT ON C'WAY	21	Other
20.28	990005878	21-MAR-99	702	$107,200	OFF PATH-STRAIGHT: RIGHT OFF CWAY	15	Off carriageway, on straight
20.28	990020413	17-SEP-99	705	$140,900	OFF PATH-STRAIGHT:OUT OF CONTROL ON CWAY	17	Out of control on straight
21.596	930019697	10-SEP-93	701	$107,200	OFF PATH-STRAIGHT: LEFT OFF CWAY	15	Off carriageway, on straight
22.3	20030029525	26-NOV-03	703	$182,300	OFF PATH-STRAIGHT: LEFT OFF CWAY HIT OBJ	16	Off carriageway on straight, hit object
25.596	980011471	30-MAY-98	701	$107,200	OFF PATH-STRAIGHT: LEFT OFF CWAY	15	Off carriageway, on straight
26.6	950009337	27-APR-95	705	$140,900	OFF PATH-STRAIGHT:OUT OF CONTROL ON CWAY	17	Out of control on straight
29.93	960011324	17-MAY-96	701	$107,200	OFF PATH-STRAIGHT: LEFT OFF CWAY	15	Off carriageway, on straight
29.93	960016258	12-JUL-96	705	$140,900	OFF PATH-STRAIGHT:OUT OF CONTROL ON CWAY	17	Out of control on straight
130.97	950000473	07-JAN-95	801	$157,300	OFF PATH-CURVE: OFF CWAY RIGHT BEND	18	Off carriageway, on curve
134.64	20010029294	07-DEC-01	701	$107,200	OFF PATH-STRAIGHT: LEFT OFF CWAY	15	Off carriageway, on straight
137.83	970023425	25-OCT-97	605	$110,000	VEH'S ON PATH: PERMANENT OBSTRUCTION	13	Permanent obstruction on carriageway
150.33	970006286	22-MAR-97	607	$0	VEH'S ON PATH: TEMPORARY OBJECT ON C'WAY	21	Other
163.89	940019734	29-AUG-94	704	$182,300	OFF PATH-STRAIGHT:RIGHT OFF CWAY HIT OBJ	16	Off carriageway on straight, hit object
166.64	960016328	11-JUL-96	301	$65,200	VEH'S SAME DIRECTION: REAR END	4	Rear-end
174	20030014916	21-JUN-03	301	$65,200	VEH'S SAME DIRECTION: REAR END	4	Rear-end
179.44	960017224	23-JUL-96	702	$107,200	OFF PATH-STRAIGHT: RIGHT OFF CWAY	15	Off carriageway, on straight
184.19	9190304	29-APR-91	705	$140,900	OFF PATH-STRAIGHT:OUT OF CONTROL ON CWAY	17	Out of control on straight
204.64	20000005773	18-MAR-00	607	$0	VEH'S ON PATH: TEMPORARY OBJECT ON C'WAY	21	Other
209.19	930016098	29-JUL-93	705	$140,900	OFF PATH-STRAIGHT:OUT OF CONTROL ON CWAY	17	Out of control on straight
211.19	90060500220	21-JUN-90		$0			
212.64	20040007312	22-MAR-04	704	$182,300	OFF PATH-STRAIGHT:RIGHT OFF CWAY HIT OBJ	16	Off carriageway on straight, hit object
213.79	920014880	02-JUL-92	101	$154,900	VEH'S ADJACENT APPROACH: THRU-THRU	1	Intersection, from adjacent approaches
213.91	970015060	11-JUL-97	703	$182,300	OFF PATH-STRAIGHT: LEFT OFF CWAY HIT OBJ	16	Off carriageway on straight, hit object
214.19	20000006315	24-MAR-00	703	$182,300	OFF PATH-STRAIGHT: LEFT OFF CWAY HIT OBJ	16	Off carriageway on straight, hit object

CUMULATIVE COST of CRASHES by "ACCIDENT TYPE" 1991 - 2003 for 99C							
CH Range (km)	No of Accidents	Total Accident Cost ($)	Average Cost Per Year ($)	Accident Per (km)	Accident Per (km) Narrow Only - Quantities	Narrow (km)	Wide (km)
0-10	0	0	0	0	0.0	8.6	1.4
10-20	8	783100	65258	0.8	1.2	6.7	3.3
20-30	8	1033800	86150	0.8	0.0	0.0	10.0
30-40	0	0	0	0	0.0	5.6	4.4
40-50	0	0	0	0	0.0	0.5	9.6
50-60	0	0	0	0	0.0	0.0	10.0
60-70	0	0	0	0	0.0	0.0	10.0
70-80	0	0	0	0	0.0	0.0	10.0
80-90	0	0	0	0	0.0	0.0	10.0
90-100	0	0	0	0	0.0	0.0	10.0
100-110	0	0	0	0	0.0	0.0	10.0
110-120	0	0	0	0	0.0	0.0	10.0
120-130	0	0	0	0	0.0	0.0	10.0
130-140	3	374500	31208	0.3	0.0	0.0	10.0
140-150	0	0	0	0	0.0	0.0	10.0
150-160	0	0	0	0.1	0.0	0.0	10.0
160-170	2	247500	20625	0.2	0.0	0.0	10.0
170-180	2	172400	14367	0.2	0.0	0.0	10.0
180-190	1	140900	11742	0.1	0.1	8.3	1.7
190-200	0	0	0	0	0.0	9.8	0.2
200-210	2	140900	11742	0.2	0.2	10.0	0.0
210-220	5	701800	58483	1.1	2.6	1.9	2.7
	31					51.3	163.3
		Accidents Per km = (narrow sections)		0.60 Total No Accidents / Narrow Length		**Total Length**	214.6
		Accident Per km = (entire link 1 year)		0.05 Divide by 5 Years			

Gregory Developmental Road 99C - Factor Matrix CH 10 - 20		Number of Accidents Each Year / Insert Years in Consecutive Order															Direction of the Other Vehicle				Types of Road Users								Surface		Light Condition				Type of Day			
Accident-Type DCA Code (Dominant ones first	Key Direction To	91'	92'	93'	94'	95	96'	97'	98'	99'	00'	01'	02'	03'	Total for this combination of DCA code & Key Direction		To North	To East	To South	To West	Cars or Similar	Road Train/ B Double/ Triple	Van, Lt Truck	Truck	Bus	Motorcycle	Pedal Cycle	Pedestrian	Dry	Wet	Dawn	Daylight	Dusk	Dark	Weekday	Saturday	Sunday	Most Common day (if any)
701-5 + 801-5	S			1							1				2						1		1							1		2			1	1		
800 Off Path	S														0																							
701-5 + 801-5	N				1					1					2						2									1		2			2			
600	N			1											1						1											1			1			
201 Head On	S										1				1		1				2											1			1			
800 Off Path	N														0																							
607	N							1				1			2						1					1				1		2			2			
Totals		0	0	2	1	0	0	1	0	1	2	1	0	0	8	0	1	0	0	0	7	0	1	0	0	1	0	0	0	3	0	8	0	0	7	1	0	0

Gregory Developmental Road 99C - Contributing Factor Matrix CH 10 - 20

		Driver				Animal Uncontrolled				Violation					Driver Conditions				Road			Road Conditions				Lighting			Condition			Vehicle		Atmospheric Conditions			
Accident-Type DCA Code (Dominant ones first	Key Direction To	Inexperience/Lack Experience	Taking Avoiding Action	Fatigue/Fell Asleep	Underage (Inxperience)		On Road			Undue Care & Attention	Fail to Keep Left	Over prescribed concentration	Disobey Stop Sign	Exceeding Speed Limit		Miscellaneous		Excessive Speed for Circumstances	Gravel/Dirt	Wet/Slippery	Rough Surface		Miscellaneous				Sunlight Glare (Dawn/Dusk)			Under Influence of Liquor		Tyres (i.e Low tread, puncture)		Heavy Rain	Miscellaneous		
701-5 + 801-5	S						1													1														1			
800 Off Path	S																																				
701-5 + 801-5	N																		1	1	1																
600	N																						1														
201 Head On	S																	1			1																
800 Off Path	N																																				
607	N	1																		1	2		1														
Totals		1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	3	4	0	2	0	0	0	0	0	0	0	0	0	0	1	0	0	

APPENDIX N

ESTIMATED COSTS PER CRASH BY ‘ACCIDENT TYPE’

Crash Costs for Queensland - Estimated costs per crash by crash type (2001)

DCA Code Group	DCA Codes	Description	Low Speed < 80km/h $	High Speed 80 km/h + $
Two Vehicle Crashes				
1	100 - 109	Intersection, from adjacent approaches	$67,000	$154,900
2	201, 501	Head on	$154,700	$270,500
3	202 - 206	Opposing vehicles, turning	$67,100	$133,400
4	301 - 303	Rear end	$33,700	$65,200
5	305 - 307, 504	Lane change	$52,600	$161,900
6	308, 309	Parallel lanes, turning	$47,000	$132,400
7	207, 304	U turn	$64,300	$136,200
8	401, 406-408	Entering roadway	$47,600	$88,500
9	503, 505, 506	Overtaking, same direction	$63,700	$101,300
10	402, 404, 601, 602, 604, 608	Hit parked vehicle	$47,700	$107,200
11	903	Hit railway train	$188,000	$379,000
Single Vehicle Crashes				
12	001 - 009	Pedestrian	$142,800	$252,000
13	605	Permanent obstruction on carriageway	$65,000	$110,000
14	609, 905	Hit animal	$35,000	$39,000
15	502, 701, 702, 706, 707	Off carriageway, on straight	$52,600	$107,200
16	703, 704, 904	Off carriageway, on straight, hit object	$100,800	$182,300
17	705	Out of control, on straight	$73,200	$140,900
18	801, 802	Off carriageway, on curve	$89,100	$157,300
19	803, 804	Off carriageway, on curve, hit object	$119,400	$203,900
20	805, 806, 807	Out of control, on curve	$76,100	$104,000
Exceptions				
21	000, 200, 300, 400, 500, 600, 700, 800, 900, 901, 906, 907, 403, 405, 606, 607, 610	Crashes which are unlikely to be attributable to any road environment factor, and which are therefore unlikely to be addressed by any road based remedial treatment Crashes in this DCA code group will not be used in crash rates or BCR calculations or reports.		

Notes:

1 Costs are in 2001 dollars

2 Costs are based on the costs contained in "Crash costs 200: cost by accident type" produced by Dr David Andreassen of Data Capture and Analysis

APPENDIX O

NET PRESENT VALUE AND BENEFIT COST ANALYSIS

ACCIDENT COST SAVINGS

Project No. **Gregory Developmental Road**

CH SECTION: 38 - 48

High Speed Environment: 100km/h

Accident Base: 13 years
Analysis Period: 20 years

Annual Crash Reduction Savings

Accident Type	$ Cost / Crash	No of Crashes per year	Likely Crash Reduction	
			%	$/year
803	203,900	0.08	-40	-6,274
703	182,300	0.08	-40	-5,609
201	270,500	0.08	-40	-8,323
Total				**-$20,206**

Note: 1 accident in 13 years = 0.08

INITIAL CAPITAL COST

Narrow Length (km)	Seal Width (m)	Type Section	Amount (per km)	Cost of Upgrade
3.125	3.4	3C	$149,188	**$466,213**

Net Present Value (20 year Design Life)

Project No. Gregory Developmental Road

CH SECTION: 38 - 48

High Speed Environment: 100km/h

Accident Base: 13 years
Analysis Period: 20 years

Year	Discount Rate (i%)				
	5	6	7	8	9
1	-19244	-19062	-18884	-18709	-18538
2	-18328	-17983	-17649	-17324	-17007
3	-17455	-16965	-16494	-16040	-15603
4	-16624	-16005	-15415	-14852	-14315
5	-15832	-15099	-14407	-13752	-13133
6	-15078	-14245	-13464	-12733	-12048
7	-14360	-13438	-12583	-11790	-11053
8	-13676	-12678	-11760	-10917	-10141
9	-13025	-11960	-10991	-10108	-9303
10	-12405	-11283	-10272	-9359	-8535
11	-11814	-10644	-9600	-8666	-7831
12	-11252	-10042	-8972	-8024	-7184
13	-10716	-9473	-8385	-7430	-6591
14	-10205	-8937	-7836	-6879	-6047
15	-9720	-8431	-7324	-6370	-5547
16	-9257	-7954	-6845	-5898	-5089
17	-8816	-7504	-6397	-5461	-4669
18	-8396	-7079	-5978	-5057	-4284
19	-7996	-6678	-5587	-4682	-3930
20	-7615	-6300	-5222	-4335	-3605
Total	**-$251,813**	**-$231,763**	**-$214,064**	**-$198,387**	**-$184,453**

BCR =	Net Present Value / Cost of Upgrade				
BCR =	$251,813 / $466,213	$231,763 / $466,213	$214,064 / $466,213	$198,387 / $466,213	$184,453 / $466,213
BCR =	0.54	0.50	0.46	0.43	0.40

NPV = Net Present Value - Cost of Upgrade

NPV =	$251,813	$214,064
	- $466,213	- $466,213
	-$214,400	**-$252,149**

ACCIDENT COST SAVINGS

Project No. **Gregory Developmental Road**

CH SECTION: 128 - 138

High Speed Environment: 100km/h

Accident Base: 13 years
Analysis Period: 20 years

Annual Crash Reduction Savings

Accident Type	$ Cost / Crash	No of Crashes per year	Likely Crash Reduction	
			%	$/year
801	157300	0.08	-40	-4,840
201	270500	0.08	-40	-8,323
803	203900	0.08	-40	-6,274
609	39000	0.08	0	0
Total				**-$19,437**

Note: 1 accident in 13 years = 0.08

INITIAL CAPITAL COST

Narrow Length (km)	Seal Width (m)	Type Section	Amount (per km)	Cost of Upgrade
8.9	5.7	1E	$167,270	**$1,488,703**

Net Present Value (20 year Design Life)

Project No. Gregory Developmental Road

CH SECTION: 128 - 138

High Speed Environment: 100km/h

Accident Base: 13 years
Analysis Period: 20 years

Year	Discount Rate (i%)				
	5	6	7	8	9
1	-18511	-18337	-18165	-17997	-17832
2	-17630	-17299	-16977	-16664	-16360
3	-16790	-16320	-15866	-15430	-15009
4	-15991	-15396	-14828	-14287	-13770
5	-15229	-14524	-13858	-13228	-12633
6	-14504	-13702	-12952	-12249	-11590
7	-13813	-12927	-12104	-11341	-10633
8	-13156	-12195	-11312	-10501	-9755
9	-12529	-11505	-10572	-9723	-8949
10	-11933	-10853	-9881	-9003	-8210
11	-11364	-10239	-9234	-8336	-7532
12	-10823	-9660	-8630	-7719	-6911
13	-10308	-9113	-8066	-7147	-6340
14	-9817	-8597	-7538	-6618	-5816
15	-9349	-8110	-7045	-6127	-5336
16	-8904	-7651	-6584	-5673	-4896
17	-8480	-7218	-6153	-5253	-4491
18	-8076	-6810	-5751	-4864	-4121
19	-7692	-6424	-5374	-4504	-3780
20	-7326	-6061	-5023	-4170	-3468
Total	**-$242,227**	**-$222,940**	**-$205,915**	**-$190,835**	**-$177,431**

BCR = Net Present Value / Cost of Upgrade

BCR =	$242,227 / $1,488,703	$22,940 / $1,488,703	$205,915 / $1,488,703	$190,835 / $1,488,703	$177,431 / $1,488,703
BCR	0.16	0.15	0.14	0.13	0.12

NPV = Net Present Value - Cost of Upgrade

NPV =

$242,227	$205,915
- $1,488,703	- $1,488,703
-$1,246,476	**-$1,282,788**

ACCIDENT COST SAVINGS

Project No. **Gregory Developmental Road**

CH SECTION: 208 - 218

High Speed Environment: 100km/h

Accident Base: 13 years
Analysis Period: 20 years

Annual Crash Reduction Savings

Accident Type	$ Cost / Crash	No of Crashes per year	Likely Crash Reduction	
			%	$/year
701	102,700	0.08	-40	-3,160
702	102700	0.08	-40	-3,160
703	182,300	0.08	-40	-5,609
705	140,900	0.08	-40	-4,335
609	39,000	0.08	0	0
Total				**-$16,265**

Note: No savings for DCA 609
Note: 1 accident in 13 years = 0.08

INITIAL CAPITAL COST

Narrow Length (km)	Seal Width (m)	Type Section	Amount (per km)	Cost of Upgrade
1	5.5	1E	$167,270	$167,270
4.7	3.4	1A	$198,033	$930,755
				$1,098,025

Net Present Value (20 year Design Life)

Project No. **Gregory Developmental Road**

CH SECTION: 208 - 218

High Speed Environment: 100km/h

Accident Base: 13 years
Analysis Period: 20 years

Year	**Discount Rate (i%)**				
	5	**6**	**7**	**8**	**9**
1	-15490	-15344	-15201	-15060	-14922
2	-14752	-14475	-14206	-13944	-13690
3	-14050	-13656	-13277	-12911	-12559
4	-13381	-12883	-12408	-11955	-11522
5	-12744	-12154	-11596	-11069	-10571
6	-12137	-11466	-10838	-10249	-9698
7	-11559	-10817	-10129	-9490	-8897
8	-11009	-10205	-9466	-8787	-8163
9	-10484	-9627	-8847	-8136	-7489
10	-9985	-9082	-8268	-7534	-6870
11	-9510	-8568	-7727	-6976	-6303
12	-9057	-8083	-7222	-6459	-5783
13	-8625	-7625	-6749	-5980	-5305
14	-8215	-7194	-6308	-5537	-4867
15	-7824	-6787	-5895	-5127	-4465
16	-7451	-6403	-5509	-4747	-4097
17	-7096	-6040	-5149	-4396	-3758
18	-6758	-5698	-4812	-4070	-3448
19	-6436	-5376	-4497	-3769	-3163
20	-6130	-5071	-4203	-3490	-2902
Total	**-$202,693**	**-$186,554**	**-$172,308**	**-$159,688**	**-$148,472**

BCR = Net Present Value / Cost of Upgrade

	5	6	7	8	9
BCR =	$202,693 / $1,098,025	$186,554 / $1,098,025	$172,308 / $1,098,025	$159,688 / $1,098,025	$148,472 / $1,098,025
BCR	0.18	0.17	0.16	0.15	0.14

NPV = Net Present Value - Cost of Upgrade

NPV =

$202,693	$172,308
- $1,098,025	- $1,098,025
-$895,332	**-$925717**