DEVELOPMENT OF THE RAMM SYSTEM

SUMMARY OF RESPONSES TO DISCUSSION DOCUMENT AND RECOMMENDATIONS ARISING

Allan Kennaird, Consultant
Wellington, New Zealand

Transit New Zealand Research Report No. 59

ISBN 0-478-10517-7
ISSN 1170-9405

PO Box 5084, Lambton Quay, Wellington, New Zealand
Telephone (04) 499-6600; Facsimile (04) 499-6666

Kennaird, A. 1996. Development of the RAMM System - Summary of Responses to Discussion Document and Recommendations Arising.
Transit New Zealand Research Report No. 59. 51pp + appendices.

Keywords: asset management, information system, maintenance management, pavement management, RAMM system, road management.

DISCLAIMER

While this document is believed to be correct at the time of publication, Transit New Zealand and its employees and agents involved in preparation and publication cannot accept any contractual, tortious or other liability for its content or for any consequences arising from its use and make no warranties or representations of any kind whatsoever in relation to any of its contents.

The document is only made available on the basis that all users of it, whether direct or indirect, must take appropriate legal or other expert advice in relation to their own circumstances and must rely solely on their own judgement and such legal or other expert advice.

The material contained in this document is the output of research and should not be construed in any way as policy adopted by Transit New Zealand but it may form the basis of future policy.

CONTENTS

EXECUTIVE SUMMARY 7

ABSTRACT 7

1. INTRODUCTION 9

1.1 Background and Purpose of this Report 9
1.2 Overview of this Report 10

2. SUMMARY OF RESPONSES 12

2.1 Introduction 12
2.2 Classification of Written Responses 12
2.3 Specific Issues - Support and Opposition 12
2.4 Other Comments 15

3. CONCLUSIONS 22

3.1 Introduction 22
3.2 Conclusions from the Discussion Document 22
3.3 Conclusions from Responses to Specific Issues 25
3.4 Conclusions from Other Comments 27

4. RECOMMENDATIONS 28

4.1 Introduction 28
4.2 Scope, Objectives and Functionality 28
4.3 Developments That Should Be Undertaken 40
4.4 Benefits and Costs 42
4.5 Responsibilities for Development and Support 42
4.6 Financial Assistance 44
4.7 Further Research 45
4.8 Summary of Recommendations 45

5. REFERENCES 51

APPENDIX 1. ISSUES ON WHICH RESPONSE WAS INVITED 53

APPENDIX 2. RESPONDENTS BY CATEGORY 57

APPENDIX 3. SUMMARY OF RESPONSES TO ISSUES 61

APPENDIX 4. RAMM QUESTIONNAIRE AND RESPONSES 77

EXECUTIVE SUMMARY

This report summarises responses to a discussion document on the development of the Road Assessment and Maintenance Management (RAMM) system, issued by Transit New Zealand in 1995.

Seven regional workshops were held on the discussion document and a total of 32 written responses were received from local authorities, Transit New Zealand and consultants. There was a wide range of response on almost all of the issues raised in the discussion document. Two issues that had almost universal support were the need to urgently improve pavement treatment selection, and the need to transfer RAMM to a WINDOWS environment. Most respondents considered that Transit New Zealand/Transfund should continue to manage the development of RAMM.

It is recommended that RAMM becomes part of a modular Road Management Information System (RMIS) covering all road assets and supporting the sectoral, network and project programming functional levels, using appropriate links to other databases and systems. A five year development programme for RAMM is recommended.

Responsibilities of Transfund, the RAMM Advisory Group, Transit New Zealand, local authorities and other agents in the development and support of RAMM are defined. Recommendations are made on financial assistance and research needs.

ABSTRACT

Responses to a discussion document on the development of the Road Assessment and Maintenance Management (RAMM) system, issued by Transit New Zealand in 1995, are summarised. Conclusions are drawn from the information in the discussion document and from the responses. Recommendations are made for development of the RAMM system covering the scope, objectives and functionality of the system, developments that should be undertaken, the involvement of Transit New Zealand, Transfund and other agents, financial assistance and research needs.

1. INTRODUCTION

1.1 Background and Purpose of this Report

Transit New Zealand (TNZ) currently owns the copyright to, and manages the development of, the Road Assessment and Maintenance Management (RAMM) system, which it inherited from the National Roads Board. The system is used by TNZ for management of pavement maintenance on state highways. In the early years of its development, territorial local authorities (TLAs) were encouraged to also use the system to manage maintenance on their roads. TNZ financial assistance was provided to TLAs for establishment of the system and data collection. In June 1993 the Minister of Transport gave a directive requiring all TLAs to have in place a maintenance management information system based on RAMM no later than June 1994 to justify ongoing maintenance. Many TLAs employ consultants to collect data for their RAMM systems, and in some cases the consultant operates the RAMM system.

The resulting wide range of users of RAMM and their differing requirements gives problems in deciding how RAMM should be developed. RAMM has been subject to a number of reviews over recent years including:

- An evaluation of RAMM compared to other pavement management systems by the Australian Road Research Board, August 1993.

- An "ease of use" assessment of the computer software and user manual by the Computer Science Department of Victoria University, Wellington, May 1993.

- A review of RAMM's treatment selection analysis for flexible pavements, (under action).

In addition various research contracts have been commissioned to investigate technical improvements and additions to RAMM, including:

- A pavement performance prediction model and associated optimisation techniques.

- High speed data collection.

TNZ sees the need for a document, agreed by users, that defines the scope and objectives of RAMM and the development strategy for the short to medium term. The purpose and scope of RAMM needs to be defined relative to other systems of information management used by, or required by, TNZ and TLAs. The development strategy needs to make allowance for implementation of the research listed above, user requests for changes, and also upgrades of computer software and systems.

A discussion document (Kennaird 1995) was issued as a first stage towards preparing a development strategy for RAMM. The discussion document summarises the present status of RAMM regarding its use, development initiatives, agency involvement in development, and financial assistance policy. It also describes similar and complementary systems, reviews TNZ and TLA information needs, and suggests options for RAMM development. A number of conclusions are put forward in the discussion document and specific issues are raised for consideration.

A series of workshops was held in October 1995 at which the issues raised in the discussion document were canvassed and input was obtained from RAMM users. The workshops are documented in detail in a separate report (Transit New Zealand 1995). TNZ also circulated a questionnaire to RAMM users on the effectiveness of RAMM.

This present report summarises all responses to the discussion document, both from the workshops and written responses, summarises responses to the questionnaire, and makes recommendations on the scope, objectives and functionality of the RAMM system and how RAMM development should be managed, in a form suitable as input to a formal development strategy for RAMM.

It is emphasised that this report does not constitute TNZ policy. The recommendations will be used to prepare a formal development strategy for RAMM for the short to medium term, once responses to them have been received from interested parties.

A considered response was sought from interested parties so that RAMM can be developed and supported in a manner that satisfies the needs of the various agencies involved with road management in New Zealand.

1.2 Overview of this Report

This report is structured as follows:

- Section 2 summarises the responses to the discussion document.
- Section 3 draws conclusions from the discussion document and the responses.
- Section 4 contains recommendations for a development strategy for RAMM.
- Appendix 1 lists the specific issues raised in the discussion document on which response was invited.
- Appendix 2 lists respondents that made written submissions on the discussion document.

- Appendix 3 lists the responses to the specific issues raised in the discussion document.

- Appendix 4 contains the RAMM questionnaire and summarises responses to the questionnaire.

2. SUMMARY OF RESPONSES

2.1 Introduction

This section provides a summary of the responses to the discussion document received in writing and at the workshops. Most of the responses are support for, or opposition to, the specific issues raised in the discussion document. The issues are listed in Appendix 1 for reference. Comments made by respondents, that do not directly relate to the specific issues, are summarised at the end of this section.

The RAMM questionnaire and a summary of responses to the questionnaire are included in Appendix 4.

2.2 Classification of Written Responses

A total of 32 written responses to the discussion document were received. The respondents can be classified as:

Local authorities	21
Transit New Zealand	3
Consultants	8

The respondents are listed by category in Appendix 2.

2.3 Specific Issues - Support and Opposition

Responses to the specific issues raised in the discussion document are given in detail in Appendix 3. Numerical support for, and opposition to, the issues is summarised in Table 2.3.

Responses attributed to the workshops relate to comments made at any of the seven regional workshops. These are generally not consensus views, even from a particular workshop. Rather they reflect the full range of comments made. Comments from the Workshops are counted as one response in Table 2.3. Comments relating to individual workshops are documented in the workshop proceedings (Transit New Zealand 1995).

Table 2.3. Support for, and opposition to, specific issues.

Issue	No. Supporting	No. Opposing	Other Options
(a) Which requested facilities should be included in standard RAMM and with what priority?			
Enhanced signs inventory	9	4	3
Bridge module	9[1]	4[1]	4
Non-pavement assets	10	3	2
High speed data collection	17	1	1
Skid resistance data	16	1	1
Accident data	8	1	11
Inspection scheduling	7	3	2
Road asset valuations	15	1	2
Access control details	6	3	3
Access permissions	6	3	3
Pipeline easements	7	3	2
CBR values for pavement layers	15	-	1
Benkelman beam readings	14	1	1
Lighting facilities inventory	15	3	2
(b) Should RAMM be linked to land ownership and tenure data?	10	7	1
(c) Which functions should be supported by an extended RMIS?			
Network statistics	15	2	-
Budgeting	11	1	1
Asset management strategy	14	2	1
Planning	7	1	1
Auditing maintenance expenditure and performance	9	1	3
Investigations and inspections	8	1	-
(d) Should routine maintenance needs be included and optimised in RAMM?	9	7	1
(e) Should improvement projects be included in the optimisation process?	8	6	-
(f) Should RAMM databases be integrated and optimised nationally?	4	12	-
(g) Should an extended RMIS store pictures of assets?	12	3	1

[1] Workshops differed over this issue.

Issue	No. Supporting	No. Opposing	Other Options
(h) What degree of detail should be recorded for an asset's work history?	See Appendix		
(h) What degree of detail should be recorded for material properties?	See Appendix		
(i) Should travel times/delays and other road capacity measures be included in RAMM?	5	10	1
(j) Should RAMM allow optional data in tables and should this be extended?	14	1	1
(k) Is a full bridge management system necessary, or just a RAMM compatible inventory?	-	13[2]	7
(l) Should all RCAs have a standard bridge inventory?	7	6	3
(m) Should RAMM keep geographic co-ordinates for road sections and features?	19	-	-
(n) Should RAMM be the main database for traffic information, or just linked to other databases?	7	13[3]	1
(o) Should RAMM be extended to produce multi-year strategic programmes for all maintenance and rehabilitation?	13	5	1
(p) Should there be more explicit instructions on how RAMM treatment selection *should* be used?	10	5	2
(q) Should safety and capacity prediction be included in an expanded RMIS?	11[4]	7[4]	-
(r) Should TNZ advise a general specification for a PMS instead of prescribing a system?	5	16	2
(s) Should TNZ/Transfund continue to control development of standard RAMM?	15	-	9
(t) Is the current training/support arrangements satisfactory?	12	6	6
(u) Should standard RAMM be converted to WINDOWS?	28	-	2
(v) How should RAMM be treated for financial assistance purposes?	See Appendix		

[2] Opposition to a full bridge management system.

[3] Opposition to RAMM being the main database.

[4] Workshops were divided on this issue.

2.4 Other Comments

Comments made in addition to those on the specific issues are summarised in the following paragraphs.

2.4.1 Scope/Priority for RAMM Development

Auckland C C and Hutt C C considered that the first priority for RAMM was to provide improved pavement functionality.

Waitakere C C submited that the most important issue for RAMM was for it to be technically sound, i.e. able to accurately and repeatably predict shape corrections and reseals. The next priority was to make RAMM user-friendly. This view was supported by comment at the Workshops.

Selwyn D C and TNZ (Gilberd) considered that effort should be concentrated on developing RAMM for carriageway management. TNZ (Gilberd) advocated that systems for facilities outside this should be separate programs.

Opinion from the Workshops was that:

- RAMM must cater for the whole road reserve rather than just the carriageway.
- Asset management needs must be satisfied.
- Contractors should have some form of access to RAMM for assessing and scheduling field work, and for entering work records into RAMM.
- Five year strategic planning should be supported by RAMM.
- Commercial interests should be encouraged to develop non-core modules.

Napier C C submited that RAMM should be developed urgently into a modular total road asset management information system, i.e. dealing with road reserve, structures, traffic management facilities, furniture, fixtures and fittings and landscaping, which could cost and rate all components and accept information from contractors.

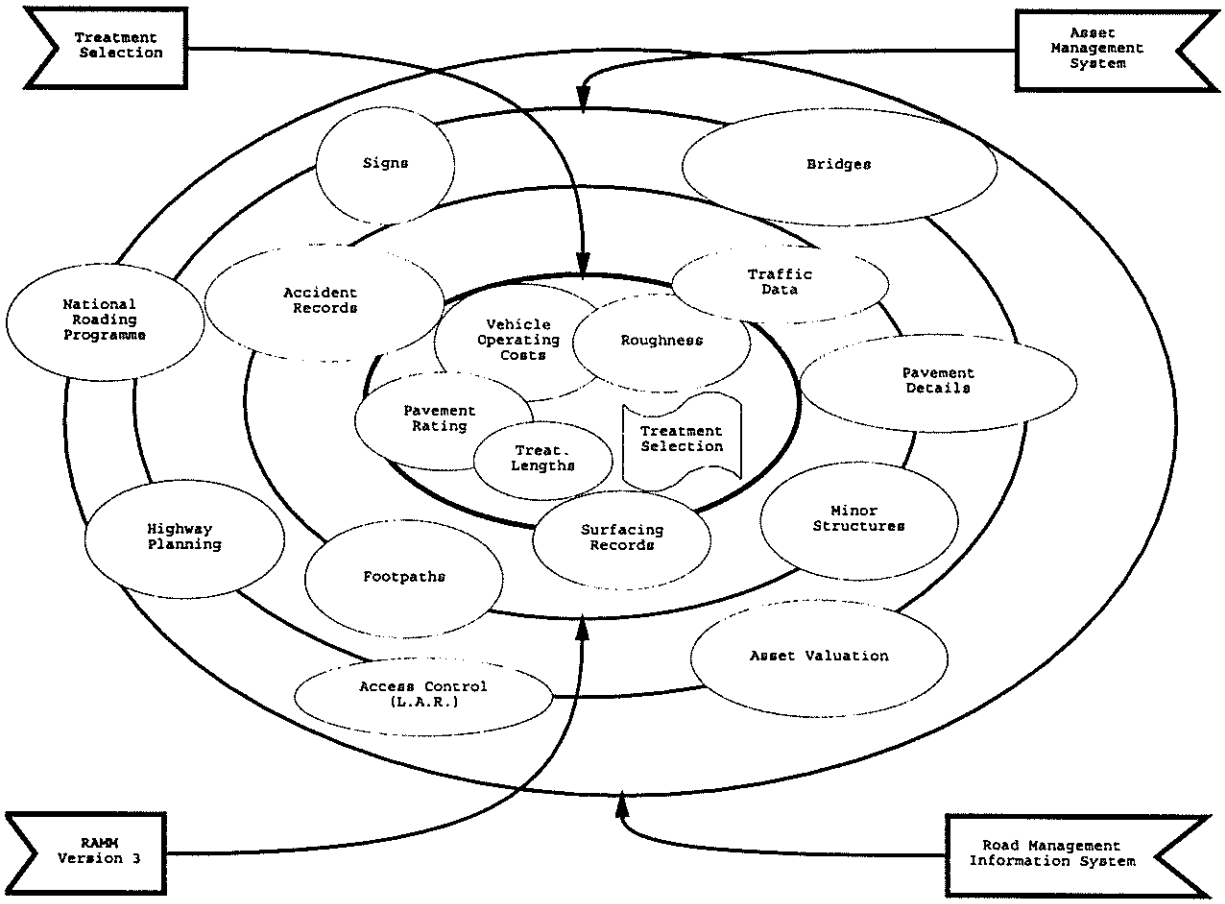
Beca Carter Hollings & Ferner submited that TNZ/Transfund must clearly define the core RAMM system that it supported. TNZ should also facilitate development of non-standard RAMM modules from which output was required, by specifying minimum requirements, ensuring compatibility of location referencing and an easy means of updating location, and providing financial assistance where appropriate.

T H Jenkins advocated that standards and performance guidelines be established for data collection, quality, completeness, security, updating

schedules and software modules for a full road asset management and information system (RAMIS). An overall plan, to facilitate development of systems and ensure ease of data transfer, should be included. An advisory group should be formed for this purpose and funding made available. RAMM development should not proceed until this had been done.

The SH Management division of TNZ considered that the future development of RAMM should be within the framework of a Road Management Information System (RMIS) - refer Figure 2.4.1, with procedures and guidelines for maintenance of database integrity and currency. The different components of asset management should be allowed for by a modular design. RAMM should focus on pavement maintenance. Other components should be separate but linked. A separate module should be developed to manage position referencing. TNZ/Transfund should facilitate development of non-standard RAMM modules by policies, guidelines, research and financial assistance.

Figure 2.4.1. **Relationships between functional coverage and data needs.** (Supplied by TNZ - SH Management)



TNZ (SH Management) submitted that priorities for development should be:

High -	Resolve strategy for development. Interim upgrade to pavement treatment selection. Develop quality system approach for data collection and management. Develop policies and guidelines for Asset Management Systems. Develop WINDOWS environment PMS. Provide sectorial/network planning module.
Medium -	Review treatment selection from first principles. Incorporate pavement prediction modelling and budget optimising. Integrate comprehensive analysis of projects. Develop road network database for RMIS. Pilot GIS applications.
Longer Term -	Extend integration of RMIS databases. Extend GIS applications.

2.4.2 Network/Project Level

TNZ (Gilberd) submitted that the first decision needed to be whether RAMM was to be a **network** tool or a **project** tool. The level of data collected was an important consideration in this. It was suggested that TNZ/Transfund support and fund the RAMM system to the network level only. Project level developments should be left to third parties.

Hutt C C and South Taranaki D C considered that RAMM should operate at a global (network) level. This view was supported by the Workshops.

Works Consultancy (Napier) considered that RAMM did not work well at either the project or network level compared with treatments selected through maintenance costs history and field inspections. The consultancy submitted that road managers needed a project level tool and RAMM should be developed into this.

Bennett advocated that RAMM be developed into a project level tool because present rating data was geared towards this, and this was primarily how local authorities were using it. He considered that network level analysis should be either based on aggregation of project level data or use less intensive data.

TNZ (SH Management) submitted that RAMM should be developed as a **project programming** tool, with recognition of the consequent data collection, data management and resource requirements. Project programming

was defined as selecting the treatment, identifying the location and evaluating the work using standard treatment options.

Opinion at the Workshops was that it is important for RAMM to be accurate at a network level, but it should also be able to identify projects. It should not become a design tool.

2.4.3 Road Segmentation

Hastings D C, Tararua D C, TNZ (SH Management) and Workshops opinion was that RAMM should allow more flexible segmentation relating to pavement type and condition.

Bennett submitted that dynamic segmentation and automatic sectioning were essential to any project level management system.

2.4.4 Pavement Treatment Selection

A number of respondents submitted that problems in the pavement treatment selection algorithm must be sorted out with high priority. (Christchurch C C, Matamata Piako D C, Waitakere C C, TNZ - SH Management, TNZ - Gilberd, Bennett, Works Consultancy - Christchurch, Works Consultancy - Napier, Workshops).

Southland D C and Waitakere C C considered that maintenance costs should be an input to pavement treatment selection so that the recommendations were more accurate, and that maintenance activity definitions must be resolved urgently. This was supported by the Workshops.

Waitakere C C submitted that repeatability of roughness measurements used in pavement treatment selection needed to be addressed urgently. This need was also identified in the Workshops.

TNZ (SH Management) and Bennett advocated that the treatment selection analysis be made compatible with the Project Evaluation Manual, and that the adequacy of the present level of rating data for determining treatment selection be reviewed. These needs were also identified at the Workshops.

2.4.5 Pavement Performance Modelling

Hastings D C requested an ability to run life-cycle/pavement life modelling.

A number of other respondents considered that more was needed on pavement deterioration modelling. (Hutt C C, South Taranaki D C, Waipa D C, TNZ - SH Management, Bennett).

2.4.6 Reports/Presentation

Auckland C C considered that improved reporting should be a priority, for data checking among other things. This view was also supported by the Workshops.

Opinion from the Workshops was that an ability to show data graphically, e.g. on a screen, was important.

Christchurch C C submited that more analytical reports should be provided, e.g. seal life, top surface defects, condition rating defects.

Invercargill C C considered that more use needed to be made of RAMM information for trends reporting.

Selwyn D C and CJN Technologies considered that schematic presentation of information along a road should be provided. This was also requested at the Workshops.

Waimakariri D C submitted that RAMM should have a separate report for seal widening project evaluation.

Waipa D C and CJN Technologies advocated that a WINDOWS report writer be provided. This was also requested at the Workshops.

Waitakere C C considered that RAMM should have a report writer which could access information from a GIS.

Opinion was expressed at the Workshops that RAMM should be more like a GIS where the user can just click an area, or a road, and be supplied with the required information.

2.4.7 Links to Other Systems

Ashburton D C submitted that RAMM needed to have interface compatibility with other systems, e.g. accident data.

Hastings D C considered that RAMM needed to allow for links, via a GIS, to other databases such as street lighting, signs, property, asset valuation, maintenance and other road asset data.

Hutt C C considered that RAMM needed to interface with other specialist software, such as street lighting, signs and services, which should be specified by the outputs required.

Invercargill C C noted that linking RAMM to the LTSA accident database had

had proved beneficial.

Masterton D C submitted that provision should be made to link RAMM with a GIS and other databases, e.g. Accident Investigation System (AIS), signs management system (SAM), CM2000, DOSLI.

Napier C C and Southland D C advocated that RAMM should be part of a TLA's total management information system, i.e., it needed to be able to "feed" other systems as well as read from them. This view was supported in the Workshops.

Selwyn D C and Waitakere C C submitted that RAMM needed to be developed to interface better with GISs, and to provide standard procedures for maintaining data up to date. Workshops supported this need but also expressed the opinion that TNZ/Transfund should not specify a particular GIS - GIS vendors should supply the links.

Waimakariri D C submitted that RAMM should be enhanced and expanded to work with other systems such as BARR, BRIMMS and the Accident Investigation System.

Works Consultancy (Napier) and Workshops advocated linking the Accident Investigation System and RAMM, because they needed to be more compatible.

Works Consultancy (Napier) submitted that interfaces should be provided between other software products, e.g. DBASE, PARADOX, ACCESS, LOTUS, EXCEL.

2.4.8 Extra Features

Christchurch C C submitted that more development was needed on footpath inventory and analysis.

Opinion was expressed at the Workshops that provision should be made to store stop lines and parking zones.

2.4.9 Database Updating

Works Consultancy (Christchurch) suggested that, where a consultant managed the RAMM system, the consultant be responsible for updating the database rather than the TNZ regional office.

TNZ (SH Management) advocated a quality systems approach for data collection and management.

2.4.10 Development Management

CJN Technologies advocated that TNZ/Transfund provide the RAMM software developer with an annual budget of $10K - $15K for small enhancements and that these be sent direct rather than through the RAMM Advisory Group.

TNZ (SH Management) advocated the re-establishment of the RAMM Advisory Group in accordance with the revised scope of RAMM, and the use of partnerships for application development.

3. CONCLUSIONS

3.1 Introduction

This section reviews the conclusions listed in the discussion document and provides a summary of conclusions that can be drawn from the information provided in the previous sections.

3.2 Conclusions from the Discussion Document

There were few responses to the conclusions contained in the discussion document. Most comments made were in support. Conclusions drawn in the discussion document are repeated below unmodified, followed by specific comments made by respondents, other than agreement.

(a) 75 percent of expenditure on New Zealand public roads is for maintenance and rehabilitation (this to some extent reflects the type of pavement used).

(b) There is currently little expenditure on bridge renewals. **Response:** The low expenditure on bridge renewals results from TNZ policy rather than need. (South Taranaki D C). Bridges represent a significant proportion of the road asset value and should not be overlooked. (TNZ - SH Management). ***Comment:*** *The responses do not change the conclusion, just qualify it.*

(c) All road-controlling authorities must have a road information system (Minister of Transport's directive and Audit Office requirements).

(d) The benefits of a single unified system for pavement management in New Zealand are enormous. **Response:** There are benefits provided RAMM is not allowed to stagnate. (South Taranaki D C). The benefits come from improved distribution and management of maintenance expenditure. (TNZ - SH Management). ***Comment:*** *The responses only explain the conclusion.*

(e) RAMM is a means of rationalising road maintenance and rehabilitation expenditure in the same way that project evaluation is used for road improvement proposals. **Response:** RAMM should remain a network level tool rather than be used for project evaluation. (South Taranaki D C). ***Comment:*** *The conclusion did not advocate that RAMM be used for project evaluation.*

(f) RAMM is specifically designed for New Zealand conditions and should continue to be the platform for pavement management in the medium term.

(g) Requirements for effective road management systems have been defined.

(h) Safety management should be included as a component of a road management

system. **Response:** Safety management should be part of an RMIS only if road condition can be shown to make a difference (Auckland C C). Safety management should be outside RAMM but perhaps the Accident Investigation System should be linked to RAMM. (South Taranaki D C). ***Comment:*** *The role of road controlling authorities in safety management may need to be re-thought.*

(i) Users have not in general made use of the spatial referencing capability within RAMM. **Response:** More TLAs are moving to GIS and will make use of spatial referencing. (Invercargill C C, South Taranaki D C). State highway reference stations have used spatial referencing. (TNZ - SH Management). ***Comment:*** *The response does not change the conclusion, but indicates that use is increasing.*

(j) RAMM at present does not cover routine maintenance needs.

(k) RAMM is at present a network level pavement management system with some project level ability.

(l) The more recent pavement and bridge management systems include performance prediction and optimisation and this functionality should be provided for RAMM.

(m) RAMM should support TNZ's overview level and the road controlling authority operational level, and be integrated with the corporate systems of these organisations. **Response:** Disagree on the need for integrating with corporate systems. (South Taranaki D C). ***Comment:*** *This part of the conclusion may not be supported.*

(n) RAMM should be available to consultants involved with road management, but it should not become an engineering design system.

(o) RAMM should not cover activities that are the responsibility of contractors, e.g. work scheduling and analysing workforce efficiency.

(p) The official development and use of RAMM should be limited to public roads.

(q) The main types of road asset not presently covered by RAMM are: major structures; lighting and land. **Response:** Keep major structures, lighting and land as an adjunct to RAMM. (South Taranaki D C). ***Comment:*** *This opinion doesn't change the conclusion.*

(r) RAMM should become part of a total road management system which covers all road assets and supports decision making at all levels of organisations involved with road management. **Response:** Its too late to include major structures in RAMM - most TLAs now have their own system. (South

Taranaki D C). Agree that RAMM should become part of a total road management system. (South Taranaki D C). ***Comment:*** *The conclusion could still hold true.*

(s) Structure inventory and rating systems compatible with RAMM are available. **Response:** Do not waste time re-inventing structural inventories. (South Taranaki D C). TNZ/Transfund should have a policy or guidelines on requirements and financial assistance for non-RAMM systems. (TNZ - SH Management). ***Comment:*** *These opinions do not change the conclusion.*

(t) Functions such as travel demand management and property management which use specialised computer systems should remain outside RAMM. **Response:** Travel demand management and property management may, in time, become part of the total Road Management Information System. (TNZ - SH Management). ***Comment:*** *Both statements could be true. They could still be outside RAMM.*

(u) RAMM life-cycle analysis should be compatible with TNZ's Project Evaluation Manual procedures.

(v) Commercially supported statistical packages should be used for historical and trend analysis with data exported from the road management system. **Response:** Standard historical and trend analysis should be developed within RAMM. (TNZ - SH Management). ***Comment:*** *This is an opposing view. The conclusion should be reviewed.*

(w) RAMM should be able to operate under a WINDOWS environment when difficulties of interfacing UNIX and MS-DOS have been overcome so as to give access to a wide range of graphical display facilities. **Response:** RAMM should be ported to a Windows database program such as PARADOX or ACCESS. (South Taranaki D C). Current processing performance, data entry efficiency, and data management competency must not be sacrificed. (TNZ - SH Management). ***Comment:*** *The two views expressed here are essentially opposites. The conclusion is still true.*

(x) TNZ should continue to monitor overseas developments of road management systems, particularly

- US pavement and bridge management systems being designed to meet the ISTEA requirements;
- The UK pavement management system;
- The upgrade of the World Bank HDM system; and;
- Road management systems integrated by GIS. **Response:**

Monitoring of overseas developments of road management systems is being achieved through journals, conferences and informal contacts. (TNZ - SH Management). ***Comment:*** *This supports the conclusion.*

(y) TNZ should monitor TLA experience with GIS.

3.3 Conclusions from Responses to Specific Issues

Conclusions that can be drawn from the responses to the specific issues raised in the discussion document summarised in Appendix 3 and Table 2.3 include (using the issue numbering):

(a) There is no consensus on which of the currently requested items should be included in standard RAMM, or on the priorities. Each of the items on the list has its advocates and equally there are some respondents that don't see the need for the item. High speed data collection, skid resistance data, road asset valuations, CBR values, Benkelman Beam readings and lighting facilities inventory have the most support, but within this there is a wide range of priorities. Inspection scheduling, access control details, access permissions and pipeline easements tend to have lower overall support and priorities. For each item, there are respondents that consider the item should be outside standard RAMM but linked. Existing (commercial) systems may, at least partially, fulfil needs for an enhanced signs inventory, bridge inventory and rating system, accidents, traffic and lighting facilities inventory.

(b) Only one respondent supported land ownership data being included in RAMM. Most advocate that this should only be linked via a GIS. Requirements for a road centerline database for road management purposes should be resolved.

(c) Respondents are interested in having support for most of the functions listed. Network statistics, asset management strategy and budgeting have the most advocates. Planning, auditing maintenance expenditures and performance, and investigations/ inspections have the lowest number of advocates.

(d) Opinion is almost equally divided on whether routine maintenance should be included and optimised in RAMM.

(e) Opinion is almost equally divided on whether improvement projects should be included in the optimisation process.

(f) Opinion is predominately against integrating RAMM databases and optimising maintenance nationally.

(g) There is more support for than against an extended RMIS having the ability to store pictures of assets.

(h) There is a wide range of opinion on the degree of detail which should be recorded on an asset's work history and its material properties.

(i) Most respondents do not see a need to include travel time delays and other road capacity measures in RAMM.

(j) Nearly all respondents support provision for optional data in RAMM tables.

(k) Nearly all respondents consider that a RAMM-compatible inventory, or inventory and rating system, would be sufficient for bridges, and that a full bridge management system is not needed.

(l) Opinion is almost equally divided on whether all RCAs should have a standard bridge inventory.

(m) There is almost universal agreement that RAMM should keep geographic co-ordinates, mainly for linking to a GIS.

(n) Opinion is nearly equally divided on whether RAMM should be the main database for traffic information or whether it should just have links to other databases.

(o) There is some interest in the proposal that RAMM should be extended to produce multi-year strategic programmes for all maintenance and rehabilitation.

(p) The majority of respondents consider that TNZ/Transfund should provide more information on how RAMM treatment selection *should* be used. Some consider that this should wait until the treatment selection algorithm has been upgraded.

(q) There is a variety of opinions on whether safety and capacity prediction should be included in an expanded RMIS - some advocating that safety should be left to the LTSA's Accident Investigation System.

(r) Most respondents are opposed to a general specification for a pavement management system and support having a single prescribed system.

(s) Most respondents consider that TNZ/Transfund should continue to control development of standard RAMM, although some people suggest that there could be a formal partnership with ALGENZ. A number point out the need for TNZ/Transfund to make a resource commitment to RAMM development.

(t) Most respondents consider that current training/support arrangements work satisfactorily, although there are problems of lack of flexibility in some parts of the South Island. TNZ/Transfund underwriting of training costs is

suggested by some respondents as a means of overcoming the problems.

(u) There is almost universal agreement that the standard version of RAMM should be converted to WINDOWS. Some of the smaller councils advocate moving the system completely off UNIX. Providing a WINDOWS report writer has the most urgency.

(v) Some respondents support treating RAMM like other professional services for financial assistance, others consider that Transfund should provide direct assistance for training, software and hardware, and a few advocate 100 percent funding for RAMM. There is split opinion on whether financial assistance should be provided for non-core systems.

3.4 Conclusions from Other Comments

Conclusions from comments summarised in section 2.4 include:

(a) There is a general consensus that a framework plus standards for a total Road Management Information System need to be established as a first step towards deciding on the scope and priorities for RAMM development. Standard RAMM and other modules should then be defined within this framework.

(b) While some respondents advocate that RAMM operate at the network level only, there is a majority that see the need for RAMM to be developed into a project level system, but not for design. There are consequent data collection, management and resource requirements.

(c) Dynamic segmentation and automatic sectioning should be considered for RAMM and related systems.

(d) The treatment selection algorithm must be improved urgently. This includes utilising maintenance costs and resolving problems with repeatability of roughness measurements.

(e) An ability for pavement performance modelling is required in RAMM.

(f) There is a significant demand for improved and easier reporting and presentation of RAMM data.

(g) Many RAMM users request formal links from RAMM to other systems.

(h) Procedures for updating RAMM data and managing RAMM development should be reconsidered in light of the revised scope of RAMM.

4. RECOMMENDATIONS

4.1 Introduction

This section sets out a vision of where RAMM should be within 5 years (2000) based on the discussion document and the responses to it. Recommendations are made on the following issues:

- The scope, objectives and functionality of RAMM.
- Developments to RAMM that should be undertaken with likely costs and benefits.
- The involvement of TNZ/Transfund and other agents in the provision, development, management and operation of RAMM.
- Financial assistance for RAMM.
- Further research required for RAMM development.

4.2 Scope, Objectives and Functionality

The scope, objectives and functionality of RAMM are considered under the following headings:

- System framework.
- Assets covered.
- Functional levels supported.
- Functions supported.
- Data.
- Analysis.
- Presentation.
- Software.

4.2.1 System Framework

The discussion document identifies a standard version of RAMM for which TNZ takes responsibility and for which TNZ financial assistance is provided. Users can supplement, and have supplemented, this standard version with associated modules dealing with other assets and functionality. However, both the extent of standard RAMM and the associated modules have been developing without a coherent overall framework.

It was concluded in the discussion document (conclusion 3.2(r) of this report) that standard RAMM should become part of a total Road Management Information System (RMIS). The need for an overall framework and standards is supported by the responses from RAMM users (conclusion 3.4(a)).

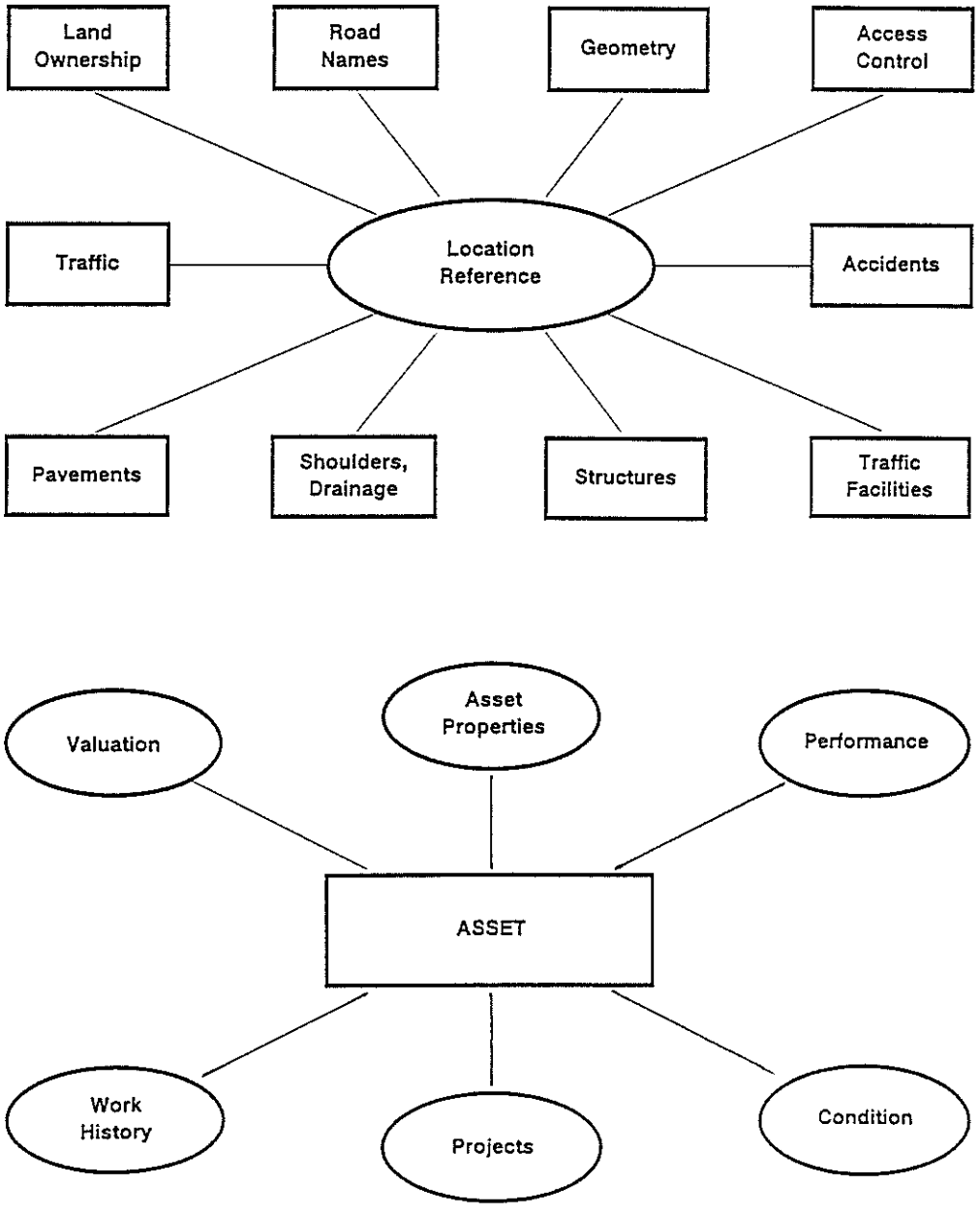
Current work by the local government National Asset Management Steering Group (NAMS) on asset management systems and asset management plans also needs to be accommodated within the overall system framework.

The vision for RAMM therefore is that it becomes part of a comprehensive RMIS.

It is recommended that the framework for the overall RMIS be logically modular as shown by the data groups in Figure 4.2.1. The modules are essentially based on asset groupings which reflect the division of functional responsibility within road management in New Zealand. This modularity clarifies ownership, accountability, and development management for the software and databases.

One of the first considerations for a modular RMIS is how the modules need to be connected so that data can be related and shared. Figure 4.2.1 shows a possible relationship.

Figure 4.2.1. Schematic of a Road Management Information System.



One of the most important requirements is to relate road assets, names, traffic, accidents, etc, to a location on the road. ***It is recommended that the modular framework for the RMIS has at its centre a link-node location referencing module***, designed to:

- Give the relationship between a position on a road at any time and its spatial co-ordinates.
- Maintain a history of route changes.
- Provide a standard location reference for use by all modules.
- Provide a link to GISs.

The ability to track the location of road sections over time is not currently available in RAMM. It is important when analysing network performance and the performance of a discrete section of road. Road referencing modules with the recommended functionality have been developed by the Roads and Traffic Authority (RTA) in New South Wales, and for the World Bank Highway Design and Maintenance (HDM-IV) system.

4.2.2 Assets Covered

Conclusion 3.2(p) is that, as RAMM has been specifically designed for roads, its official development and use should be limited to public roads. ***It is recommended that the overall RMIS applies only to public roads.*** Logically a RMIS should access all information necessary for the management of all roads under the control of an organisation. This is also an implied requirement of the Audit Office. Such a requirement is a large and complex undertaking but can be worked towards in a modular manner within the framework of the RMIS.

The advantages of having a single RMIS covering all road-related assets include the resulting uniformity of approach and efficiency in not having to refer to other databases for some of the assets. The disadvantage is maintaining up-to-date information for assets that require little management.

It is recommended that the RMIS covers all road assets, i.e:

- Carriageway pavements (including surfacings)
  - sealed
    (flexible thin surfaced, flexible structural asphalt, rigid)
  - unsealed.
- Structures
  - bridges (on, under, over)
  - culverts
  - retaining and other structures.
- Traffic facilities
  - signs
  - markings

- safety hardware
- lighting.

- Road shoulders and surface water channels.
- Road drainage.
- Footpaths, grassed areas, landscaping.
- Special features.
- Land.

In general, each of the major groups above would be a separate RMIS module.

Figure 2.4.1 shows that standard RAMM deals mainly with carriageway pavements, but that it contains some information about other assets, traffic and accidents. ***It is recommended that the existing RAMM module be restricted to carriageway pavements, road shoulders and surface water channels.*** It is recognised that this module will need to have access to traffic volumes and other inputs necessary for pavement analysis. These inputs should be provided by links to other specialist modules.

The main assets from the above list not currently covered by standard RAMM are structures - bridges, lighting and land. Structure inventory and rating systems, and a lighting inventory compatible with standard RAMM are already available. ***It is recommended that an inventory and rating system for major structures and a traffic facilities inventory remain as separate but linked modules.***

Based on conclusion 3.3(b), ***it is recommended that none of the DOSLI land database information be duplicated within RAMM or even directly linked to RAMM.***

Traffic facilities could be accommodated by an extension to currently available commercial signs management systems. ***It is recommended that discussions be held with vendors of signs management systems for the purpose of extending their systems to include traffic facilities.***

It is recommended that commercial interests be encouraged to develop a new module covering footpaths, grassed areas and landscaping. This may be able to be accommodated as part of the proposed PARKS module of the Pipeline Asset Management System (PAMS). ***It is recommended that consideration be given to whether drainage could be handled by PAMS.***

It is recommended that links be provided between RMIS modules so that information can be considered together.

4.2.3 Functional Levels Supported

The discussion document set out the five primary functional levels of an RMIS identified by the World Bank:

- **Sectoral** (the road system viewed as a whole) - used for overall budgets and level of service reporting.
- **Network** (part of the road system defined by a set of links with jurisdictional, functional, traffic and physical characteristics) - used for planning, forecasting, allocating finance, scheduling and reporting expenditures.
- **Project** (a particular road section, structure or facility) - used for programming and designing work, reporting work done and expenditures.
- **Operational** (all road sections, structures and facilities managed as a unit) - used for real-time or short time frame activities.
- **Research** (a selection of road sections, structures or facilities) - used to establish relationships.

In New Zealand organisational arrangements largely correspond with the above functional levels. The requirements of each of the functional levels are distinctly different and consequently need different information, presentations and support systems.

Like the US FHWA, Transfund needs a RMIS to effectively fulfil its sectoral oversight and funds allocation functions. This was the reason why RAMM was developed and supported by both the NRB and TNZ. ***It is recommended that RAMM have the functionality to fully support Transfund activities.***

The biggest demand for RAMM is at the road controlling level. Use and functionality at this level is to some extent dictated by Transfund requirements. However, ***it is recommended that RAMM or a comprehensive RMIS also adequately support the road management needs of all road controlling authorities.***

The discussion document concluded that RAMM should support the network level for each road controlling authority. It concluded that currently RAMM was basically a network level system with some project level ability. The responses (conclusion 3.4(b)) support developing RAMM into a project level tool but not a design tool, because RAMM currently has the structure and capability to identify treatments at a project level. The issue is largely one of the amount of data required for accurate project identification. ***It is recommended RAMM become a project identification tool, but not a project design tool.*** This recommendation means that there are consequent data collection, management and resource requirements which will need to be worked through.

It is recommended that RAMM be not primarily designed to support the operational and research functional levels.

In general, *it is recommended that there be a distinct separation between RAMM and systems used by contractors in assessing, estimating, scheduling, executing, reporting and billing work.* However, *it is recommended that RAMM provide information to contractors to the extent that it is available, and that RAMM have links with operational level systems to facilitate data transfer. It is recommended that the specification of a comprehensive RMIS include requirements for operational level systems as far as information is required for the other levels.*

It is recommended that the RMIS be made available to consultants involved with road management. However, because of the competitive nature of consultants activities and the need for other more specialised systems and procedures, *it is recommended that RAMM not be designed specifically for consultants.*

The discussion document noted that it is inefficient if other systems are used to obtain information that RAMM is capable of producing because of a lack of understanding or easy access to RAMM. The advantages of having RAMM as part of an organisation's corporate system were seen as being improved efficiency and elimination of duplication of data. The disadvantage of the added complexity and effort to integrate RAMM with other corporate systems was recognised. *It is recommended that integration of RAMM with corporate systems be left as a decision for each organisation.*

4.2.4 Functions Supported

There are a number of options as to the range of functions supported by RAMM, or an expanded RMIS, at each of the functional levels referred to above.

At the sectoral level the discussion document noted that functions supported could include:

- network statistics;
- optimising network expenditure;
- budgeting;
- network condition and performance monitoring;
- road controlling authority performance monitoring and reporting; and
- standards and guidelines development.

It is recommended that Transfund reviews and specifies its requirements for the sectoral level.

The above functions also apply at the network level, but there are the following additional functions, as identified in the discussion document:

- record assets;

- asset management strategy;
- asset valuation;
- routine maintenance needs assessment;
- rehabilitation needs assessment;
- improvement needs assessment;
- planning;
- travel demand management;
- administration of road access and use;
- property management;
- recording work done; and
- auditing maintenance expenditures and performance.

It is recommended that RAMM continues to support the recording of assets, rehabilitation needs assessment and recording work done for carriageway pavements. This functionality is currently provided.

Conclusion 3.2(t) noted that travel demand management and property management, although currently handled by specialised systems, may in time become part of the total RMIS. ***It is recommended that systems for travel demand management and property management not be duplicated in RAMM.***

Conclusions 3.3(a) and (c) show a significant demand for network statistics, asset management strategy, budgeting and asset valuation. Administration of road access and use, planning, auditing maintenance expenditures and performance have the lowest demand. Planning and administration of road access and use vary significantly from organisation to organisation. One option is for RAMM to only support these to the extent of recording and providing data. Conclusion 3.3(o) shows that there is some demand for RAMM to be extended to produce multi-year strategic programmes. ***It is recommended that network statistics, asset management strategy, budgeting, asset valuation, administration of road access and use, planning and auditing maintenance expenditures and performance be supported by the RMIS and have priorities for development in proportion to demand as indicated by the responses.***

Conclusion 3.3(e) shows that there is divided support for including improvement projects within RAMM (or the RMIS). ***It is recommended that improvement projects not be included in RAMM or an extended RMIS in the medium term.***

It was noted in the discussion document that RAMM contains the prime information required to determine routine maintenance needs for some road assets, e.g. shoulders and surface water channels, footpaths, drainage and traffic facilities. If additional routine maintenance information was added, then it would be possible to determine future levels of routine maintenance for pavements. The advantage of this would be the ability to optimise all pavement maintenance, reseal and rehabilitation activities at the same time. The responses were almost evenly

divided on whether routine maintenance should be included and optimised in RAMM (conclusion 3.3(d)). Because most of the required information will be required for accurate project level treatment identification, ***it is recommended that routine maintenance activities be included in network level optimisation.***

As identified in the discussion document, at the project level functions supported could include:

- Investigations/inspections.
- Treatment selection.
- Design.

Conclusion 3.3(c) shows that there is low demand for investigations/inspections to be supported within RAMM. ***It is therefore recommended that support for investigations/inspections not be provided in the medium term.***

Treatment selection for a network is one of the prime reasons for RAMM. As discussed above, ***it is recommended that treatment selection be supported at a project identification level.***

Support for design would require more detailed data than that required for road management. Pavement design is presently a manual process and there does not appear to be any benefit in computerising it. Design of other roading features use specialised computer programs that should remain outside a RMIS. ***It is recommended that the extended RMIS have links to design programs, but that design programs not be duplicated within RAMM.***

It is recommended that support for research and development only involve supply of data if available.

4.2.5 Data

As identified in the discussion document, the following data could be maintained in RAMM, or an extended RMIS, for all assets where applicable:

- Asset descriptions and dimensions;
- Pictures of assets;
- Work history and cost of construction, maintenance, rehabilitation, and reconstruction;
- Asset condition
    - ride;
    - surface texture (skid resistance, flushing);
    - distress (rutting, cracking, etc);
    - structural (deflections, sonic, etc); and
    - material properties.

- Asset performance
  - traffic accidents and incidents;
  - capacity (travel times/delays).

Data collection and updating is the single most costly activity associated with any RMIS function and this must be taken into account in deciding on what is needed. ***It is recommended that all data elements be tested against the criteria: relevance, reliability, affordability, appropriateness.***

It is also recommended that quality procedures be developed to ensure data integrity. These procedures should encompass the field collection of data, updating the database and database management from an Information Technology perspective. ***It is recommended that maintenance and updating of the database incorporate software features to minimise editing, corrections and data management.***

RAMM already provides for asset descriptions and dimensions, some aspects of work history and pavement condition (ride and distress).

It is recommended that provision be made for integration of digital pictures in future developments of RAMM (conclusion 3.3(g)) ***on an optional use basis.***

Conclusion 3.3(h) shows that further investigation is required on the degree of detail on work history and asset properties that should be supported in RAMM. ***It is recommended that the degree of detail on work history and asset properties be resolved relative to end use of the information.***

Conclusion 3.3(a) indicates some demand for including pavement profile, skid resistance (SCRIM) and deflections (Benkelman Beam, Falling Weight Deflectometer) in RAMM. ***It is recommended that provision be made in RAMM for pavement profile, skid resistance (SCRIM) and deflections (Benkelman Beam, Falling Weight Deflectometer) data on an optional use basis.*** However, ***it is recommended that serious consideration be given to the amount of such data that should be collected and how it should be stored.***

In New Zealand traffic accidents and incidents are presently recorded in the Land Transport Safety Authority's (LTSA) AIS database but there is some difficulty in relating them directly to road sections and features in RAMM. Based on conclusion 3.3(q), ***it is recommended that the AIS system not be duplicated within RAMM or an extended RMIS but that the linkage be improved***, so that the safety performance of road sections can be measured more accurately and more appropriate remedial measures designed.

Based on conclusion 3.3(i), ***it is recommended that provision for recording travel time delays and other road capacity measures not be included in RAMM in the short term.*** However, ***it is recommended that provision be made within a separate traffic module.***

Nearly all responses to the discussion document (conclusion 3.3(j)) considered that there should continue to be provision for optional data in the standard RAMM databases. The advantage of this that it goes some way to satisfying special user needs. The disadvantage is that it makes all RAMM databases larger. ***It is recommended that provision continue to be made for optional data.***

4.2.6 Analysis

Required analysis ability follows from the functions to be supported. As noted in the discussion document, either the same analysis ability could be provided for all types of assets or only some may require detailed analysis capability.

As identified in the discussion document, analysis capability could include the following:

- network level treatment selection with costs for funds allocation;
- budget optimisation and network condition for a given budget;
- project level analysis;
- historical and trend analysis; and
- work programmes.

It has already been recommended that treatment selection operate at both the project and network levels.

Conclusions 3.4(d) and (e) indicate that there are significant deficiencies in the present pavement treatment selection analysis. As this is one of the prime purposes of RAMM, ***it is recommended that the treatment selection analysis be improved. It is recommended that an initial upgrade to the treatment selection analysis incorporate maintenance costs, updated project evaluation methodology, and revised condition rating, followed by a redesign of the algorithm to incorporate pavement performance modelling, dynamic segmentation and automatic sectioning*** (conclusion 3.4(c)), ***high speed data, skid resistance data, CBR values for pavement layers, and Benkelman Beam and Falling Weight Deflectometer readings.***

Next to treatment selection, budget optimisation and the converse (network condition for a given budget) are the prime reasons for a computer based Pavement Management System. RAMM currently does not have this functionality but research is currently being undertaken to identify a suitable module for use with RAMM. ***It is recommended that RAMM provide budget optimisation and network condition for a given budget.*** Network level optimisation could be simplified by only considering the economics of doing the work now, compared with deferring the work for a year. This is the approach currently used in RAMM for reseals and is the approach proposed for the new United Kingdom pavement management system. The alternative is to use a full life-cycle analysis.

Optimisation needs also depend on whether fund allocation is to be optimised only within each TLA area and TNZ region, or whether optimisation is required over the whole public road network. In the latter case the network would have to be simplified for optimisation purposes and procedures would need to be developed for aggregation of data from the various RAMM databases. Conclusion 3.3(f) indicates little support for aggregation of RAMM databases, and ***it is recommended that no special provision be made for nation-wide optimisation.***

RAMM currently only attempts to optimise shape correction and reseals (verses continued routine maintenance). A number of overseas systems also include construction projects in the network level optimisation as well as routine maintenance and specific treatments for safety reasons. Because TNZ uses a rigorous manual project evaluation process to allocate funds to safety and construction projects, ***it is recommended that safety and construction projects not be included in the optimisation process.*** However this does not address the problem of identifying road sections that have potential for improvement and ***it is recommended that methods of identifying road sections with potential for improvement be considered further.***

The PONTIS network level optimisation system for bridges has been recommended for trial in New Zealand. This was developed in the USA to assist funds allocation to the large number of deficient bridges in that country. The bridging situation in New Zealand is under better control as evidenced by the low expenditure on bridge renewals. Based on this together with conclusion 3.3(k), ***it is recommended that network optimisation of bridge activities is not necessary,*** particularly given the use of benefit cost analysis in bridge project selection.

As noted in the discussion document, performance prediction could cover some or all of:

- asset condition (ride, structural);
- safety; and
- capacity.

It could be based on detailed mechanistic models, such as is used in the World Bank HDM-III system, or simple curves as in the proposed United Kingdom pavement management system. The disadvantage of simple curves is that they have to be calibrated for each road section. The advantage is that this approach may be easier to understand than a mechanistic model which could appear as a black box. On the other hand a mechanistic model can automatically handle a range of situations. Research is currently being undertaken to identify a performance prediction model for New Zealand road pavements. ***It is recommended that RAMM have the ability to predict pavement performance.***

Safety and capacity performance are specialised subjects and these are inherently difficult to predict. For these reasons together with conclusion 3.3(q), ***it is***

recommended that prediction of safety and capacity performance be left outside of a RMIS in the medium term.

RAMM currently includes a type of project evaluation in selecting rehabilitation treatments. However this is different from TNZ's manual project evaluation process. ***It is recommended that the evaluation processes be made the same so that a RAMM analysis is acceptable for funds programming purposes.***

The discussion document concluded that historical and trend analysis should use a standard statistical analysis package external to RAMM, because it would be a waste of resource to develop this type of analysis within RAMM with the ready availability of commercially supported statistical packages. It was recognised that the disadvantage of using an external program is the difficulty of making the interface seamless. TNZ SH Management response was that standard analyses should be developed within RAMM. ***It is recommended that requirements for trend analysis be accommodated by pre-programming analysis macros in standard statistical packages.***

4.2.7 Presentation

Conclusion 3.4(f) shows that there is a significant demand for easier reporting and presentation of RAMM data. Options for presentation of RAMM data and output are basically:

- developing pre-programmed reports and graphing capability as part of RAMM;
- using off-the-shelf report writing tools to allow users to create their own reports; and
- developing a tool which allows the user to view, report and graph data in standard formats, but which also allows the user to create their own reports.

Conclusion 3.3(u) shows that there is almost universal agreement that the standard version of RAMM be converted to WINDOWS. This will allow easier interfacing of WINDOWS applications with RAMM and hence access to a wide range of graphical display of RAMM data. ***It is recommended that RAMM report and analysis screens be the first transferred to WINDOWS.***

The discussion document identified that plan view presentation of RAMM information would be facilitated by using a geographic information system (GIS). However the resources involved in establishing a GIS are substantial. A GIS uses computer generated maps as the base for locating and displaying spacial information. Some TLAs in New Zealand have begun the development of GIS for purposes of resource management and management of urban infrastructure.

Conclusion 3.3(m) shows that there is almost universal agreement that RAMM

should keep sufficient geographical co-ordinates to link with a GIS. RAMM has provision for road sections to have unique numeric identifiers sufficient to allow linking to a digitised road network and presentation by a GIS. Storage of further geographic coordinates in RAMM is unlikely to be cost effective. A few TLAs are investigating linking RAMM to their GIS, and ***it is recommended that local authority experience linking RAMM to GIS be monitored and taken into account in future RAMM developments.***

It is recommended that Transfund does not try to specify a particular GIS for use with RAMM, but works with GIS vendors to develop means of linking RAMM databases and modules to GIS developments.

4.2.8 Software

Conclusion 3.3(u) conveys the almost universal agreement that RAMM should be converted to a WINDOWS environment. WINDOWS 95 and WINDOWS NT are independent of the MS-DOS limitation and offer the best opportunity of providing a fully WINDOWS version of RAMM. This was supported by most workshop participants, however there is some user pressure to have RAMM operate under WINDOWS 3.11, at least in the medium term.

The discussion document noted that options for future development of RAMM include:

(a) provide standard RAMM in WINDOWS only; or
(b) provide versions of standard RAMM in both WINDOWS and UNIX.

The advantages of (a) are improved facilities for using the RAMM system and compatibility with other modern computer programs. A disadvantage could be the requirement for all users to transfer to an appropriate WINDOWS environment. Option (b) overcomes this disadvantage but has the disadvantage of having two systems to support, maintain and upgrade. ***It is recommended that standard RAMM be made WINDOWS based, with data management facilities transferred after "report" and "analysis" screens.***

4.3 Developments That Should Be Undertaken

For the RAMM system to be useful and justify the resources applied to it, it is essential that it meets the reasonable needs of users. As previously noted, the system has many users with differing requirements and interests. The present review, including the specific issues raised in the discussion document, is an attempt to identify users' requirements, interests and priorities in a way that can be included in a strategy for future development of the system.

The responses show that there is little consensus on needs and priorities for development, apart from the need to make RAMM more user friendly, and the

urgent need to improve treatment selection for pavements. As noted above, there is also a clearly expressed need for development to be within a modular framework for a total RMIS.

The discussion document has, if anything, widened the functionality requested. It would be difficult, if not impossible, to meet all needs in the short to medium term. ***Recommended developments and priorities are given below based on the foregoing part of this section.***

High Priority Developments (within 2 years)

- *Agree on a WINDOWS report writer and development tool.*
- *Transfer existing reporting and analysis software for RAMM to WINDOWS.*
- *Develop further WINDOWS reports and graphical presentations, including network statistics, history reports and trend analyses.*
- *Upgrade pavement treatment selection to give more accurate project level treatment identification by incorporating maintenance costs, updated project evaluation methodology, revised condition rating.*
- *Develop a quality systems approach for data collection and updating (e.g. repeatability of roughness measurements and condition rating).*
- *Agree scope and functionality, policies and guidelines for the modules for a total RMIS, allowing for existing bridge, lighting, signs, accidents and traffic systems as far as possible.*
- *Develop a separate position referencing module as the core of a total RMIS.*
- *Redesign the existing RAMM module.*
- *Standardise modules for major structures and traffic facilities.*
- *Develop separate modules for footpaths, grassed and landscaped areas, drainage, minor structures and special features.*

Medium Priority Developments (within 5 years)

- *Redesign pavements treatment selection to incorporate pavement performance modelling, dynamic segmentation and automatic sectioning, high speed data, skid resistance data, CBR values for pavement layers, Benkelman Beam and Falling Weight Deflectometer readings.*
- *Develop a network budget optimising and asset management strategy module covering routine maintenance, reseals and rehabilitation. (Review World Bank module).*
- *Develop database of actual road centre lines.*
- *Develop a traffic module with provision for: network volumes from counts, vehicle types, loadings, growth, travel times and delays, and link with pavements module.*
- *Develop modules for asset valuation, administration of road access and use, planning, and auditing maintenance expenditures and performance.*

Lower Priority Developments

- ***Develop links with the LTSA Accident Investigation System, street lighting, signs, land, digital pictures and other databases, and with road operations systems such as CM2000.***
- ***Facilitate links with GIS products (GIS vendors to provide).***
- ***Support for investigations/inspections, access control, access permissions and pipeline easements.***

4.4 Benefits and Costs

With the level of information available at this stage, it is not possible to provide any quantifiable costs and benefits for the developments recommended. ***It is recommended that each of the recommended developments be scoped and costed as a separate project before a final decision to proceed with that development is made.*** The likely order of cost, including research as well as software development, for the high priority developments in total is $300,000 - $500,000. As pointed out in the discussion document (para 3.16) the cost of the development for use in a cost/benefit analysis, also needs to allow for the cost of obtaining the data and keeping it current. This cost will be significant for some of the recommended developments, e.g. the improved treatment selection, but will be zero for other developments.

Benefits from a RMIS are savings in road expenditures (compared with expenditures without the RMIS), and savings in road user costs (from better roads compared with the situation without the RMIS). As identified in the discussion document, it is difficult to quantify such benefits, particularly before the RMIS is operational. However studies of operational systems that have been undertaken in Canada and the USA indicate benefit cost ratios ranging from 14 to more than 100.

The main benefits resulting from the recommended developments for the RAMM system are likely to come from improvements in treatment selection and network optimisation. Quantifiable benefits from developments such as converting RAMM to WINDOWS and providing better presentation ability, will be relatively small but, based on the expressed demand for these facilities, there are significant intangible benefits of getting RAMM accepted as a user-friendly tool for road network management.

4.5 Responsibilities for Development and Support

TNZ has been involved with development and support of RAMM because:

- It is a major user of RAMM.
- It wanted to assist TLAs in developing road management systems in a cost effective manner.
- It wanted to manage the cost of RAMM development.

- It wanted a common system so that comparisons could be made between TLAs.

Conclusion 3.3(s) is that TNZ/Transfund continue to manage the development of standard RAMM. Under the new TNZ structure recently implemented, overall responsibility for RAMM has been assigned to the Programme and Funding Division. The functions of this division will become the responsibility of Transfund from 1 July 1996. Thus the responsibility for RAMM development will reside with Transfund. TNZ will remain a major user of RAMM in its role as state highway manager.

It is recommended that the standard set of RMIS modules for which Transfund is primarily responsible be:

- *Location reference.*
- *Road names.*
- *Carriageway pavements, road shoulders and surface water channels.*

In terms of its statutory functions Transfund should have an interest in other modules such as those for bridges and other road assets. There are, however, commercially developed systems already available for these assets. Transfund can facilitate the harmonisation and further development of other modules by establishing specifications for all RMIS modules in co-operation with other interested parties and recognising these systems in its research and development and financial assistance funding.

It is recommended that Transfund be responsible for:

- *Establishing policies, specifications and a development plan for a total RMIS.*
- *Controlling and funding the development of a standard set of RMIS modules.*
- *Establishing a RMIS Advisory Group consisting of representatives from Transfund, TNZ, ALGENZ and consultants to oversee the use and development of the standard set of RMIS modules and facilitate the development and use of other RMIS modules.*
- *Owning the standard set of RMIS modules and providing these to TLAs at nominal cost.*
- *Assisting with funding for training and support for the standard set of RMIS modules if necessary.*
- *Assisting with research and development funding for modules other than the standard set.*

It is recommended that the RMIS Advisory Group be responsible to Transfund for:

- *Recommending policies, specifications and a development plan for a total RMIS.*
- *Providing advice to Transfund on the implementation of the RMIS development strategy.*
- *Managing development of the standard set of RMIS modules.*
- *Overseeing training and use of the standard set of RMIS modules.*
- *Facilitating commercial or co-operative development of other RMIS modules.*
- *Working with vendors to develop links with the standard set of RMIS modules.*

It is recommended that users, including TNZ, TLAs and consultants, be responsible for:

- *Funding, developing, documenting and supporting complementary applications, and making these available to other users.*
- *Training their staff in the use of RAMM.*

It is recommended that software for the standard set of RMIS modules be developed and supported by organisations under contract to Transfund.
It is recommended that opportunities for co-operative development of RMIS modules between such organisations as the local government National Asset Management Steering Group (NAMS) and the state highway management division of TNZ be investigated.

It is recommended that the market be encouraged to develop systems outside the standard set of RMIS modules to Transfund guidelines for sale to users.

It is recommended that users be free to decide where they obtain support for computer hardware, WINDOWS, and use of RMIS systems.

It is recommended that training packages for the standard set of RMIS modules be developed under contract to Transfund, and that the delivery of training be provided by any competent organisation.

It is clear from the responses that many RAMM users are disappointed with the progress that has been made with RAMM development. It is essential that in agreeing to a development strategy for RAMM, Transfund understands and makes the necessary resource commitment. *It is recommended that at least one senior person within Transfund be responsible full time for RMIS.*

4.6 Financial Assistance

The recommended basis for financial assistance is:

- *All costs of purchasing computer hardware, and software (including*

upgrades) be treated as capital with depreciation costs only qualifying for financial assistance.

- *Computer hardware and software maintenance costs be output costed as a professional service.*

- *Staff training for the standard set of RMIS modules and any associated modules be an overhead on the business unit, or network manager, and not qualify directly for financial assistance.*

- *Inventory and condition rating surveys, data entry and analysis for the standard set of RMIS modules be output costed as for other professional services.*

- *Costs of operating the standard set of RMIS modules be charged to the Maintenance Management System work category.*

- *Transfund underwrite training costs, if necessary, for the standard set of RMIS modules to ensure adequate availability of courses.*

The advantage of the above changes would be to bring financial assistance for RAMM into line with that for other management and professional services activities, and also to provide financial assistance to associated road management systems.

To speed up implementation of small enhancements and changes to standard RAMM modules, *it is recommended that the software developer be provided with a small annual budget to be used within guidelines set by the RMIS Advisory Group.*

4.7 Further Research

It will be clear from the developments recommended that there is a significant amount of further research required for RAMM and an extended RMIS. Each development recommended requires research to define the scope and details of the development prior to the commissioning of software development.

4.8 Summary of Recommendations

(1) That RAMM becomes part of a comprehensive Road Management Information System (RMIS) (4.2.1).

(2) That the framework for an overall RMIS be logically modular as shown by the data groups in Figure 4.2.1 (4.2.1).

(3) That the modular framework for the RMIS has at its centre a link-node

location referencing module (4.2.1).

(4) That the overall RMIS applies only to public roads (4.2.2).

(5) That the RMIS covers all road assets (4.2.2).

(6) That the existing RAMM module be restricted to carriageway pavements, road shoulders and surface water channels (4.2.2).

(7) That an inventory and rating system for major structures and a traffic facilities inventory remain as separate but linked modules (4.2.2).

(8) That none of the DOSLI land database information be duplicated within RAMM or even directly linked to RAMM (4.2.2).

(9) That discussions be held with vendors of signs management systems for the purpose of extending their systems to include traffic facilities (4.2.2).

(10) That commercial interests be encouraged to develop a new module covering footpaths, grassed areas and landscaping (4.2.2).

(11) That consideration be given to whether drainage could be handled by PAMS (4.2.2).

(12) That links be provided between RMIS modules so that information can be considered together (4.2.2).

(13) That RAMM have the functionality to fully support Transfund activities (4.2.3).

(14) That RAMM or a comprehensive RMIS also adequately support the road management needs of all road controlling authorities (4.2.3).

(15) RAMM become a project identification tool, but not a project design tool (4.2.3).

(16) That RAMM be not primarily designed to support the operational and research functional levels (4.2.3).

(17) That there be a distinct separation between RAMM and systems used by contractors in assessing, estimating, scheduling, executing, reporting and billing work (4.2.3).

(18) That RAMM provide information to contractors to the extent that it is available (4.2.3).

(19) That RAMM have links with operational level systems to facilitate data transfer (4.2.3).

(20) That the specification of a comprehensive RMIS include requirements for operational level systems as far as information is required for the other levels (4.2.3).

(21) That the RMIS be made available to consultants involved with road management (4.2.3).

(22) That RAMM not be designed specifically for consultants (4.2.3).

(23) That integration of RAMM with corporate systems be left as a decision for each organisation (4.2.3).

(24) That Transfund reviews and specifies its requirements for the sectoral level (4.2.4).

(25) That RAMM continues to support the recording of assets, rehabilitation needs assessment, and recording work done for carriageway pavements (4.2.4).

(26) That systems for travel demand management and property management not be duplicated in RAMM (4.2.4).

(27) That network statistics, asset management strategy, budgeting, asset valuation, administration of road access and use, planning, and auditing maintenance expenditures and performance be supported by the RMIS and have priorities for development in proportion to demand as indicated by the responses (4.2.4).

(28) That improvement projects not be included in RAMM or an extended RMIS in the medium term (4.2.4).

(29) That routine maintenance activities be included in network level optimisation in sufficient detail to allow optimisation (4.2.4).

(30) That support for investigations/inspections not be provided in the medium term (4.2.4).

(31) That treatment selection be supported at a project identification level (4.2.4).

(32) That the extended RMIS have links to design programs, but that design programs not be duplicated within RAMM (4.2.4).

(33) That support for research and development only involve supply of data if available (4.2.4).

(34) That all data elements be tested against the criteria: relevance, reliability, affordability, appropriateness (4.2.5).

(35) That quality procedures be developed to ensure data integrity (4.2.5).

(36) That maintenance and updating of the database incorporate software features to minimise editing, corrections and data management (4.2.5).

(37) That provision be made for integration of digital pictures in future developments of RAMM on an optional use basis (4.2.5).

(38) That the degree of detail on work history and asset properties be resolved relative to end use of the information (4.2.5).

(39) That provision be made in RAMM for pavement profile, skid resistance (SCRIM) and deflections (Benkelman Beam, Falling Weight Deflectometer) data on an optional use basis (4.2.5).

(40) That serious consideration be given to the amount of such data that should be collected and how it should be stored (4.2.5).

(41) That the AIS system not be duplicated within RAMM or an extended RMIS but that the linkage be improved (4.2.5).

(42) That provision for recording travel time delays and other road capacity measures not be included in RAMM in the short term, but that provision be made within a separate traffic module (4.2.5).

(43) That provision continue to be made for optional data (4.2.5).

(44) That the treatment selection analysis be improved (4.2.6).

(45) That an initial upgrade to the treatment selection analysis incorporate maintenance costs, updated project evaluation methodology, and revised condition rating, followed by a redesign of the algorithm to incorporate pavement performance modelling, dynamic segmentation and automatic sectioning, high speed data, skid resistance data, CBR values for pavement layers, Benkelman Beam and Falling Weight Deflectometer readings (4.2.6).

(46) That RAMM provide budget optimisation and network condition for a given budget (4.2.6).

(47) That no special provision be made for nation-wide optimisation (4.2.6).

(48) That safety and construction projects not be included in the optimisation process (4.2.6).

(49) That methods of identifying road sections with potential for improvement be considered further (4.2.6).

(50) That network optimisation of bridge activities is not necessary (4.2.6).

(51) That RAMM have the ability to predict pavement performance (4.2.6).

(52) That prediction of safety and capacity performance be left outside of a RMIS in the medium term (4.2.6).

(53) That the evaluation processes be made the same so that a RAMM analysis is acceptable for funds programming purposes (4.2.6).

(54) That requirements for trend analysis be accommodated by pre-programming analysis macros in standard statistical packages (4.2.6).

(55) That RAMM report and analysis screens be the first transferred to WINDOWS (4.2.7).

(56) That local authority experience linking RAMM to GIS be monitored and taken into account in future RAMM developments (4.2.7).

(57) It is recommended that Transfund does not try to specify a particular GIS for use with RAMM, but works with GIS vendors to develop means of linking RAMM databases and modules to GIS developments (4.2.7).

(58) That standard RAMM be made WINDOWS based, with data management facilities transferred after report and analysis screens (4.2.8).

(59) Developments and priorities be as set out in section 4.3.

(60) That each of the recommended developments be scoped and costed as a separate project before a final decision to proceed with that development is made (4.4).

(61) That the standard set of RMIS modules for which Transfund is primarily responsible be:

- Location reference.
- Road names.
- Carriageway pavements, road shoulders and surface water channels (4.5).

(62) That the responsibilities of Transfund, the RMIS Advisory Group and users (including TNZ, TLAs and consultants) be as set out in section 4.5.

(63) That software for the standard set of RMIS modules be developed and supported by organisations under contract to Transfund (4.5).

(64) That opportunities for co-operative development of RMIS modules between such organisations as the local government National Asset Management Steering Group (NAMS) and the state highway management division of TNZ be investigated (4.5).

(65) That the market be encouraged to develop systems outside the standard set of RMIS modules to Transfund guidelines for sale to users (4.5).

(66) That users be free to decide where they obtain support for computer hardware, WINDOWS, and use of RMIS systems (4.5).

(67) That training packages for the standard set of RMIS modules be developed under contract to Transfund, and that the delivery of training be provided by any competent organisation (4.5).

(68) That at least one senior person within Transfund be responsible full time for RMIS (4.5).

(69) That the basis for financial assistance for RMIS be as set out in section 4.6.

(70) That the software developer be provided with a small annual budget to be used within guidelines set by the RMIS Advisory Group (4.6).

5. REFERENCES

Kennaird, A. 1995. Development of the RAMM system - A discussion paper. *Transit New Zealand Discussion Document.* 80pp.

Transit New Zealand 1995. RAMM - Discussion document workshops.

APPENDIX 1

ISSUES ON WHICH RESPONSE WAS INVITED

APPENDIX 1 - ISSUES ON WHICH RESPONSE WAS INVITED

(a) Which of the following items should be included in standard RAMM and what priority should be given to each:

- i an enhanced signs inventory;
- ii an inventory, condition rating, and treatment selection module for bridges;
- iii condition rating and treatment selection for other non-pavement assets;
- iv allowance for high-speed data collection;
- v skid resistance data in treatment selection;
- vi accident data;
- vii inspection scheduling;
- viii road asset valuations;
- ix access control details;
- x access permissions for drain cleaning;
- xi pipeline easements;
- xii CBR values;
- xiii Benkelman Beam readings;
- xiv a lighting facilities inventory.

(b) Should RAMM be linked to land ownership and tenure data?

(c) Which of the following functions should be supported by an extended road management system and to what extent:

- i network statistics;
- ii budgeting;
- iii asset management strategy;
- iv planning;
- v auditing maintenance expenditures and performance;
- vi investigations and inspections.

(d) Should routine maintenance needs be included in RAMM and be optimised together with rehabilitation?

(e) Is there a need to extend RAMM to include improvement projects in the optimisation process?

(f) Should provision be made for the various RAMM databases to be integrated so as to allow the nationwide optimisation of road maintenance and rehabilitation decisions?

(g) Should an extended road management system allow for the storage and retrieval of pictures of assets?

(h) What degree of detail should be allowed for recording:

- i the history of work carried out on an asset;
- ii material properties of an asset.

(i) Should travel times/delays and other road capacity measures be recorded against road sections?

(j) Should RAMM continue to allow optional data in tables and should this be extended?

(k) Given the current small amount of expenditure on bridge renewals, is it necessary to have a full bridge management system, or would a bridge inventory compatible with RAMM be sufficient?

(l) Should TNZ require all road controlling authorities to have a standard computer based bridge inventory?

(m) Should geographic coordinates be input into RAMM for all road sections or features?

(n) Should RAMM be the principle database for traffic information or should it just have a link to other databases?

(o) Should RAMM be extended to include standard procedures for preparing a multi-year strategic programme of all maintenance and rehabilitation activities?

(p) Should there be more explicit instructions from TNZ as to how RAMM treatment selection should be used?

(q) Should a facility to predict safety and capacity of a road section or network be included in an expanded road management system?

(r) Would you prefer TNZ to publish a general specification for a pavement management system and allow road controlling authorities to use any complying system, or is the present requirement to use only one system preferred?

(s) Should TNZ continue to control development of the standard version of RAMM, and if not, what arrangement is favoured?

(t) Is the present arrangement for training and support (para 2.25) working satisfactorily, or is there a better way?

(u) Should the standard version of RAMM be converted to a WINDOWS environment, or should this be only an option?

(v) Should financial assistance for RAMM be brought into line with other management and professional services activities in the manner listed in para 5.37, and what other changes should be made?

APPENDIX 2

RESPONDENTS BY CATEGORY

APPENDIX 2 - RESPONDENTS BY CATEGORY

Local Authorities

Ashburton District Council
Auckland City Council (via Auckland City Development Consultancy)
Christchurch City Council
Gisborne District Council
Gore District Council
Hastings District Council
Hutt City Council
Invercargill City Council
Manukau City Council
Masterton District Council
Matamata Piako District Council
Napier City Council
Selwyn District Council
Southland District Council
South Taranaki District Council (2)
Tararua District Council (via Tararua Consultancy)
Waimakariri District Council
Waipa District Council
Waitakere City Council
Westland District Council

Transit New Zealand

State Highway Management Division
Gilberd
Inch

Consultants

Beca Carter Hollings & Ferner
Christopher Bennett
CJN Technologies
T H Jenkins & Associates
University of Auckland
WDM Limited
Works Consultancy Services (Christchurch)
Works Consultancy Services (Napier)

APPENDIX 3

SUMMARY OF RESPONSES TO ISSUES

APPENDIX 3 - SUMMARY OF RESPONSES TO ISSUES

A3.1 Which Requested Facilities Should Be Included in Standard RAMM and with What Priority?

A3.1.1 Enhanced Signs Inventory

Include in RAMM with high priority. (Invercargill C C, Matamata Piako D C, Southland D C).
Include with medium priority, but could be outside standard RAMM. (Beca Carter Hollings & Ferner).
Include with priority. (Manukau C C).
Include. (Gore D C, South Taranaki D C, Works Consultancy - Napier).
Possibly include. (Christchurch C C).

Should be supported by an extended road management system, but should remain optional. (Tararua D C).
Support via links into other systems. (Waimakariri D C).
Link RAMM to signs inventory (SAM) in the medium term instead of including it in RAMM. (Masterton D C).

Only minor modifications should be made to the existing signs inventory. (Selwyn D C, TNZ - SH Management).
Current RAMM database is adequate. (Westland D C).
Don't include. (Works Consultancy - Christchurch).

A3.1.2 Bridge Module

Include bridge management system (BRIMMS) with high priority. (Invercargill C C).
Include in RAMM with high priority. (Matamata Piako D C, Southland D C, Waipa D C).
Include with medium priority, but could be outside standard RAMM. (Beca Carter Hollings & Ferner).
Include. (Christchurch C C, South Taranaki D C, Waitakere C C, Works Consultancy - Napier).

Should be supported by an extended road management system, but should remain optional. (Tararua D C).
Link RAMM to bridge inventory (BRIMMS) in the medium term instead of including it in RAMM. (Masterton D C).
Support via links into other systems. (Waimakariri D C).
Should be outside RAMM. (Works Consultancy - Christchurch).

Don't duplicate existing bridge inventory and maintenance systems. (Ashburton D

C, TNZ - SH Management).
Don't include. (Selwyn D C, Westland D C).

A system is required for bridges, but there is a difference of opinion as to whether this should be part of RAMM or kept separate. Only need a simple treatment selection and optimisation process, if any at all. (Workshops).

A3.1.3 Non-pavement Assets

Include with medium priority. (Invercargill C C, Matamata Piako D C).
Include condition rating and treatment selection for stormwater channels, shoulders and culverts with priority. (Manukau C C).
Include condition data for stormwater channels, parking lanes, and footpaths. (Hutt C C).
Include with low priority. (Southland D C).
Include in standard RAMM. (South Taranaki D C, Works Consultancy - Napier).
Possibly include. (Christchurch C C).
Possibly include, but could be outside standard RAMM. (Beca Carter Hollings & Ferner, TNZ - SH Management).

Should be supported by an extended road management system, but should remain optional. (Tararua D C).
Support via links into other systems. (Waimakariri D C).

Don't include. (Selwyn D C, Westland D C, Works Consultancy - Christchurch).

A3.1.4 High Speed Data Collection

Include in RAMM with high priority. (Southland D C, South Taranaki D C, Westland D C, Beca Carter Hollings & Ferner, TNZ - SH Management).
Primary effort should be given to high speed data collection. (Masterton D C).
Include high-speed data collection import/export as a [high] priority. (Ashburton D C).
Include in RAMM with medium priority. (Auckland C C, Invercargill C C, Matamata Piako D C).
Include with medium priority, with refined technology. (Christchurch C C).
Include. (Gore D C, Hutt C C, Waimakariri D C, Works Consultancy - Christchurch, Works Consultancy - Napier).
Provide for high speed data collection if cost effective. (Selwyn D C).

Should be supported by an extended road management system, but should remain optional. (Tararua D C).

High speed data collection is not important at present. (Manukau C C).

A3.1.5 Skid Resistance Data

Include with high priority. (Auckland C C, Invercargill C C, Westland D C, Beca Carter Hollings & Ferner, TNZ - SH Management).
Include in RAMM medium priority. (Matamata Piako D C, Southland D C).
Include with medium priority, with refined technology. (Christchurch C C).
Include with priority. (Manukau C C).
Include. (Gore D C, South Taranaki D C, Waimakariri D C, Waitakere C C, Works Consultancy - Christchurch, Works Consultancy - Napier, Workshops).

Should be supported by an extended road management system, but should remain optional. (Tararua D C).

Don't include. (Selwyn D C).

A3.1.6 Accident Data

Include accident data tables in standard RAMM with high priority. (Beca Carter Hollings & Ferner).
Include with medium priority. (Auckland C C, Matamata Piako D C).
Include. (Gore D C, Waipa D C, Waitakere C C, Works Consultancy - Napier).
Possibly include. (Christchurch C C).

Should be supported by an extended road management system, but should remain optional. (Tararua D C).
Provide accident data with medium priority by linking with accident database. (Southland D C).
Link RAMM to accident data instead of including this in RAMM. (Ashburton D C, Masterton D C, South Taranaki D C, Waimakariri D C, Westland D C, Works Consultancy - Christchurch, TNZ - SH Management).
Accident data and road geometry should be provided as add-on packages. (Hutt C C).
Keep accident data separate but possibly linked by GIS. (Manukau C C).

Don't include. (Selwyn D C).

A3.1.7 Inspection Scheduling

Include with medium priority. (Invercargill C C, Matamata Piako D C).
Include in standard RAMM. (South Taranaki D C, Waimakariri D C, Works Consultancy - Napier).
Include with low priority. (Southland D C).
Possibly include. (Christchurch C C).

Should be supported by an extended road management system, but should remain optional. (Tararua D C).
Link inspection records to standard RAMM. (TNZ - SH Management).
Don't include. (Selwyn D C, Westland D C, TNZ - SH Management).

A3.1.8 Road Asset Valuations

Include in RAMM with high priority. (Christchurch C C, Invercargill C C).
Include with medium priority. (Auckland C C, Matamata Piako D C, Southland D C).
Include with medium priority, but could be outside standard RAMM. (Beca Carter Hollings & Ferner).
Include. (Ashburton D C, Gore D C, Hastings D C, Selwyn D C, Waipa D C, Works Consultancy - Christchurch, Works Consultancy - Napier).
Possibly include. (Waimakariri D C, Waitakere C C).

Could be supported by an extended road management system, but should remain optional.(Tararua D C, TNZ - SH Management).

Don't include. (Westland D C).

TNZ/Transfund should develop guidelines for road asset valuation. (Workshops).

A3.1.9 Access Control Details

Include in standard RAMM. (South Taranaki D C, Works Consultancy - Napier).
Include in RAMM with low priority. (Invercargill C C, Matamata Piako D C, Southland D C).
Possibly include, but could be outside standard RAMM. (Beca Carter Hollings & Ferner).

Support via links into other systems. (Waimakariri D C).
Should be supported by an extended road management system, but should remain optional. (Tararua D C, TNZ - SH Management).

Don't include. (Christchurch C C, Selwyn D C, Westland D C).

A3.1.10 Access Permissions

Include in standard RAMM. (South Taranaki D C, Works Consultancy - Napier).
Include in RAMM with low priority. (Invercargill C C, Matamata Piako D C, Southland D C).
Possibly include, but could be outside standard RAMM. (Beca Carter Hollings & Ferner).

Support via links into other systems. (Waimakariri D C).
Should be supported by an extended road management system, but should remain optional. (Tararua D C, TNZ - SH Management).

Don't include. (Christchurch C C, Selwyn D C, Westland D C).

A3.1.11 Pipeline Easements

Include in RAMM with low priority. (Invercargill C C, Matamata Piako D C, Southland D C).
Include in standard RAMM. (South Taranaki D C, Works Consultancy - Napier).
Possibly include, but could be outside standard RAMM. (Beca Carter Hollings & Ferner, TNZ - SH Management).

Should be supported by an extended road management system, but should remain optional. (Tararua D C).
Support via links into other systems. (Waimakariri D C).

Don't include. (Christchurch C C, Selwyn D C, Westland D C).

A3.1.12 CBR Values for Pavement Layers

Include with high priority. (Christchurch C C, Beca Carter Hollings & Ferner).
Include with medium priority. (Auckland C C, Invercargill C C, Matamata Piako D C, TNZ - SH Management).
Include with priority. (Manukau C C).
Include. (Gore D C, Hastings D C, Selwyn D C, South Taranaki D C, Works Consultancy - Christchurch, Works Consultancy - Napier).
Possibly include. (Waimakariri D C, Westland D C).

Should be supported by an extended road management system, but should remain optional. (Tararua D C).

A3.1.13 Benkelman Beam Readings

Include in standard RAMM with high priority. (Christchurch C C).
Include with high priority, and should include falling weight deflectometer readings. (Beca Carter Hollings & Ferner).
Include with medium priority. (Auckland C C, Invercargill C C, Matamata Piako D C, Southland D C, TNZ - SH Management).
Include with priority. (Manukau C C).
Include. (Gore D C, Selwyn D C, South Taranaki D C, Works Consultancy - Christchurch, Works Consultancy - Napier).
Possibly include. (Waimakariri D C).

Should be supported by an extended road management system, but should remain optional. (Tararua D C).

Don't include. (Westland D C).

A3.1.14 Lighting Facilities Inventory

Include in RAMM high priority.(Matamata Piako D C).
Include street lighting inventory (SLIMS) with high priority. (Invercargill C C).
Include with medium priority. (Southland D C).
Include with medium priority, but could be outside standard RAMM. (Beca Carter Hollings & Ferner).
Include lighting inventory (SLIMS) with priority. (Manukau C C).
Include. (Gore D C, Selwyn D C, South Taranaki D C, Waipa D C, Waitakere C C, Works Consultancy - Napier, Workshops).
Include overhead street lighting. (Ashburton D C).
Include or could be a separate system linked to RAMM. (Works Consultancy - Christchurch).
Possibly include. (Christchurch C C).

Should be supported by an extended road management system, but should remain optional. (Tararua D C).
Support via links into other systems. (Waimakariri D C).

Street lighting is already covered by the SLIMS package. (Auckland C C, TNZ - SH Management).
Not a priority. (Westland D C).

A3.2 Should RAMM Be Linked to Land Ownership and Tenure Data?

RAMM should have a land ownership table. (Works Consultancy - Napier).

Yes, but only via a GIS. (Christchurch C C, Invercargill C C, Manukau C C, Southland D C, South Taranaki D C, Waimakariri D C, Beca Carter Hollings & Ferner, Works Consultancy - Christchurch, TNZ - SH Management).
Yes, but with low priority. (Matamata Piako D C).

It doesn't need to be in the standard RAMM system (Beca Carter Hollings & Ferner, Works Consultancy - Christchurch).

No. (Ashburton D C, Auckland C C, Gore D C, Selwyn D C, South Taranaki D C, Westland D C, Works Consultancy - Christchurch).

There are problems using the DOSLI database for some road management purposes because this shows road reserves but not actual road centre lines. TNZ/Transfund should approach DOSLI to resolve the detail required for road management. (Workshops).

A3.3 Which Functions Should Be Supported by An Extended RMIS?

None! Get the core system right first before embellishments. (Selwyn D C).

Only asset management strategy. Network statistics is already supported.

(Invercargill C C).
Only network statistics. (Westland D C).
Network statistics and investigations should be supported by an extended RAMM system. Other functions should be provided for by links to other systems. (Waimakariri D C).
Support network statistics and asset management.(Auckland C C, South Taranaki D C).

Auditing of maintenance is available through CM2000. (Auckland C C, Manukau C C).

Support network statistics, asset management, and investigations and inspections. (Works Consultancy - Christchurch).
Support network statistics, budgeting, and asset management. (Ashburton D C).
Support network statistics, budgeting, asset management, and planning. (South Taranaki D C).

Network statistics, budgeting (except operational), auditing of maintenance, and some data from investigations and inspections. The asset management strategy should not be produced by a single computer process. (TNZ - SH Management).

Budgeting, asset management, planning, and auditing of maintenance. (Gore D C).

Network statistics, budgeting, asset management strategy facility, planning (including allowance for changes in pavement loading), auditing of maintenance. (Beca Carter Hollings & Ferner).

All listed functions except planning. (Christchurch C C, Invercargill C C).
All listed functions except investigations and inspections. (Matamata Piako D C).

All listed functions should be supported. (Southland D C, T H Jenkins, Works Consultancy - Napier).

A3.4 Should Routine Maintenance Needs Be Included and Optimised in RAMM?

Yes. (Auckland C C, Matamata Piako D C, Southland D C, South Taranaki D C, Waimakariri D C, TNZ - SH Management).
Yes, if a 100 percent survey is used. (Manukau C C, Works Consultancy - Christchurch).
On an annual basis only. (Works Consultancy - Napier).

No. (Christchurch C C, Invercargill C C, Selwyn D C, South Taranaki D C, Tararua D C, Westland D C, Beca Carter Hollings & Ferner).

Needs should be based on evaluation of maintenance history. Should define how maintenance data is collected. (T H Jenkins).

A3.5 Should Improvement Projects Be Included in the Optimisation Process?

Yes. (South Taranaki D C, Tararua D C, Waimakariri D C, TNZ - SH Management).
Yes, but not a high priority. (Southland D C, Beca Carter Hollings & Ferner).
Yes, but this would mean a shift in focus to project level and that may cause problems (Selwyn D C, Works Consultancy - Napier).

No. (Auckland C C, Christchurch C C, Invercargill C C, Manukau C C, Westland D C, Works Consultancy - Christchurch).

A3.6 Should RAMM Databases Be Integrated and Optimised Nationally?

Yes. (South Taranaki D C).
Good idea for research. (Beca Carter Hollings & Ferner, T H Jenkins).
Low priority (Southland D C).

No. (Auckland C C, Christchurch C C, Gore D C, Invercargill C C, Manukau C C, Matamata Piako D C, Selwyn D C, Tararua D C, Waimakariri D C, Westland D C, Works Consultancy - Napier, TNZ - SH Management).

A3.7 Should An Extended RMIS Store Pictures of Assets?

Yes. (Gore D C, Invercargill C C, Selwyn D C, Tararua D C, Waimakariri D C, Westland D C).
Yes, especially for bridges, street lighting and signs. (Matamata Piako D C, South Taranaki D C).
Yes, but low priority. (Southland D C, Works Consultancy - Napier).
Possibly, if the cost of storage comes down significantly. (Beca Carter Hollings & Ferner, TNZ - SH Management).

May be more easily accomplished in other systems linked to RAMM. (Works Consultancy - Christchurch).

No. (Auckland C C, Christchurch C C, Manukau C C).

A3.8 What Degree of Detail Should Be Recorded for Work History and Material Properties?

A3.8.1 An Asset's Work History

Sufficient provision already exists, with the exception of bridges and signs. (Beca Carter Hollings & Ferner).

Record broad information only. (Auckland C C).
Record location. (Christchurch C C).
Record sufficient to enable cost monitoring. (Southland D C, Waipa D C).
Record at the level that is material for managing the asset, e.g. activity, location, cost, quantity, date and fault. (South Taranaki D C, Westland D C, TNZ - SH Management).
Record sufficient for pavement deterioration modelling. (Works Consultancy - Christchurch).

A3.8.2 Asset Material Properties

Keep only what is needed. Existing provision is sufficient. (Auckland C C, Christchurch C C, Westland D C, Works Consultancy - Christchurch).
Optional fields for material properties could be provided, but don't clutter RAMM with project level data. (Beca Carter Hollings & Ferner).
Record it for all assets. (Works Consultancy - Napier).
Sufficient detail to describe size, type, composition, and standard. (TNZ - SH Management).

A3.9 Should Travel Times/delays and Other Road Capacity Measures Be Included in RAMM?

Yes, if cost justified. (South Taranaki D C, Tararua D C, Waitakere C C).
Yes, if RAMM is expanded to include improvement projects. (Beca Carter Hollings & Ferner, Works Consultancy - Napier).

Could be optional. (Southland D C).

No. (Auckland C C, Christchurch C C, Gore D C, Invercargill C C, Selwyn D C, Waimakariri D C, Westland D C, Works Consultancy - Christchurch, TNZ - SH Management, Workshops).

A3.10 Should RAMM Allow Optional Data in Tables and Should this Be Extended?

Yes. (Ashburton D C, Auckland C C, Christchurch C C, Gore D C, Invercargill C C, Manukau C C, Matamata Piako D C, Selwyn D C, Southland D C, South Taranaki D C, Waimakariri D C, Westland D C, Beca Carter Hollings & Ferner, Works Consultancy - Napier).

No, a comments field is all that is needed. (Works Consultancy - Christchurch).

Required data should be reconsidered relative to supported functions and analysis. (TNZ - SH Management).

A3.11 Is A Full Bridge Management System Necessary, Or Just A RAMM Compatible Inventory?

A compatible inventory is all that is needed, at least initially. (Auckland C C, Christchurch C C, Manukau C C, Matamata Piako D C, Southland D C, Waimakariri D C, Westland D C, Works Consultancy - Christchurch, Works Consultancy - Napier).
A compatible inventory and rating, e.g. BRIMMS, would be sufficient. (Gore D C, Invercargill C C).
An inventory and rating is probably sufficient. (Beca Carter Hollings & Ferner, TNZ - SH Management).

Most councils have a bridge inventory already. (South Taranaki D C).
Strategic planning ability should be included for bridges. (Waipa D C).
Use it for monitoring and programming maintenance not replacement. (T H Jenkins).
Keep bridge management separate from RAMM. (Auckland C C, Christchurch C C, Selwyn D C, Waimakariri D C).

A3.12 Should All RCAs Have A Standard Bridge Inventory?

Yes. (Gore D C, Invercargill C C, Matamata Piako D C, Southland D C, South Taranaki D C, Works Consultancy - Napier).
Yes, but low priority (Manukau C C).

No. (Auckland C C, Christchurch C C, Selwyn D C, South Taranaki D C, Waimakariri D C, Westland D C).

TNZ/Transfund should develop a specification for a RAMM-compatible system. (Southland D C, Beca Carter Hollings & Ferner, TNZ - SH Management).

A3.13 Should RAMM Keep Geographic Co-ordinates for Road Sections and Features?

Yes, for the purpose of linking RAMM information to a GIS. (Auckland C C, Christchurch C C, Hastings D C, Manukau C C, Selwyn D C, Westland D C, Beca Carter Hollings & Ferner, University of Auckland, Works Consultancy - Napier).

Yes, this is the direction to take (Ashburton D C, Invercargill C C, Southland D C, South Taranaki D C, Tararua D C, Waimakariri D C, TNZ - SH Management, Works Consultancy - Christchurch).

Yes, but standards are needed set for spatial referencing. (TNZ - Inch).

The capability already exists. Geographic co-ordinates are only needed for road section reference points. (TNZ - SH Management, Beca Carter Hollings & Ferner,

Bennett).

A3.14 Should RAMM Be the Main Database for Traffic Information, Or Just Linked to Other Databases?

RAMM should contain the principal traffic database. (Matamata Piako D C, South Taranaki D C, Tararua D C, Waimakariri D C, Beca Carter Hollings & Ferner, University of Auckland, Works Consultancy - Napier).

Link RAMM to other systems. (Auckland C C, Christchurch C C, Invercargill C C, Manukau C C, Masterton D C, Selwyn D C, Southland D C, South Taranaki D C, Waitakere C C, Westland D C, TNZ - SH Management, Works Consultancy - Christchurch).

RAMM currently contains some traffic data. Traffic volumes should be in traffic modelling packages linked to RAMM. A specification for linking should be provided. (Workshops).

Guidelines should be given on the determination of traffic volumes for a network from count data. (Waitakere C C).

A3.15 Should RAMM Be Extended to Produce Multi-year Strategic Programmes for All Maintenance and Rehabilitation?

Yes, using: road condition surveys, dynamic segmentation of the road network, economic analysis of treatment options, budget optimisation, pavement management strategy software, and recording of work done. (Beca Carter Hollings & Ferner, Bennett).

Yes, this would be useful. (Ashburton D C, Auckland C C, Gore D C, Invercargill C C, Manukau C C, Matamata Piako D C, Selwyn D C, South Taranaki D C, Waitakere C C, Works Consultancy - Napier).

Possibly when treatment selection output is accurate. (Southland D C).

RAMM should provide data to a purpose built system. (Works Consultancy - Christchurch).

No. (Christchurch C C, South Taranaki D C, Waimakariri D C, Westland D C, TNZ - SH Management).

A3.16 Should There Be More Explicit Instructions on How RAMM Treatment Selection *Should* Be Used?

Yes. (Auckland C C, Gore D C, Manukau C C, Selwyn D C, Waimakariri D C, Westland D C, Beca Carter Hollings & Ferner).

Yes. Instructions are needed on how to modify the treatment selection to include actual and predicted maintenance costs. (Works Consultancy - Napier).

Maybe in the longer term when the treatment selection algorithm has been upgraded. (Matamata Piako D C, Works Consultancy - Christchurch).

No. (Christchurch C C, Invercargill C C, Southland D C, South Taranaki D C, Tararua D C).

An upgraded treatment selection should minimise the need for more explicit instructions. (TNZ - SH Management).

Education is needed, not instructions. (South Taranaki D C).

A3.17 Should Safety and Capacity Prediction Be Included in An Expanded RMIS?

Yes. (Christchurch C C, Gore D C, Matamata Piako D C, Southland D C, South Taranaki D C, Tararua D C, TNZ - SH Management, Beca Carter Hollings & Ferner).

Yes, if triggered by volume at peak hour per lane (Manukau C C).

Yes to capacity prediction, but safety should be analysed by linking to the Accident Investigation System. (Works Consultancy - Napier).

Include a simple safety analysis in treatment selection. (Beca Carter Hollings & Ferner).

There are differences of opinion on this. Some consider that safety should be an integral part of RAMM. Others consider that safety is not relevant to RAMM and should be left to the LTSA's Accident Investigation System. Generally there is no support for including capacity prediction. (Workshops).

No. (Auckland C C, Invercargill C C, Selwyn D C, South Taranaki D C, Waimakariri D C, Westland D C, Works Consultancy - Christchurch).

A3.18 Should TNZ Advise A General Specification for A PMS Instead of Prescribing A System?

Preference is for a general specification (Auckland C C, South Taranaki D C, Bennett). Then let the market decide how the specification is implemented. (Bennett).

TNZ/Transfund should set standards for road asset management information systems and encourage private sector development of conforming modules. (T H Jenkins,

Workshops).

No, keep the current approach (Ashburton D C, Christchurch C C, Gore D C, Invercargill C C, Manukau C C, Matamata Piako D C, Selwyn D C, Southland D C, South Taranaki D C, Waimakariri D C, Waipa D C, Westland D C, TNZ - SH Management, Beca Carter Hollings & Ferner, Works Consultancy - Napier, Workshops).

TLAs should be allowed to develop systems outside of the standard core RAMM. (Tararua D C, Waimakariri D C).

A3.19 Should TNZ/Transfund Continue to Control Development of Standard RAMM?

Yes. (Auckland C C, Christchurch C C, Gore D C, Invercargill C C, South Taranaki D C, Westland D C, TNZ - SH Management, Bennett, Works Consultancy - Napier).

Yes, but a resource commitment is needed from TNZ/Transfund. (Manukau C C, Waipa D C, Waitakere C C, Beca Carter Hollings & Ferner, CJN Technologies, Workshops).

A partnership with local government and/or ALGENZ should be considered (Ashburton D C, Masterton D C, Matamata Piako D C, Selwyn D C, Southland D C, Tararua D C, Waimakariri D C, Workshops).

A TNZ/Transfund advisory group is best placed to provide direction for road asset management systems development. (T H Jenkins).

A3.20 Is the Current Training/Support Arrangement Satisfactory?

Yes, present arrangements are generally satisfactory. (Auckland C C, Christchurch C C, Invercargill C C, Matamata Piako D C, South Taranaki D C, Waimakariri D C, Westland D C, TNZ - SH Management, Works Consultancy - Christchurch, Works Consultancy - Napier).

Yes, but Transfund should contract The NZ Institute of Highway Technology to provide a specified number of courses and fund any shortfall. (Beca Carter Hollings & Ferner, Workshops).

Competing training and support organisations may provide better service. (Selwyn D C).

No, more flexible training is needed. (Manukau C C, Tararua D C).

No. Other training options are needed for parts of the South Island. (Ashburton D

C, Gore D C, Southland D C).

No. There are problems with number of courses and locations. Rating training needs to be reintroduced. Training for contractors and consultants should receive more attention. TLAs should consider arranging support from CJN Technologies and Beca Carter Hollings & Ferner. (Workshops).

A3.21 Should Standard RAMM Be Converted to WINDOWS?

Yes. It would help user-friendliness and accessibility. (Auckland C C, Gore D C, Hastings D C, Hutt C C, Masterton D C, Matamata Piako D C, Napier C C, Southland D C, South Taranaki D C, Tararua D C, Waitakere C C, Westland D C, TNZ - SH Management, Works Consultancy - Christchurch, Works Consultancy - Napier).

The move to WINDOWS is urgent, particularly for report writing. A decision needs to be made soon so that the changes can be planned. (Workshops).

Reporting and analysis software should be moved to WINDOWS first, using a known report writer such as Microsoft ACCESS or CRYSTAL. A development tool also needs to be chosen for moving other RAMM software to WINDOWS. (CJN Technologies).

Yes. The platforms should be WINDOWS 95/NT. (Ashburton D C, Christchurch C C, TNZ - Inch, Workshops).

Yes, a WINDOWS front-end to UNIX. (Invercargill C C, Manukau C C, Waimakariri D C, Waipa D C, Workshops).

Yes. Move it *totally* out of UNIX and into WINDOWS as the highest priority. (Gisborne D C, Selwyn D C, Bennett, Works Consultancy - Napier).

RAMM should be ported to a Windows database program such as PARADOX or ACCESS. (South Taranaki D C).

A WINDOWS version should be available optionally and the cost should be borne by those that require it. (Beca Carter Hollings & Ferner).

The present RAMM environment is unsuitable and needs to be made more flexible. (T H Jenkins).

A3.22 How Should RAMM Be Treated for Financial Assistance Purposes?

Like any other professional service - output costed with training as an overhead. (Auckland C C, Christchurch C C, Manukau C C, South Taranaki D C, TNZ - SH

Management, Beca Carter Hollings & Ferner, Works Consultancy - Napier).

Training should be directly supported, with output costing for other components. (Manukau C C, Selwyn D C, Westland D C).
Hardware, software, and training should be directly supported. (South Taranaki D C).

TNZ/Transfund should pay all costs associated with transitioning RAMM to WINDOWS, and all dedicated software should receive financial assistance. (Workshops).
Transfund should pay *all* the costs, at least for the core system (Gore D C, Invercargill C C, Southland D C, Waimakariri D C).

Transfund should not contribute to hardware costs at all. (TNZ - SH Management).

Only RAMM should routinely receive financial assistance. (Selwyn D C, South Taranaki D C, TNZ - SH Management).

Financial assistance should be provided for peripheral systems. (Masterton D C, Waimakariri D C, Workshops).
Financial assistance for non-core software should be considered as special cases. (TNZ - SH Management).

Financial assistance should be based on length of the road network and number of bridges. RAMM activities should not be subject to CPP. (Tararua D C).

APPENDIX 4

RAMM QUESTIONNAIRE AND RESPONSES

EFFECTIVENESS OF RAMM

The following questionnaire is designed to provide information on the practical effectivenss of the RAMM inventory and treatment selection.

The objectives of the questionnaire is to identify areas within the system where the expected practical application is being achieved and other areas where improvements can be made.

Road Controlling Authority: . . . . . .

Name of person completing questionnaire . . . . . .

1. INVENTORY

1.1 Are you using the Inventory to:

1.1.1 Manage the maintenance (including reseals) of individual assets

Yes ☐
No ☐

Comment . . . . . .

. . . . . .

. . . . . .

. . . . . .

1.1.2 Determine quantities for contracts

Yes ☐
No ☐

Comment . . . . . .

. . . . . .

. . . . . .

1.1.3 Value the asset

Yes ☐
No ☐

Comment .....

.....

.....

.....

1.1.4 Monitor change in condition, etc., to measure the effectiveness of maintenance strategies.

Yes ☐
No ☐

Comment .....

.....

.....

.....

1.1.5 Locate individual assets for/as part of more detailed evaluation/design.

Yes ☐
No ☐

Comment .....

.....

.....

.....

1.2 Updating of Inventory Data:

1.2.1 Do you have formal procedures in place for maintaining the inventry database?

Yes ☐
No ☐

1.2.2 How would you describe the level of confidence in the reliability of inventory?

95%+ ☐
75 - 90%+ ☐
50 - 75%+ ☐

1.3 Frequency of Use:

1.3.1 Please indicate how frequently the inventory would be accessed, other than for updating.

Daily ☐
Weekly ☐
Monthly ☐
> Monthly ☐

1.3.2 Do you use the UNIX vi text editor and SQL to write your own queries on the inventry?

Yes ☐
No ☐

1.4 Completeness of Data:

1.4.1 Do you maintain parallel inventory systems?

Yes ☐
No ☐

1.4.2 If so, have these been developed to reference the RAMM tables?

Yes ☐
No ☐

1.4.3 Please indicate the general nature of off-line or parallel systems.

. . . . . .

. . . . . .

. . . . . .

. . . . . .

2. TREATMENT SELECTION FUNCTION

2.1 Did you find it necessary to run treatment selection several times against differing criteria (such as B/Cs), to get meaningful results?

Yes ☐
No ☐

2.2 To what extent was the output analysed to ascertain what it was telling you about your network?

Extensively ☐
Moderately ☐
Not At All ☐

2.3 Were the treatment selection reports supplied with RAMM useful, or deficient?

Useful ☐
Deficient ☐

2.4 To what extent were the recommendations validated?

Extensively ☐
Moderately ☐
Not At All ☐

2.5 At a network level, were the recommendations credible?

Yes ☐
No ☐

2.6 At a network level, how reliable would you assess the results:

2.6.1 Pavement structure related recommendations _____ %

2.6.2 Pavement shape related recommendations _____ %

2.6.3 Surfacing related recommendations _____ %

2.6.4 Drainage related recommendations _____ %

2.7 How useful were the outputs in identifying needs at a project site level?

Not At All ☐
Only to Support Decisions made using Different Criteria ☐
Has the potential of being useful ☐
Good Match ☐

2.8 Are the implications of treatment selection outputs, in their present format, understandable?

Yes ☐
No ☐

2.9 At what level were the results used, (including summaries derived from them)?

Executive Management ☐
Technical Management ☐
Field Staff ☐

2.10 Please indicate in general terms, the functional areas where the data was used.

Budgeting ☐
Performance Monitoring ☐
Management Strategy Establishment ☐
Work Identification ☐
Other: ..... ☐
..... ☐

2.11 To what extent did the outputs influence investment in the asset over 12 months following publication?

Not At All ☐
To Some Extent ☐
Significantly ☐

3. ALTERNATE OPERATING SYSTEM

As you know, RAMM runs under the UNIX operating system. There have been requests to have RAMM rewritten to run under a more user friendly environment. This may enable more users to design and run their own reports on the RAMM database, or to integrate the RAMM database with other databases and/or inventories.

Moving RAMM to a new operating system would most probably not be without some initial teething problems, additional costs, retraining and probably a significant speed penalty when running treatment selection.

3.1 Would you like to see RAMM rewritten to run under Windows in a DOS environment?

Yes, definitely ☐
Yes, maybe ☐
Don't know ☐
No ☐

3.2 Would Asset Managers make more use of RAMM if it were in a more user friendly system?

Yes ☐
No ☐

4. Please feel free to offer any feedback (positive or negative) on the inventory or treatment selection function:

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

5. What enhancements would you like to see to enable the RAMM system to provide greater benefits to the road asset manager?

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

Thank you for your input.

EFFECTIVENESS OF RAMM

Graph	Questionnaire
Manage maint on individual assets	**Are you using the Inventory to:** Manage the maintenance (including reseals) of individual assets
Determine quantities for contracts	Determine quantities for contracts
Value the asset	Value the asset
Monitor change in condition	Monitor change in condition, etc., to measure the effectiveness of maintenance strategies.
Locate individual assets	Locate individual assets for/as part of more detailed evaluation/design.
Formal inventory updating process	Is there a process for updating the inventory
Level of confidence in inventory	How would you describe the level of confidence in the reliability of inventory?
Frequency of access	Frequency of Use: Please indicate how frequently the inventory would be accessed, other than for updating.
UNIX - SQL	Do you use the UNIX vi editor and SQL to write your own queries on the inventory
Parallel systems?	Do you maintain parallel inventory systems?
Do they reference RAMM tables	If so, have these been developed to reference the RAMM tables?
Run TS several times	Did you find it necessary to run treatment selection several times against differing criteria (such as B/Cs), to get meaningful results?
Are TS reports useful	Were the reports supplied with the application useful, or deficient?
Validation of recommendations	To what extent were the recommendations validated?
Recommendations: Network	At a network level, were the recommendations credible?
Project level usefulness	How useful were the outputs in identifying needs at a project site level?
TS understandable	Are the implications of treatment selection outputs, in their present format, understandable?
Influence on asset investment	To what extent did the outputs influence investment in the asset over 12 months following publication?
Move to Windows	Would you like to see RAMM rewritten to run under Windows in a DOS environment?
Asset Managers if User Friendly	Would Asset Manager make more use of RAMM if it were in a more user friendly system?

RAMM Questionnaire Responses