Improving Kuranda Range Road Traffic Incident Management Operations

Independent Review by
Professor Phil Charles

Report

4-Feb-16

Executive Summary

The recommended approach to road traffic incident management operations on the Kuranda Range Road is:

Prevent. Detect. Respond. Inform. Clear.

There has been a number of high-profile incidents on the Kuranda Range Road (Kennedy Highway) between Cairns and Mareeba, resulting in major disruptions to road users, attracting significant media attention and a public meeting in August 2015.

An independent review was undertaken on improving the performance of traffic incident management operations on the Kuranda Range Road, in relation to unplanned traffic incidents.

The approach for this project was based on a *Managing for Results* framework as outlined in Section 2.
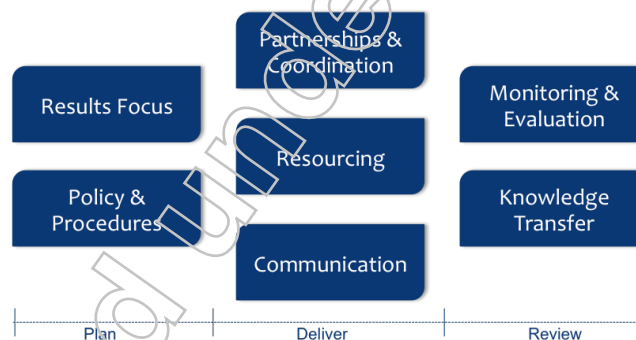
Part A provides a summary of the key issues and findings and Part B recommendations for improvement.

Part C outlines guidelines and recommendations for performance measures and investment assessment using a multi-criteria approach.

Contents

Glossary

BCR   Benefit-cost ratio
KPI   key performance indicator
NPV   Net present value
QAS   Queensland Ambulance Service
QFES   Queensland Fire and Emergency Services
QPS   Queensland Police Service
SIMS   STREAMS Incident Management System
SOP   standard operating procedure
TIM   traffic incident management
TMR   Transport and Main Roads

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1. Context

The Transport and Main Roads (TMR) Strategic Plan states that TMR aims to *provide a safe, integrated, reliable and efficient transport system* and "*manage and operate the state-controlled road network to ensure travel reliability and efficiency*"[1].

There has been an increased number of high-profile incidents on the Kuranda Range Road (Kennedy Highway) between Cairns and Mareeba, particularly the section between Smithfield and Kuranda, in early to mid 2015, resulting in major disruptions to road users, attracting significant media attention and a public meeting in August 2015.

TMR commissioned a review of traffic incident management operations on the Kuranda Range Road, to identify opportunities for improvement.

Kuranda Range Road

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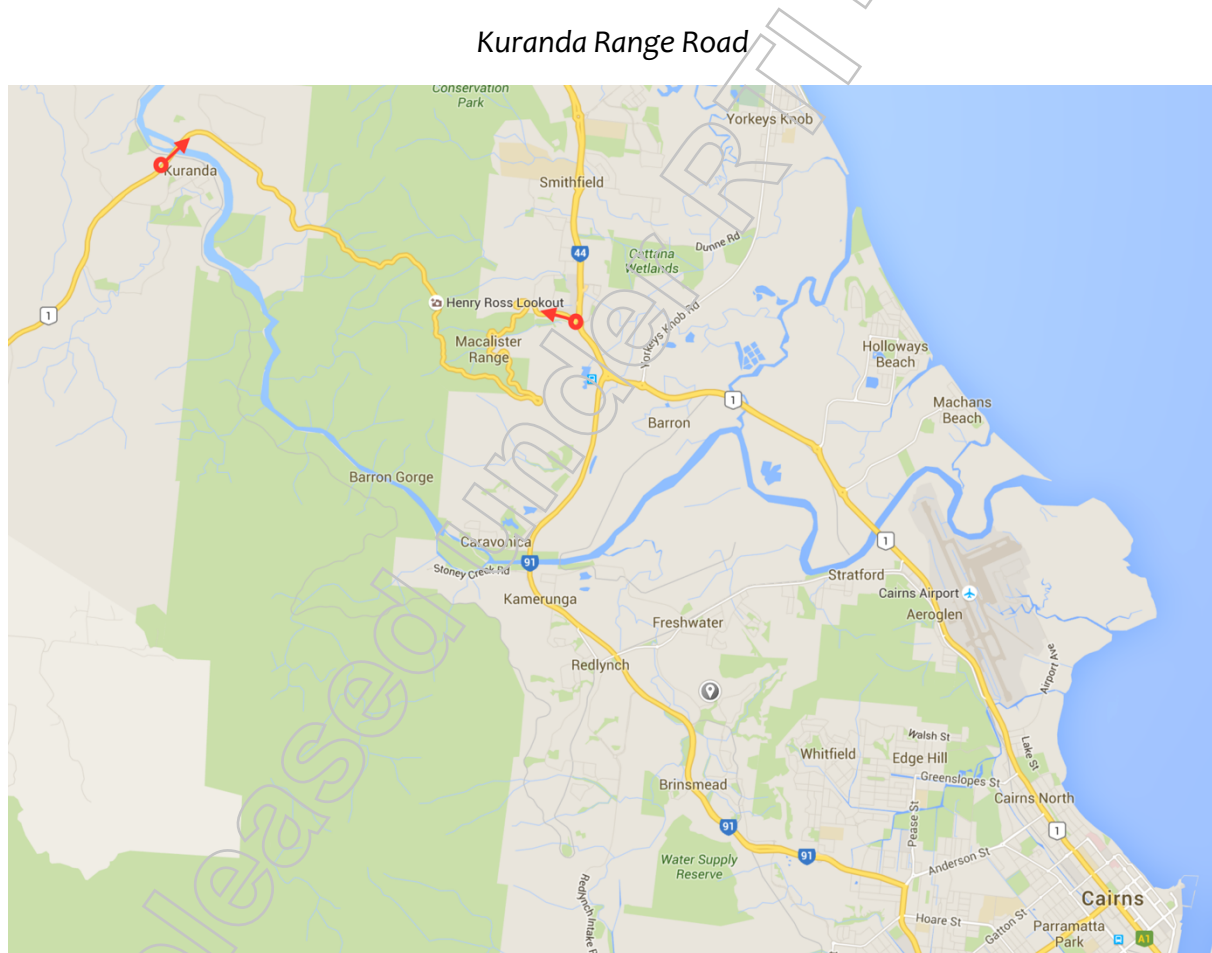
[1] Transport and Main Roads, *Strategic Plan 2015-2019*.

2. Project Overview

The primary purpose of this project is to undertake an independent review and provide advice on improving the performance of traffic incident management operations on the Kuranda Range Road, particularly in relation to unplanned traffic incidents.

The objectives of this project are to:

Identify opportunities to improve traffic incident management operations to improve mobility, accessibility, safety and customer service outcomes for road users.

2.1 Project Methodology

Six tasks were outlined in the project methodology as illustrated below.

Project Methodology

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Task 1.                Task 2.              Task 4.           Final
Analyse                Consult key          Draft             Report:
Context &              stakeholders         Findings          A: Current
review                                                        B: Findings
current                Task 3.              Task 5.           C: Guidelines
practice               Identify key         Develop
                       issues               operations
                                            guidelines
                                            Task 6.
                                            Develop
                                            assessment
                                            guidelines

  Context              Research            Findings & Recommendations
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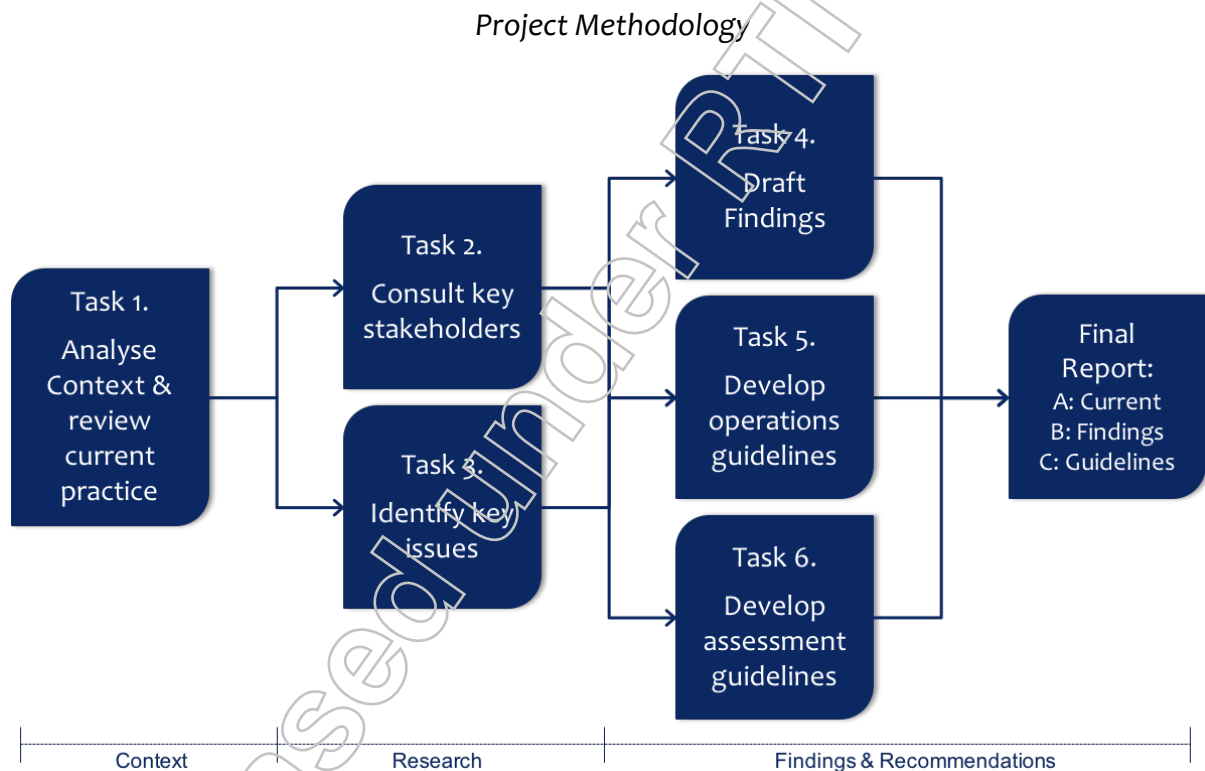
Task 1: Analyse Context & Review Current Practice

This task involved a review of the current and future strategic and operational context, including international best practice and current practice in incident management in the TMR Far North District based in Cairns.

This review included analysing recent incidents, including types of incidents, timelines and communications, by reviewing available reports, documents and statistics on Kuranda Range Road incidents, from sources including TMR, key stakeholders, and media reports, including social media.

Task 2: Consult Key Stakeholders

This task involved undertaking discussions with relevant key stakeholders, primarily key TMR staff, both in the District and those with a state-wide interest; Queensland Police Service (QPS) as a key stakeholder; and road operations delivery partner RoadTek. The aim of the discussions was to review current incident management operations, processes and resourcing and identify opportunities for improvement.

Task 3: Identify Key Issues

This task involved the review of information collected in Tasks 1 and 2 to identify key issues considering the various phases of current incident management operations, and best practice critical success factors.

Task 4: Findings

A report on findings was prepared after analysing information collated, assessing the broad impacts, identify risks and challenges and potential for future improvements, based on best practice.

Practical and cost-effective recommendations were developed for the improvement of traffic incident management operations, and improving mobility, accessibility, safety and customer service outcomes.

Task 5: Develop Operational Guidelines

Guidelines for the review of the performance of incident management operations were developed, with a particular focus on the impact of investments in improvements and enhancements.

Task 6: Develop Assessment Guidelines

Guidelines for the assessment of proposed investment in incident management operations were developed to assist in selecting cost-effective improvement projects.

Deliverables

The deliverables for this project involve a report on improving Kuranda Range Road traffic incident management in three parts:

Part A: Assessment of current incident management operations

Part B: Recommendations for the improvement of traffic incident management, safety and customer service

Part C: Guidelines for ongoing performance review and assessment of proposed investment in incident management operations.

The approach for this project was based on a *Managing for Results* framework.

2.2 Managing for Results

The methodology for reviewing the management of incidents and analysing implications has been based on a *Managing for Results* framework. This is an adaptation of a framework that has resulted in sustained improvements in road safety[2], particularly over the past two decades.

The *Managing for Success* framework identifies seven key success factors, which when applied in a systematic, sustained and accountable process in response to critical problems enables a sustained improvement in outcomes.

This framework is used in this report to assess current performance and identify areas for improvement.

A *Capability Maturity Matrix* was also used as a summary assessment – detail of the tool is provided in Appendix 2.
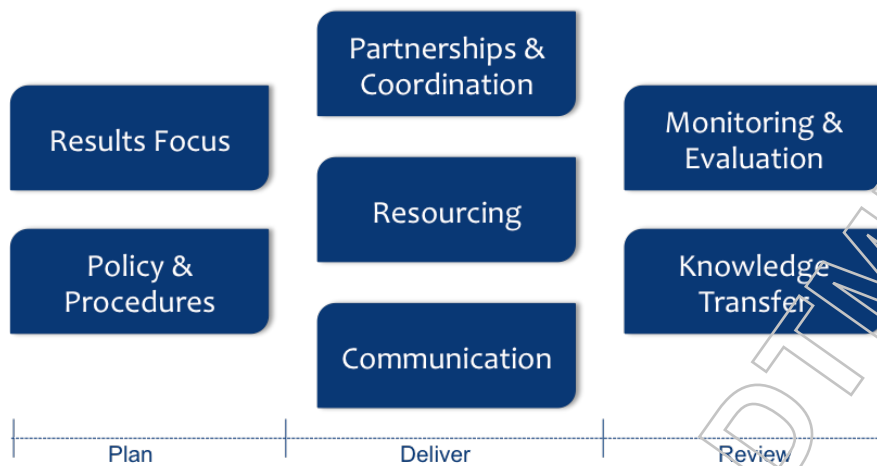
A summary assessment based on this framework is included in Part A below.

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[2] Bliss, T and Breen, J (2009) *Implementing the Recommendations of the World Report on Road Traffic Injury Prevention*, The World Bank Global Road Safety Facility, Washington DC.

Managing for Results Framework

The seven critical success factors for traffic incident management operations are:

- **Results focus** – clearly identified, specific desired outcomes for customers, government, key stakeholders/partners and the community.

- **Policy and Procedures** – clear policies and procedures defined and in operation, including defined responsibilities and accountabilities, with due consideration to cost effectiveness, practicality, timeliness and public acceptability.

- **Partnerships and Coordination** – deliverables of the key partners aligned and managed, and accountable decision-making arrangements at senior and operational levels between government agencies and operators.

- **Resourcing** – appropriate level of resources (people, equipment, information etc.) available and pre-deployed as appropriate.

- **Communication** – a sustained communication process with key stakeholders, partners, government, travelling public and the community.

- **Monitoring and Evaluation** – performance monitored through systematic and ongoing measurement of key outputs and outcomes against agreed measures and targets. All major incidents reviewed with findings and recommendations documented and actioned for ongoing improvements.

- **Knowledge Transfer** – international good practice and experience identified and translated to the local context to ensure ongoing development in capability, best practice guidelines and improvements to systems and procedures.

Each of these factors are described in more detail below.

Results Focus

In responding to traffic incidents it is important to have a clear focus on the desired outcomes.

A *results focus* means having an agreed approach that establishes an ambition to improve, and a clear and an accountable focus on results and is key to success. The strategic orientation drives a series of progressive actions, plus incorporating a performance framework enables progress towards desired results to ne monitored.

In this context there are a number of outcomes that should be considered as desirable, noting that in some cases trade-offs between competing objectives may be required.

Desired outcomes for traffic incident management include:

- Safety – rapid recovery and treatment of injured and reduce risk for road users and responders (including the risk of secondary incidents)

- Reliability – consistent, regular travel times

- Mobility – ability to travel to desired destinations with minimum delay (i.e. quick clearance)

- Customer Service – keep road users informed of traffic conditions, and ensure appropriate investigation of incidents

- Value for money – optimise benefits from community investment and minimising cost of operations (i.e. efficient use of multi-agency resources).

These outcomes may be formal requirements, such as a policy; or less formal, such as an operational procedure or professional practice.

Partnerships & Coordination

Traffic incident management requires a partnership approach, with a combination of different agencies, and units within agencies involved. The orchestration and alignment of deliverables by key partners is central to success.

Partnerships need to be engaged throughout the life cycle of planning and operations – planning, resourcing, operations, incident response, and review – at both management and operations levels in the key agencies.

In relation to traffic incidents, the key agencies in the Cairns area TMR, RoadTek, QPS, QFES, and QAS. QPS as the lead agency for traffic incidents, is responsible for the coordination of response to incidents, with TMR providing support for traffic operations and information.

Within these agencies, specific divisions or units lead elements of the response and recovery operations.

The concept of inner and outer cordon is used in traffic incident management and is applicable for significant or major incidents.

The *inner cordon* focus is on the incident itself and involves making the scene safe, recovery of any injured, any immediate investigation, managing traffic and returning the road to normal operation. QPS as the lead agency has the primary responsibility, with a focus on safety and clearing road blockages.

The *outer cordon* focus, outside of the immediate incident scene, is then managed by TMR, closely coordinated with QPS, to arrange alternatives, manage traffic and clearance operations, and provide traffic information to responders and the community.

Policy & Procedures

Establishing the policy parameters that outlines the legitimate bounds of key partners, is another key to success. To be effective, a clear policy and defined procedures on the management of traffic incidents are required, which define roles, responsibilities and accountabilities, at the same time being practical, flexible, cost-effective and ensure due process is timely and acceptable to the public.

A very conservative process that takes an excessive time to complete is not acceptable to customers and key stakeholders, because of the adverse impacts that occur, primarily uncertain travel time delays. Collaborative policies and procedures ensure cost-effective use of government resources.

There is a need to move from a tactical, procedural or reactive method of operation to become a more active, pre-planned, 'time is of the essence' focus during traffic disruptions.

Resourcing

Having fit-for-purpose resources available to enable a quick response to traffic incidents at critical locations and in high traffic periods, is critical for success in responding to incidents. Being able to accurately detect and verify incidents is critical, plus being able to communicate with affected and potential road users.

Planning and pre-deploying people and equipment ensures rapid response at those critical locations and times.

Communication

Sustained communication of traffic conditions, both with key delivery partners and with road users (customers) is vital to achieving desired outcomes.

This communication involves providing timely and accurate information on traffic conditions – to the travelling public, other key responding agencies and to government and the community.

Providing estimates of the expected duration of incidents (which need to be regularly updated as events unfold) and alternative means of travel – such as don't travel, defer travel, change travel mode or route – are examples of communication messages.

Monitoring & Evaluation

Monitoring traffic incident management performance, through systematic and ongoing measurement of key outputs and outcomes against agreed measures and targets, is needed to achieve the desired focus on results. The adage '*what gets measured gets done*' is very true.

This involves having a few simple measures against the desired outcomes, such as customer satisfaction and the amount of delay.

One useful example – *a target average clearance time of less than 40 minutes for 95% of unplanned incidents on major transport routes.* This provides a focus and sense of urgency to response activities.

Knowledge Transfer

Transfer of learnings from a review of past major incidents is key to ongoing development in capability and improvements in the management of traffic incidents.

Identifying lessons from major incidents is a very useful way of ensuring continuous improvement. Providing training opportunities to test working relationships, such as desktop exercises, also improves the effectiveness of incident management.

This involves arranging multi-agency debriefs and independent reviews of significant and major incidents, providing recommended actions and a follow up process to ensure the lessons have been acted on.

In addition, monitoring state, national and international developments and promoting the findings, plus providing ongoing capability development and best practice guidelines, is also important for ongoing improvement.

Part A: Assessment of Current Operations

Part A provides an assessment of current traffic incident management operations on the Kuranda Range Road.

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3. Review of Current Practice

3.1 Incident Timeline

A summary of a timeline for managing an incident affecting traffic incidents is shown in the illustration below – based on international good practice.

Timeline of a traffic incident
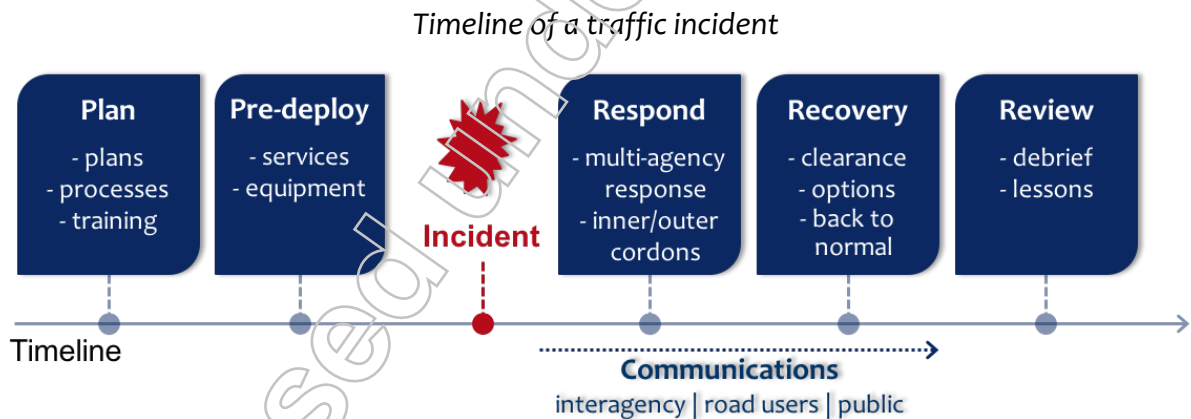
The stages of incident management start with planning, including a governance framework, and contingency plans to enable a quick response when an incident occurs.

Pre-deploying resources, such as key equipment and staffing at critical locations during peak traffic periods or known critical times (e.g. wet season), enables a quick response and rapid recovery of traffic back to normal operations.

Multi-agency coordination is necessary to enable a seamless response to major disruptions and recovery, plus the provision of appropriate information and updates to affected road users.

3.2 Policy Context

Consideration of the policy context, including government and agency policy statements, is the first component of the review of the current incident management framework.

The *Transport Coordination and Delivery Plan*[3] sets the strategy and direction for TMR to deliver government priorities over the next 10 years. A key goal is:

> *An efficient and reliable transport system: people and freight can move easily; and travel times are predictable…*

TMR aims to provide a *safe, integrated, reliable and efficient transport system* and "*manage and operate the state-controlled road network to ensure travel reliability and efficiency*"[4].

The safe and quick clearance of traffic incidents is a key component of ensuring travel reliability. TMR *Open Roads* and *Quick Clearance* policies aim to reduce traffic delays on the road network[5].

QPS policies and procedures are contained in various internal documents including the Traffic Manual[6].

> "*Incident management includes the process of coordinating the activities of response agencies at an incident site so that the problem is solved as effectively as possible and with minimum effect on people, property and the environment.*" (QPS Traffic Manual 5.1)

QPS are also required to investigate and record details of particular types of traffic incidents including fatalities and injury crashes.

> "*Where a traffic crash results in a significant traffic flow disruption, first response officers should … consider implementing a multi-agency response … to assist with the quick clearance of the crash and to minimise traffic flow disruptions*" (QPS Traffic Manual 5.3)

The 2010 *Strategic Alliance (Road Operations)* between TMR, QPS and the former Department of Community Safety (now QFES and QAS), as ratified by the respective

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[3] Transport and Main Roads, *Transport Coordination and Delivery Plan*, 3 June 2013

[4] Transport and Main Roads, *Strategic Plan 2015-2019*.

[5] Transport and Main Roads, *Traffic and Road Use Management*, Volume 1 – Guide to Traffic Management, Part 9: Traffic Operations, April 2015

[6] QPS Traffic Manual https://www.police.qld.gov.au/corporatedocs/OperationalPolicies/default.htm

chief executives, was established to facilitate close cooperation and joint working arrangements with the aim to improve:

- road safety and reduce congestion
- incident response and clearance times
- inter-operability.

3.3 Cost of Incidents

Traffic incidents have a number of cost impacts on road users, government, key stakeholders and the community, including:

- Safety – cost of property damage, injuries and fatalities – to agency responders, road users and the community

- Travel time delay – the cost of lost time or productivity – both personal and business related

- Travel time reliability – people have to allow a buffer time or make other arrangements to cover unexpected delays – also see discussion below on unexpected delays. Can also result in costs involved in loss of airfares for missed flights etc.

- Costs to agencies – this includes additional staff, overtime or extra shifts, allowances, and additional equipment costs, hire of equipment, etc., which is directly proportional to the incident duration.

Unexpected Delays and the Value of Travel Time Reliability

There is an increasing awareness of the importance of travel time reliability. From a user perspective, the reliability of travel ranks as one of the most important attributes, even ahead of total trip travel time. Unexpected delays tend to be perceived as much costlier to travellers than expected delays.

Research indicates that the value of reliability can increase the perceived time to **three to five times** that of the in-vehicle travel time[7].

Hence, the provision of regular information updates on traffic status can reduce the anxiety and stress caused by uncertainty and allows road users to make choices regarding travel.

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[7] Concas, S. and Kolpakov, A. (2009) *Synthesis of Research on Value of Time and Value of Reliability*, Center for Urban Transportation Research, University of South Florida.

These results can be used to increase expected benefits to justify investment on programs to improve the response to incidents and provide better communication.

3.4 Traveller Information

There has been considerable media attention to extended closures on the Kuranda Range Road due to traffic incidents. This includes articles in the Cairns Post and other local media, plus social media, particularly the Kuranda Range Facebook page.

The Facebook page is run by locals for the purpose of informing users (+1,000) of the Kuranda Range of any delays, police presence and general comments or opinions. A quick review of postings indicated the emphasis:

- 50% enforcement issues
- 20% road conditions
- 15% lane or road closures, and crashes
- 12% road works.

There also appears to be either a lack of knowledge of the TMR 131940 traveller information service, or a lack of trust in the timeliness and accuracy of the information that is provided.

TMR also provides a text message (SMS) service for registered users, approximately 5,000 have registered. This service has been recently reactivated, but only provides messages for closures expected to last more than 30 minutes. There has been an issue with the cost of this service, considering the number of people registered. A review of a more cost-effective service is worth consideration.

3.5 Analysis of Data

An analysis of SIMS[8] data between January 2007 and July 2015 provided 1,152 incidents of which 33% were crashes, for the Kuranda Range area. A breakdown of these incidents is provided in the following chart.

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[8] SIMS: STREAMS Incident Management System
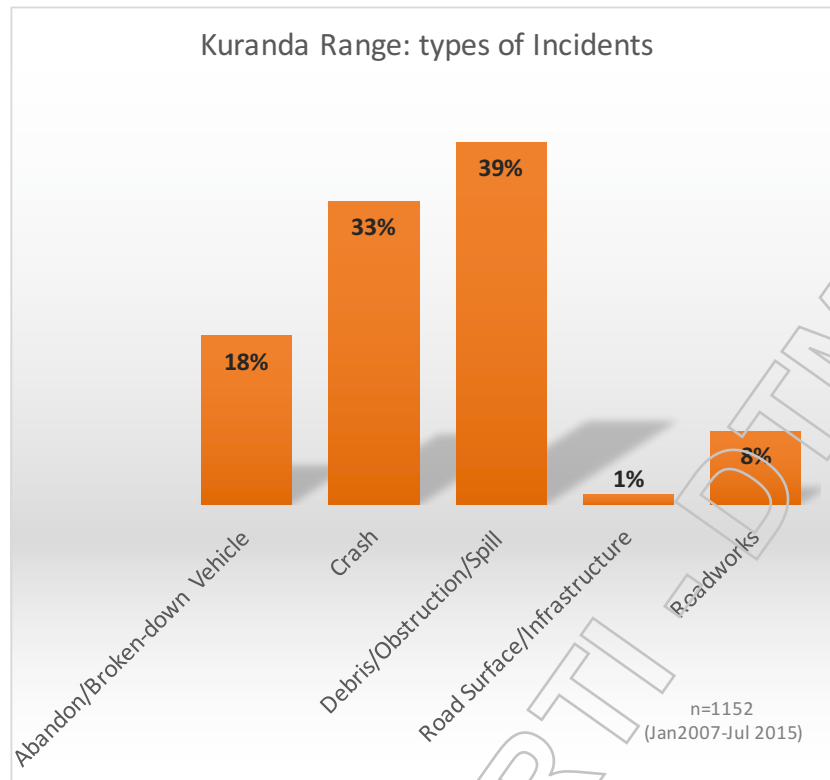
Analysis of the duration of incidents was also conducted, noting there are concerns about the accuracy of the data, based on inadequate advice on when incidents are resolved. Also the duration is not necessarily related to closures, as this information is not readily available from the SIMS data. Of the 344 entries with start and end times for the incident:

- 75% less than 2 hours
- 25% more than 2 hours (approx. 10 per annum).

An analysis of crash data between July 2007 and June 2012 was undertaken by RoadPro Consulting with the following results:

- 115 casualty crashes, average of 23 crashes per year
- 80% of the incidents were between 7am and 6pm
- 3% fatal, 39% hospitalised, 38% medical and 20% minor
- 52% wet pavement
- 47% run off road, 30% head-on crash.

An extract of QPS traffic crash data on the Kuranda Range was obtained and a summary of the data is provided in the following charts. QPS crash data reported in the media included:

- 95% of crashes were local residents (92 reported crashes in 2 years)
- 38% due to driver error; 58% on wet roads; 46% single vehicle
- 50% resulted in injury.

Kuranda Range Road – data from QPS Jun 2005-Jul 2015

Hour of Day

n=270
(Jun 2005-Jul 2015)

Day of Week

n=270
(Jun 2005-Jul 2015)

Month of Year

n=270
(Jun 2005-Jul 2015)

Traffic Crash Type

n=270
(Jun 2005-Jul 2015)
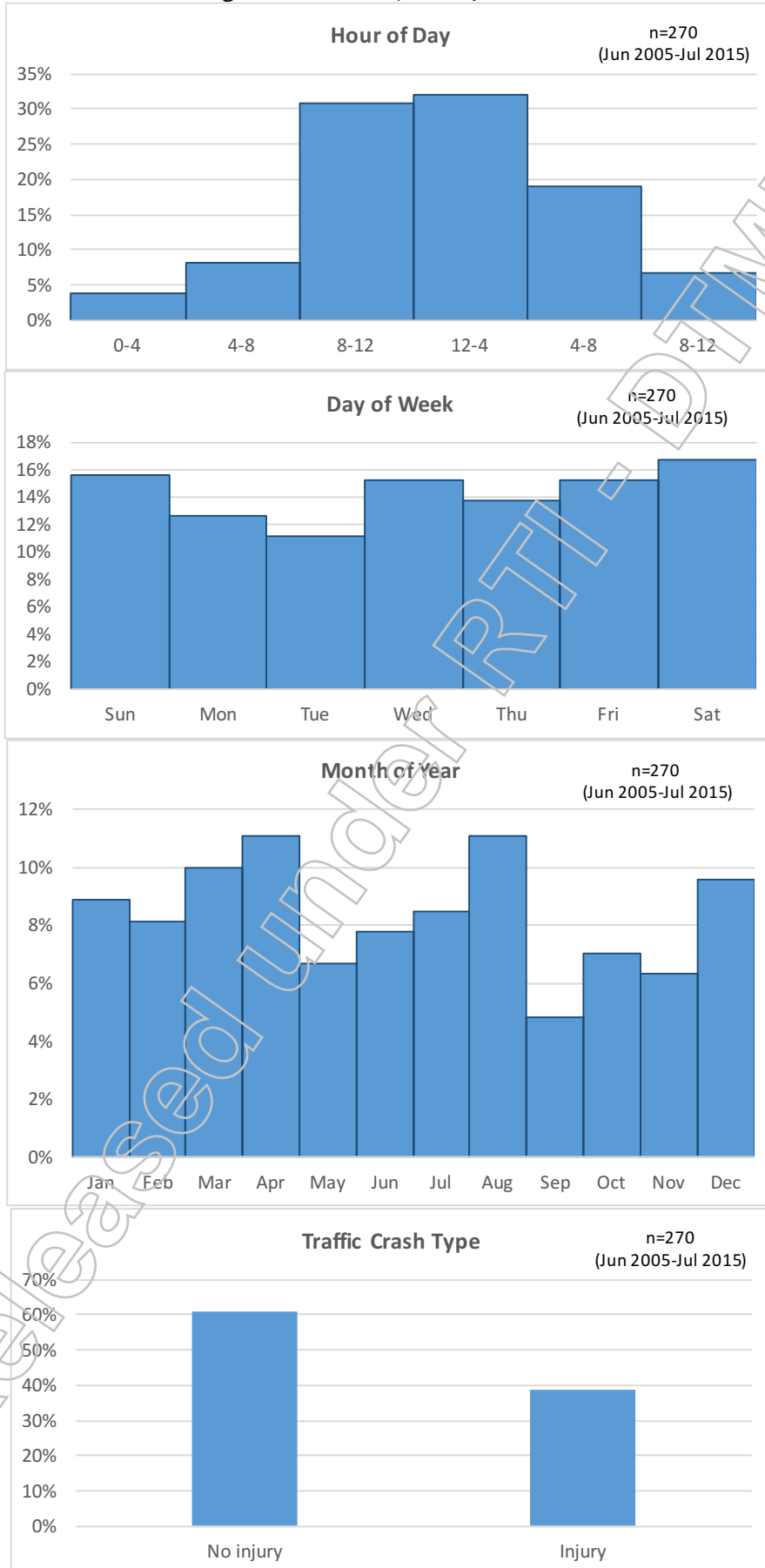
4. Key Issues and Findings

This task involved a review of information and stakeholder consultation to identify key issues and findings in relation to traffic incident management on the Kuranda Range Road, considering the various phases of current incident management operations and best practice success factors.

Discussions were undertaken with key stakeholders including:

- Transport and Main Roads – from Far North Coast District, RoadTek, South East Queensland and corporate areas

- Queensland Police Service – from Cairns, Smithfield and Kuranda areas.

A list of people consulted is included in Appendix 1.

A summary of the key issues and findings for traffic incident management on the Kuranda Range Road are outlined below using the *Managing for Results* framework outlined in Section 2.2.

4.1 Results Focus

- Need for a defined traffic incident management policy, strategy or plan, including a statement of desired outcomes for TMR Cairns and multi-agency arrangements.

- Excessive clearance times for traffic incidents have been experienced – a significant number of incidents with duration more than two hours over the past few years (approx. 10 per annum). There are few opportunities for queued vehicles to turn around, limited alternatives (considerable additional travel involved), and thus has resulted in adverse public opinion.

- Travel time reliability has become a significant community issue with rising expectations of road users, particularly those commuting between Cairns area and Kuranda and beyond.

- Responder agency objectives are not aligned, e.g. for major incidents QPS emphasis is on crash investigation and protection of evidence, with a lesser focus on quick clearance and getting traffic moving.

- There has been a loss of focus, priority for road operations in TMR Cairns over the past few years, with no readily identified road operations champion.

4.2 Partnerships & Coordination

- No inter-agency traffic incident management agreement or governance arrangements.

- Relationship between TMR and QPS is not well aligned with respect to traffic incident management – has fallen away in the past few years.

- No agreement in place about respective roles and responsibilities for responders, including inner and outer cordon arrangements.

- Relationship between TMR and RoadTek, within resource constraints, has been operating effectively.

- Need for an inter-agency incident management group, or road operations forum, to meet on a regular basis (e.g. quarterly) to undertake planning, agree roles and responsibilities, priorities and resourcing, and provide a forum for debriefs on major incidents and training opportunities.

4.3 Policy & Procedures

- No traffic incident management policy, or application of *Open Roads* or *Quick Clearance* policies, and limited standard operating procedures in use to provide strategic direction, priority and focus for TMR Cairns.

- No evidence of inter-agency procedures currently involving TMR for traffic incident management.

- A robust procedure to improve incident detection and response is needed. There are limited means to verify traffic incidents and the primary means of detection relies on public phone calls, resulting in delayed response and information provision.

- The quick clearance objective, as stated in QPS Traffic Manual and TMR-QPS Strategic Alliance (refer Section 3.2) should be incorporated in a joint QPS-TMR operational procedure.

- Limited opportunities for QPS to be able to enforce speed limits on Kuranda Range (speeding identified as a primary cause of incidents) – locations used are known by regular users, resulting in a limited halo of influence on driver behaviour. Potential to pilot point-to-point speed enforcement concept in a range crossing context.

- A number of instances of excessive delay in notification of the need to respond to an incident, particularly after hours, results in delayed response by RoadTek, who don't have a direct contact process with QPS.

4.4 Resourcing

- Dispersion of road operations functions across a number of areas in the TMR Cairns organisation structure has resulted in a loss of focus, accountability and inter-agency integration for traffic incident management.

- Road operations staffing reductions and re-structuring in TMR Cairns over the past few years, plus turnover and loss of experienced staff, has resulted in a low morale, loss of focus and issues with resourcing (e.g. due to leave etc.).

- An effective operations centre in Cairns is important to ensure local knowledge and quick response to critical incidents. It is key to being able to maintain and build inter-agency relationships, to enable quick clearance of incidents, efficient use of resources and provide an acceptable level of customer service.

- RoadTek provide traffic incident response crews and have been able to respond during high traffic periods (generally within 20 minutes). They position crews close by to the problem areas on the Kuranda Range and are on call after hours during the wet season. They also have a contractor on call for traffic control at either end of the Kuranda Range.

- No guidance is available for the assessment of investment in traffic incident management initiatives. The cost of traffic incidents, including the higher perceived value of unexpected delays could be used to justify resource requests.

- Need for a rapid crash investigation system, such as iWitness using standard digital cameras, precision markers and photogrammetric software, hence enable a focus on quick clearance of traffic incidents. Photometrix[9] is a Melbourne based company providing specialist digital photogrammetric measurement system, iWitness, a robust, flexible, inexpensive and easy-to-use software package developed primarily for crash reconstruction and forensic photogrammetry.

4.5 Communication

- Inadequate provision of advice on expected duration of closures, limited updating and long delays in providing information to road users during traffic incidents, primarily due to difficulty in getting reliable information.

- Difficulties in getting timely traffic information or updates to road users – due to limited detection capability, no CCTV vision, etc., resulting in road users

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[9] http://www.photometrix.com.au/applications/#accidentreconstruction

iWitness has been extensively used in the US by police agencies

complaining about being caught in traffic queues for extended periods without advice on the expected duration of delay, hence media articles (including social media) and the public meeting.

- There are communication challenges on Kuranda Range due to limitations on mobile phone coverage. Limited availability of power and communications connections to provide intelligent transport systems, such as detectors and variable message signs.

- Limited feasible alternative routes when Kuranda Range Road is closed due a traffic incident, the main alternatives involve at least a two-hour diversion.

- TMR Cairns has had difficulty in communicating with QPS and QFES Cairns communication centres.

- 131940 traffic information has not been well publicised, is not always timely, and not seen by road users as reliable, timely, easy to access or accurate.

- Difficult to find relevant messages in the automated 131940 Twitter feed among the list covering all of Far North Queensland.

- After hours, the operations monitoring reverts to the State TMC at Nerang in SEQ, while this arrangement is working well, it has resulted in delays in advising responders of incidents and updating 131940 information. Lack of local knowledge is a challenge for SEQ operators.

- TMR provide a text messaging SMS service which has a large number of subscribers (estimated subscriptions of 5,000), which was recently reactivated after limitations due to budget constraints. It is only used for closures expected to be greater than 30 mins. Cost-effectiveness needs to be reviewed.

- Recent provision of temporary variable message signs has provided useful roadside information to users. Permanent variable message signs are expected to be installed in the first quarter of 2016.

- The next generation 131940 traffic information system is expected to be available by August 2016. Potential to use Kuranda Range Road as a pilot to test new functionality.

- Need to consider incident prevention education and messaging opportunities, through communication messages including VMS.

4.6 Monitoring & Evaluation

- Minimal, if any monitoring of current traffic incident management performance. No identified performance measures or targets were evident for incident response and clearance.

- Limited quality traffic incident data is available for analysis – TMR SIMS and QPS data have different elements and categories and not readily comparable to provide useful analysis for performance assessment.

- Need for critical data to be collected, e.g. duration of major incidents with length of lane or road closures resulting in extended delays to road users.

- Anecdotal evidence that inappropriate driver behaviour, including excessive speed and not driving to conditions as a major cause of incidents.

- Recent trials of Bluetooth readers and Google Dashboard (also proposing ANPR) to identify suitable incident detection sources.

- The next version of SIMS (STREAMS Incident Management System) is expected to be available by mid 2016. TMR Cairns could pilot new features. Looking to provide fusion of various sources of traffic data, including private data sources, emergency services despatch, Bluetooth, etc.

4.7 Knowledge Transfer

- Review of Kuranda Range Road operations and advice by an experienced TMR North Coast District operations professional has resulted in a valuable, independent and effective approach. Ongoing mentoring and exchange of information needed to improve performance and share experiences.

- No recent road operations or incident management training undertaken for TMR Cairns staff.

- No recent inter-agency debriefs of major traffic incidents undertaken in recent times. No inter-agency knowledge sharing or training conducted. No specific inter-agency relationships or discussions with respect to traffic incident management best practices and enable sharing of resources or capability.

Using the *Managing for Results* framework and the Capability Maturity Matrix concept outlined in Appendix 2, the following qualitative assessment was made of the **current and desired future capability** for managing traffic incidents. This can serve as an initial benchmark for future assessment.
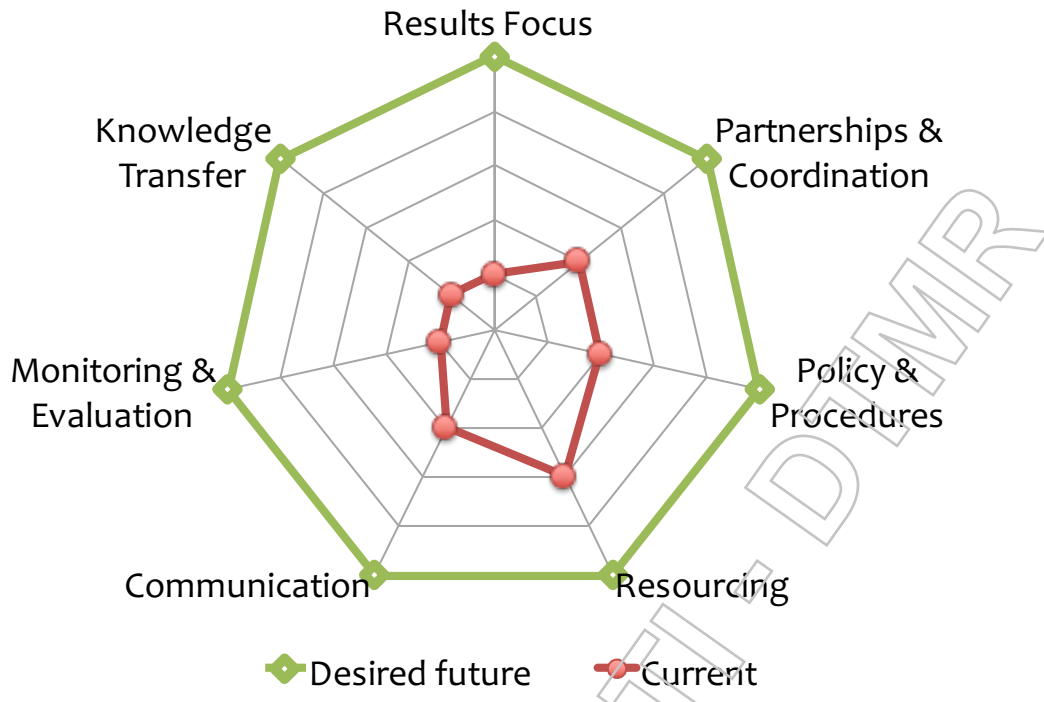
Part B: Recommendations for Improvement

Part B provides practical recommendations for the improvement of traffic incident management operations for the Kuranda Range Road, improving mobility, accessibility, safety and customer service outcomes.

5. Traffic Incident Management Recommendations

The recommended approach to road traffic incident management operations on the Kuranda Range Road is: Prevent. Detect. Respond. Inform. Clear.

Widespread availability of mobile communication technology and ready access to social media networks has resulted in **rising customer expectations** – demands for an increasing levels of service, in terms of safety, access and mobility outcomes.

Coupled with the pace of life and the peoples' value of time increasing as a result, there is an increasing expectation of being able to access **real time, accurate traffic information**, especially during traffic incidents and road closures.

When coupled with the research on the **value of unexpected delays**, being at least **three times** that of expected delays, then greater emphasis has to be placed on providing useful and practical traffic information, as quickly as possible.

Time is of the essence during response to major incidents. This requires a shift to a **quick clearance** mindset by all responders during major disruptions.

A results focus means a focus on:

(a) **preventing** traffic incidents occurring, e.g. increasing speed enforcement and advisory messaging

(b) early **detection** and verification of traffic incidents

(c) rapid **response**, quick recovery of injured and making incident sites safe for responders and road users

(d) providing traffic **information** quickly, with frequent updates and providing options and alternatives where possible, and

(e) quick **clearance** of incidents and restoring access and mobility as soon as safe to do so.

A key means of improving customer service is to **learn** from each major incident by holding regular inter-agency debriefs and making improvements.

It is recommended that consideration be given to the following actions to improve traffic incident management:

5.1 Results Focus: clear outcomes

1. Prepare a TMR **traffic incident management action plan** for Kuranda Range Road, in consultation with QPS, with an emphasis on safety and quick clearance. A draft outline of an action plan is included in Appendix 3.

2. Establish a **focus and priority for road operations** in TMR Cairns organisation structure, including a senior road operations champion and review staffing to ensure adequate capability and capacity.

3. Develop a funded **priority program** of road traffic operations initiatives.

4. Develop **contingency plans** to respond to major incidents. The most effective approach is to establish standard operating procedures involving a limited set of 'business rules' covering diversion routes, alternative transport options and traveller information good practice guidelines.

5. Review provision of **timely traffic information** and updates and ensure improved customer service.

5.2 Partnerships & Coordination: key partners aligned

6. Develop an **inter-agency agreement** for traffic incident management, aligning key responder objectives, with agreed roles and responsibilities. This should at least include TMR, QPS and QFES. A draft outline of an agreement is included in Appendix 4.

7. Establish **governance arrangements** such as an inter-agency incident management forum to meet on a regular basis (at least quarterly) to agree strategic direction, priorities, resourcing, hold debriefs of major incidents, provide training opportunities and report on annual activities and outcomes.

8. Re-establish **interagency relationships**, both formal and informal, particularly with QPS.

5.3 Policy & Procedures: cost-effective, practical, timely

9. Review and develop traffic incident management **policies** to provide strategic direction, priority and focus, based on state-wide requirements, including *Open Roads* and *Quick Clearance*.

10. Review and **streamline key procedures** used to detect, respond and clear traffic incidents, to improve timeliness and focus on desired outcomes, including developing agreed inter-agency operating procedures emphasising quick clearance when safe to do so.

11. Establish appropriate alternative means of **detection and verification** of incidents, using intelligent transport systems and other sources of traffic data.

12. Investigate the feasibility of **point-to-point enforcement** of speed on Kuranda Range with QPS.

13. Establish **direct contacts** and procedures between TMR, RoadTek and QPS for after-hours callouts, to complement current arrangements.

5.4 Resourcing: people, equipment, information

14. Establish an enhanced **road operations focus** in TMR Cairns, including organisational re-structure and staffing requirements, to ensure cohesive operations, focus and accountability and enable improved inter-agency integration.

15. Maintain an **effective operations centre** in Cairns, to ensure local knowledge and maintain and build inter-agency relationships, to enable quick clearance, efficient use of resources and provide an acceptable level of customer service during traffic incidents.

16. Utilise incident management **investment assessment guidelines** (as outlined in sections 7 and 8 below)

17. Encourage QPS to consider the use of a rapid crash **investigation system**, such as iWitness which uses digital cameras, precision markers and photogrammetric software, to enable a focus on quick clearance of traffic incidents.

5.5 Communication: effective process

18. Establish standard operating procedures for **traffic information** for road users, including regular estimating duration of lane closures, regular updates, use of media, including social media, improving the timeliness and accuracy of messages, liaison with QPS and QFES, and after-hours processes.

19. Review all **communications** means available to make messaging more effective for road users during disruptions, including providing variable message signs at critical locations, effectiveness of the SMS service and promote the use of 131940 throughout the area.

20. Discuss potential for improved **mobile phone coverage** with Telstra by installing additional communication tower(s).

21. Offer to pilot **new functionality** of the next generation 131940 as it becomes available.

22. Consider potential for **traffic incident prevention**, through communication messages including VMS.

5.6 Monitoring & Evaluation: measurement against targets

23. Establish improved **monitoring** of traffic on Kuranda Range, following evaluation of Bluetooth, ANPR and Google Dashboard.

24. Adopt **performance measures** for traffic incident management (see recommendations in sections 6 and 8 below), establish appropriate targets and report at least quarterly.

25. Review traffic incident **data collected** using appropriate technology and fuse data sources, to ensure useful analysis for performance assessment. Offer to pilot new features of SIMS.

5.7 Knowledge Transfer: good practice

26. Arrange **multi-agency debriefs** for all major incidents, at regular intervals, to collate learnings and monitor actions to incorporate improvements as required.

27. Arrange inter-agency **seminars and specific training** events, including scenario exercises to test and refine procedures, and share knowledge and experience on a regular basis.

28. Establish peer-to-peer **mentoring arrangements** with SEQ road operations professionals to assist TMR Cairns build capability and ensure cost-effective investments.

Part C: Guidelines for Performance Review and Investment Assessment

Part C provides guidelines for:

- the ongoing review of the performance of traffic incident management operations; and

- assessment of proposed investment in incident management operations.

"What gets measured gets done"
"You can't manage what you can't measure" ~ Peter Drucker

6. Performance Measurement

Performance measurement involves the use of evidence to determine progress toward specific objectives. In a service industry such as transport, the performance measurement process starts by defining the level of service (eg timeliness, reliability, etc) to be delivered.

Performance measures should reflect the satisfaction of the road user, in addition to providing information to road operations managers how well the services are being managed.

We should be looking for measures which:

- comprise a limited set of key measures

- are accepted by, and meaningful to customers

- tell managers how well the desired objectives are being met

- are simple, understandable, logical, and repeatable

- provide timely and useful information, at a reasonable cost.

Traffic incident management can be described by a process map:

Input > Actions > Outputs > Outcomes

Measures need to include both lead and lag measures. *Lead* measures involve inputs and key actions or processes, which are readily measured. *Lag* measures on the other hand consider outputs and outcomes, and there is usually a time lag before measure data becomes available.

6.1 Traffic Incident Management Performance Measures

The objective of traffic incident management can best be described as:

Ensure rapid response to incidents and manage traffic to minimise impact on the road network.

As described in Section 2.2 *Managing for Results*, the desired outcomes for traffic incident management are:

- Safety – reduce risk for road users and responders (including secondary incidents), and rapid recovery and treatment of injured

- Reliability – consistent, regular travel times

- Mobility – ability to travel to desired destinations with minimum delay (quick clearance)

- Customer Service – keep road users informed of traffic conditions, and ensure appropriate investigation of incidents

- Value for money – optimise benefits from community investment and minimising cost of operations (efficient use of multi-agency resources).

Transport agencies generally collect information about various aspects of traffic incidents, and measures used include the number of incidents, detection time, response time and clearance time. Emergency services agencies generally collect different information related to their agency for resource management, including response times and time spent on scene.

Key performance indicators (KPIs) are useful for assessing the performance of ongoing operations, and assessing whether a particular initiative has been able to improve customer satisfaction. They can also be use as a trigger for additional investment, when the performance deteriorates below a certain benchmark.

6.2 Performance Measurement Framework

A performance management framework for traffic incident management on the Kuranda Range Road should include:

Traffic Incident Management Performance Measures

Input	Action or process	Output	Outcomes
Detection and verification	*Response, site management, site investigation, traffic diversions, traveller information*	*Quick clearance, minimise secondary incidents, traffic management*	*Mobility, Safety, Customer Service*
• number of incidents (by category) • time to verify	• **time to respond #** • time to investigate • traffic delayed (volume) • number of traffic reports	• **duration of incident #** • number of secondary incidents	• **travel time reliability #** • **level of customer satisfaction #**

 # key performance indicator (KPI)

Other measures that could be considered include some or all of:

- delays due to incidents (vehicle-hours), cost of delays (to community)

- level of safety at the scene (number or cost of responder safety incidents)

- secondary incidents (number or cost to community)

- quality of traffic reports (qualitative assessment)

- relationships with responders (survey of responders)

- major incident debriefs and/or audits undertaken (number; or based on proportion of major incidents greater than 2 hour closure or serious injury incidents)

- prevention of incidents (proportion of users exceeding posted speed limit).

Time to respond measured from time of detection or verification, to first responder on site (minutes).

Duration of incident measured where traffic is delayed due to lane or road closure, and categorised in (i) less than 2 hours and (ii) more than 2 hours (minutes).

Travel time reliability measured as proportion of travel at various levels of reliability (per cent of days with travel time more than 20% longer than a typical journey).

Level of customer satisfaction measured by proportion of items with positive tone of media, including social media.[10]

Targets would need to be determined based on an assessment of actual performance for at least 12 months.

Could also consider prevention measures, such as speed of road users and enforcement infringements.

6.3 Capability Maturity Matrix

Using the *Managing for Results* framework and the Capability Maturity Matrix concept outlined in Appendix 2, a qualitative assessment can be made on an annual basis, of the **current and desired future capability** for managing traffic incidents, using the initial assessment provided in section 4 of this report.

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[10] Could also use customer satisfaction surveys similar to those used by Translink

7. Investment Assessment

Improvement in traffic incident management can generate a number of benefits to the community. Some of these benefits can be quantified and valued, while others are more difficult to value, so a combination of quantitative and qualitative analyses, using benefit-cost and multi-criteria analysis, will provide a more robust assessment process to determine the most appropriate investment.

Traffic incidents have a number of impacts on road users, responder agencies and the community, including:

- Safety – cost of property damage, injuries and fatalities – to responders, road users and the community

- Travel time delay – the cost of lost time or productivity – both personal and business related

- Travel time reliability – allow buffer time to cover unexpected delays – also see discussion on unexpected delays. Can result in costs involved in loss of airfares for missed flights, etc.

- Costs to agencies – this includes additional staff, overtime or extra shifts, allowances etc., and additional equipment costs, hire of equipment etc.

Investment in traffic incident management projects (both infrastructure and operations services) aims to reduce the number and duration of incidents, hence improve safety, mobility and customer service.

The estimated benefits of improved incident response can include:
- improved safety through reduced exposure risk and secondary incidents
- reduction in travel time delays and improved reliability
- reduction in unexpected delays, through the provision of accurate traffic information
- reduced costs to responder agencies
- improved customer service to road users.

The most appropriate investment appraisal approach is to use a multi-criteria analysis that incorporates a benefit-cost analysis. A brief outline of how to undertake a multi-criteria analysis (MCA) for traffic incident management is included in Appendix 5, including an example. A summary MCA is provided in the table below.

Traffic Incident Management Investment Assessment Summary

Objectives	Evaluation Criteria	Monetary	Quantitative Effects	Qualitative Effects
		[PV $ value]	[quantity]	[comment]
A. Project or Initiative Cost				
Optimal project/ initiative specification	Capital cost			
	Operating cost			
	Maintenance cost			
B. Project or Initiative Impact				
Safer Transport	Cost of health cost/ impacts for crash victims			
	OHS related costs/ impacts for responders			
	Cost of crashes for road users			
Efficient and sustainable transport	Road user travel costs (car, bus, truck)			
	Efficient use of agency resources			
Environmental Sustainability	Emissions, energy use, noise impacts, hazmat			
Liveable Communities	Traffic diverted			
	Traffic information			
Net Effect		NPV: BCR:		(Optional) MCA score

PV: Present value; NPV: Net present value; BCR: Benefit-cost ratio

8. Recommendations: Performance Review and Investment Assessment

29. Establish traffic incident management **performance measurement** for the Kuranda Range Road, to include (at least) the following KPIs:
    - time to respond
    - duration of incident
    - travel time reliability
    - level of customer satisfaction.

30. Establish an appropriate **data collection and analysis** system for traffic incident management.

31. Prepare an annual **Capability Maturity Matrix** of current incident management capability.

32. Regularly **report** performance measures (at least quarterly) and reviewed (at least annually).

33. **Establish targets** for KPIs after at least one year of performance data is available.

34. Use a multi-criteria analysis **investment appraisal approach** that incorporates a benefit-cost analysis as outlined in section 7.

Appendix 1: Stakeholders Consulted

The following stakeholders were consulted in relation to this project.

Transport and Main Roads

Far North District

Sandra Bourke, District Director

David Hamilton, Program Performance Advisor

Brett Martin, Manager, Project Planning and Corridor Management

Jim Harding-Smith, Manager, Delivery and Operations

Julianne Whiteside, Principal Engineer Civil, Delivery and Operations

Peter Agar, Principal Engineer Civil, Delivery and Operations

Peter Grant, Senior Program Support Officer, Delivery and Operations

Rod Taylor, Principal Technical Officer, Delivery and Operations

SEQ Region

Paul Venz, Manager Road Operations, North Coast

Gavin Massingham, Manager Operations, South Coast

Andrew Wheeler, Director, SEQ Operations

Engineering & Technology

Joanna Robinson, Director, Traffic Systems & Road Use

Lachlan Faulkner, Principal Advisor, Road Operations

RoadTek

Danny Michael, RMPC Manager

Cameron Riddell, Kuranda Range Supervisor

Maria Grant, Support Officer

Queensland Police Service

Rhys Newton, Inspector Cairns

Bruce Macdonald, OIC Smithfield

Shane Mattes, OIC Kuranda

Mark Bayliss, Kuranda

(unable to attend) Rolf Straatemeier, Mareeba

Appendix 2: Capability Maturity Matrix

A useful framework to assist in reviewing organisational performance is the Capability Maturity Model[11] developed by Carnegie Mellon University as a process improvement model for the development of products and services in the systems engineering industry.

This is a qualitative framework, which has been adapted to many different contexts, provides a useful means of assessment and helps us to think about potential future developments to the planning horizon, and to identify opportunities and compile actions, investigations etc that need to proceed. It is a means of stimulating thinking, with a focus on outcomes.

It should be reiterated that this is a subjective assessment and depends on the interpretation and judgement of the reviewer, and that there are no right or wrong answers and different reviewers may arrive at different conclusions.

This concept was developed and extended for this review using the *Managing for Results* framework – see the table below, which provides the review framework and succinct descriptors of each matrix cell. It is not a definitive framework but is a useful tool for the purposes of this review. In some cases, describing the actual situation may span a number of levels.

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[11] Carnegie Mellon University (2006) *Capability Maturity Model® Integration for Development*, CMMI-DEV, V1.2

Capability Function:		1. Initial	2. Managed	3. Defined	4. Predictable	5. Optimising
		limited, ad hoc, poorly defined	some objectives, often reactive	defined processes, managed	manage processes quantitative	performance optimised
Results focus	clear outcomes	Poorly defined	Some outcomes defined	Defined agency outcomes & targets	Defined outcomes & targets reported	Agreed inter-agency clear, specific customer, & community outcomes
Partnerships & Coordination (P&C)	key partners aligned	Limited P&C, informal	Limited P&C internal team	Some P&C, internal team	Inter-agency P&C, some agreements	Key partners aligned
Policy and Procedures (P&P)	cost-effective, practical, timely	Minimal P&P, poorly defined	Some P&P defined & documented	P&P defined & regularly reviewed	P&P integrated with other agencies	Cost-effective, practical, timely multi-agency P&P
Resourcing	people, equipment, information	Limited	Response crews available in peak periods, basic ops centre	Quick response crews & equip in business hours	Rapid response crews & equip + ops centre on call 24/7	Pre-deployed resources, multi-agency contingency plans
Communication	effective process	Limited, no regular updates	Some traffic reporting	Pre-trip, on-route, regular updates	Multi-channel, web, mobile	Comprehensive, effective, location based
Monitoring & Evaluation	Measure against targets	Minimal, ad hoc	Operational measures, some reporting	Selected measures, some targets, some reporting	Agreed measures, systematic, selected reporting	Metrics & targets, regular reporting & review
Knowledge Transfer	good practice	Ad hoc, minimal	Internal debriefs & training	Irregular multi-agency debriefs & training	Some multi-agency debriefs & training	Best practice guides, regular multi-agency debriefs & training

Capability Maturity Level:

Appendix 3: Outline of Traffic Incident Management Action Plan

DRAFT Outline

TMR Traffic Incident Management Action Plan for Kuranda Range Road

Purpose

This Plan aims to achieve the Desired Outcomes for the Kuranda Range Road (Kennedy Highway) between Cairns and Mareeba, through quick and safe clearance of traffic incidents.

Desired Outcomes

(a) preventing traffic incidents occurring

(b) early detection and verification of traffic incidents

(c) rapid response, quick recovery of injured and making incident sites safe for responders and road users

(d) providing traffic information quickly, with frequent updates and providing options and alternatives where possible, and

(e) quick clearance of incidents and restoring traffic flow as soon as safe to do so.

Action Plan

Action	Priority	Timing	R[12]
A. Results Focus: clear outcomes			
A1. Establish a **focus and priority for road operations** in TMR Cairns organisation structure, including a senior road operations champion and ensure to ensure adequate capability and capacity of staffing.	H	S	2
A2. Develop a funded **priority program** of road traffic operations initiatives.	M	S	3
A3. Develop **contingency plans** to respond to major incidents, establish standard operating procedures covering diversion routes, alternative transport options and traveller information guidelines.	H	S	4
B. Partnerships & Coordination: key partners aligned			
B1. Develop an **inter-agency agreement** for traffic incident management, in consultation with QPS and QFES, including governance arrangements.	H	S	6, 7, 8
C. Policy & Procedures: cost-effective, practical, timely			
C1. Review and develop traffic incident management **policies** to provide strategic direction, priority and focus.	H	S	9
C2. Review and **streamline key procedures** used during incidents to improve timeliness and focus on the desired outcomes, including agreed inter-agency operating procedures emphasising quick clearance when safe to do so.	H	S	10
C3. Establish appropriate alternative means of **detection and verification** of incidents, using intelligent transport systems and other sources of traffic data.	H	S	11
C4. Investigate the feasibility of **point-to-point enforcement** of speed on Kuranda Range with QPS.	M	M	12
C5. Establish **direct contacts** and procedures between TMR, RoadTek and QPS for after-hours callouts, to complement current arrangements.	H	S	13

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[12] R: Recommendation [Note: *Recommendation 1 relates to preparing this Action Plan*]

Priority: <u>H</u>igh/<u>M</u>edium/<u>L</u>ow   Timing: <u>S</u>hort/<u>M</u>edium/<u>L</u>ong/<u>O</u>ngoing

Action	Priority	Timing	R[12]
D. Resourcing: people, equipment, information			
D1. Establish an enhanced **road operations focus** in TMR Cairns.	H	S	14
D2. Maintain an **effective operations centre** in Cairns.	H	O	15
D3. Utilise incident management **investment assessment guidelines**.	M	S	16
D4. Encourage QPS to consider a rapid **crash investigation** system.	M	M	17
D5. Use a multi-criteria analysis **investment appraisal approach** that incorporates a benefit-cost analysis.	H	S	34
E. Communication: effective process			
E1. Review provision of **timely traffic information** and updates and establish **standard operating procedures for traffic information** for road users.	H	S	5, 18
E2. **Review all communications means** available to make messaging more effective for road users during disruptions.	H	S	19
E3. Discuss potential for **improved mobile phone coverage** with Telstra by installing additional communication tower(s).	M	M	20
E4. Offer to **pilot new functionality** of the next generation 131940.	M	S	21
E5. Consider potential for **traffic incident prevention**, through communication messages including VMS.	M	M	22
F. Monitoring & Evaluation: measurement against targets			
F1. Establish improved **monitoring** of traffic flows on Kuranda Range.	H	M	23
F2. Adopt **performance measures** for traffic incident management, establish appropriate targets and report at least quarterly.	H	O	24,29, 32, 33
F3. Review traffic incident **data collected** using appropriate technology and fuse data sources, to ensure useful analysis for performance assessment.	M	S	25, 30
F4. Offer to pilot **new features** of SIMS.	M	S	25
F5. Prepare an annual **Capability Maturity Matrix** of current incident management capability.	M	O	31

Priority: <u>H</u>igh/<u>M</u>edium/<u>L</u>ow   Timing: <u>S</u>hort/<u>M</u>edium/<u>L</u>ong/<u>O</u>ngoing

Action	Priority	Timing	R[12]
G. Knowledge Transfer: good practice			
G1. Arrange **multi-agency debriefs** for all major incidents at regular intervals, to collate learnings and monitor actions to incorporate improvements as required.	H	S	26
G2. Arrange inter-agency **seminars and specific training** events and share knowledge and experience on a regular basis.	H	S	27
G3. Establish peer-to-peer **mentoring arrangements** with SEQ road operations professionals to assist TMR Cairns.	M	O	28

Priority: <u>H</u>igh/<u>M</u>edium/<u>L</u>ow   Timing: <u>S</u>hort/<u>M</u>edium/<u>L</u>ong/<u>O</u>ngoing

Appendix 4: Outline of an Inter-Agency Agreement

DRAFT Outline

Traffic Incident Management Inter-Agency Agreement
for Kuranda Range Road

between

Department of Transport and Main Roads (TMR)
Queensland Police Service (QPS)
Queensland Fire and Emergency Service (QFES)

Purpose

This Agreement is a statement of intent of a cooperative working relationship between participating agencies to achieve Desired Outcomes for the Kuranda Range Road (Kennedy Highway) between Cairns and Mareeba, through quick and safe clearance of traffic incidents.

Desired Outcomes

      (a) preventing traffic incidents occurring

      (b) early detection and verification of traffic incidents

      (c) rapid response, quick recovery of injured and making incident sites safe for responders and road users

      (d) providing traffic information quickly, with frequent updates and providing options and alternatives where possible, and

      (e) quick clearance of incidents and restoring traffic flow as soon as safe to do so.

Roles and Responsibilities

Participating agencies are to support each other, to ensure safety, quick clearance of traffic incidents and getting traffic moving, to achieve the Desired Outcomes.

In particular, QPS is responsible for public safety and traffic policing, including managing the overall incident response and controlling the immediate traffic incident scene (inner cordon) in accordance with established procedures. TMR is responsible for providing traffic management and information (outer cordon) for traffic incidents on state controlled roads, including the Kuranda Range Road.

Protocols and procedures are to be established, as required, and regularly reviewed, by participating agencies.

Governance

Traffic incident management operations on the Kuranda Range Road is subject to the oversight of a Traffic Incident Management Forum comprising participating agencies, to:

- provide strategic direction
- progress policies and procedures as required
- facilitate a cooperative working relationship
- review lessons from recent major incidents
- regularly review and report achievements and outcomes
- facilitate training and development.

Membership of the Traffic Incident Management Forum is to include senior representatives of local participating agencies who are in a position to commit their agencies to actions agreed by the Forum.

Decisions of the Forum are intended to be consensual and do not override individual participating agency accountabilities.

The Forum should meet sufficiently often to achieve the objectives of this Agreement, and at least quarterly.

Reporting

An annual report is to be prepared and provided to each participating agency which can include:

- significant cooperative activities undertaken
- achievements, outcomes, benefits and costs (qualitative and quantitative)
- performance against agreed measures, which could include: time to respond to incidents; duration of incidents; level of road user satisfaction.

Appendix 5: Example Multi-Criteria Analysis

Multi-Criteria Analysis (MCA) provides a framework to enable decision-makers to overcome difficulties in handling large amounts of complex information in a consistent way, particularly as some costs or benefits can be difficult to put into monetary terms.

MCA provides a structured approach to present alternative options, where the options accomplish several objectives. Desirable objectives are specified and corresponding attributes or measurable criteria identified.

The actual measurement of indicators need not be in monetary terms, but can be quantitative (value, scoring, ranking and weighting) or qualitative. Social and environmental indicators may be considered along with economic costs and benefits.

The key steps for performing an MCA are:

1. Identify performance criteria for assessing the option against stated goals
2. Compile an assessment of monetary, quantitative and qualitative impacts.
3. (Optional) Devise a scoring scheme for each criterion
4. (Optional) Establish weights to reflect the relative importance of each criterion
5. (Optional) Score each option against the criteria and apply weightings
6. (Optional) Calculate overall results and test for sensitivities of different scores
7. Report and interpret findings.

Some suggested principles and evaluation criteria for a multi-criteria analysis of traffic incident management are outlined below.

Multi-criteria objectives, principles and evaluation criteria for Traffic Incident Management

Objectives		Traffic Incident Management			Assessment and Valuation	
Public Policy	*Transport Sector*	*Principles*	*Evaluation Criteria*	*Effect*	*How to assess*	*Valuation*

A. Project or Initiative Cost

Optimal project/ initiative specification	Optimal project/ initiative specification	Minimise life-cycle cost	Capital cost	Initial capital cost; need for re-investment	Cost estimate	Monetised
			Operating cost	Recurrent operations cost	Cost estimate (annual)	Monetised
			Maintenance cost	Recurrent cost of specific infrastructure	Cost estimate (annual)	Monetised

Objectives		Traffic Incident Management			Assessment and Valuation	
Public Policy	*Transport Sector*	*Principles*	*Evaluation Criteria*	*Effect*	*How to assess*	*Valuation*

B. Project or Initiative Impact

Public Policy	Transport Sector	Principles	Evaluation Criteria	Effect	How to assess	Valuation
Safer Communities	Safer Transport	Reduce safety impacts/ costs on crash victims	Cost of health cost/ impacts for crash victims	Reduction in safety impact (fatality, serious injury) reduced time to extract victims & transport	Assessment of health impact	Qualitative. (Monetise)
		Improved occupation health & safety (OHS) of responders (police, fire, ambulance, transport etc)	OHS related costs/ impacts for responders	Improved OHS for responders due to reduced exposure (by quick clearance)	Qualitative assessment. Estimate safety costs if possible	Qualitative. (Monetise)
		Reduce secondary crash costs	Cost of crashes for road users	Reduction in safety impact (fatality, serious injury, property damage)	Based on records, estimates	Qualitative. (Monetise)
Support economic growth	Efficient & sustainable transport	Efficient road user travel cost (including commuting, business & recreational)	Road user travel costs (car, bus, truck)	Effect of changes in vehicle operating costs & travel time	Change in veh-hrs, veh-km. Qualitative comment on travel reliability	Monetise, based on unit costs. Qualitative comment
		Reduction in cost of responders & equipment	Efficient use of agency resources	Time spent at incidents	Quantify cost of reductions in incident duration	Monetise. Qualitative comment
Ensure environmental sustainability	Reduce transport emissions	Reduce vehicle emissions	Vehicle emissions	Change in quantity of emissions due to incidents	Qualitative comment. Quantify change in veh km & speed	Qualitative & Quantitative (Monetise)
	Reduce transport noise	Reduce noise due to diverted traffic	Level of exposure to noise	Change in level of noise & exposure	Noise assessment.	Qualitative & Quantitative (Monetise)
	Energy use	Reduce energy use due to incidents	Energy used	Changes in quantity of energy use	Quantify change in veh km & speed	Qualitative & Quantitative. (Monetise)
	Hazardous spills	Reduce impact of hazardous spills	Impact of hazardous spills	Change in impact of hazardous spills	Qualitative comment	Qualitative
Create liveable communities	Improve urban environment	Improved amenity	Traffic diverted	Change in amenity due to diverted traffic	Qualitative comment	Qualitative
	Improve customer satisfaction	Improve customer service	Traffic information	Quality of traffic updates	Qualitative comment	Qualitative

Traffic Incident Management Investment Assessment Example

Objectives	Evaluation Criteria	Monetary	Quantitative Effects	Qualitative Effects
		[PV $ value]	[quantity]	[comment]
A. Project or Initiative Cost				
Optimal project/ initiative specification	Capital cost	Estimate $xx		
	Operating cost	Estimate $xx		
	Maintenance cost	Estimate $xx		
B. Project or Initiative Impact				
Safer Transport	Cost of health cost/ impacts for crash victims	Value of fatalities & injuries saved	No of fatalities & injuries saved	Improved safety
	OHS related costs/ impacts for responders	Value of OHS reduction	No of OHS incidents reduced	Improved OHS
	Cost of crashes for road users	Value of secondary incidents saved	No of secondary incidents saved	Reduced secondary Incidents
Efficient Transport	Road user travel costs (car, bus, truck)	Value of travel time savings (factored for unexpected delays)	Amount of travel time savings	Travel time savings
	Efficient use of agency resources	Reduction in agency costs due to quick clearance	Reduction in agency time on scene	Quick clearance results
Environmental Sustainability	Emissions, energy use, noise impacts, hazmat	Value of environmental impact reduction	Amount of environmental impact reduction	Environmental impact reduction
Liveable Communities	Traffic diverted			Traffic diversion change
	Traffic information			Traffic updates
Net Effect		NPV: xx; BCR: xx		

PV: Present value; NPV: Net present value; BCR: Benefit-cost ratio