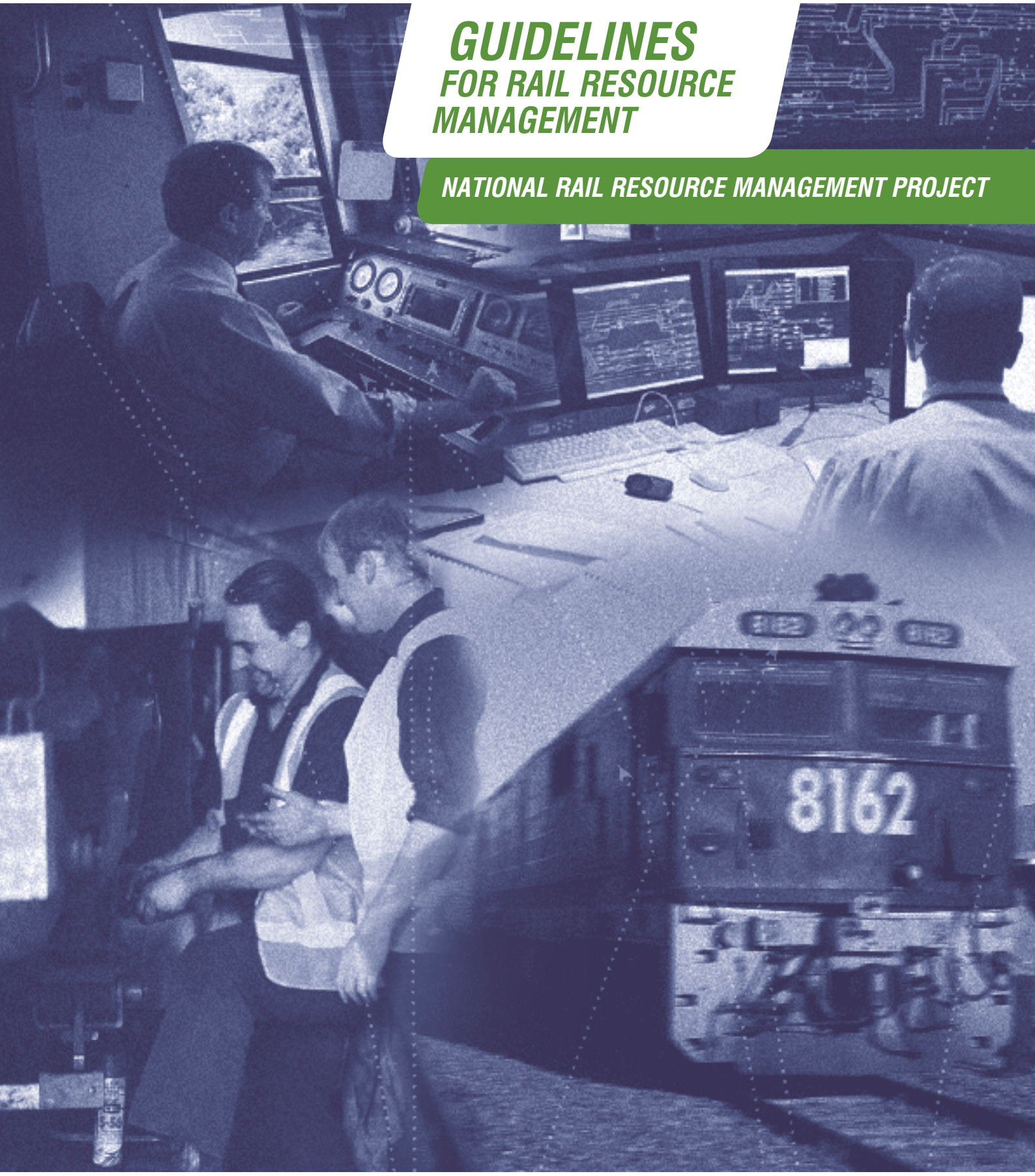
GUIDELINES
FOR RAIL RESOURCE MANAGEMENT

NATIONAL RAIL RESOURCE MANAGEMENT PROJECT



Rail Safety Regulators' Panel

INDEPENDENT TRANSPORT SAFETY AND RELIABILITY REGULATOR

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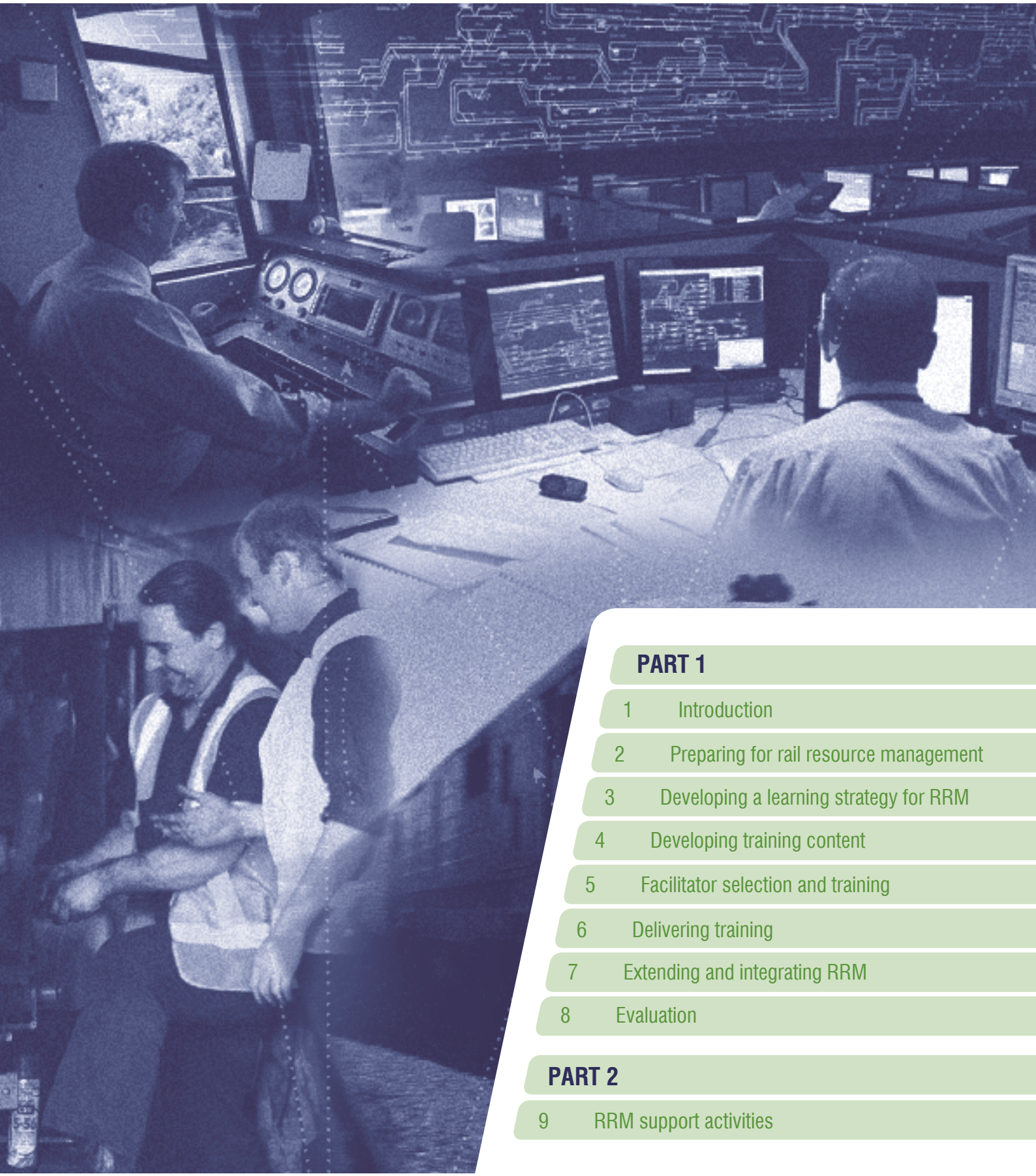

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CD ROM CONTENTS

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FOREWORD

The Rail Safety Regulators' Panel (RSRP)[1] is pleased to endorse these Guidelines for Rail Resource Management (RRM) to the Australian rail industry. The guidelines were produced through the National Rail Resource Management Project, a joint industry and government initiative, sponsored by the NSW Independent Transport Safety and Reliability Regulator (ITSRR) and Public Transport Safety Victoria (PTSV), with the support of the Australasian Railway Association (ARA). The RSRP fully supports this project as a national initiative aligned to our charter to improve safety knowledge and performance within the rail industry.

In our business, as in other hazardous industries, incidents and accidents represent an immense annual cost. Virtually all of these events involve human failure, in the form of errors, violations or flawed decisions. Rail Resource Management is a specialised form of Human Factors training, designed to provide employees with the knowledge, skills and attitudes to minimise and mitigate error, improve operational performance and prevent serious accidents. The RSRP commends Rail Resource Management to all industry operators as a practical and potentially very valuable means of enhancing safety and efficiency, thereby adding to public confidence and sustaining the 'bottom line'.

The approach presented in these RRM Guidelines is considered best practice. It is based on the model of Crew Resource Management developed initially in the aviation industry to help prevent aircraft accidents and successfully adapted into a wide range of other industries. In this project considerable investigation and research with local stakeholders has been undertaken however, to ensure that this approach is appropriately customised to the needs of the Australian rail industry.

The RSRP appreciates the contributions made by government and industry representatives from around Australia to develop these Guidelines, and thanks them for their efforts.

In endorsing the RRM Project to industry, the RSRP hopes that all rail operators will adopt Rail Resource Management in some form, using these Guidelines to plan their journey and keep them on track. The significant safety benefits experienced in other domains from this type of training will only be achievable in the Australian rail industry if this national approach is supported by individual rail operators at the highest level. We encourage your commitment and active participation.

Mick Quinn
Chair RRM Steering Committee
(on behalf of the RSRP)
November 2007

1 The RSRP consists of the Rail Safety Regulators from all Australian States, the Northern Territory and New Zealand.

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LIST OF ABBREVIATIONS

ARO	Accredited Rail Organisation
CAA	Civil Aviation Authority (UK)
CASA	Civil Aviation Safety Authority (Australia)
CMAQ	Cockpit Management Attitudes Questionnaire
CORS	Confidential Observations of Rail Safety
CRM	Crew Resource Management
FAA	Federal Aviation Administration (USA)
FMAQ	Flight Management Attitudes Questionnaire
FRA	Federal Railroad Association
GSA	Generic Safety Activity
HRO	High Reliability Organisation
ICAO	International Civil Aviation Organization
ITSRR	Independent Transport Safety and Reliability Regulator (NSW)
LOFT	Line Oriented Flight Training
LOSA	Line Operations Safety Audit
NASA	National Aeronautics and Space Administration
NOTECHS	Non-technical skill evaluation system
NTSB	National Transportation Safety Board (USA)
OTSI	Office of Transport Safety Investigations (NSW)
PTSV	Public Transport Safety Victoria
QR	Queensland Rail
ROI	Return on investment
RRM	Rail Resource Management
RRMAQ	Rail Resource Management Attitudes Questionnaire
RTO	Registered Training Organisation
T & H	Tourist and Heritage
TCRM	Train Crew Resource Management (US term for RRM)
TLISC	Transport and Logistics Industry Skills Council
TEM	Threat and Error Management
TNA	Training Needs Analysis
TRM	Team Resource Management (CRM in Air Traffic Control)

ACKNOWLEDGEMENTS

The following organisations and individuals are acknowledged for their significant contribution to the National Rail Resource Management Project.

The RRM Steering Committee, which provided governance for the project since its inception, was chaired by Mr Mick Quinn of ITSRR. Members of the Steering Committee have included Dr Graham Edkins, Ms Elizabeth Grey and Mr Chris McKeown (PTSV), Dr Barbara Klampfer, Dr Natalie Pelham, Ms Catherine Herriman and Dr Rob Lee (ITSRR), Mr Phil Sochon (ARA), Ms Cinthia Del Grosso and Ms Lisa Davies (TLISC), Mr Barry Hedley and Ms Robyn Archer (Connex) and Mr Mike Nendick (CASA). We also acknowledge the ongoing support of Mr Alan Osborne (PTSV).

The RRM Reference Group was formed from stakeholders throughout the industry to provide subject matter expertise and "RRM user" perspectives to the project. They played an integral role in shaping the direction, scope and outcomes of this project. The following organisations contributed invaluable support to the project through the time and expertise of their representatives on the Reference Group:

- Australasian Railway Association (ARA)
- Australian Rail Track Corporation (ARTC)
- Australian Railroad Group (ARG)
- Connex Melbourne Pty Ltd
- Department of Transport, Energy and Infrastructure, South Australia
- Independent Transport Safety and Reliability Regulator, NSW (ITSRR)
- National Transport Commission (NTC)
- Office of Rail Safety, Department of Planning & Infrastructure, Western Australia
- Public Transport Safety Victoria (PTSV)
- Queensland Rail
- Queensland Transport
- RailCorp
- Rail Tram & Bus Union, National, NSW
- Transport and Logistics Industry Skills Council (TLISC)
- V/Line Passenger Pty Ltd
- Works Infrastructure Pty Ltd
- Yarra Trams

In addition to Reference Group members, numerous other industry representatives from operators, unions and government made their time available at various phases of the project to provide valuable input and feedback. These included volunteers from the Tourist & Heritage sector, who are especially thanked for their interest and involvement in the project.

Finally, thanks go to Dédale Asia Pacific – in particular Mr Brent Hayward, Dr Andrew Lowe, Dr Kate Branford and Ms Alyson Dalton – for their commitment and expertise in preparing the project deliverables.

PREFACE

These Guidelines for Rail Resource Management in Australia ('the Guidelines') are a key deliverable of Stage 1 of the National Rail Resource Management (RRM) project. This project is being undertaken under the auspices of the Australian Rail Safety Regulators Panel, with the objective of reducing error and improving operational safety in the Australian rail industry through the implementation of applied human factors training, referred to as Rail Resource Management.

This document is the second major deliverable of the National Rail Resource Management project. An Interim Report completed in March 2006 provides background information for those in the rail industry who may be involved in approving, implementing or supporting an RRM program.[1] The Interim Report describes human factors training practices in other industries, including the development and evolution of Crew Resource Management (CRM) in aviation, and its dissemination into other hazardous domains. Best practice principles for designing and delivering RRM are outlined and issues likely to impact on the successful translation of CRM into the Australian rail industry are described.

The Guidelines are designed to provide information to Accredited Rail Organisations (AROs) on the process for implementing and supporting RRM training. Stage 2 of the project involved the development of generic training resources (including a syllabus, training manual, and assessment and evaluation tools) as a starting point for rail organisations to implement a version of RRM training customised to their own context and needs.

The purpose of these Guidelines is to encourage AROs to adopt and support RRM as a form of training and ultimately as an operating philosophy that promotes safety and efficiency for individuals, work teams and organisations. There is currently no intention for RRM training to be a mandatory requirement under National or State rail safety regulation.

These Guidelines present a 'best practice' approach for implementing RRM, based on the experience of CRM in aviation and other industries (and reported in the project Interim Report). It is understood that the best practice model may not be a realistic objective for some parts of the Australian rail Industry at the present time. The reasons for this, reported in detail as implementation barriers in the Interim Report, include a range of practical, commercial and cultural considerations. A number of options for the way RRM can be designed and introduced have thus been included in the Guidelines, recognising that these barriers exist, yet still allowing AROs to implement RRM in some form. These options should be considered acceptable alternatives to the best practice model.

1 Dédale Asia Pacific. (2006). Interim Report, National Rail Resource Management Project: Review of Best Practice, Implementation Issues and Task Analysis. Melbourne/Sydney: PTSV/ITSRR.

NB: The Interim Report is available for download from the ITSRR website: http://www.transportregulator.nsw.gov.au and the PTSV website: http://www.ptsv.vic.gov.au

HOW TO USE THIS DOCUMENT

These Guidelines have been designed to provide basic practical information on the process involved in implementing an initial RRM training program. The Guidelines follow a similar path to one that would be used in introducing any new training activity: analysing the need for training; designing the concept; developing training content and supporting materials, delivering courses and managing the entire program. There are however some unique characteristics associated with the implementation of CRM/RRM training programs, and these are also described.

Figure 1 depicts the major steps described in the Guidelines, corresponding to the main sections of this document.

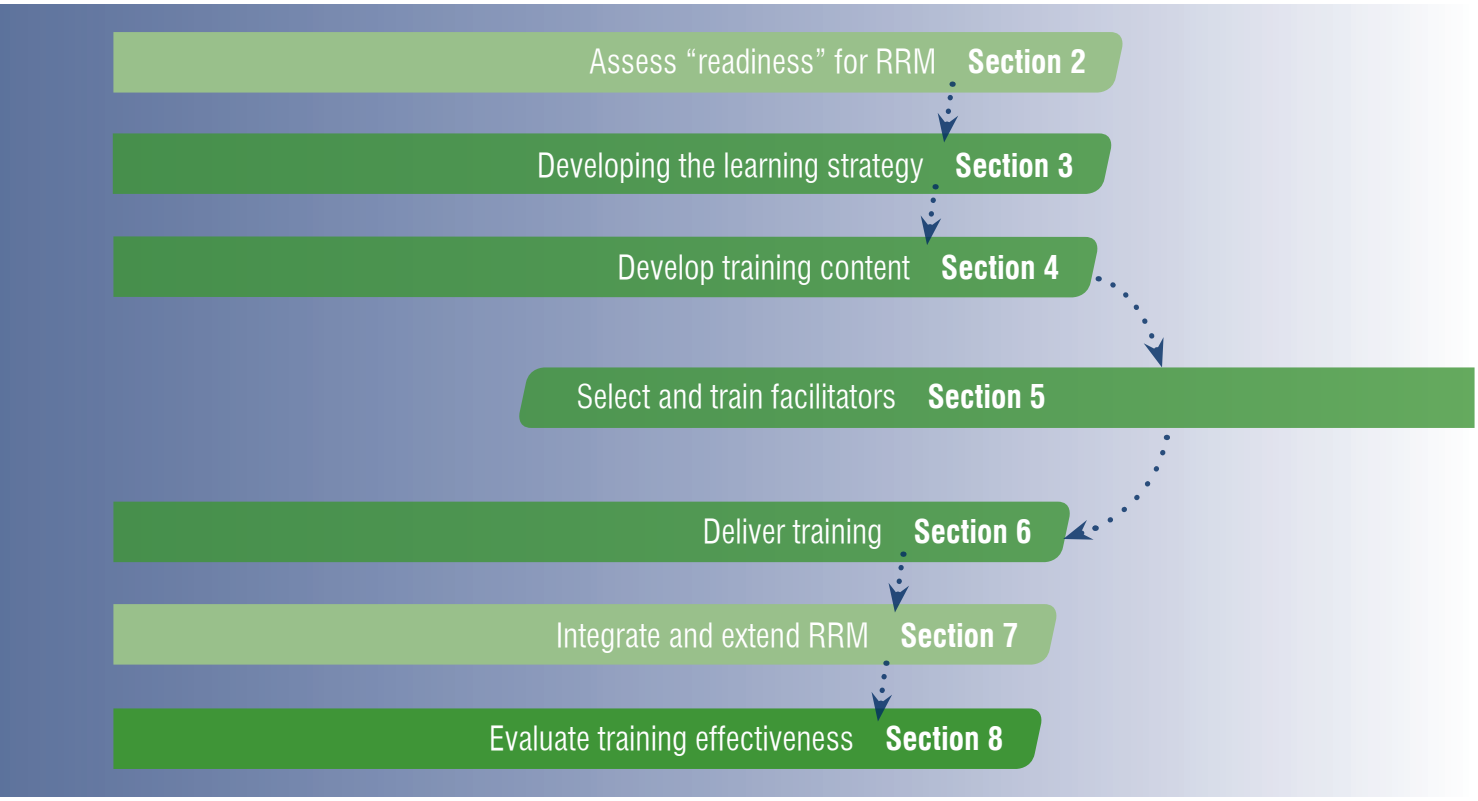

FIGURE 1 OVERVIEW OF RRM IMPLEMENTATION STEPS

Figure 1 includes an initial activity that allows AROs to make a preliminary, informal assessment of their "readiness" to introduce an RRM program. This activity employs a self-assessment questionnaire developed by Professor James Reason to determine the extent to which a "safety culture" can be said to exist in an organisation. The analysis of "Implementation issues" undertaken in the previous stage of this project, and described in Section 7 of the Interim Report, suggested that, apart from practical and resourcing issues, the absence of an established safety culture was likely to be a significant challenge for RRM. The identification of safety culture as a desirable pre-condition for implementing RRM in the rail industry is consistent with experience in other industries where CRM has been implemented.

The self-assessment of readiness for RRM is not intended to discourage or preclude an organisation from proceeding with RRM. It is intended to highlight the issues that could impede or facilitate the success of RRM, and to encourage safety culture enhancement activities in support of RRM implementation.

GUIDELINES STRUCTURE

As apparent from the Table of Contents, these Guidelines have been written using a "question and answer" format. This approach was adopted in consideration of the fact that RRM is a relatively new and unfamiliar concept for the rail industry, and as such users of the Guidelines are likely to have many unanswered questions. This format will also be appropriate for future use on a website that could be accessed by AROs.

The Guidelines have two main parts.

Part 1 includes eight sections relating to the development and implementation of RRM training within AROs.

Section 1 answers questions about the nature and origins of CRM and RRM, and provides relevant background information for ARO managers who want to understand why RRM is being recommended and promoted to the industry.

Section 2 describes some desirable pre-conditions or critical success factors for the implementation of RRM. The use of a Safety Culture self-assessment questionnaire is explained, as tool for evaluating an organisation's readiness for RRM.

Section 3 describes the considerations and decisions involved in developing a learning strategy for RRM. Guidance is provided on adopting an RRM philosophy, determining specific training needs, identifying the target audience for RRM, delivering training and managing the program.

Section 4 explains how the generic RRM training materials (developed as part of this project) can be used and appropriately customised to meet the needs of each ARO. This information will be of interest to Training Managers and Registered Training Organisations (RTOs).

Section 5 describes the important issues involved in selecting and training RRM facilitators. As explained above, peer facilitation is a critical element in successful CRM programs. The quality of RRM facilitators will affect both the classroom experience for participants as well as the wider acceptance and integration of RRM across an organisation.

Section 6 builds on the development of a learning strategy, and explains some of the more practical options for delivering RRM training.

Section 7 refers to the integration of CRM principles and concepts into other training. This is one of the steps through which RRM is extended throughout an organisation's activities as an "operating philosophy" rather than just a set of skills and behaviours shown by individuals who have attended training.

Section 8 concludes the Guidelines by explaining options for evaluating the effectiveness of RRM. Like any training activity, it is proposed that different forms of evaluation should be used to ensure the investment in RRM has tangible benefit to the host organisation.

Part 2 of the RRM Guidelines provides information on ways that an RRM training program can be supported, to ensure that its initial implementation is effective and that it remains a viable long-term program. Seven activity areas are described, covering the broad objective of each activity and the particular actions that will be beneficial. These RRM support activities have been identified from best practice in other industries where Crew Resource Management training has been successful.

Annexes A to I: The Guidelines conclude with a series of Annexes providing further information on a variety of subject matter and tools referred to within the main document.

GETTING STARTED ON RRM IMPLEMENTATION

These Guidelines are directed towards AROs that have developed an interest in implementing RRM and want to know how to proceed. Determining how to begin RRM may seem difficult at first, not least because these Guidelines contain a number of options and issues that should be considered and resolved before an RRM implementation plan is developed.

The process of implementing RRM is likely to be challenging, but need not be excessively difficult or complicated. AROs are encouraged to pursue a form of RRM appropriate to their circumstances and constraints, rather than 'give up' because they seem unable to adhere to every suggestion made in these Guidelines.

To assist AROs that may be unsure how best to proceed, this section sets out a simple plan for getting started. This plan follows the principles of good practice, but omits the more complex options that may not be practical for some AROs, and are not immediately necessary to derive benefits from RRM training. For example, delivering RRM to mixed groups of rail safety workers (such as train drivers and signallers together)[2] could be expected to reduce the risk of particular safety occurrences, but is not essential to gaining the fundamental benefits of RRM.

The steps for getting started on RRM are explained in Table 1 on page 15. Specific sections of the Guidelines relating to each step are referenced in the Table. It is possible therefore to set off down the path to implementing RRM by becoming familiar with each of these sections rather than studying the Guidelines in full. Once a foundation level of RRM has been introduced successfully, AROs should be better placed to tackle the more progressive options that enable RRM to be extended and fully integrated throughout an organisation.

2 For the purposes of this project, 'rail safety workers' are considered to include: train drivers, guards, conductors, signal operators or other employees involved in the control or movement of trains or trams; maintenance workers and supervisors working on the maintenance, repair or alteration of tracks and equipment; employees with duties relating to operational procedures or emergency response; and authorised officers.

TABLE 1 GETTING STARTED ON RRM IMPLEMENTATION

Steps	Reference to relevant section of the Guidelines
1. Assess the extent to which your organisation is 'ready' for RRM. This might only be an intuitive, but honest self-assessment about your organisation's safety culture.	Section 2.1 *Fundamentals of RRM* *Training Implementation*
2. Identify a Project Sponsor and form an RRM Implementation Team, to develop the RRM implementation strategy and oversee RRM activities.	Section 9.4 *Formalise RRM Implementation*
3. Select a group of rail safety workers where RRM would appear to be of benefit (eg., drivers).	Section 3.4 *Identifying the Target Audience*
4. Determine which RRM behaviours are applicable to the nominated worker group, and are not currently covered in training.	Section 3.3 *Defining the Training Need*
5. Customise the generic training materials (provided through the National RRM Project) to your local requirements.	Section 4.4 *Customising Core RRM Materials*
6. Identify current trainers suitable to facilitate initial RRM training, or able to be cross-trained to do this.	Sections 5.1 and 5.3 *RRM Facilitator Requirements/Training*
7. Incorporate RRM modules in existing training programs, as opportunities arise.	Section 6.2 *Alternative RRM Delivery Options*
8. Use existing methods of training evaluation to determine the extent to which learning outcomes have been achieved.	Section 8.1 *Options for Evaluating RRM Effectiveness*

PART 1

DEVELOPMENT AND IMPLEMENTATION OF RRM TRAINING

SECTION 1

INTRODUCTION

1.1 BACKGROUND ON RAIL RESOURCE MANAGEMENT

What is the national RRM project?

The National Rail Resource Management (RRM) project was commissioned in June 2005 with the objective of providing guidance to the Australian rail industry on implementing contemporary applied human factors training. The project is jointly sponsored by the Department of Infrastructure, Public Transport Safety Victoria (PTSV) and the NSW Independent Transport Safety and Reliability Regulator (ITSRR).

What is RRM?

RRM is the generic name being given to the version of Crew Resource Management (CRM) training being developed for the Australian rail industry. Organisations implementing RRM may well choose to adopt their own "brand name" for the in-house program.

It is the intention of the RRM Project sponsors that a version of CRM applicable to the rail environment be developed, including the guidance information and basic training support materials necessary to facilitate its implementation throughout the Australian rail industry.

How did CRM originate?

Crew Resource Management (CRM) training is a form of applied human factors training that aims to provide operational personnel with the knowledge, skills and attitudes to manage themselves and available resources more safely and effectively.

CRM began in the aviation industry in the late 1970s following a string of serious aviation accidents precipitated by the ineffective management of available resources. The philosophy and training approach used in CRM has since become the accepted model for developing applied human factors skills amongst front-line operators in many high-risk industries.

Further information on the history of CRM is provided in Annex A. A comprehensive review of CRM in aviation and other industries is contained in the Interim Report prepared in the previous phase of the National RRM project.

Why is RRM being introduced?

The aim of the RRM project is to reduce rail safety occurrences attributable to human error, through the introduction of applied human factors training, thereby preventing harm to rail employees and passengers, and increasing public confidence in rail transport systems.

Rail safety workers face the same challenges as front line operators in other hazardous industries – to ensure safety in a dynamic, demanding operational environment by managing threats and errors effectively. Although rail workers are provided with good technical and procedural training, there has been comparatively little focus on the non-technical skills that enable groups such as drivers, guards, train controllers, signallers and around/on the track personnel to work safely.

continued …

continued …	Recent high profile rail accidents such as those at Glenbrook, Hexham and Waterfall in NSW, and the Broadmeadows/Spencer Street Station runaway train accident in Victoria, have highlighted a particular need for rail safety workers to also be better prepared to deal with emergency situations.
Who will be involved in RRM training?	RRM training is designed to develop the non-technical competencies of rail safety workers, that is, all full-time, contracted or volunteer staff (including train drivers, guards, conductors, signal operators or other employees) involved in the control or movement of trains or trams; maintenance workers and supervisors working on the maintenance, repair or alteration of tracks and equipment; employees with duties relating to operational procedures or emergency response; and authorised officers. It is expected that, as part of the process of developing a learning strategy, AROs will determine the particular training needs and the priority target groups for RRM in their own organisation.
Is RRM training mandatory?	While RRM units will be embedded within the Transport & Logistics Training Package and training to achieve the relevant learning outcomes is encouraged, there is no Regulatory requirement for these units to be selected as part of a qualification or in the development of a training program. The adoption of the Transport & Logistics Training Package in National Model Legislation will not require the selection of RRM units. The selection of such units should be based on the requirements of a rail organisation for this type of training and based on a training needs analysis.
How much do managers need to know about RRM?	Managers of an ARO that is implementing RRM need to be fully committed to the philosophy and objectives of RRM. Commitment will come from understanding and accepting that: · human factors and RRM have an important contribution to make to (rail) safety; · the benefits of RRM will not be realised without some investment and hard work within their company; and · RRM will impose obligations on them individually to “walk the talk” of RRM. To properly support RRM, managers need to understand the principles of a safety culture and be prepared to demonstrate a visible commitment to this. This includes, for example, accepting that errors occur, dealing with them in a just way, and creating an environment that allows the organisation to learn from them.

When will RRM be conducted?

The knowledge and skills acquired through RRM training are relevant throughout the entire career of rail safety workers. Ideally therefore, some RRM or associated human factors training would be provided very early in a person's career, for example, as part of initial employment qualifications or as part of company induction programs. RRM knowledge and skills would then be reinforced on the job and progressively developed through further formal training. Under this 'cradle to grave' model, RRM is an integrated element of other on-going professional training, rather than a stand-alone course.

Because there has been little exposure to RRM in the rail industry to date, the initial implementation plan is to allow as many rail safety workers as possible to acquire basic RRM skills through a very broad, single level initial RRM course, attended by workers of all levels of industry experience. In the longer term, this delivery option would not be necessary, as people joining the industry would 'grow up' with RRM fully integrated into other qualifications.

What are the main features of RRM training?

Crew Resource Management training was first developed in aviation to meet a practical and pressing need. Aviation accidents were occurring not because crewmembers lacked technical competence, but for reasons associated with human and team performance factors. CRM had the objective of providing pilots with non-technical skills to complement their high technical proficiency, covering topics such as teamwork, leadership, communication, situational awareness, effective judgement and decision making, and workload management.

A model for delivering initial CRM courses subsequently evolved in which the training experience and process were as important as the individual learning outcomes. The main features of this preferred model for CRM delivery are explained in Table 2 on page 22.

This model is not presented as the only approach to implementing CRM successfully. It is recognised that similar learning outcomes can be achieved through quite different learning activities and experiences. Rather, it is provided as a reference point when different options for implementing CRM are discussed throughout this document.

FURTHER READING

Dédale Asia Pacific. (2006). *Interim Report, National Rail Resource Management Project: Review of Best Practice, Implementation Issues and Task Analysis*. Melbourne/Sydney: PTSV/ITSRR.

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Wilson, J.R., Norris, B., Clarke, T., & Mills, A. (Eds.). (2005). *Rail human factors: Supporting the integrated railway.* Aldershot, UK: Ashgate.

TABLE 2 FEATURES OF THE TRADITIONAL CRM DELIVERY MODEL

1. Safety objective	The concepts presented should have direct relevance to the operational safety issues encountered by participants. Highlighting the safety benefit is designed to attract the interest of even highly experienced and professionally self-assured operators in acquiring new skills.
2. Course focus	Training is focused on enhancing the performance of crew as members of a team rather than as individuals, although some self-management competencies are typically also addressed.
3. Course facilitation	Courses are conducted by trained volunteer "peer facilitators", whose operational experience gives them credibility with the group. They are also selected on their ability to act as positive CRM role models in the organisation.
4. Course structure and length	Initial CRM topics are ideally delivered in a single consolidated training event, rather than dispersed over many months, providing a substantial one-off exposure to human factors and safety concepts. Initial training courses are usually between one and three days' duration, and are usually supplemented by single day annual recurrent training events.
5. Participants	CRM training typically brings together in the classroom participants with different experience, backgrounds, knowledge, beliefs and opinions. This is a valuable opportunity to exchange experience and to influence attitude change through exposure to other opinions and ideas.
6. Joint training [4]	Where practicable, members of extended or distributed teams will be involved in joint training, reinforcing the 'one team concept' and increasing mutual understanding and respect. (In aviation for example, pilots and cabin crew often attend joint CRM training sessions).
7. Classroom climate	A classroom climate is created that allows open discussion and disclosure, and the potential to learn from the mistakes and 'near misses' of others in a 'no blame' environment.
8. Feedback to organisation	CRM training courses can provide a new avenue for organisational feedback and learning, if management agrees to listen to participant concerns on issues such as fatigue, additional training needs, or operational hazards.
9. Assessment of learning	Learning is not assessed at the end of initial CRM training, but appropriate CRM skills and behaviour become the focus of feedback, development and ongoing reinforcement as CRM concepts are integrated into subsequent training activities or performance management programs.

4 Joint training refers to courses that are attended by participants from more than one specialised work role. For example, train drivers and signallers and/or controllers could be rostered to attend the same RRM training sessions.

1.2 THE CONCEPT OF RAIL RESOURCE MANAGEMENT

What is Human Factors?	Human factors is a multidisciplinary field concerned with optimising the performance of individuals and teams in the workplace. The broad domain of human factors is an applied science that draws on methods and principles from psychology, other behavioural and social sciences, as well as engineering, ergonomics and physiology. The aim of human factors is to reduce error and improve safety and efficiency through an understanding of human capabilities, limitations and the way people interact with their work environment. This includes the equipment they use, the rules and procedures they work under, and how they communicate with other people to successfully accomplish a wide range of tasks. This knowledge can then be applied to improve training, and the design of the work environment and systems that will reduce the likelihood of incidents and accidents.
How does CRM/RRM differ from Human Factors training?	CRM is a form of applied human factors training. In contrast to purely or predominantly knowledge-based human factors courses, CRM training uses an experiential, adult learning approach to provide operational personnel with the understanding and skills required to manage themselves and all available resources more safely and effectively. CRM training does not just provide theoretical knowledge. Rather, it encourages participants to examine their own operating style and challenges them to adopt attitudes and behaviours that are associated with the effective management of threats and errors in the work environment.
What topics are covered in RRM training?	There is no prescribed list of topics for RRM training. The support materials developed for this project will include topics based around a set of identified competencies (referred to as Behavioural Markers) known to be associated with safe and effective work performance. These relate to the skills involved in effective leadership, communication, task and workload management, teamwork and coordination, self-management, problem solving and decision making, risk management, situational awareness and emergency management. Further information on the core topics for initial RRM training is provided in Section 4.2 and in Annex B.
Do we need RRM if some of these topics are already being trained?	It is recognised that a number of units of competence in the current rail industry training package[5] include aspects similar to those that may be covered by RRM. For example, units already exist on fatigue management, problem-solving, communication and teamwork. In the future it is intended that some of these units will be expanded, where applicable, to include elements of RRM, thus helping to embed RRM in all training programs. In the interim however the outcomes of this project will provide specific RRM units of competence and a specialised training program, designed around a

continued …

5 A Training Package is a framework of nationally endorsed qualifications and competency standards (units of competence) and assessment guidelines. Training Packages describe the skills and knowledge required to perform competently in the workplace, define Industry Standards and present learning outcomes without being prescriptive about how these are to be achieved.

continued …	specific set of RRM competencies. The intention in providing for industry both a model delivery program and units of competence is to make the implementation of RRM as easy as possible for AROs. It is also important that the RRM units of competence be formalised so that workers completing RRM training can have their knowledge and skills acknowledged as part of nationally recognised Qualifications and/or Statements of Attainment.
Where else has this form of training been used?	The CRM training model first developed for airline pilots was subsequently extended to other important components of the aviation system, including cabin crew, maintenance workers and air traffic controllers, with the aim of enhancing the performance of individuals and teams in both routine and emergency situations. Forms of CRM training are currently being used to improve safety and prevent accidents and incidents attributable to human error in other high-hazard domains, including the maritime industry, healthcare, offshore oil and gas production, nuclear power generation, military operations and space flight.
Can CRM benefits be demonstrated?	Formal and informal evaluation processes have been used to measure the effectiveness of CRM, in aviation and other industries. While it is difficult to demonstrate the exact commercial benefits of CRM, there is mounting evidence, both empirical and anecdotal, that CRM does contribute to organisational safety and efficiency, and thus has direct financial payoffs for an organisation. It also promotes the development of a 'Safety Culture' and other characteristics associated with so-called 'High Reliability Organisations' (HROs; see Weick, 1987; Roberts, 1990, 1993). Evidence emerging from a recently-completed US study of the economic value of CRM training sponsored by the Federal Railroad Association (FRA) is reputed to strongly support a business case for the benefits of CRM-style training for rail (Olsen, 2006). Further discussion of evaluation is included in Section 8 of this document and in the project's Interim Report (Section 3).
Can RRM fix other organisational problems?	While it is expected that RRM will improve safety and efficiency by changing the attitudes and behaviour of individuals and teams in the workplace, it should not be viewed as a universal panacea for the myriad of systemic deficiencies that hamper rail operators, as they do many other industries and organisations. RRM will not in itself transform dysfunctional, poorly managed organisations, described by Westrum (1995) as "pathological", into healthy, well-functioning ones.

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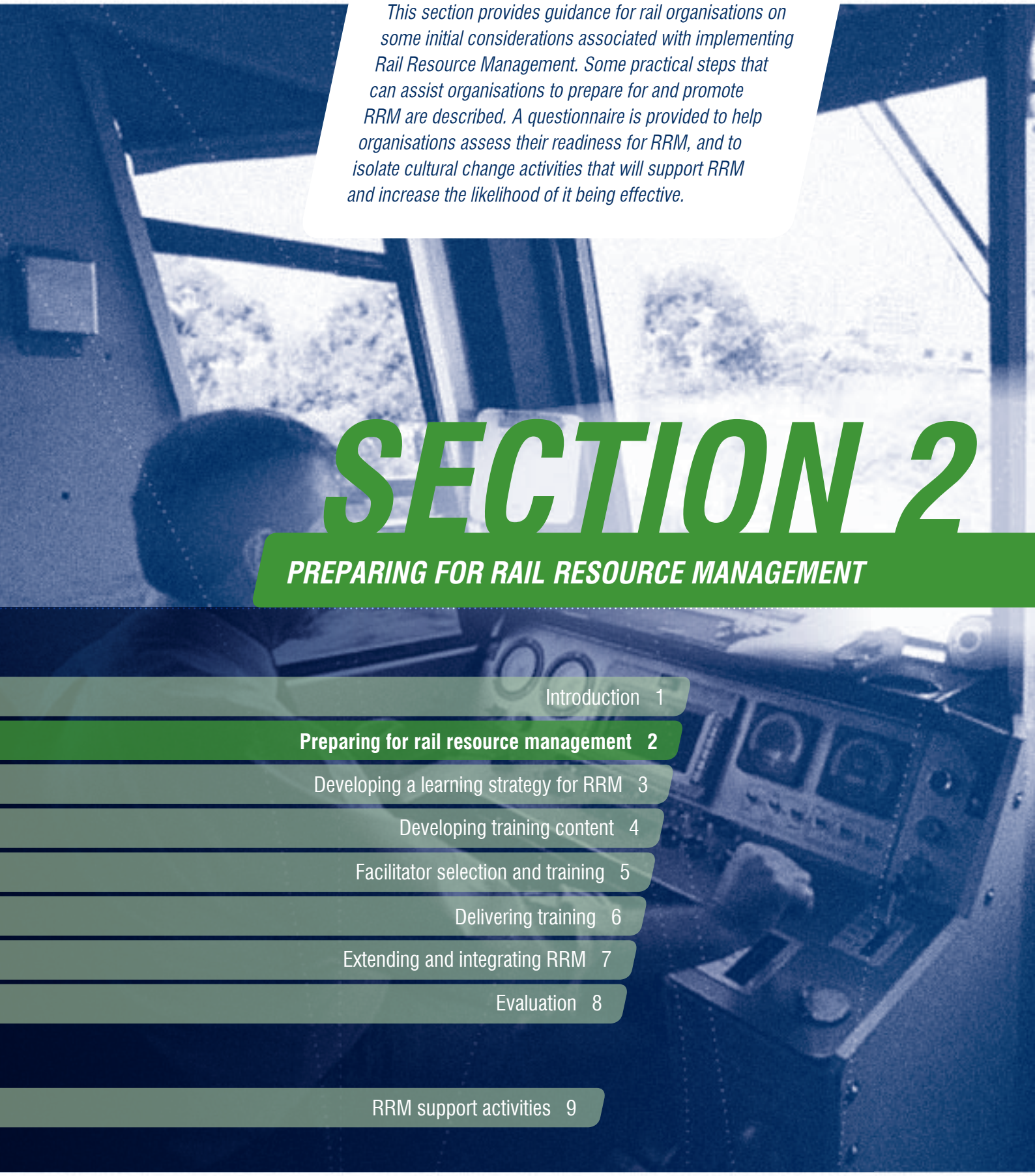

This section provides guidance for rail organisations on some initial considerations associated with implementing Rail Resource Management. Some practical steps that can assist organisations to prepare for and promote RRM are described. A questionnaire is provided to help organisations assess their readiness for RRM, and to isolate cultural change activities that will support RRM and increase the likelihood of it being effective.

SECTION 2

PREPARING FOR RAIL RESOURCE MANAGEMENT

2.1 FUNDAMENTALS OF RRM TRAINING IMPLEMENTATION

Can RRM be implemented in any rail organisation?

All organisations employing rail safety workers will be free to implement these Guidelines and use the associated RRM training support materials. When preparing to introduce RRM it is important to consider the "readiness" of the organisation for this form of training. This is because the philosophy of RRM may clash with the existing culture, by challenging current beliefs, attitudes and operating practices.

In these circumstances it will be difficult for the principles being presented in RRM training to be put into practice in the workplace. For example, RRM supports the principle that workers should report errors that might have had serious consequences, so that everyone can learn from them and safety will be enhanced. If the present culture is inclined to blame and/or punish people for committing 'normal errors' then employees are unlikely to speak up.

What if we do not have a good safety culture?

Organisations where the culture is not already aligned to the RRM philosophy should not be deterred from introducing it. RRM is a significant organisational development activity, designed to be a catalyst for cultural change by influencing the attitudes and behaviour of all employees.

It can be concluded from the experience of industries like aviation that organisations already showing the attributes of a proactive or generative safety culture will find it easier to implement RRM and will see greatest effect from it. Conversely, organisations lacking such a culture are likely to take longer to see initial improvement and to realise the full benefits of RRM. In any organisation however RRM training can contribute to the development and maintenance of a positive safety culture.

Is a "just culture" important?

As one element of safety culture, a "just culture" is also very important to the successful implementation of RRM. In a just culture, acceptable and unacceptable behaviour is clearly defined, and people are not blamed for normal errors. Equally importantly, those who intentionally violate established rules and procedures should be held accountable for their actions. Such a policy encourages people to openly discuss errors and even routine violations, so that other people can learn from them and improvements can be made to the error tolerance of the system.

An established just culture philosophy is important to RRM because RRM training will promote open disclosure and discussion of errors as a means of sharing experience and better appreciating the presence of threats and errors. The practice of candidly exchanging information in the RRM classroom will not transfer into the workplace if a culture of blame predominates in the wider organisation.

The earlier consultation phase of the National RRM project revealed that the just culture philosophy is not yet formalised in most AROs contacted. The level to which it is established varies from companies which appear to have "just" values

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continued …	regarding error, blame, and punishment, without ever having formalised such a policy or practice, through to those in which there is still a strong insinuation or demonstration of individual blame after an error or incident.
How can "readiness" for RRM be assessed?	When contemplating the implementation of RRM and the "readiness" of the organisation for this, it is useful to make at least an informal appraisal of the current organisational culture. This is because most of the factors that influence the long-term viability of RRM relate to aspects of the host organisation's safety culture. There are numerous approaches available for gaining insight into safety culture. These include quantitative methodologies such as administering questionnaires on opinions about safety to representative samples of employees, through to more qualitative methods such as interviews or focus groups. While it is outside the scope of this project to review these alternatives and recommend an approach, a Safety Culture Questionnaire is provided in Annex C that may assist AROs to make an informal self-assessment of the likely 'fit' between their present culture and RRM.[6] It should be noted that while CRM training is mandatory for airlines in most jurisdictions, many airlines have successfully implemented CRM without the benefit of a pre-existing mature or positive safety culture.

6 This questionnaire was developed by Professor James Reason and presented at the Manly 2000 Symposium of the Australian Aviation Psychology Association. A version of the questionnaire that can be completed and automatically scored on the internet can be found on the Transport Canada website: http://www.tc.gc.ca/civilaviation/systemsafety/brochures/menu.htm

2.2 RRM CRITICAL SUCCESS FACTORS

What will influence the success of RRM?

The single most important influence on the success of an RRM program will be the level of commitment to the program demonstrated by an organisation's managers. The senior management group in particular plays an important role, not only in ensuring that RRM is adequately resourced at the outset, but by continuing to demonstrate active interest and support. Even more critically, all managers should provide visible leadership in clearly demonstrating the principles and standards of behaviour associated with RRM. Like any other major cultural change initiative, RRM must be strongly supported not just by what management says, but also by what management does.

How important is management commitment?

Experience from aviation indicates that if CRM training does not have true management support it will wither, never realising its full potential (Helmreich, 1993). Organisations in which senior management have demonstrated a firm commitment to CRM and its importance for safety by providing the resources required to implement intensive initial and recurrent CRM training have experienced greater acceptance of CRM than those which merely provide a brief introduction to the training and concepts.

In fact, management involvement can extend beyond the immediate focus of RRM. Helmreich and Merritt (1998) suggest that true management commitment will be achieved when it is apparent management accepts that "CRM training is not a single fix for human error. Rather, it is a part of an organization's commitment to error management that includes building and nurturing a safety culture".

How is management commitment gained?

The first step in promoting management commitment to implement RRM is to inform them about its potential benefits. Because RRM will in effect be competing with other projects and priorities for resources and attention, individual managers need to be convinced that RRM is of benefit to their core business activities and that it will pay for itself through improved safety and efficiency.

Management awareness and interest in RRM can be realised through briefing sessions and/or workshops, designed to establish a high level of understanding amongst managers about:

- the place of human factors in (rail) safety
- the nature, benefits and limitations of RRM training
- the responsibility placed on managers for demonstrating commitment and appropriate behaviour in support of RRM.

Ideally, managers should be involved in these awareness sessions well before the rollout of RRM training to rail safety workers begins. As part of this project, a series of presentations have been made to a range of ARO managers, to begin the process of communicating benefits and gaining support. It is suggested that

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these introductory sessions should be followed up with in-house RRM awareness programs for all employees.

Material will be supplied through the project to assist organisations to build business cases and promote the related benefits of RRM implementation.

Further information on promoting RRM awareness is provided in Part 2 of these Guidelines.

How is employee awareness about RRM raised?

Well before RRM training begins it is also important to alert employees to the forthcoming initiative. Information about RRM should be disseminated to the workforce through normal internal communication channels (intranet, newsletters, etc.) which reach management, employees, and relevant unions. These should include an overview of why RRM is being introduced, what the training will involve, the anticipated benefits, and an outline of plans for initial and recurrent training.

Investment in this initial communication strategy will help prevent potential misunderstandings about the focus of the training or any aspect of its implementation. The way an RRM program is "advertised" to future attendees is also important in overcoming attitudinal barriers to its acceptance. For example, more experienced employees may feel threatened by having to attend training that invites them to share information about their errors and safety attitudes. Advance information on the RRM program should emphasise the potential for workers to enhance communication and teamwork skills and to learn from the experiences of others.

Those responsible for managing safety and conducting incident and accident investigations within relevant organisations should also be made aware of and/or required to participate in the RRM training initiative in order to promote adequate consideration of human factors and RRM-related issues in investigations. Ensuring that safety investigations adequately consider RRM-related issues can also provide a valuable source of information on RRM-related problems and successes in the field that can be used as case studies in future RRM courses.

What else impacts on RRM effectiveness?

The way training is delivered will have some bearing on the profile and ultimate effectiveness of RRM. The "best practice model" for RRM (explained further in Section 3.1 below) involves a consolidated block of training over two or three consecutive days. This model has proven effective in aviation by providing a significant one-off exposure to the safety thinking and processes of CRM, which tends to be diluted if training is delivered over a more extended period of time.

The RRM training package will nevertheless be flexible enough for organisations to deliver either as a stand alone consolidated course (eg., over two to three days) if resources allow, or to deliver the modules progressively as time permits if consolidated course delivery is impossible. This will assist organisations which

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may be unable in the short-term to roll-out a comprehensive initial RRM program because, for example, they are unable to release adequate numbers of workers for training.

Although the best practice model is a consolidated course, RRM has been delivered differently in elements of the US rail industry, with some operators for example modifying the delivery schedule and presenting RRM training in four to five segments over a four to six week period (Morgan et al, 2003). Another solution is to provide organisations with brief but meaningful RRM modules that can be more easily integrated into existing training, thus overcoming timing and resourcing issues. This solution may be particularly advantageous for the Tourist and Heritage industry where rail workers are mostly part-time volunteers.

Given that progressive modularised delivery of RRM training may be necessary for some organisations, it should be remembered that this approach is unlikely to yield the full benefits associated with consolidated interactive training in a classroom setting.

How important is joint training?

Joint training is the option that best fulfils a fundamental goal of RRM, which is to improve cooperation between extended or distributed work teams and optimise the use of all available resources.

Implementing joint RRM training will be difficult in the Australian rail industry where many groups of safety workers who interact regularly in the workplace are not employed by the same company. If the full benefits of RRM are to be realised a new training paradigm for the industry will be needed, involving inter-organisational cooperation to plan and conduct RRM courses that bring together rail safety workers from different roles and organisations. Where this proves impractical, the option of single-group RRM training will still provide substantial benefits to the participants.

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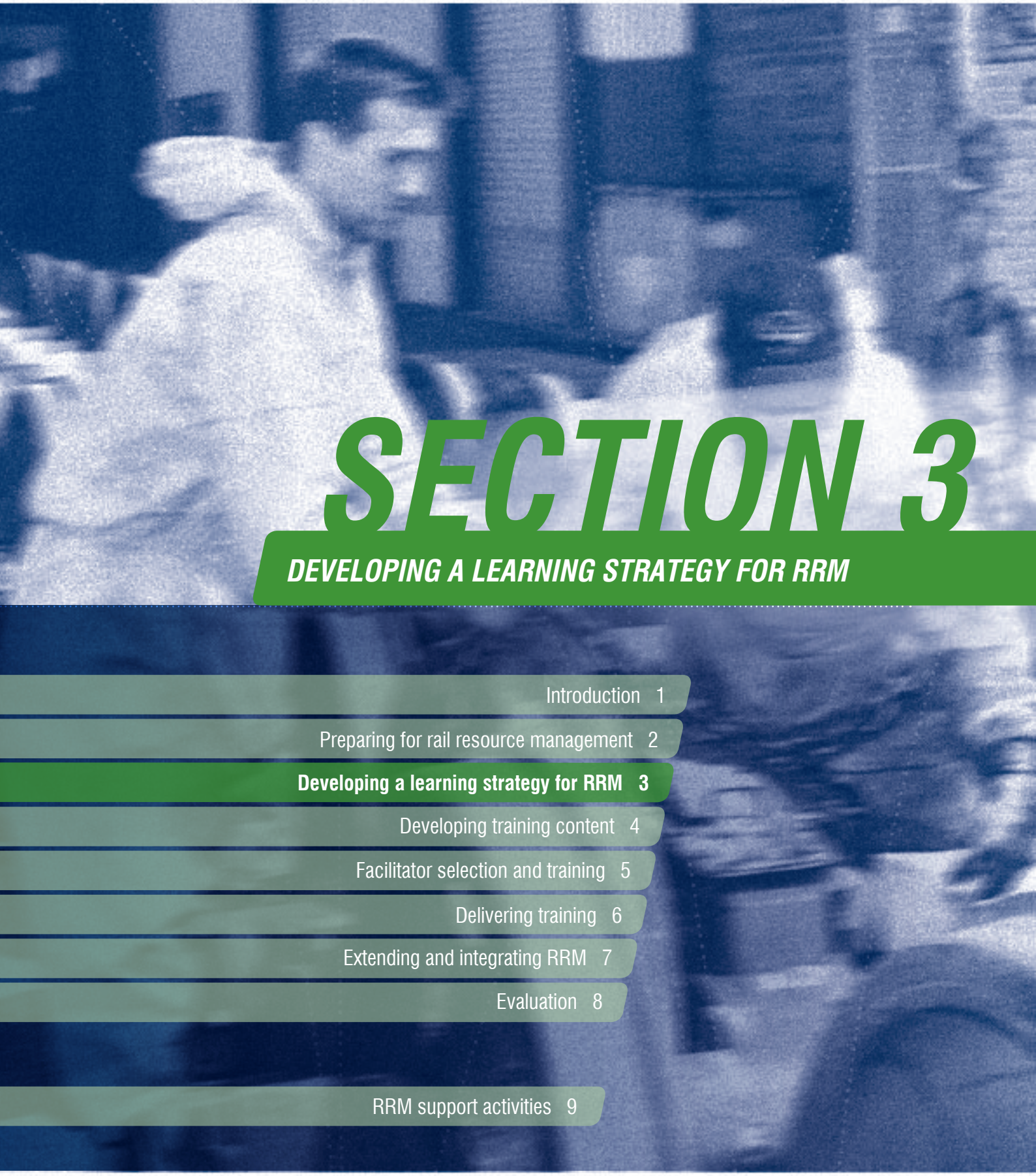

SECTION 3

DEVELOPING A LEARNING STRATEGY FOR RRM

3 DEVELOPING A LEARNING STRATEGY FOR RRM

This section explains how rail organisations can develop a learning strategy for Rail Resource Management, customised to suit their particular needs, constraints and circumstances. The elements of a basic learning strategy are outlined, drawing on the "best practice" model for RRM derived from the experience of CRM in aviation and other industries. Other alternatives for achieving benefit from RRM are provided for organisations that may be unable to implement this ideal RRM solution.

The section begins by emphasising the notion that RRM is more than simply a one-off training activity, and is in fact an "operating philosophy" that will ideally permeate an organisation's culture. The elements of a learning strategy for an initial RRM course are then described, covering options for defining the RRM training need, identifying the target audience, determining the best means of delivering training, and managing the rollout of RRM training. These steps are summarised in Figure 2 below.

FIGURE 2 DEFINING THE RRM LEARNING STRATEGY

3.1 BEST PRACTICE RRM MODEL AND OTHER OPTIONS

What characterises RRM training?

Table 3 sets out the main characteristics of a best practice RRM model, and summaries some other options that can be considered. Where alternatives are not considered viable in achieving the intended outcomes of RRM, the reason for this is stated.

TABLE 3 RRM BEST PRACTICE MODEL AND OPTIONS

Element	Best practice	Acceptable alternatives	Not recommended
1. Course focus	Safety issues affecting participants in their day-to-day work; clearly identified as RRM	Safety focus, but integrated into other workplace training or safety discussions	Lack of coherent safety focus; mixing RRM elements with other non-related training
2. Course facilitation	Conducted by specially selected and trained "peer facilitators"	Conducted by existing in-house trainers	External trainers
3. Course length	Consolidated training event delivered over 2 to 3 consecutive days	Units delivered separately over a period of months	Units not identified as "RRM"
4. Participants	Mix of participants by experience, knowledge, background, seniority	Single professional group/ cohort on each course	
5. Joint training	Members of extended teams, and different work roles on same courses	Single professional group/ cohort on each course	
6. Classroom climate	Adult learning environment, promoting open discussion and disclosure	None	Didactic, lecture style approach
7. Feedback to organisation	Process for participant concerns to be relayed to management for action	No such process	Managers 'sit in' to observe RRM courses (ie., without participating)
8. Assessment of learning	Not formally assessed at initial RRM training; RRM competencies subsequently evaluated via 'non-jeopardy' workplace assessments to provide feedback and skill development	See Section 8: Evaluation	Assessment of RRM skills with perceived career, or other negative consequences

What are the benefits of the preferred model for RRM?	The preferred model for Initial RRM training has been found effective in aviation and other industries because it: · Provides learners with a consolidated training experience over a number of days with a dedicated focus on safety; · Allows sufficient time to create a classroom atmosphere conducive to adult learning and open interaction; · Is facilitated by peers of the participants who know the topical operational concerns of participants, speak their 'language' and understand the professional and organisational cultures; · Involves exchange of views and information between extended team members who do not normally attend training together. This facilitates a better understanding of each others' roles, priorities, goals and constraints. · Can promote recognition that management is concerned about safety and prepared to accept constructive feedback; · Encourages follow-up discussion and interaction between participants outside formal classroom sessions.
What variation is possible to the best practice model?	Variations to elements of the best practice approach may be considered when practical and⁄or resourcing limitations preclude their use. The variations considered acceptable, as noted in Table 3 above are: · Learning activities are integrated with existing training at or near the workplace; · Units are delivered separately over a period of weeks or months; and · Each group of safety workers is trained separately.
What are the disadvantages of varying from best practice?	Varying from the best practice model when delivering initial RRM training will reduce the extent to which learning outcomes are achieved. For example: · The principle that RRM training should focus on the functioning of rail safety workers as a complete team will not be achieved unless joint training is conducted with all relevant work roles in the same classroom. · The impact of RRM as a philosophy for safe operations will be reduced if RRM units are distributed over many months or dissolved into other non-safety related training. · Short, isolated training sessions do not allow sufficient familiarity and understanding to be established between participants to encourage frank discussion of error and other safety concerns. RRM in some form is nevertheless preferable to no RRM at all, and variations to the best practice model should be adopted if there is no practical or commercially viable alternative.

3.2 ADOPTING THE RRM PHILOSOPHY

What makes RRM different from other forms of training?

It is important to recognise that RRM is more than just a new staff training course, although this is often the way CRM was first introduced in other industries. The ultimate aim of RRM is to fundamentally improve an organisation's operating culture and safety. This cannot be achieved through a one-off training course, or through cosmetic changes to existing training that addresses non-technical skills. A broad but cohesive set of activities is required to integrate RRM principles into an organisation's operating philosophy, policies, procedures, practices, and current training processes.

The achievement of this outcome in the Australian rail industry will involve significant change with the potential to affect everyday operating practices, the nature and focus of training, and potentially the existing management culture.

What are the limitations of RRM training?

There have been misunderstandings in the past about the objectives and limitations of CRM training. As with CRM, it is important to recognise that RRM is not intended to:

- Act as a panacea for all organisational problems
- Be a quick fix for dysfunctional individuals or systems
- Replace or compensate for a lack of technical proficiency
- Be conducted as a passive lecture course
- Dictate staff behaviour or provide a specific prescription on how to work with others
- Alter personality or provide any sort of therapy to participants.

What are the different stages of RRM training?

Based on CRM training guidance material issued by the US Federal Aviation Administration (FAA) and the UK Civil Aviation Authority (CAA), an effective RRM training program should comprise three main phases: *awareness; practice and feedback;* and *reinforcement* (Federal Aviation Administration, 2004; Civil Aviation Authority, 2002, 2003).

The **Awareness Phase** involves presenting basic knowledge to support skill acquisition. This phase is important because it provides a conceptual framework and a common vocabulary to introduce participants to crew coordination issues and the influence of these in contributing to accidents and incidents. The awareness phase typically comprises classroom presentations focusing on the role of interpersonal and team factors in establishing and maintaining effective crew coordination. Topics introduced here are likely to include communication, decision making, crew coordination, and situation awareness. For maximum learning benefit, the RRM curriculum needs to relate these concepts directly to operational issues encountered by rail safety workers.

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continued …	The second phase of RRM training involves **Practice and Feedback** to consolidate learning from awareness training and support the transfer of skills from the classroom to the working environment. The use of some form of simulation training to practice relevant behaviours is one potentially valuable way of providing practice and feedback. The third phase of RRM training involves continuous **Reinforcement** of RRM principles and behaviour in the workplace. This phase is critical because one-off classroom exposure to the RRM curriculum will not be sufficient to ensure long-term attitudinal or behavioural changes. Ideally RRM concepts will eventually be integrated into all stages of training and be continually reinforced in line operations. Further information of these phases of RRM is provided in the Interim Report. Section 7 of these Guidelines also discusses the processes involved in using practice, feedback and reinforcement strategies to further integrate and extend RRM.
How is RRM awareness training delivered?	The first step in implementing RRM is to provide awareness level training. This remainder of this section of the Guidelines describes the options for designing and implementing an RRM awareness course, referred to as Initial RRM training. The training support materials to be provided in the final stage of this project could be used as the basis for an Initial RRM Course. Consistent with the National Training Framework these Guidelines allow for flexibility in the development and delivery of Initial RRM training, and encourage further learning in the work environment to optimise achievement of learning outcomes. Notwithstanding the need for flexibility, a "best practice" model is presented as the recommended approach for Initial RRM training. The recommended model has been described in Table 3 on page 34.
Are there any other important RRM principles?	The following additional principles have been recognised as important to the successful implementation of RRM: · RRM has particular application to developing skills in emergency management and should be an integral part of all such training in an organisation. · The use of simulation training to practice relevant RRM behaviours is an important part of the practice and feedback phase of RRM training. · Ultimately, RRM concepts should be integrated into every stage of training and be continually reinforced in day-to-day operations. These topics are discussed further in Section 7, Extending and Integrating RRM.

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3.3 DEFINING THE RRM TRAINING NEED

What needs to be trained in RRM?	The objective of Rail Resource Management is to ensure that front-line operators possess the competencies necessary to perform safely in all circumstances. As with any form of training, to design, develop and evaluate RRM training properly it is necessary to clearly define these competencies – the specific interpersonal skills, behaviours and attitudes associated with safe, proficient performance. The term *Behavioural Markers* is commonly used in aviation and other industries to describe these competencies. In this project the competencies to be addressed in RRM are set out in a framework referred to as the Rail Safety Behavioural Marker System. This framework supports the implementation of RRM by providing a tool and benchmark for evaluating and developing the non-technical skills of rail safety workers. The framework is shown in Annex D.
How were the Rail Safety Behavioural Markers developed?	First, a Task Analysis was undertaken to develop a set of generic task descriptors that could be used to generate a profile of task requirements for any rail safety worker role. These have been termed Generic Safety Activities (GSAs), reflecting the fact that they are not specific to a particular occupation or task, but are underlying job requirements that enable work to be completed safely. The Behavioural Markers were developed by linking competencies to each of the GSAs. For example, if "giving clear and unambiguous instructions" was an important activity for a rail safety worker (the GSA), specific communication skills and perhaps proficiency in some aspects of task planning or situational awareness would be required to do this successfully. These competencies would be defined in the Behavioural Marker system, and become a learning outcome in RRM training.
Will all RRM training address the same Behavioural Markers?	As all rail safety worker roles and tasks are different, a specific subset of the Generic Safety Activities will apply to each role. Only those Behavioural Markers associated with relevant GSAs for a particular work role need to be addressed in RRM training.
How are training needs defined for each group of rail safety workers?	A formal process is recommended to define specific training needs for each rail safety worker role. This analysis should be undertaken by one or more subject matter experts who, individually or collectively, meet the following criteria: · Are familiar with the nature and objectives of RRM; · Have current knowledge of the job requirements and context of the role in question; and · Understand the human factors associated with safety events in their own organisation. continued …

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The process for defining RRM training needs involves:

Step 1. Determining whether a Generic Safety Activity is relevant to a particular position. Effectively this is answering the question: "Is this task, activity or responsibility a required part of the rail safety worker's role, or if not, would it be desirable for the worker to undertake this activity?"

Step 2. Rating the importance of each activity that is relevant to or it is believed should be part of the job. The *importance* of an activity can be defined as a combination of:

a. The impact of the activity on a safety outcome, and

b. The frequency with which the task is undertaken.

In effect this process constitutes a risk-based approach to identifying training needs. Risk associated with human performance will be reduced for an organisation by identifying those activities that are more frequently undertaken and have greatest direct impact on safe outcomes, and then providing RRM training in these areas.

A proforma that can be used to complete the risk-based Training Needs Analysis (TNA) is provided in Annex E.

What if training is already provided in some RRM topic areas?

As noted in Section 1.2, it is recognised that some rail organisations already conduct training on topics that would typically be included in RRM courses, for example in communication skills, fatigue management, or aspects of teamwork. Cost and efficiency considerations imply that such training should not be repeated just because it is usually a focus of RRM. Before a decision to exclude a topic from RRM is made however, it is suggested that the following evaluation be made of previous or existing training:

- Has learning been retained, or could it be usefully reinforced through RRM?
- To what extent did the learning focus on developing competence rather than just giving information?
- Did the training process allow for group interaction and discussion of safety concerns or issues?

It should also be remembered that the success or CRM in aviation and other industries was in part due to the fact that it was delivered as a stand-alone program with its own identity and unique learning process. These same outcomes cannot be guaranteed if the majority of core RRM topics are distributed throughout a range of disparate training activities. Further information on this issue is provided in Section 6.1, Delivering training.

Will different levels of RRM training be provided?

In the short term, it is proposed that the approach described in the Guidelines be adopted for RRM training. This approach will develop the desired skills and knowledge amongst rail safety workers who have not previously been required to demonstrate the non-technical competencies associated with RRM.

For the longer term, an integrated approach is recommended for developing human factors knowledge and RRM skills in the rail industry. This approach involves the Industry Skills Council developing appropriate RRM units of competence within the Australian Qualification Framework. RRM training and assessment will then allow Rail Safety Workers in the future to have their knowledge and skills assessed in respect of the units of competence and credited towards nationally recognised qualifications.

The units of competence might include for example, a Level 1 Unit on Understanding Human Factors, designed to provide rail safety workers with an introduction to the field of human factors, and to explain the concept of safety being dependent on the application of RRM skills. Competence may be gained in this area at the stage of pre-employment or induction training.

Level 2 or Level 3 competency units might then be developed for Rail Safety Workers in positions of responsibility and associated training and assessment might take the place of the initial RRM programs, while RRM competencies relevant to first line supervisors and managers would be addressed through a Level 4 unit.

The RRM units will be integrated into the Training Package in two ways. Firstly, there will be three individual units of competence inserted at various AQF levels, as outlined above. There will also be some appropriate wording regarding Human Factors integrated into the Range Statement of each rail unit. In this way, RRM becomes integrated into the context of all units.

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3.4 IDENTIFYING THE TARGET AUDIENCE

Which rail safety workers should undergo RRM training?

In principle, RRM training is applicable to all rail safety workers[7] who work in a team environment. In practice, some rail safety workers are exposed to greater hazards in their daily work than others, and some have greater capacity than others to influence accidents or safety incidents, through their action or inaction. It would be both logical and practical to begin RRM with core safety personnel, and to progressively extend it to other groups. This issue should be decided by each ARO during the process of developing a learning strategy, determining particular training needs and prioritising target groups for RRM in their own organisation (see Section 3.3, Defining the RRM Training Need).

It should not be assumed however that 'front line' workers such as train drivers or controllers are the only ones who will benefit substantially from RRM training. For example, it is likely that rolling stock and infrastructure maintenance workers will derive significant benefits from completing RRM training. The importance of CRM's application and potential benefit to aircraft maintenance functions has been recognised for some years, where behavioural change and system improvements are necessary to prevent human errors that have serious, often "delayed-action" consequences for safety.

How is a team defined for RRM purposes?

The work "team" is not always obvious or well defined in the rail industry, where the operational environment involves a variety of complex interactions between individuals. These range in nature from common, routine interactions with 'known' colleagues, through to infrequent, yet safety-critical communications with remote third parties never previously encountered.

For the purposes of RRM, all such events can be described as involving team functioning. It is helpful however to define two main team types in the rail industry:

a. those situations where team members are for the most part physically co-located and where they are able to interact face-to-face, for example a group of track workers; and

b. situations where members are located remotely from one another, and are working towards a common goal, but whose shared understanding of the environment is communicated indirectly (via radio, signals, etc.). Examples would include a driver, signaller and train controller working together to move a train safely from 'A' to 'B', or a driver, signaller and protection officer working together to maintain the safety of a work gang on track.

These two team types have been referred to as "elemental" and "interactive" teams respectively (Morgan, Kyte, Olson & Roop, 2003). Interactive teams can also be described as 'distributed teams'.

7 This group has been defined in Section 1.1 above as full-time, contracted or volunteer staff (including train drivers, guards, conductors, signal operators or other employees) involved in the control or movement of trains or trams; maintenance workers and supervisors working on the maintenance, repair or alteration of tracks and equipment; employees with duties relating to operational procedures or emergency response; and authorised officers.

Is there an alternative to joint training?

The focus of RRM is on improving team effectiveness, so joint training should be conducted whenever possible, involving all members of a workplace team, regardless of whether they are elemental or interactive teams. This presents a challenge for conducting RRM training in the rail industry, as members of the extended or "interactive" teams that should be the focus of RRM are frequently employed by different organisations. For example, train controllers, drivers and track workers on a particular network often work for different AROs.

Joint training is recommended under the best practice model for RRM training. Significant safety benefits can accrue from having participants from different occupations exchange knowledge and experiences, develop shared understanding of operational priorities, and gain an enhanced appreciation of each others' roles and responsibilities during integrated training sessions.

Hopefully, a high level of cooperation between industry participants can be established, to bring together groups who would not normally train cooperatively. Clearly the combined learning strategy allows experiences to be shared, and a new level of mutual understanding reached across a variety of professional disciplines. This would be ideal in realising the full potential benefits of RRM.

The alternative of single-role RRM courses is however far preferable to the absence of any RRM training.

Is joint CRM training used in other industries?

Joint CRM training was introduced by some airlines following several notable aircraft accidents in which cabin crew did not communicate safety-critical information to the flight crew, or the information was conveyed but ignored. Following a fatal aircraft accident at Dryden, Canada in 1989,[8] the subsequent Commission of Inquiry (see Moshansky, 1992) recommended that all airlines conduct integrated CRM training for flight crew and cabin crew.

Cabin crew have been involved in joint CRM training at some airlines since the early 1990s. The objectives of this joint training are to address some of the misperceptions that each part of the crew have about the others' jobs, and raising awareness of the teamwork and coordination skills necessary for safe flight and efficient handling of emergency situations.

Joint CRM training has also been implemented within a variety of health care settings (see Pizzi, Goldfarb & Nash, 2001; Salas, Wilson, Burke & Wightman, 2006).

8 In this accident an Air Ontario F-28 aircraft crashed on takeoff from Dryden, Canada in March 1989. An accumulation of snow and ice on the wings prevented the aircraft from gaining enough height to clear trees beyond the end of the runway. Cabin crew did not communicate important information about the build-up of snow on the wings to the flight crew due to a number of reasons, including an erroneous assumption, consistent with their training at the time, that the flight crew were aware of all relevant safety-critical information.

How can workers in short supply be trained?	Shortages of employees in roles such as train driver may make it difficult to release people for RRM training, especially if it is conducted over a number of consecutive days. Staffing issues may also make it difficult to release selected employees for RRM facilitator training, and to be able to roster their regular involvement in facilitating RRM courses whilst continuing their normal operational duties. A flexible training delivery option is appropriate for AROs which are unable to release the required numbers of workers for training and cannot roll-out a comprehensive initial RRM program. The RRM training package has been designed to be delivered as a stand alone continuous course (eg., over two to three days) if resources allow, or to deliver the modules progressively over the course of some months as time permits. Further information on different delivery options is provided in Sections 3.5 and 6.2 of this document.
How can RRM be delivered to volunteer workers?	The Tourist and Heritage (T & H) sector of the rail industry faces particular problems in encouraging people to attend training given that their predominantly volunteer workforces will be required to attend any training on their own time. Given the nature and scale of most T & H operators it is likely that the preferred RRM model will need to be varied, with RRM competency units delivered in more gradual fashion over an extended period of time, and/or integrated into existing training activities. This would allow the philosophy, concepts and language of RRM to be disseminated without requiring the resources involved in a formal RRM program.
How else can the T & H sector be supported?	There would be considerable value in establishing links between the T & H sector and other parts of rail industry for the specific purpose of promoting knowledge of RRM best practice, in addition to general human factors awareness and skill development. For example, key T & H personnel would benefit from attending RRM courses run by major AROs, by attending their facilitator training programs, and by hearing of their experiences at user group conferences and seminars. This would provide T & H operators with a direct link into industry best practice and current knowledge.

How might rail workers respond to this form of training?	Judging from experience in other industries, it is likely that the vast majority of rail workers will respond very positively to the experience of RRM training. The additional emphasis on safety, the operational focus, and the recognition of systemic as well as individual contributions to safety occurrences is usually received positively by workers. There may be some potential difficulties for those rail workers who have not been exposed to this type of highly participative classroom-based training before to adapt to a new learning environment. It is also possible that some workers could perceive RRM training as a challenge to their seniority, experience, technical competence, and established ways of working. When new ways of thinking or working are introduced there are typically some individuals who feel threatened by and/or exhibit a generalised resistance to change. This attitude can be reinforced where experienced workers who have operated safely in the workplace for many decades see no need for change, or for additional training, especially that involving "soft" or non-technical skills. However, such reactions have been minimal in other CRM domains, and usually dissipate once those affected actually attend and complete the training program.
Is industry-level support being provided to help implement RRM?	It is hoped that industry support can be obtained for the training of RRM facilitators. One model could see the rail industry sponsor the delivery of a centralised RRM Facilitator Training Course, which in addition to unburdening AROs from providing this specialised training for small groups of employees, would allow for increased industry standardisation and calibration of RRM facilitator training. This training program could be further supported by the creation of an 'Industry RRM User Group', comprising RRM Program Managers and Facilitators from AROs which were planning or had implemented RRM training. Similar initiatives have proven very effective in supporting the implementation of Team Resource Management (TRM) training within the European Air Traffic Control community (EUROCONTROL, 2004).

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3.5 CONDUCTING TRAINING

Who should conduct RRM training?

The preferred model for RRM indicates that training should be conducted by volunteer peer facilitators, that is, co-workers of the course participants who are periodically removed from operational duties to deliver the RRM program. Experience from other industries has demonstrated that a small investment in the selection and training of such individuals delivers significant benefits for an organisation. Not only are the key messages of the training program better received when delivered by appropriately trained peer facilitators, these individuals then prove to be an invaluable future resource for the organisation, equipped with human factors specialist knowledge to contribute effectively in a variety of safety and operational roles.

Peer facilitators are preferred over qualified internal or external trainers because they 'speak the language' of the participants, are deemed to have a more thorough knowledge of current workplace issues, and understand the prevailing organisational and professional cultures. This enables them to facilitate more meaningful discussions around important topical issues.

Facilitators must be carefully selected and appropriately trained in the range of skills necessary to facilitate RRM courses. Further information on RRM facilitator selection and training is provided in Section 5.

How many facilitators are needed for each course?

RRM Facilitators would typically work in a team of two when conducting a consolidated training course over one or more days. This enables the heavy workload of course facilitation to be shared and for support to be provided should difficult issues arise. In Joint RRM training, the two facilitators should be representative of the course participants (eg., one driver, one controller) and work as an effective team to co-present the course as a positive practical example of cooperation and support.

If the target audience consists of only one type of rail safety worker, the ideal model would be for an experienced or more senior worker to facilitate the course with a less experienced or more junior worker. Differences between various types of rail safety worker and between junior and senior operators are often cited as barriers to effective teamwork. The co-facilitation model is a clear demonstration that effective cooperation and teamwork is possible if these barriers can be broken down.

How many RRM facilitators does our organisation need?

When a large-scale rollout of initial RRM training is planned, a sufficient pool of facilitators is required so that they remain current in their operational work duties while developing adequate experience and confidence as facilitators, but are not overburdened by the demands of RRM training delivery.

As a 'rule of thumb' RRM Facilitators should be rostered to conduct an RRM course about once every six to eight weeks. The exact number of Facilitators required by an organisation will depend on the logistics of the RRM program for

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continued …	that organisation, including the number of employees to be trained, the frequency of scheduled training courses, etc. Facilitators do not often remain in the role for more than a year or two, then moving back into their professional career path and allowing others to gain the experience of being a facilitator.
What if we don't have suitable people to be peer facilitators?	This is a common question from organisations in a variety of industries. Practical experience has shown however that it would be highly unusual if an organisation did not employ sufficient people suitable for training as RRM peer facilitators. In any large population of workers there tend to be a percentage who are interested in learning new skills, have an interest in helping others learn, and even have an interest in understanding more about human factors and safety. Often when the facilitator role is explained and applications are called for, people apply who have surprisingly relevant credentials, including for example teaching experience or academic qualifications, on which further training can be built. Should it prove difficult to find sufficient facilitators, it is recommended that facilitators with relevant training and experience from elsewhere in the industry, or a related industry, be used as an alternative. There is a considerable investment required to select and train in-house RRM facilitators. This is repaid in the quality and effectiveness of the training for participants, and the ultimate safety benefits achieved for the organisation. Facilitators also develop valuable knowledge and skills, as well as insights in company operations, which prepare them well for future management or safety specialist roles.
What is the best class size for RRM?	Between 12 and 20 participants are suggested for each RRM course, with 16 the optimal number. Having fewer than 12 participants may make it difficult to sustain useful discussion and interaction, and will reduce the pool of experience being shared. In a group of more than 20 it is difficult to provide reasonable opportunity for everyone to participate in discussions and practical exercises. RRM courses typically include activities and exercises in small groups, so a total number that divides readily into groups of four or five is helpful.
How should RRM training be delivered?	The preferred model for RRM suggests that topics are ideally delivered in a single training event over a number of consecutive days, rather than dispersed in small segments over many months. The rationale is that this provides a substantial, concentrated exposure to the human factors and safety concepts underpinning RRM. This is particularly important in an organisation where there has been little previous information or education provided in this area. It is recognised however that the preferred model may not be achievable for some industry sectors.

Can RRM be delivered flexibly?

As noted above, although the traditional model for initial RRM delivery has been as a consolidated course, RRM has been delivered differently in the US rail industry. For example, some operators modified the delivery schedule and presented training in four to five segments over a four to six week period (Morgan et al, 2003).

Another option is to design course materials in the form of brief but meaningful CRM units that can be integrated into existing training practices. This solution overcomes some of the timing and resourcing difficulties associated with classroom training, and may be particularly advantageous for the Tourist and Heritage sector where most rail safety workers are not full-time employees.

Although the progressive modularised delivery of RRM training may be necessary for some organisations, it should be remembered that this approach is unlikely to yield the full benefits associated with consolidated interactive training in a classroom setting.

What is recurrent RRM training?

The term recurrent training refers to a regular, often annual learning activity designed to consolidate the training experience and competence of employees. Recurrent RRM should be conducted at least annually to reinforce the competencies developed in initial training. This should not be a fixed program repeated year to year, but one that is customised and updated annually to reflect issues of current concern regarding safety or operational performance.

RRM training principles can also be reinforced by any regular training or assessment activity conducted by an organisation, for example for re-accreditation, into which elements of RRM training can be incorporated. This might mean for example, introducing RRM terminology or topics into an annual safety day, or including some evaluation of RRM behaviours as part of an annual job re-accreditation.

Recurrent training is one means of integrating and extending RRM, a topic discussed further in Section 7.

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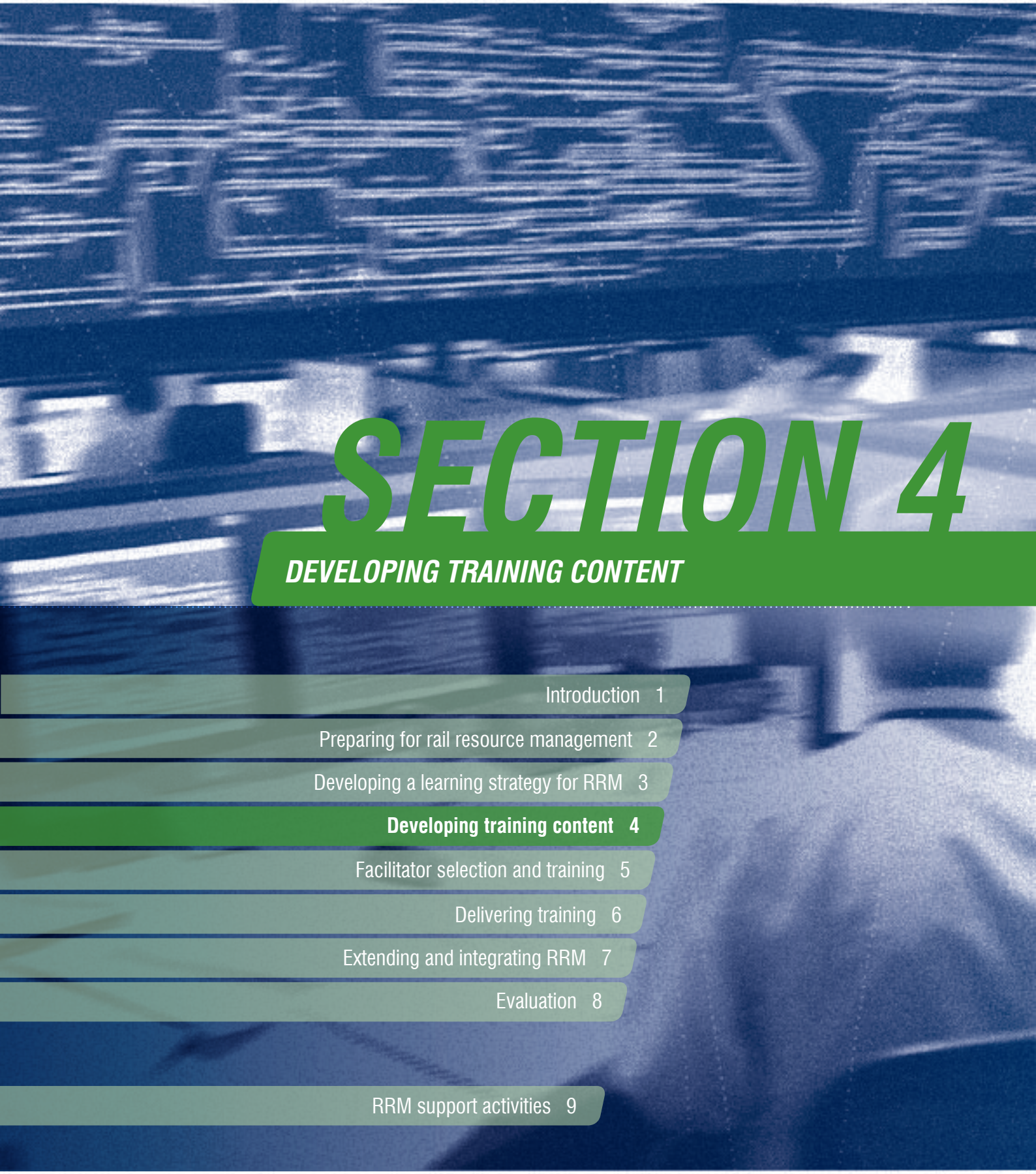
3.6 MANAGING RRM IMPLEMENTATION

What else is needed to implement RRM successfully?

The learning strategy for RRM will provide the road map for the main RRM implementation activity – that of designing and delivering training. Preparing for RRM has already been explained in Section 2 of these Guidelines, and Section 7 describes how RRM can be extended and integrated more broadly into an organisation's training and operations.

Apart from these steps, the implementation of RRM as an ongoing and successful project can be supported in other ways. Some recommended options for ensuring that RRM remains viable and effective are described in Part 2 of these Guidelines, entitled RRM Support Activities. These options include not only the internal support required within each ARO, but suggest a range of collaborative activities across the industry to share experience and promote a national best practice approach.



SECTION 4

DEVELOPING TRAINING CONTENT

4.1 BASIC PRINCIPLES

What are the basic principles for developing RRM course content?

Best practice principles for CRM training specify that the training materials and learning activities have demonstrable relevance to the day-to-day operational activities of the participants. The ideas and concepts within the curriculum, exercises and discussions should be linked directly to the safety issues that operational staff encounter. Without this link to work experiences and practices, the theoretical concepts of RRM are at risk of being too abstract to be understood and not then translated into changed workplace behaviour.

A second best practice principle requires that the scenarios and case studies used for training purposes should be also be realistic and relevant. Ideally, the culture will be sufficiently open and accepting of error so that recent incidents and/or accidents experienced by the organisation can be built into useful case studies.

It is also important that all materials be formally assessed as suitable for the reading and comprehension characteristics of the user population.

A full range of best practice principles for CRM training are included within the RRM Interim Report (see Section 5).

Salas et al. (2006b) also provide considerable guidance on designing, implementing and evaluating CRM training.

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What content will be provided through this project?	Stage 2 of the National RRM Project includes the design and development of generic courseware sufficient to deliver an initial Rail Resource Management (RRM) training course. This course will be modelled on those which typically provide the foundation program for introducing CRM and associated Threat and Error Management principles within other domains, particularly aviation. This courseware will include: · A training syllabus; · Training manual; · Presentation materials (in PowerPoint format); · Facilitator guides; · Participant notes and reference material. In addition, a basic training program evaluation methodology will be developed, focusing on issues of usability, validity, reliability and practicability. Necessary procedures and tools to implement the approved training program evaluation methodology will be included. RRM training is typically supported with additional training resources, such as video clips, simulation scenarios or role play documentation. Where these are seen as desirable to achieve specific learning outcomes with some target groups, the requirement will be described. AROs may elect to acquire or develop these items themselves or collaboratively with other AROs, however their production is not within the scope of this initial RRM project.
How has the training been trialled?	It is intended that pilot courses be conducted with a range of rail safety workers as participants, as a means of trialling the draft RRM materials and ascertaining the effectiveness of the training. The pilot courses will enable an evaluation of: · The content and relevance of each unit in the course; · The suitability of media and other training techniques used; · Areas requiring modification or further development. After this trial of the RRM training concept and materials a process will be established to evaluate the effectiveness of RRM training in delivering the expected competency outcomes amongst participants.
Where will RRM training materials reside?	The Rail Safety Regulators Panel (RSRP) has been identified as the place for current versions of the RRM materials to be held.
How will RRM training materials be updated?	RSRP will oversee the ongoing maintenance and continuous improvement of the RRM training packages and support materials.

4.2 CORE TOPICS

What are the core topics for RRM training?

The core topics for RRM training are derived directly from the Rail Safety Behavioural Marker System, set out in Annex D.

The Behavioural Marker System contains the following nine competency categories:

- Leadership
- Task Management
- Teamwork
- Communication
- Risk Management
- Situational Awareness
- Decision Making
- Emergency Management
- Self-Management

These terms are defined in the Glossary to this document. The elements of competency and performance criteria for each of these categories, around which training materials are being developed, are described in Annex B.

4.3 LEARNING APPROACHES AND ACTIVITIES

What learning approaches and activities are used?

RRM training is typically delivered through a combination of the following learning activities:

- Material presented in an interactive facilitated discussion format, including for example applied human factors concepts, ideas and models;
- Summarised, operationally-relevant case studies, for analysis, interpretation and discussion;
- Structured discussions, around workplace examples, video material or relevant empirical data;
- Exercises or activities in small groups, debriefed around the task outcomes and interpersonal processes involved;
- Role plays, to practice skills and provide feedback;
- Time allocated for discussion of topics that arise during the course which are relevant to the objectives of RRM.

Even at the initial awareness training level, role-plays and small group activities in the classroom can provide opportunities for participants to practice good RRM skills, for example being an effective team leader/team member, conducting quality briefings, communicating effectively or successful decision making. Such training exercises may involve crewmembers participating in the same work roles that they normally occupy (driver, signaller, etc.), or roles can be reversed to encourage an appreciation of others' role demands.

An important consideration for this type of training is that optimal learning occurs over time; RRM training should not be an isolated one-time event, program or lecture. As indicated above, RRM training should have an initial awareness phase, consolidated by phases involving practice and feedback, and reinforcement (ie., recurrent training). Approaches for these subsequent phases of RRM training are discussed in Section 7.

Salas et al. (2006b) provide further detail on a range of typical CRM learning principles.

How are case studies used?

The following issues should be considered when in-house incident or accident scenarios are being selected for use as case studies in RRM training:

- The *relevance* of the scenarios to the target group. Eg., old events involving equipment, procedures or operational tasks that are no longer current should not be used.
- The *contributing factors* in the event. The case study should contain one or preferably multiple examples of human factors issues (errors, error-promoting conditions) that are addressed in RRM.

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- The *recency* of the event. Accidents or serious incidents involving injury to rail workers, passengers or the public can induce stress, even amongst workers who were not personally involved. Recent incidents that might re-create stress or discomfort amongst participants should not be used as an RRM case study. Any incidents should be used with caution if workers involved in the event may be participants on the course.
- The prevailing *culture* of the organisation. It is difficult to find incidents or accidents in which human error was not involved. Indeed, the purpose of discussing such events is partly to learn from the mistakes of others. In a 'blame culture' however, some participants may feel that using a case study involving a co-worker's error is just another attempt by the company to 'blame and punish workers'. Objective introduction and discussion of the case study can partly alleviate this reaction, but careful choice of the event to be used is also important.

It is also suggested that a database of appropriate incidents be created to facilitate the development of case studies for future training, for example in recurrent or refresher RRM.

The other important source of case studies for discussion in RRM training is of course the participants themselves. This is an integral objective of RRM; to create an environment in which the participants feel sufficiently confident to provide examples from their own experience, even to reveal information about incidents involving their own errors or violations, so that others may learn from them.

4.4 CUSTOMISING CORE RRM MATERIALS

Why is customisation necessary?

It is an important principle of RRM design that while programs tend to include a common set of curriculum topics, training should be customised to reflect each organisation's unique requirements and culture. This will ensure that RRM training is seen as relevant, credible and therefore accepted by participants and valuable to the organisation.

The issue of making RRM course content relevant and acceptable to diverse worker groups has been addressed by (a) ensuring that the design of core training materials effectively addresses the required RRM competencies, and (b) providing generic materials that can be readily adapted to the specific needs of each target group. This includes processes for identifying organisation-specific training needs and developing local incident or accident examples into training case studies.

To what extent should the core materials be customised?

There is a second means by which organisational culture affects the successful implementation of RRM. Although certain cultural attributes are desirable before RRM is contemplated, RRM should also recognise and adapt to the unique cultural characteristics of the host organisation. This is a long-established principle for CRM design. As observed by one of the world's leading experts on CRM training Professor Robert Helmreich (1993):

> *"Effective CRM programs are not off the shelf but are designed after research into the culture of the organizations and reflect the national culture. Training thus has high relevance for participants and prioritises and addresses issues central to the organisation".*

In practice this means two things: First, the RRM course should include discussion of local issues and examples in terms that are relevant to participants; Second, there should be a designated focus on changing certain culturally-specific attitudes or behaviour that are detrimental to safety.

What information is needed to customise the material?

It is a best practice principle in RRM that the topics, content and examples included in initial training should be derived from empirical data, ideally from an organisation's own experience. Collecting such data is recommended to support the in-house customisation of generic RRM materials by user organisations. Customisation can occur in the following ways:

- Identifying particular performance deficiencies amongst an employee group, and giving special focus to these in RRM training. These performance areas may be found in the elements or markers of the Rail Safety Behavioural Marker System, or might relate to different behaviours that can be addressed as learning outcomes for RRM (see above);
- Choosing case studies that are operationally relevant and have good local learning points;

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- Administering surveys to ascertain the safety-related attitudes and behaviours of employees (see Annex F for an example). In particular, it is highly valuable to measure the existence of attitudes or "false beliefs" that compromise safe behaviour, and to target these as RRM training needs.
- Technical or operational performance data, for example obtained through data loggers or other monitoring equipment. This data provides a useful stimulus for discussion about how for example SPADs or other operator errors occur, and how their frequency can be reduced.
- Other observational information about crew behaviour can also be built into RRM training materials. For example, if pre-work briefings are not found to be occurring, this can be raised and discussed.
- New initiatives and related safety or cultural change projects can be reinforced through customisation of RRM topics. For example, the 'Just Culture' approach is closely aligned to the RRM philosophy, enabling links to be made within the RRM syllabus.

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This section explains the issues involved in selecting and training peer facilitators for an initial RRM program.

SECTION 5

FACILITATOR SELECTION AND TRAINING

5.1 RRM FACILITATOR REQUIREMENTS

What is the role of RRM Facilitators?	The way training is facilitated has proven critical to the acceptance of CRM principles by front line workers and the overall success of CRM programs. Identifying the right people to become facilitators is therefore essential. Existing trainers may not automatically be suitable as RRM facilitators. Facilitation is a complex task that requires competence in a range of skills quite different from those required in standard classroom teaching or training. Previous "teaching" experience can be helpful, but facilitation involves different competencies, and is usually considered a more difficult activity. The role of RRM facilitator has been likened to that of a tour guide. The facilitator guides participants through a structured learning activity, highlighting items of interest, but allowing the 'tourists' to participate and enjoy the experience in their own way. The facilitator will probably have greater knowledge than most participants, but is there to respond to the needs of participants and listen to their view of the world, not to display their own expertise or opinions.
What sorts of people make good RRM Facilitators?	The "best practice" model for RRM (see Section 3.1) calls for "peer facilitators", that is, they should come from the same worker roles or background as those attending the course. They should have current knowledge of the work environment, systems, rules and procedures and background issues, to be able to relate and communicate RRM concepts in a meaningful way. Although specific facilitation skills training must be provided for trainee facilitators, those selected should be people who feel comfortable working in front of their peers in a training setting, have the potential to deliver prepared material professionally, and also to "think on their feet" to facilitate discussion and manage the classroom climate. Most importantly, they should be people who have a reputation amongst their peers and supervisors for being competent performers on the job, and for behaving in a way that is consistent with RRM principles. That is, they should be credible positive role models for desired RRM behaviours.

Are there formal selection criteria for RRM Facilitators?	Formal selection criteria for RRM Facilitators should include: · An interest in applied human factors and crew/rail resource management training, together with the potential and enthusiasm to learn more about these areas. · Existing communication and presentational skills sufficient to enable them to facilitate an interactive training program, or the potential to readily develop these competencies. · A commitment to the philosophy and principles of RRM and its application as a means of improving operational safety and efficiency in the rail industry. · Respect and credibility amongst his/her peers as a capable, responsible and professional rail safety worker.
What level of experience do RRM Facilitators need?	There is no particular experience requirement for RRM Facilitators. The facilitator group should include people with varying degrees of operational experience, although employees within about one year of completing their initial training may lack a sufficiently broad knowledge of the work environment to participate fully in RRM course discussions. Having some experienced or 'senior' people co-facilitating with less experienced or 'junior' people sets a positive example of teamwork and cooperation across formal or informal hierarchies in the organisation, which is a core lesson of RRM. Once again peer respect and credibility are key requirements.
Is it acceptable to use retired personnel as Facilitators?	Recently retired rail safety workers may be suitable to be trained as RRM Facilitators, provided they meet the selection requirements stated above, and while their knowledge of work practices remains reasonably current.

5.2 RRM FACILITATOR SELECTION

What selection process should be used?	The selection process for RRM facilitators would normally involve the following steps: · Invite applications, explaining the facilitator role and selection criteria; · Short-list applicants, based on their application and employment history; · Interview short-listed applicants. The interview may involve a brief informal 'work sample test' in which applicants are given a few minutes to prepare and then present a sample of material from the RRM course.
Who should be involved in RRM Facilitator selection?	There is no set composition for an RRM Facilitator Selection Panel. Sound selection decisions are likely to result if the selection panel includes: · The RRM Manager, or someone familiar with RRM training and requirements; and⁄or · A training manager; and · A senior operational manager with responsibility for the target group(s) for RRM training; and · An HR representative, to clarify employment conditions and arrangements for facilitators, and oversee the selection process.
How many Facilitator trainees should be selected?	The number of trainee facilitators required to 'roll-out' an initial RRM course will depend on the following factors: · Total number of staff to be trained; · Numbers attending each course; and · Frequency of courses. Where a large workforce is to be trained, and courses will need to be run over more than a year, further batches of facilitators may need to be selected and trained to replace those who do not want to continue as facilitators. Allowance should also be made for the possibility that some people selected to be Facilitators may subsequently decide, during or after the completion of training, that they no longer want to undertake on the role. Given the expectation that Facilitators will show enthusiasm for RRM and make a personal commitment to promoting it, no pressure should be put on someone who elects not to proceed.

How are RRM Facilitators rewarded?	The employment conditions for RRM Facilitators are typically a matter for individual organisations, negotiated at the time the RRM program is set up. Under the "peer facilitator" model, facilitators will give up part of their normal rostered duty time to run RRM courses. This may involve financial disadvantage or other incidental expenses. Although many people in the aviation industry volunteer to become CRM facilitators for reasons of intrinsic motivation (ie., for the satisfaction of being involved in helping others benefit from CRM), it is an accepted principle they should not lose out financially by doing so.

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5.3 TRAINING RRM FACILITATORS

What is the best process for training RRM Facilitators?	A multi-phase training process is suggested for RRM Facilitators to ensure that they possess the required knowledge and skills to operate effectively in the role. Facilitation involves managing a complex set of tasks and objectives in a very dynamic, interactive environment. In that respect it differs significantly from standard classroom teaching or instruction. A staged training approach is proposed to ensure that facilitators are able to demonstrate the necessary competencies before they progress to the live RRM classroom environment. A multi-phase RRM Facilitator training program should include the following learning outcomes: · Demonstrate a sound knowledge of human factors, including human performance and limitations as they apply in a complex socio-technical system such as rail transport. Sufficient depth of knowledge in human factors is required to respond with authority to related questions that may arise during RRM courses; · Demonstrate understanding of the principles underlying effective facilitation and the training of small groups, as applied in an RRM setting; · Present course material in a variety of ways and conduct exercises, activities and discussions to achieve the objectives of RRM. · Demonstrate the skills associated with facilitation, group management, effective communication and dealing with conflict. Competence should be demonstrated in a facilitator training setting, followed by supervised practice, coaching and feedback while delivering components of 'live' RRM courses
What are the options for providing this training?	The project sponsors are currently exploring the capacity for the rail industry to sponsor the development and delivery of a centralised RRM Facilitator Training Course. This would be of particular benefit for many AROs who are not of sufficient size to sustain an in-house facilitator training program. Standardisation of training for facilitators across the industry would also be improved under this model.
Who should conduct RRM Facilitator training courses?	As noted above, industry cooperation would be a practical and cost-effective solution to the issue of RRM facilitator training. One possibility would be the creation of an industry-based facilitator training program, covering the core skills and common process of RRM. This program could also provide trainees with skills in customising an RRM program to the local organisational culture and requirements, and generic RRM implementation issues. Another option would be that an operator with the capacity to undertake its own facilitator training made arrangements to allow trainees from other organisations to attend.

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Civil Aviation Authority. (2003). CAP 737: *Crew Resource Management (CRM) Training. Guidance for Flight Crew, CRM Instructors and CRM Instructor-Examiners.* London: CAA Safety Regulation Group. (Chapter 5, Appendices 9 & 12).

5.4 MANAGING THE FACILITATOR GROUP

How should RRM Facilitators be managed?

As a significant project and training activity, an RRM program requires effective management. This may be a part-time or full-time responsibility, depending on the project scope and the size of the organisation involved.

The main management requirements for RRM training are administrative (arranging logistics such as rostering of facilitators, participants, venues, materials, travel, etc.). There is also a requirement however for support and guidance to be available to facilitators on technical issues associated with the way the course is conducted, for example, how material is best presented, how activities are conducted, how unusual or difficult situations are handled. Advice on such matters can really only come from an experienced RRM facilitator. Often one of the senior and/or most motivated facilitators is nominated as RRM Manager to deal with these issues, oversee the performance of other facilitators and ensure smooth program administration.

At the outset of the RRM program a regular (eg., monthly) meeting should be established to focus on the issues described above and provide support for the RRM Facilitator team. This group will be critical to the success of the RRM program and their advice and feedback should be attended to.

What on-going development do RRM Facilitators require?

RRM Facilitators should be encouraged and supported as much as possible in the following developmental activities:

- Continually reviewing their own performance, and working to develop their competence.
- Observing and being observed by other facilitators, and exchanging feedback.
- Improving their background human factors and facilitation knowledge through reading, discussion, etc.
- Being sponsored to attend Human Factors/RRM conferences, workshops, etc.
- Monitoring best practice developments in CRM/RRM in rail and other industries.

It is good practice for a network of RRM facilitators to be created in an organisation, for the purpose of ongoing peer review, coaching and mentoring. Such a network also facilitates the exchange of information and new ideas that can be used to update and improve course content.

Effective CRM programs often establish a small group of experienced facilitators to conduct quality assurance observations on other facilitators within the organisation.

This section describes the options and practical considerations involved in delivering RRM training.

SECTION 6

DELIVERING TRAINING

6.1 TRAINING OPTIONS

What is a typical program for initial RRM training?

Table 4 provides an example of a three-day RRM program. It should be noted that the topics are indicative only and will vary according to the training needs of the participant group, as explained in Section 3.3 (Defining the training need).

TABLE 4 EXAMPLE THREE-DAY RRM PROGRAM

DAY ONE		DAY TWO		DAY THREE	
0900	*Welcome*	**0900**	*Review of Day 1*	**0900**	*Review of Day 2*
0910	**Session 1:** Introduction & Course Overview	**0910**	**Session 5:** Teamwork	**0910**	**Session 9:** Decision Making
1030	*Morning Break*	**1030**	*Morning Break*	**1030**	*Morning Break*
1100	**Session 2:** Leadership	**1100**	**Session 6:** Communication	**1100**	**Session 10:** Emergency Management
1230	*Lunch Break*	**1230**	*Lunch Break*	**1230**	*Lunch Break*
1330	**Session 3:** Case Study	**1330**	**Session 7:** Risk Management	**1330**	**Session 11:** Self-Management
1500	Afternoon Break	**1500**	Afternoon Break	**1500**	Afternoon Break
1530	**Session 4:** Task Management	**1530**	**Session 8:** Situational Awareness	**1530**	**Session 12:** Consolidation Exercise & Conclusion
1700	*Close*	**1700**	*Close*	**1700**	*Close*

What training facilities are required?

RRM can be conducted successfully in a variety of in-house or off-site training venues, provided the necessary facilities and resources are provided.

Given the training techniques used in RRM, the venue should include a classroom large enough for main group activities (presenting material, discussions etc), and break-out rooms for small group discussions and exercises.

In other industries where CRM courses have been delivered regularly over a number of years, it has been found useful to set up a permanent in-house CRM classroom, with the necessary support materials and resources stored nearby.

While it is more costly to conduct RRM courses off-site, this has the additional benefits of removing participants from the distractions of their normal workplace, and encouraging informal discussions of RRM information and issues outside classroom hours, particularly if using a residential training venue. Off-site training also reinforces the message that RRM is different and valued by the organisation as an important training activity.

What training support resources are needed?

The range of learning activities used in initial RRM training are summarised in Section 4.3. The following training resources are required to undertake these activities:

- Computer and data projector to present course material, case studies etc.
- Video player (if media not held in digital format).
- Whiteboard, flip charts, pens and markers, to summarise group discussions, brainstorming activities etc.
- Flip charts, note paper and pens to support small group exercises or activities in break-out rooms.
- Other aids, equipment or documents used in demonstrations or case studies.

Note that the training materials provided under the National RRM Project will include support documentation and specify other required resources.

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6.2 ALTERNATIVE RRM DELIVERY OPTIONS

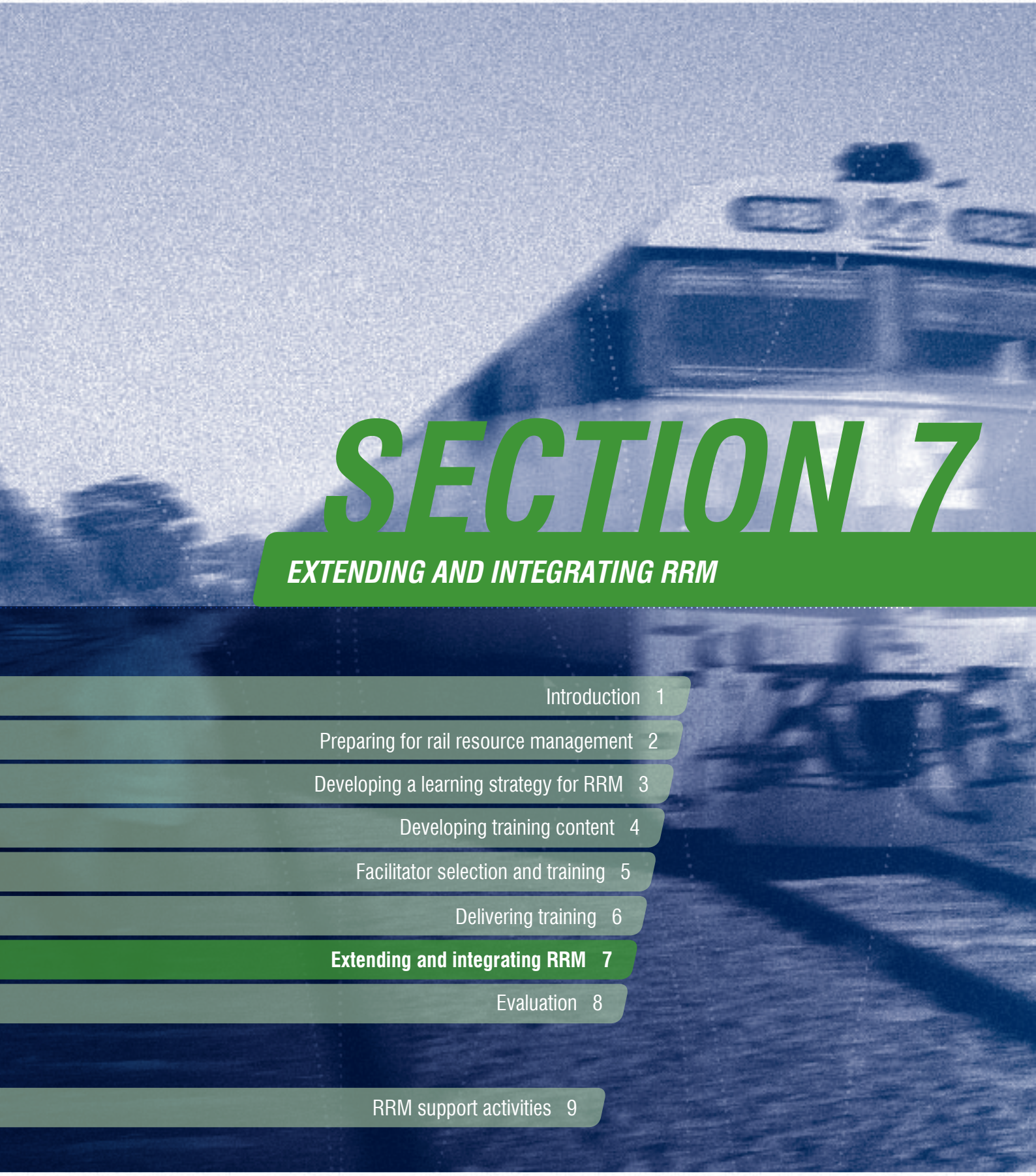
What other RRM training delivery options are viable?

As noted in Section 3, while it is recommended best practice that initial RRM training be delivered in one consolidated training event conducted over two to three consecutive days, it is recognised that some organisations will find this impractical. Reasons for this may be lack of budget and/or resources, or limited access to employees/workforce, as in the Tourist and Heritage sector.

In such cases, an acceptable alternative may be to split the RRM syllabus into smaller chunks to be delivered over a longer period of time. The generic course materials provided as deliverables for this project will be modularised in such a way as to facilitate the design of a segmented approach to training. The options for delivering segmented training will vary with the constraints faced by the particular organisations that find themselves unable to follow the recommended best practice approach.

Some organisations may find it possible to deliver initial RRM training in two or three single-day blocks spread over consecutive months.

Other organisations may find it more feasible to split the RRM program into a number of half-day segments, while others with more limited contact with their workforce may need to break the course into single-module units to be delivered on a regular basis.



SECTION 7

EXTENDING AND INTEGRATING RRM

7.1 EXTENDING RRM TRAINING

Why does RRM need to be integrated and extended?

Implementing an initial RRM awareness training program is the first phase in developing an RRM operating philosophy, culture and practices within a rail organisation. While an initial RRM training program will yield significant benefits, it is likely that these benefits will dissipate if not consolidated by further support activities.

RRM can be extended and integrated in three major ways:

a. by providing additional, dedicated RRM training activities, usually referred to as "recurrent" RRM;

b. incorporating the concepts, principles and language of RRM into existing training; and

c. integrating RRM in other organisational processes and functions.

The ultimate aim of these activities is to ensure that RRM skills are continually reinforced and that the expected attitudes and behaviours associated with RRM are permanently and universally integrated into everyday work practices. Achieving this fundamental objective of RRM presents a challenge for organisations who believe that one-off training activities will be sufficient to guarantee long-term change in the safety-related attitudes and behaviour of their employees.

This section describes how RRM can be reinforced not only through additional training, but by integrating RRM principles into an organisation's work processes and functions, including for example its selection system, operating procedures and performance management practices.

What dedicated RRM training should be provided?

As explained in Section 1, RRM is typically implemented through an initial training course that promotes awareness about the RRM philosophy and concepts, allows some RRM skills to be practiced and provides feedback to participants on the impact of their own attitudes and behaviour. It is important to remember that an initial RRM course of two or three days duration is only the first step: the RRM attitudes and competencies established within initial training need to be consolidated and reinforced if they are to endure. After rail safety workers have completed initial RRM training, they should attend periodic follow-up sessions to help sustain long-term attitudinal or behavioural change. This form of follow-up exposure to RRM is referred to as Recurrent RRM training.

What is recurrent RRM training?

Recurrent RRM training typically involves participation in half- or full-day training sessions conducted on an annual basis, where core RRM concepts and principles are reinforced through the provision of new information, case studies, exercises or role-plays.

Experience within other domains has demonstrated that without reinforcement through recurrent training and associated activities, any positive changes in

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continued …	attitudes and behaviour observed after the initial awareness phase of training may be eroded (see Helmreich, Merritt & Wilhelm, 1999; Salas, Burke, Bowers & Wilson, 2001). Salas and colleagues (2006b) further emphasise the critical importance of these follow-up activities: "if safety is the main concern, then recurrent training is a must".
What other training helps develop RRM skills?	Research within the aviation domain has demonstrated that any structured activity that provides practice and feedback significantly enhances the effectiveness of initial CRM training and increases the rate of skills transfer to the working environment (Prince, Brannick, Prince & Salas, 1997). Simulator training is an integral part of the proficiency development process for airline pilots, and has proven to be a valuable tool for reinforcing CRM skills. The use of cockpit and train cab simulators to give practice and feedback on non-technical competencies is discussed in more detail below. Role-playing or 'desktop' training exercises requiring group coordination and problem solving are another effective and relatively low-cost option for consolidating and refining RRM skills. These exercises can be used in initial RRM, recurrent RRM or as part of other safety training such as emergency management exercises. To be truly effective in developing RRM skills, the exercise should be debriefed using the same Behavioural Marker System, that underpins the learning outcomes for initial RRM training.
Should managers and supervisors do RRM training?	It is particularly important to ensure that an organisation's supervisory and management staff are both familiar with and support the RRM program. It is also critical that they behave in a manner consistent with the principles of RRM. For this reason it is highly desirable that they participate in RRM training. The early years of CRM training in the airline industry demonstrated clearly that if an organisation's managers did not believe in or demonstrate appropriate human or team behaviours, the key messages of CRM could be undermined. It is virtually impossible for employees to make lasting changes in their own attitudes or behaviours when the actions and examples of managers are incongruent. A review of CRM development and implementation at one airline concluded that *"CRM is effective only when its principles are unconditionally adopted at the top of an organisation and flow down through the organisation"* (Byrnes & Black,1993).

How are managers and supervisors trained in RRM?

Although there are important benefits to be derived from having managers and senior staff complete RRM training, consideration must be given to how this is best achieved, as their involvement can potentially have some negative consequences on other participants. One option is to roster these senior staff as participants on the same courses as the organisation's other personnel. While this clearly demonstrates that RRM is important for everyone, in some circumstances the presence of 'authority figures' in the same training room as other participants may tend to inhibit free-flowing and open discussion.

Another alternative is to involve senior staff in trialling and evaluating the RRM training program before it is finalised for presentation to other employees. Byrnes and Black (1993) suggest involving an organisation's senior influential operational staff, including supervisors, trainers, etc., as participants on early trial or 'pilot' training courses. They note that such staff can be the most resistant to the attitudinal and behavioural changes proposed by this form of training.

These individuals tend to believe that the skills and behaviours which brought them recognisable success are proven and thus adequate, and suggestions for change can be interpreted by some as criticism of past performance. As such, involving them in early training courses can be a good test of the suitability and effectiveness of the course materials, and a good, if potentially challenging training ground for facilitators.

Enlisting their support in trialling the training concept and materials can be very valuable. Listening to their feedback and incorporating their suggestions will develop "ownership" and support for the RRM program amongst this influential group.

Where it is not possible to involve senior staff in this way, briefing sessions on the RRM training concept, goals and techniques can be conducted to ensure that they have adequate awareness of the program before it commences.

7.2 INCORPORATING RRM IN OTHER TRAINING

How is RRM incorporated into existing training?	To be most effective, RRM concepts should ultimately be integrated into all stages of rail safety worker training, as a way of reinforcing the learning outcomes from initial RRM training. After an initial RRM training program is established it is desirable for RRM concepts and principles to be embedded in all significant training received by an organisation's rail safety workers. This should include induction training and any initial or subsequent technical, professional and/or safety training provided. In most cases embedding RRM principles will involve fine-tuning of existing training content to ensure consistency with RRM messages and practices, rather than any major revisions or structural changes.
What training do instructors need?	Instructors, trainers and assessors in an organisation play an important role in reinforcing RRM skills amongst the wider workforce. These groups should not only have attended initial RRM training, but should possess special skills applicable to the roles of instructing and improving workplace performance. These include competence in discerning undesirable or negative RRM behaviour, evaluating and rating non-technical performance, facilitating RRM debriefing/feedback sessions with individuals and teams, and reinforcing positive RRM behaviour. It is particularly important therefore that RRM principles and competencies become a significant focus in all train-the-trainer programs, so that trainers, instructors and assessors understand how non-technical skills can be practiced and reinforced in other technical and specialist training, and developed as a part of a wider workplace assessment process. Given the potential influence that trainers have as role models for those they are training, it would also be beneficial if selection for these critical positions considered the extent to which the candidates were able to demonstrate positive RRM characteristics and behaviour.

Can RRM be integrated with Emergency Management training?

RRM skills and attitudes are relevant to the effective management of non-standard, degraded or emergency situations. Evidence from incident and accident investigations suggests that due to the unfamiliarity, complexity and unique pressures involved in most emergency situations, the value of non-technical skills is magnified significantly in preventing or minimising harm. For example, effective leadership and resource management will promote the likelihood of a safe outcome, and poor leadership or communication will dramatically increase the risk of an undesirable outcome.

Numerous rail accidents in recent years have demonstrated the need to improve the way that emergency response situations are handled, and have highlighted the potential for RRM training to better prepare rail workers for such crises (see Australian Transport Safety Bureau, 2003; McInerney, 2005a, 2005b; Transport NSW, 2002a, 2002b).

Existing emergency management training conducted across the rail industry is an ideal vehicle through which RRM can be further practiced, reinforced and integrated.

7.3 USING RRM IN SIMULATOR TRAINING

How can simulation? complement RRM training

Sophisticated flight simulators have been used to enhance technical proficiency within the airline industry for many years. These same flight simulators are now also increasingly used to support team-based CRM training exercises. The use of simulation training to practice relevant behaviours is an important part of the practice/feedback and reinforcement phases of CRM training.

Line Oriented Flight Training (LOFT; see Lauber & Foushee, 1981; Butler, 1993) is a non-jeopardy team performance training exercise, usually conducted in high-fidelity flight simulators, that provides the opportunity for both practice and feedback of CRM behaviours.

LOFT participants are presented with full mission flight scenarios requiring effective crew coordination in order to ensure successful performance. These exercises provide participants with the opportunity to practice CRM skills and receive feedback on their performance. They are highly rated by both pilots and instructors and have been demonstrated to improve crew performance across a range of non-technical dimensions (Clothier, 1991).

The use of videotaped feedback from these sessions is particularly effective in that it provides participants with a unique insight into their personal strengths and weaknesses, and allows scenarios to be debriefed with reference to expected CRM behaviours.

Simulation exercises focussed on CRM training have also been used with positive effect within a variety of health care settings (see Salas et al., 2006a).

Can the Australian rail industry use RRM in simulators?

Although a number of AROs have access to reasonably sophisticated train cab simulation facilities, it would appear that some of these resources may be under-utilised in relation to effective driver training.

Queensland Rail (QR) Passenger Services are an exception to this observation. QR have developed scenario-based LOFT-style simulator training exercises for train drivers, conducted within a high-fidelity train cab simulator. These simulator sessions have been positively received by urban drivers and will soon be used in conjunction with QR's Confidential Observations of Rail Safety (CORS) program, which has successfully adapted the LOSA methodology[10] and contemporary CRM principles to QR Passenger operations (McDonald, Garrigan & Kanse, 2006; Garrigan, McDonald & Kanse, 2006).

10 LOSA: Line Operations Safety Audit technique, a behavioural observation data gathering technique developed for evaluation of airline crew performance. For further discussion of LOSA see Section 8.1.

7.4 INTEGRATING RRM IN OTHER ORGANISATIONAL ACTIVITIES

How else can RRM be integrated?

This section describes a number of opportunities that exist to further reinforce RRM principles and practices via the integration of RRM concepts into an organisation's work processes and functions. These include:

- Aligning work rules and procedures with the philosophy, principles and language of RRM;
- Establishing processes to formally evaluate RRM skills in the workplace;
- Providing other forms of feedback to individuals on the extent to which they are demonstrating the expected behaviours;
- Adapting selection criteria to reflect the importance of RRM skills as required attributes in all employees; and
- Using RRM principles and terminology in accident and incident investigation processes and reports, to reinforce the importance of human factors as countermeasures to error.

How does RRM affect work rules and procedures?

RRM concepts and principles should be integrated into an organisation's operating procedures and work rules. Using RRM terminology and ideas within procedures will provide further integration and reinforcement of RRM principles and encourage the use of RRM tools and techniques in day to day operations.

Further information on the way RRM can be reflected in an organisation's operating philosophy and policies is provided in Section 9.2.

How are RRM skills assessed in the workplace?

A number of options exist for evaluating RRM skills or non-technical competence in the workplace. These range from highly structured assessments conducted annually as part of a formal performance management process, through to informal, on-the-job feedback delivered by supervisors. In all cases it is beneficial if there is a clear alignment between the RRM skills being developed in initial and recurrent RRM courses, and the skills being assessed on the job.

The simplest way to accomplish this is to use a common Behavioural Marker system to underpin training activities and performance management processes. At the formal end of the scale, for example, annual appraisal of non-technical skills by supervisors can be conducted using a customised appraisal form built around relevant behavioural markers.

At the other end of the spectrum, it is beneficial if the markers become familiar to all operational staff in an organisation, and the provision of informal but immediate feedback becomes a normal action when an individual has clearly not adhered to an expected behaviour. Recognition of good performance in accordance with the markers should naturally also be encouraged. Whatever the circumstance, effective critique and feedback requires a good working knowledge of RRM concepts and relevant behavioural markers.

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Behavioural markers can also be employed for the evaluation of RRM training effectiveness, as discussed in Section 8.

Can other feedback processes use RRM markers?

A commonly used technique for providing balanced, structured performance feedback is "360 degree feedback". The 360 degree feedback process involves participants completing a questionnaire comprising statements about their own work performance, with similar data collected and compared from a supervisor and a sample of co-workers and subordinates. When developing the rating questionnaire, it is logical to use a selection of the same non-technical skills contained in the Behavioural Marker system.

The 360 feedback technique is most often used for staff development purposes, with a detailed feedback report provided to those participating, as a basis for devising a personal development/improvement plan. This is often done in conjunction with a supervisor, and is an effective way to reinforce RRM behaviours and address particular work performance and/or behavioural problems.

Can RRM behaviours be identified at selection?

Recruitment and selection processes are designed to identify candidates who have the attributes necessary to perform successfully in the job, usually after relevant training has been successfully completed. It follows therefore that if RRM attitudes, skills and behaviours are accepted as important for qualified rail safety workers, it should be possible to identify at selection those applicants who already show the desired attributes to some degree, or who have the aptitude to develop them more readily.

The non-technical skills sought in applicants can be defined as a subset of those required for safe and effective job performance. Elements found in generic Behavioural Marker systems such as Teamwork, Communication, Problem Solving and Self-management are fundamental to many roles, and can thus be prescribed as selection criteria and evaluated in the same way as other elements of the selection process. Properly customised markers will also reflect the organisation's culture and values, and help identify applicants who are compatible with these. The highly specific and observable nature of behavioural markers makes them ideal for use in selection processes such as assessment centres or other work sample techniques involving group interaction, communication and effective team performance.

Is RRM relevant to safety investigation?

In the vast majority of safety occurrences the sequence of events leading up to the event could be disrupted, and the incident prevented, if someone had acted differently. RRM is designed to prevent incidents and accidents by giving rail safety workers the skills to anticipate and manage the operational threats and errors that typically contribute to safety occurrences. It follows therefore that a thorough and focused accident investigation process should identify the human actions that need to be adapted if similar events are to be avoided in future (as well as other local and systemic conditions that influenced the outcome).

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The goal of fully integrating RRM in an organisation will be served if the human behaviour identified as contributing to an accident is expressed in similar terms to the markers used to define RRM learning outcomes. In theory it is even possible for investigators to use the RRM Behavioural Markers directly, either to cross-check the presence or absence of a particular action, or to report findings (asking, for example: "were questions asked to clarify understanding", or concluding: "the risk was not assessed before starting an unusual or difficult task"). Using these same RRM markers when distributing feedback from safety investigations (eg., in incident summaries or safety bulletins) is a highly effective method of reinforcing general understanding about RRM.

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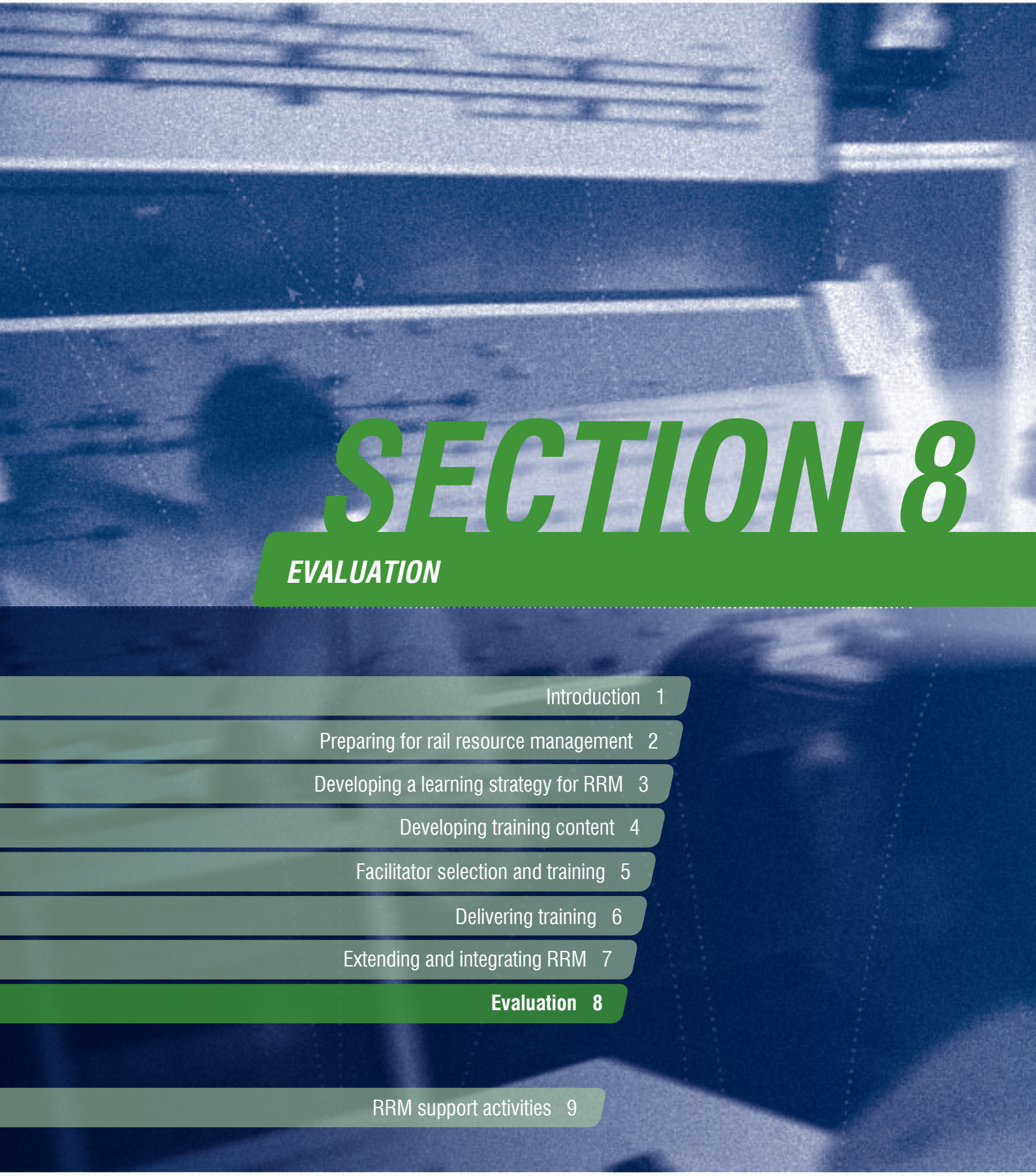

SECTION 8

EVALUATION

8.1 OPTIONS FOR EVALUATING RRM EFFECTIVENESS

Is evaluation of training effectiveness important?

It is vitally important to evaluate the effectiveness of any significant organisational training intervention. Accurate evaluation contributes to understanding the impact of the training, in addition to identifying ways in which the training can be continuously improved to focus on areas of most benefit to participants.

Training evaluation can consolidate the benefits of RRM by continuously assessing the impact of training courses and monitoring changes in the attitudes and behaviour of operational staff in the work environment. Information acquired through the evaluation process can be used to identify critical topics for recurrent training activities.

Multiple levels of the available evaluation processes should be used to demonstrate the extent to which RRM training is effective. The various levels of training evaluation are described below.

How can training effectiveness be evaluated?

There are four levels of evaluation that can be used to measure the effectiveness of RRM training.[11] Successive levels (from 1 to 4) provide a more comprehensive indication of the effectiveness of training and thus demand more resources to collect and analyse data.

This four level evaluation model (Kirkpatrick, 1976,1994) involves gathering data on:

- participant responses to the training (Level 1 – Reaction),
- the extent of learning that takes place (Level 2 – Learning),
- the application of learning to operational tasks (Level 3 – Transfer), and
- tangible organisational benefits (Level 4 – Results).

It is suggested that evaluation of RRM should at least be undertaken at level one, and then, as time and resourcing allows, at additional levels two, three, and four in sequential order. Data from each prior level serves as a base for evaluation at the next level.

What is involved in Level 1 training evaluation?

Level 1 evaluation measures participant reactions to a training course by means of post-training questionnaires, or so-called "happy sheets". These are brief surveys which participants complete at the end of their RRM training course. The survey assesses participants' reaction to the training in terms of its perceived relevance and usefulness, and the extent to which content is interesting and practical.

Participants' reactions impact on their potential to learn from the training, in that while a positive reaction does not guarantee learning, a negative reaction

11 Based on Kirkpatrick's four-level model of training evaluation (1976, 1994).

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will almost certainly detract from it (Kirkpatrick, 1994). Results can be used to improve the course structure and materials for the benefit of future students.

While Level 1 is a very common form of CRM training evaluation, and the results of most published Level 1 evaluations have been positive, it simply satisfies the basic criterion that the training has popular acceptance. Evaluation at deeper levels will confirm the benefits of continuing with training.

A sample Participant Evaluation Questionnaire is provided at Annex G.

What is involved in Level 2 training evaluation?

Level 2 training evaluation attempts to measure learning that has resulted from participation in the training program. This involves measuring participant's skills, knowledge or attitudes before training, and again some time after completing training to measure the amount of learning that has occurred.

Level 2 evaluation of RRM training requires a context-specific attitude questionnaire, to be administered pre- and post-RRM training. The initial measure examines participant attitudes and knowledge related to RRM before training commences. Results establish a baseline against which attitude change can be measured following completion of RRM training. The questionnaire can then be re-administered some time after the course (typically 6 to 12 months) and results compared to the pre-course baseline measure, to determine whether attitudes have moved in the desired direction or otherwise.

The data gathered can assist the organisation to identify worker attitudes regarding team coordination, operational safety and resource management. It can also be used to highlight broad operational problems and to identify and prioritise training needs.

Structured self-report questionnaires such as the Cockpit Management Attitudes Questionnaire (CMAQ) and the Flight Management Attitudes Questionnaire (FMAQ) have been used successfully to evaluate CRM training in the aviation industry. Adaptations of the FMAQ have also been employed within health care, maintenance and maritime settings.

Level 2 Tools: The RRMAQ

A generic local adaptation of the FMAQ, the Rail Resource Management Attitudes Questionnaire (RRMAQ), is a product of this project and has been included at Annex F. While the RRMAQ has been developed for use within the Australian rail industry, some further adaptation may be required to ensure a best fit with individual ARO cultures.

Use of the RRMAQ before and after RRM training will allow organisations to take a 'snapshot' of worker opinions and attitudes before training and to continue to monitor them as desired after program implementation.

What is involved in Level 3 training evaluation?	Level 3 evaluation focuses on the transfer of learning achieved as a result of completing a training course. It measures the change that has occurred in participants' on-the-job behaviour as a result of attending the training program. Level 3 evaluation attempts to answer the question: To what extent are the desired skills, knowledge, or attitudes being applied in the operational environment by participants? For many this level represents the most accurate measure of a program's effectiveness. However, measurement of transfer of learning is complex: it is hard to predict when changes in behaviour will occur, and how long they may last. Thus, decisions about when, how, and how often to evaluate are important. As with any evaluation, it is also difficult to establish a causal link between training and outcomes. Evaluation of Level 3 outcomes can be achieved by having trained observers assess the non-technical work performance of operational staff against a set of relevant behavioural markers.
Level 3 Evaluation Tools	Level 3 evaluation techniques have recently been developed for use in the Australian rail industry. In 2005 CountryLink commissioned the development of customised behavioural markers for train drivers and on-board staff. As noted above Queensland Rail (QR) are currently conducting the CORS (Confidential Observations of Rail Safety) project, which has successfully adapted LOSA (Line Operations Safety Audit) methodology developed for the aviation industry (Federal Aviation Administration, 2005) and related Threat and Error Management (TEM)[12] principles for use in the enhancement of safety in QR Passenger operations. Most such techniques rely on purpose-developed behavioural markers or descriptors as the basis for capturing data on the performance of operational staff during normal operations. This data can be used not only to determine the extent to which previous RRM skills training has transferred to the workplace. Information on the threats encountered by rail safety workers, the errors they commit and the way these situations are managed can be used to guide future customisation of training and to provide topical content for recurrent RRM. Level 3 evaluations are best conducted under strict 'non-jeopardy' conditions. This means that workers are not at risk of any penalty if shortcomings are observed. Observers, for example in a signal box, train cab or control centre, are trained to make anonymous, confidential and non-punitive assessments of performance for a group of employees.

[12] **Threat and Error Management (TEM) is the operational focus of contemporary CRM training. The RRM Interim Report (page 15) provides further detail on TEM.**

What is involved in Level 4 training evaluation?	Level 4 evaluation focuses on the identification of tangible organisational benefits that can be attributed to a training program. It is the highest level of training evaluation, and can be regarded as the most important in determining whether a program has achieved material results for an organisation, and in demonstrating the importance of the program from a business perspective. Level 4 evaluation seeks to identify organisational benefits such as enhanced safety, increased productivity or quality, decreased operating costs, and higher return on investment (ROI). A number of studies in recent years have focussed on demonstrating ROI benefits of CRM training within the aviation maintenance and maritime environments. Reported benefits include reductions in lost-time injuries, fewer major safety occurrences and lower corporate insurance premiums. It is anticipated that a recent study sponsored by the US Federal Railroad Association (FRA) will provide a solid business case for the implementation of CRM-style training in railroad settings (Olsen, 2006).
Level 4 Tools: ROI modelling	Patankar and Taylor (2004, Chapter 8) advocate and discuss methods for fiscal modelling of ROI delivered by CRM-style training. They conclude that ROI can be calculated for organisational change programs such as RRM as easily as for more traditional forms of capital investments. However, they add that while demonstrating ROI and other tangible benefits is important in order to ensure support from senior management and to compete for available funds, there are other intangible benefits of CRM-style training that cannot be represented by financial indicators. These 'softer' outcomes are also very important to system success and program champions must seek ways of identifying and gaining recognition for them as well.
What level of evaluation should be used for RRM?	The best approach is undoubtedly to employ several separate levels of RRM program evaluation, including the highest levels possible for your organisation. Virtually all AROs should be in a position to employ Level 1 (eg., Participant Evaluation Questionnaires) and Level 2 (eg., RRMAQ) evaluations without too much difficulty or cost. While Level 3 and 4 evaluations will require more effort and resources, the potential additional benefits for the organisation and the RRM program are substantial. Annex H includes a table displaying the results of a survey of 113 UK aviation operators regarding the Crew Resource Management evaluation methods they employed (Civil Aviation Authority, 2003).

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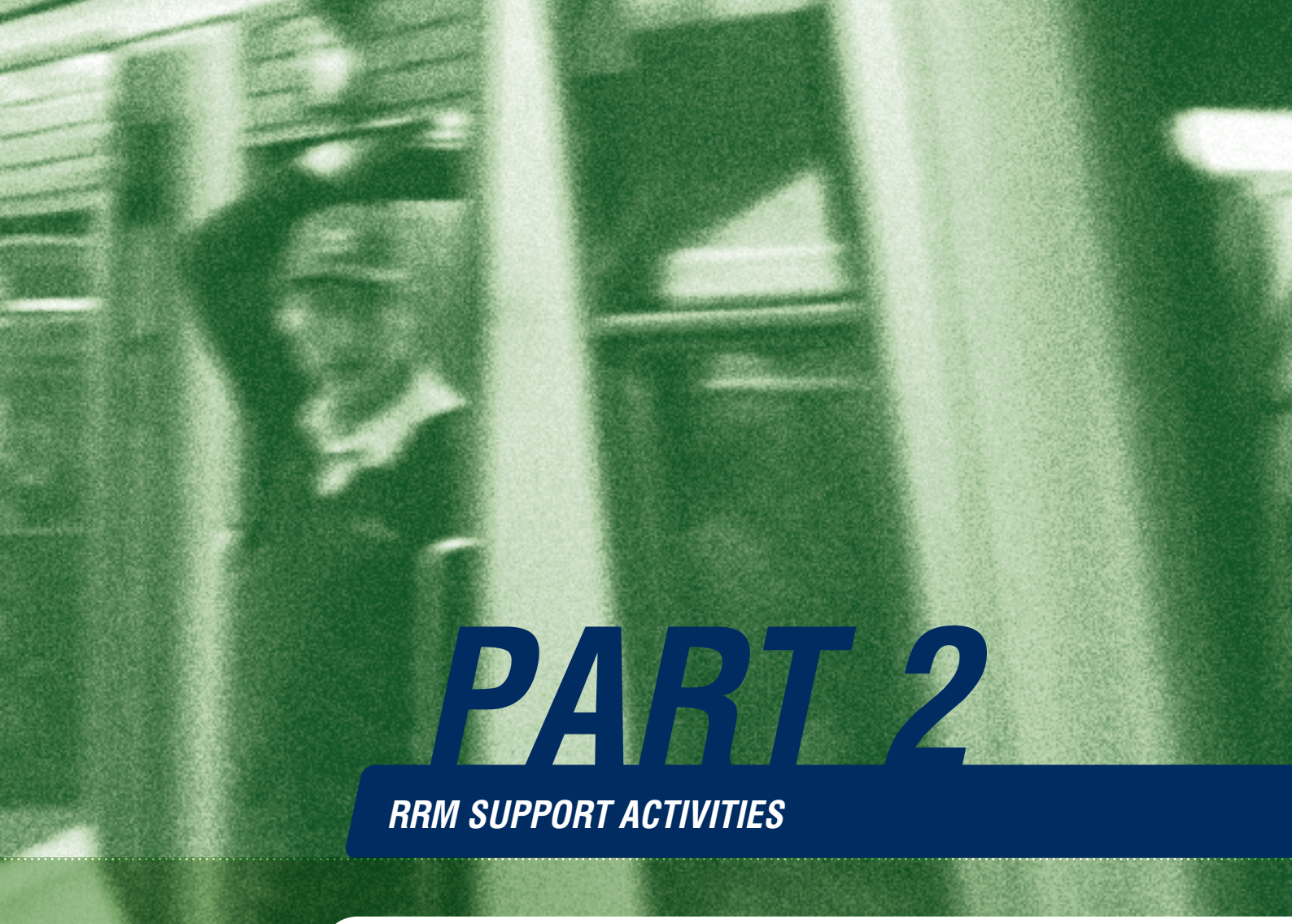


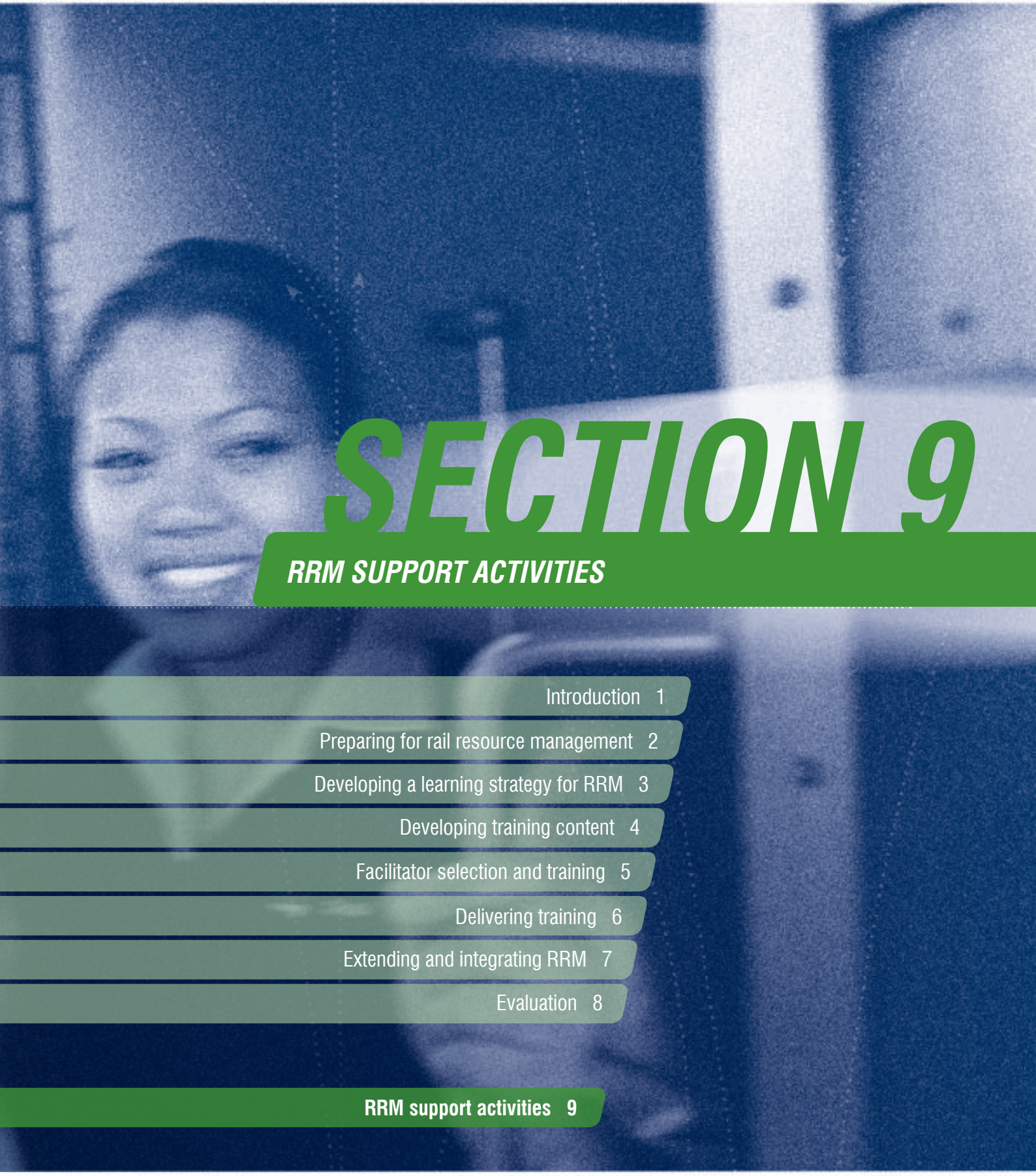
PART 2

RRM SUPPORT ACTIVITIES

This section of the RRM Guidelines provides information on ways that an RRM program can be supported, to ensure its initial implementation is effective and that it remains a viable long-term program for the host organisation. Seven areas of activity are described, covering the broad objective of each activity and the particular actions that will be beneficial. These RRM support activities have been identified from best practice in other industries where Crew Resource Management training programs have been successful.

The proposed support activities are based on a number of assumptions. First, it is assumed that there is a firm organisational commitment to RRM, and that it is valued as more than just another training activity. Unless the long-term cultural change benefits are recognised by an organisation, it is unlikely that the necessary resources will be committed for many of these implementation support activities.

Second, while some of these proposed activities are the responsibility of individual AROs, others assume a degree of industry-wide and/or inter-organisational cooperation. This could occur through informal local arrangements, for example to collaborate on training RRM facilitators or allowing external participants to attend an in-house RRM course, through to sponsorship of formal follow-up RRM projects by national industry bodies. Examples of the latter would include mechanisms through which data is collected and shared, or projects to develop and make available further RRM tools and resources.



SECTION 9

RRM SUPPORT ACTIVITIES

9.1 ONGOING COMMUNICATION

Objective	*To continue to promote RRM within the organisation, so that it is understood by all employees and remains accepted and valued.*
General information package	It is important that information about the purpose and benefits of RRM continues to be made available beyond the initial Communication Strategy employed to introduce the concept of RRM. This information will help maintain the profile of RRM amongst current rail safety workers, keep them up to date on RRM program initiatives and also ensure that new employees in the organisation can easily find out about RRM. A range of media can be used to provide Information, including hard copy (printed brochures, circulars etc.) or soft copy, for example on the company intranet or website. General information can be supported by special reports and updates on RRM activities, for example articles or feature stories in newsletters, company magazines or websites links.
Management awareness	Earlier sections of the Guidelines explained why it is important that managers have a sound understanding of what RRM is, and the importance of their role in supporting RRM and demonstrating commitment to the underlying principles. This is likely to require more than just written information. It is suggested that as well as the General Information Package explained above, managers with direct responsibility for line operations are provided with more comprehensive information on their responsibilities in supporting RRM and safety culture principles. This might take the form of group RRM briefings, workshops, mentored discussions or as a designated agenda item at regular management and/or safety meetings.

9.2 CREATE AN RRM POLICY

Objective	To facilitate the integration of Rail Resource Management by embedding it in the organisation's policies and procedures.
RRM Policy	One means of reinforcing the importance of RRM is to create and issue an RRM Policy, a formal document describing how the organisation envisages RRM is to be introduced and applied across the workforce. This demonstrates a clear organisational commitment to RRM and provides a basis for extending RRM into other activities such as staff selection, training, performance management, and the development of rules and procedures.
Integrate RRM in related policy areas	Existing policy areas that are impacted by RRM should be reviewed and aligned with the RRM philosophy and Policy. For example: · *Accident and Incident Investigation* procedures should reflect the importance of identifying human factors in safety occurrences, and reinforce the principle of open disclosure of errors; · *Training* policy and documentation should promote the development and assessment of 'non-technical' competence as an integrated aspect of all forms of training; · *Performance Management* practices should recognise the benefits of developing and evaluating RRM skills to confirm the effectiveness of training and as a necessary step in the process of continuous performance improvement; · *Risk Management* policies and procedures should acknowledge the 'sharp end' risk management activities undertaken by individuals and teams as a natural part of their everyday work; · Policies on *Just Culture* or other aspects of *safety culture* should cross-reference RRM, explaining how these policies empower people to behave in the ways prescribed by RRM, for example, to admit to errors without fear of blame, or to raise safety concerns without being rebuked.

9.3 INTEGRATE HUMAN FACTORS THROUGHOUT THE ORGANISATION

Objective	*To extend the benefits of Rail Resource Management by integrating human factors thinking, practices and principles throughout the organisation.*
Human factors approach	RRM is just one example of the way human factors principles can be applied to improve individual and organisational performance. Human factors can in fact be integrated through all of an organisation's functions to enhance safety and efficiency. Broad acceptance and integration of human factors principles will provide a highly congruent organisational setting in which to implement RRM.
Philosophy, policy and procedures	The growth of human factors as a discipline comes from recognition that the greatest threats to safety will arise in the domain of human factors, broadly defined to include people's behaviour and performance at work, as influenced by the workplace conditions around them and by the organisational context and culture. A human factors approach suggests that the interaction between these elements will be optimised by an operating philosophy that: · values people's knowledge, skills and judgement in carrying out their work safely, · recognises their human limitations and potential for error, · treats them justly when errors are made, and · accepts organisations are imperfect and will only improve if they are open to feedback and prepared to learn and adapt. Human factors principles can then be converted into tangible actions through a set of inter-related policies such as those referred to in the previous section. Policies in turn act as the foundation for operating procedures and rules that should also be aligned with the organisation's operating philosophy. Consistency is required between the philosophy, policies and procedures to give certainty to people's actions, and ensure that workplace practices achieve the intended objectives. For example, promulgating a 'just culture' philosophy and policy but in practice blaming people for errors would inhibit open disclosure of near misses.

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9.4 FORMALISE RRM IMPLEMENTATION

Objective	*To ensure the success of RRM implementation through effective project management.* As with any major innovation, the implementation of RRM training requires formal project management processes and support structures. It is particularly important that adequate resources are provided during the design, implementation and on-going deployment phases of the project. This section describes the critical elements required to formalise the implementation of RRM training.
Project sponsor	A project sponsor is required to provide high-level support for the RRM project, and to advocate and defend the project against pressure from competing organisational objectives. The project sponsor should be a person who: · Holds a senior management position, preferably with direct access to the CEO and⁄or Board; · Understands the values, goals, methods and resource requirements of RRM training; · Believes the RRM project is important and is prepared to argue on its behalf, for example, for resources and priority over other projects and tasks.
RRM implementation team	A two-level implementation team is recommended to provide effective project management and oversight. This comprises: 1. An RRM Steering Committee to set the project strategic direction, allocate resources and oversee progress, including management reporting. This committee would also be responsible for internal communication and marketing within the organisation. 2. An RRM Working Group, to develop the learning strategy, facilitate customisation of materials, manage facilitator selection and training, and oversee all practical elements of the implementation process. The RRM Working Group would typically include a mixture of experienced operational personnel, safety specialists, union representatives, workplace trainers, and qualified human factors specialists (if available). It is beneficial to project continuity if the RRM Manager (see below) belongs to this group, or is appointed from it. External consultants or training advisors (if used) would work with the Working Group, but provide strategic advice to the Steering Committee when required. The RRM Working Group should have direct access to the Project Sponsor, who may also be a member of the RRM Steering Committee.

Project Plan	A formal project plan for RRM implementation should be created, setting out the standard elements of such a project (timeframe, milestones, resources, risk factors etc.).
RRM Manager	As noted in Section 5.4, an RRM program is a significant project and training activity, and requires effective initial and ongoing management. The position of RRM Manager can be created to oversee the rollout and ongoing management of RRM training, and as a link between the design and implementation phases of the project. This may be a full-time position (perhaps with other associated Human Factors or training responsibilities) or a part-time position, depending on the organisation's size and resources and the anticipated scope of the RRM training program. The responsibilities of the RRM Manager would include: · Oversight of training schedules, resourcing, facilitator rosters and administration; · Resolving problems associated with course delivery, support or administration; · Quality control of training delivery and materials; · Selection, training and continuing professional development of new RRM facilitators; · Monitoring facilitator performance and overall suitability; · Reviewing and updating course content, case studies and other materials as required; · Management, analysis and reporting of course evaluation processes and data; · Liaison with external organisations regarding Joint Training or other forms of industry cooperation; · Oversight of Recurrent Training and other specialised RRM activities. Finally, the RRM Manager will be accountable for the effectiveness of the process through which matters of concern to participants that arise during RRM courses are recorded and communicated to management for action. The qualifications required by an RRM Manager include those specified for RRM facilitators (see Section 5.2). In addition, the RRM Manager should be an excellent role model for the RRM program, possess project management skills, be qualified as a trainer/facilitator, be reliable and attentive to detail, have sound organising skills and be able to act as mentor and provide general support to the RRM facilitator cohort.

9.5 INDUSTRY-BASED SUPPORT

Objective	*To deliver cost efficiencies through industry collaboration in resourcing components of RRM training.*
Facilitator training	The preferred model for RRM suggests that in-house peer facilitators be selected and trained to conduct courses. For large AROs the cost of providing this training is justified by the large number of safety workers who will ultimately attend RRM courses. Smaller AROs, including those in the Tourist and Heritage sector, may not have the need or capacity to train RRM facilitators in-house. As discussed above, an option in this case is the provision of centralised training of RRM facilitators, where smaller AROs could nominate a few individuals to attend an externally provided facilitator training program. Such a program could also address other relevant knowledge and skill requirements for facilitators or RRM Managers, for example, explaining how generic RRM course materials can be customised, and the methodology for development of in-house case studies. Centralised training of RRM facilitators could be arranged informally, or be coordinated and/or supported by industry bodies who wish to promote RRM amongst operators where this activity would otherwise be difficult.
Industry RRM courses	For the same reasons that smaller AROs would find it too costly to train their own facilitators, they may find the cost of conducting RRM initial training prohibitive where only small participant numbers are involved. Furthermore, where the workforce is highly distributed geographically, additional costs would be incurred bringing workers together for training. A proposed solution is to conduct industry RRM courses, open to any rail safety workers from AROs who cannot otherwise provide it. These courses would be generic in nature rather than customised to a particular role or work environment, but would still be beneficial in achieving general learning outcomes. This option would also provide the flexibility to conduct RRM in regional or remote locations where no single ARO would normally be able to justify delivering their own group training. RRM in this form may have incidental side benefits. Industry RRM courses provide an opportunity to manage the mix of course participants, and bring together rail workers from different organisations who form extended teams in the workplace (eg., drivers and signallers employed by different companies). This approach provides all the benefits of joint training described previously (see Section 3.4). Once again the involvement of rail industry associations to sponsor, promote, coordinate or otherwise support this approach to RRM training would be highly beneficial.

9.6 COLLECT DATA

Objective

To identify priority areas for RRM from empirical data, and to measure the effectiveness of RRM training initiatives.

To be most effective, RRM needs to be targeted to the areas of human performance that provide maximum payoff in preventing accidents. This section describes the forms of hard data that organisations should collect on staff attitudes and work performance in order to (a) properly focus the content of RRM training, and (b) to evaluate how effective RRM training or other activities have been in improving attitudes and work performance.

Attitude surveys

As discussed in Section 8 above, surveys have been widely used in aviation and other industries to evaluate worker attitudes about issues that can influence operational safety. The topics of interest here include for example the effects of fatigue, the perceived role and utility of other team members, the way authority should be exercised, and the flexibility with which procedures can be applied. In aviation, the Flight Management Attitudes Questionnaire (FMAQ) and its derivatives have been custom-designed and administered to pilots, flight attendants and maintenance workers. Similar instruments have also been adapted for surgical teams in the healthcare industry, and for maritime transport workers.

Attitude surveys are used with two objectives:

- To identify undesirable attitudes, false beliefs or flawed understanding that may lead to inappropriate workplace behaviour and potentially contribute to ineffective management of threats or errors.
- To evaluate the effectiveness of RRM training, by quantifying attitude changes following involvement in RRM, usually an initial RRM training course.

The suggested methodology is to collect baseline attitude measures before implementing RRM training, and use this information to focus and customise course materials. A second survey administration post-RRM training will indicate how effective this training has been, and allow future training to be further customised.

The Rail Resource Management Attitudes Questionnaire (RRMAQ) is a generic adaptation of the FMAQ to the local rail environment. A sample RRMAQ is provided in Annex F.

Ongoing performance evaluation

The objective of workplace training is to develop competence to perform work tasks and activities effectively. Data about the quality of work performance is essential if training needs are to be adequately identified and addressed. In regard to RRM, behavioural markers can be used as the benchmark for measuring non-technical job performance (see Section 7.4 above).

In aviation, a methodology was developed to collect direct and very detailed

continued …

continued …	observational data on pilot performance during normal line operations. Referred to as Line Operations Safety Audit (LOSA), this process has the objective of understanding how well CRM skills are applied to manage threats and errors successfully. Where observations indicate that pilots in an airline collectively lack particular CRM skills, these gaps can be addressed in CRM courses or in other practical flying training sessions. It is strongly recommended that AROs examine the feasibility of collecting this form of operational data, and using it to guide future training.
Incident data	Two forms of incident data can be collected and analysed to help identify RRM training needs: · *Incident and accident reports.* These reports will be most useful where a human factors perspective exits in the organisation, and analyses contain specific information on human performance failures and potential improvements. · *"Near miss" events,* typically collected through a confidential incident reporting system. Once again, this information will feed more smoothly into RRM interventions if the operators being encouraged to complete confidential reports understand human factors principles and terminology. It should also be noted that confidential reporting systems are only effective where a positive safety culture exists and trust exists that this information will not be misused.
Feedback loop	Continuous improvement of worker performance depends on an efficient feedback loop from the workplace into training. Whether the data being fed back involves attitudinal measure, behavioural observation, safety events or even technical performance data, this information needs to be collected continuously and transferred reliably into updated training. The effectiveness of these feedback loops is compromised in some organisations by a silo culture in which different departments (training, safety, workplace assessment etc.) are not well-connected and the interchange of information is poor.
Comparative analyses	Benchmarking against other organisations is a useful way of determining current levels of performance and measuring improvement. In aviation, a system was established to collect LOSA data centrally in a standard and confidential way, allowing an individual airline to then compare their own performance with data from a group of similar operators. There is potential for the rail industry to establish similar systems to collect comparative data on RRM-related measures of the kind described above, and to make this available to those who participate for benchmarking purposes. This would constitute a significant long-term research activity, one perhaps best conducted in association with a university of other research organisation.

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9.7 ONGOING ADVICE

Objective	*To provide timely ongoing advice and support to AROs if they encounter problems or difficulties implementing or sustaining RRM.* It is likely that these Guidelines will not answer every question that arises for an ARO implementing RRM This section describes options for providing advice to resolve these issues or concerns into the future.
RRM Facilitator group	The group of RRM facilitators and RRM Manager within an organisation are a readily accessible resource for solving problems that arise as RRM is implemented. If, as recommended, facilitators and RRM Managers develop a good understanding about how CRM has operated in other industries, they should have the knowledge to resolve day-to-day issues involving for example course management, content, facilitation or participant behaviour. Where facilitators do not have an immediate answer they should be sufficiently connected to the extensive literature on CRM to be able to obtain relevant information.
RRM User Group	It is proposed that an Industry RRM User Group be established amongst AROs undertaking RRM projects. This network might include RRM managers or other representatives, and be established with the following objectives: · To share experience through the RRM design and implementation phases; · To exchange information such as case studies, or other content found to be useful; · To solve problems with any aspect of RRM; · To consider and plan future RRM activities, such as recurrent training, data sharing, or evaluation techniques; · To facilitate joint training or industry RRM courses, as discussed in Section 9.5 above.

National RRM website	It is proposed that a dedicated National RRM Project website be established, to contain information including: · A copy of these Guidelines; · Generic materials and courseware; · 'Best practice' tips and ideas; · New case studies developed and made available by the owner; · Links to other CRM/RRM and human factors resources; · Notification about industry courses or courses being opened up to external participants There is clearly a need for an industry body or association to sponsor such a website. Decisions would also be required about levels of access, confidentiality and copyright matters.
Project Help Desk	The RRM Project sponsors are considering the establishment of an RRM implementation 'Help Desk' to follow conclusion of the main project activities. Under this initiative, consultants or other individuals experienced in implementing CRM and RRM training programs could be made available to answer questions and provide advice by phone or email.

GLOSSARY

Ability	The capacity of a person to perform a physical or mental function that is not derived from specialised, job specific training, education or experience. Abilities can be cognitive (eg., written comprehension, spatial orientation), psychomotor (eg., reaction time, eye-hand coordination) or sensory (eg., visual acuity, colour perception, hearing sensitivity).
Accident	An unintended rail system occurrence that results in: death or serious injury to a person; derailment of any unit of rolling stock; a collision between rolling stock and any person; collision between rolling stock and any other vehicle, infrastructure, obstruction or object which results in significant property damage; or an implosion, explosion, fire or other occurrence which results in significant property damage.
Aptitude	A combination of abilities and other characteristics, either inherited or acquired, that enables a person to learn or develop proficiency in a particular area if appropriate education or training is provided.
Assertiveness	Non-aggressively affirming, stating and defending what you consider to be right and appropriate in the context. Using clear and persuasive communication techniques to ensure your position is understood by others.
Attention	The intentional assignment of mental resources to a given subject, object or event.
Attitude	A mental disposition or feeling, generally favourable or unfavourable, towards a person or object.
Behavioural Marker	A short, precise statement describing a single non-technical skill or competency.
Behavioural Marker System	An organised set of competency descriptors, collectively representing the domain of non-technical skills required for successful performance in a specified role.
Communication	The process of verbal or non-verbal information transfer between a sender and receiver.
Competence	The possession of defined skills and knowledge, and the application of these to the standards required to safely and efficiently perform work.
Crew Resource Management training (CRM)	A team training and operational philosophy originating within the aviation industry. Defined as the use of all available resources – information, equipment, and people – to achieve safe and efficient flight operations (Lauber, 1984).
Decision making	The mental process of selecting a course of action from one or more alternatives, with the objective of achieving a specified outcome.
Emergency Management	The timely application of knowledge, skills and experience in a crisis to mitigate the threat of harm or loss.

Error (Human Error)	Definition by James Reason in "Human Error" (1990): "Error is intimately bound up with the notion of intention. The term 'error' can only be meaningfully applied to planned actions that fail to achieve their desired consequences without the intervention of some chance or unforeseeable agency. Two basic error types: slips and lapses, where actions do not go according to plan, and mistakes, where the plan itself is inadequate to achieve its objectives. An error is NOT intentional. You make an error when: what you do differs from what you intended, or your plan was inappropriate."
Error Management	The set of behaviours and processes designed to prevent, detect, recover from and mitigate the consequences of slips, lapses and mistakes. Error Management also involves the capacity to discriminate those errors with consequences from those that can be ignored, either because they have no serious potential consequences, or because they will be corrected in a future process. Not all errors need to be corrected.
Facilitator	A person who enables learning in a student-centred environment by guiding participants through discussions, interactions, structured exercises and experiences.
Generic Safety Activity (GSA)	Tasks or responsibilities that are not specific to a particular (rail safety worker) role or occupation, but represent the underlying requirements for work to be completed safely. Rail Resource Management competencies are designed to enable workers to perform Generic Safety Activities.
Human Factors	Human factors is a multidisciplinary field concerned with optimising the performance of individuals and teams in the workplace. The broad domain of human factors is an applied science that draws on methods and principles from psychology, other behavioural and social sciences, engineering, ergonomics and physiology. The aim of human factors is to reduce and mitigate error and improve safety and efficiency through an understanding of human capabilities, limitations and the way people interact with their work environments.
Incident	A near-accident event where safety was or could have been compromised, that is, the circumstances and human actions at the time could have resulted in an accident.
Just Culture	An organisational perspective that discourages blaming the individual for an honest mistake that contributes to an accident or incident. Sanctions are only applied when there is evidence of a conscious violation or intentional reckless or negligent behaviour.
Leadership	The function taken on with a particular style by an individual or group placed in a defined situation, with the aim of influencing or even transforming the behaviour of others in order to achieve assigned objectives or to implement specified tasks.

Mental Model	A cognitive (or mental) representation of the present or future external environment, used to drive a person's performance when interacting with the world to achieve an objective. These representations are based on perception combined with experience and various types of knowledge, and include awareness about task demands and task performance.
Rail Resource Management (RRM)	The generic term used for the version of Crew Resource Management being provided for the Australian Rail Industry. Adapting the definition of CRM, RRM is the effective use of all available resources – information, equipment, and people – to achieve safe and efficient rail operations.
Rail Safety Worker	A person performing or responsible for *safety related work*, as a paid member of the staff of the railway, a contractor, subcontractor, or an employee of either, or as a volunteer.
Recurrent Training	Learning activities designed to refresh, reinforce and confirm knowledge and competence at regular intervals.
Risk Management	The systematic processes used to identify, analyse, evaluate, treat and monitor hazards or other conditions and events that could cause harm or loss.
Safety Culture	The set of beliefs, norms, attitudes, and practices within an organisation concerned with minimising exposure of the workforce and the general public to dangerous or hazardous conditions. In a positive safety culture, a shared concern for, commitment to and accountability for safety is promoted.
Safety Related Work	Safety related activity in one or more of the following work areas: a) Driving and operation of trains; b) Control and movement of trains; c) The design, construction, repair, maintenance, upgrading, inspection or testing of track, rolling stock, civil and electric traction infrastructure, and signalling and telecommunications equipment; d) Development, design, implementation and management of safety related processes; and e) Any other duties prescribed by an organisation as safety related work.
Self Management	Being responsible for one's own capacity to perform safely and effectively, to the degree that is reasonable and possible in the circumstances.
Situational Awareness	Having a clear and up to date understanding of what is going on around you, and what may happen next. In RRM, ensuring safe operations by maintaining an accurate mental picture of the local environment, correctly interpreting this information and using it to anticipate what will happen in the future.
Situational Leadership	A form of leadership involving flexibility in approach according to the nature of the situation and the characteristics and abilities of the team members or followers (model developed by Hersey & Blanchard).

Stress	A mismatch between the demands placed on a person and their perceived ability to cope. Also used to refer to the demand or stimulus itself (the stressor), and to the physiological and psychological effects that result.
Task Management	The process of matching competence, resources and actions to the requirements of the job to achieve the intended outcome safely and efficiently.
Teamwork	Group effort applied to work.
Threat and Error Management	A model describing the processes used by operators in high risk environments to ensure safety by dealing effectively with external threats, their own errors and with undesired or abnormal situations. Non-technical skills such as those addressed in RRM training are seen as counter-measures to threats and errors. Model developed by Professor Robert Helmreich and colleagues at the University of Texas at Austin.
Training	The systematic development of the knowledge, understanding, skill, attitude and behaviour pattern required by an individual in order to perform adequately a given task or a job.
Training Needs Analysis (TNA)	A systematic process used to identify training requirements for a specified occupation or employee group.
Unit of Competency	Under Australian National Standards, a defined group of competencies required for effective performance in the workplace. A competency comprises the specification of knowledge and skill and the application of that knowledge and skill at an industry level, to the standard of performance required in employment.
Violation	A deliberate deviation from rules, regulations or procedures. A person committing a deliberate violation fully intends their actions as well as the consequences of their actions.
Violation, routine	A deviation from rules, procedures or regulations that, because it results in short-term advantages and produces no apparent negative consequences, is repeated. When one or more people adopt the same non-compliant behaviour it becomes standard practice or the norm within the sub-culture. Routine violations are dangerous because the safety margin created by the rule or procedure has been reduced. A typical routine violation is exceeding the speed limit in a motor vehicle.

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ANNEX A: OVERVIEW OF CRM AND RRM

Crew Resource Management

Crew Resource Management (CRM) training has its origins in a very practical problem first described in the late 1970s: a string of serious aviation accidents precipitated by the ineffective management of available resources (see Lauber, 1979; Helmreich, 1979; National Transportation Safety Board, 1979). In short, as the technical and mechanical reliability of aircraft improved, it was observed that many aviation accidents were occurring for a broad range of "human factors" related to ineffective teamwork, including inadequate leadership, preoccupation with technical problems, deficient communication, poor task allocation, judgement and decision making. At the time, flight crew training focused almost exclusively on the technical aspects of flying and did not effectively address these crew management issues that were (with hindsight) so essential for safe flight. Cockpit Resource Management training thus emerged in the early 1980s as a means of addressing these issues and improving teamwork in the cockpit.

In its initial iterations, Cockpit Resource Management training focused on social interaction in the cockpit and on changing attitudes towards teamwork amongst pilots and flight engineers (see Lauber, 1984; Foushee, 1984; Foushee & Helmreich, 1988; Orlady & Foushee, 1986; Salas, Prince et al., 1999). It also emphasised the correction of deficiencies in behaviour such as lack of assertiveness by junior crewmembers, and authoritarian behaviour by captains.

By the early 1990s, *Cockpit* Resource Management had evolved into *Crew* Resource Management training and the focus had shifted from individual behaviour to group dynamics. By then a range of authors were documenting the evolving training rationale and processes of what became universally known and increasingly accepted within the airline industry as CRM training (see Diehl, 1991; Helmreich, 1991; Helmreich & Foushee, 1993; Lauber, 1987; Wiener, Kanki & Helmreich, 1993).

Dr John Lauber first defined CRM as *"using all available resources – information, equipment and people – to achieve safe and efficient flight operations"* (Lauber, 1984, p. 20). While CRM has evolved considerably over the past 20 years, this basic definition remains valid and oft quoted. Helmreich and Foushee (1993) later noted that CRM training aimed to optimise the human-machine interface and interpersonal activities, including effective team building and maintenance, information transfer, leadership, problem solving, decision making and maintaining situation awareness. Contemporary CRM programs include a focus on threat and error management: the avoidance, management and mitigation of human error. Training rationale is based on the acceptance that error is inevitable and participants are trained in recognising the limits of human performance and managing errors as they occur.

Over the past 15 years CRM has been extended to a range of other groups involved in flight operations, including cabin crew, maintenance workers, ramp staff, despatch officers, operations managers and air traffic controllers (see Hayward, 1995, 1997a; Helmreich, Merritt & Wilhelm, 1999). CRM has also been adapted to other high-risk industries where effective teamwork, communication, and coordination are essential for safe and efficient operations. These include the maritime industry, health care, the offshore oil industry, and the rail industry in North America.

Rail Resource Management

Much as Crew Resource Management was introduced to address safety and teamwork issues in aviation, Rail Resource Management has been developed to address similar issues in the rail industry. The objective of RRM is to provide rail safety workers with the knowledge, skills and attitudes to manage themselves and available resources more safely and effectively.

Accident investigation and research provide strong support for the view that CRM training can be of potential benefit for the rail industry. For example, the US Federal Railroad Administration (FRA; Federal Railroad Administration, 2002) reports that since 1985, human factors issues have accounted for approximately one-third of all rail accidents and half of all rail yard accidents in the United States. More specifically, human error has been indicated as a causal factor in up to 37% of all train accidents not related to highway rail grade crossings (Federal Railroad Administration, 1999). Further, ineffective CRM has been identified as a contributing factor in a number of major rail accidents (eg., National Transportation Safety Board, 1999a; National Transportation Safety Board, 1999b, Office of Transport Safety Investigation, 2004; Transportation Safety Board, 1998), confirming a direct link between CRM behaviours and safety within the industry.

The NTSB investigation report into a 1998 train collision in the US state of Indiana (National Transportation Safety Board, 1999b) concluded that railroad safety would be enhanced if rail safety workers received "Train Crew Resource Management" training (TCRM) and recommended that TCRM training be developed for all train crew members. The recommendation stipulated that the training should at a minimum address:

- crewmember proficiency,
- situational awareness,
- effective communication and teamwork, and
- strategies for appropriately challenging and questioning authority.

The Special Commission of Inquiry report into the rail accident at Waterfall NSW in 2003 included the recommendation that "Train driver and guard training should encourage teamwork and discourage authority gradients" (McInerney, 2005a). A subsequent review of safety management systems within the operator was even more prescriptive, recommending "customised human factors training for rail safety workers and management/supervisory level staff based on contemporary Crew Resource Management principles" (McInerney, 2005b).

The need for CRM within the Australian rail industry had been identified well before Waterfall. The investigation of a collision between a passenger train and a derailed ballast train near Bargo NSW in 2002 (Transport NSW, 2000) identified deficiencies in post-accident communication and emergency management, and attributed these to inadequate CRM. A recommendation for corrective action was made that "all Rail Safety Workers undertake Crew Resource Management training to increase their competence in the use of all resources".

ANNEX B: RRM COMPETENCY ELEMENTS

1. LEADERSHIP

Element	Performance Criteria
Accountability	Roles and responsibilities are clarified for routine and abnormal situations
Decisiveness	Decisive action is taken when informed of a situation affecting safety
Maintaining standards	Behaviour of team members is corrected if rules or procedures are not applied appropriately
Monitoring performance	Supervisors ensure others follow standard procedures and complete safety-related tasks correctly
Promoting participation	Team members are encouraged to contribute to task planning and completion
Situational leadership	A leadership role is taken on if the situation requires
Authority gradient	An optimal authority gradient is fostered within the team

2. TASK MANAGEMENT

Element	Performance Criteria
Concentration	Attention is focussed and distractions are managed, especially in high workload situations
Cross-checking	Actions of other team members are monitored and cross-checked
Delegation	Delegation is used when appropriate to manage workload for safety-critical and routine tasks
Flexibility	Existing plans are reviewed and modified when necessary
Managing automation	Automated systems and controls are managed effectively
Prioritising action	Actions are prioritised to manage multiple tasks and high workload
Time management	Time constraints are discussed with other team members when managing workload

3. TEAMWORK

Element	Performance Criteria
Assisting others	Assistance and advice are provided to other team members
Considering others	The workload of other team members is considered before interacting with them
Developing others	Experiences are shared eg. about incidents and near misses, to enhance team awareness of safety
Positive atmosphere	Open communication and effective working relationships are established with others
Preventing conflict	Professional or personal biases are put aside to promote cooperation
Resolving conflict	Interpersonal skills are used to defuse arguments and resolve conflict
Using available resources	Advice is sought from other team members and sources

4. COMMUNICATION

Element	Performance Criteria
Assertiveness	Concerns about safety are expressed strongly and persistently
Briefing	Information and operational plans are shared with others prior to shift/task
Debriefing	Critical events are debriefed to improve the way they are handled next time
Ensuring understanding	Understanding is confirmed at the end of a briefing or debriefing
Inquiry	Questions are asked to clarify understanding if uncertain
Keeping others informed	Relevant information is passed on to keep other team members up to date
Providing clear information	Clear and unambiguous instructions, information and explanations are given
Radio procedures	Correct radio protocol is used
Shift handover	Operational tasks are properly handed-over to another person or team eg., at the end of shift

5. RISK MANAGEMENT

Element	Performance Criteria
Exercising caution	Particular caution is exercised under unusual or demanding conditions
Handling competing goals	Deadlines (eg., on-time-running requirements) are balanced with safety considerations
Judgement	Tasks are carried out in accordance with procedures unless exceptional circumstances render this unsafe
Managing pressure	Rules and procedures are followed (short cuts are not taken) even if under pressure
Planning for threats	Discussion is held with other team members on how potential hazards or abnormal situations will be managed
Risk assessments	Operators stop, assess risk and plan before unusual or difficult tasks
Safe operation	Equipment is operated safely in accordance with rules and limits
Safety focus	Concern is shown for safety in operational preparation and planning

6. SITUATIONAL AWARENESS

Element	Performance Criteria
Alertness	Vigilance is shown when approaching known hazards
Anticipation	Potential problems are identified from available information
Awareness of systems	Changes in train/vehicle instruments/control systems are monitored, reported and acknowledged (eg., in two driver operations)
Road knowledge	A "mental model" of the operating environment is used as a basis for action
Removing uncertainty	Uncertainty is resolved by seeking further information
Verification	Assumptions and/or expectations are verified before proceeding

7. DECISION MAKING

Element	Performance Criteria
Define the problem	All relevant information is gathered and analysed to help understand the problem
Consult others	Others' opinions and suggestions are sought before deciding what to do
Consider options	Available time is used to consider all options, not just the most obvious alternative
Weigh up risks	Potential risks are discussed for each alternative being considered
Review consequences	Outcomes of decisions are reviewed to ensure solution was effective

8. EMERGENCY MANAGEMENT

Element	Performance Criteria
Evaluating risk	Risk is regularly re-assessed when dealing with emergency situations
Intuitive decision making	Training and experience is applied to instinctively carry out the most important actions in an emergency
Providing support	Others are reassured and helped to remain calm in an emergency
Safety action	Action is taken to protect passengers and other rail workers from further danger in an emergency

9. SELF-MANAGEMENT

Element	Performance Criteria
Composure under pressure	Composure is shown in managing emergency or other demanding situations
Fitness for work	Employees report for work fit for duty, ie. well rested and stress free
Managing fatigue	The effect of fatigue in oneself and others is recognised and appropriate action taken to manage this
Self control	Effectiveness is maintained under stress or periods of high workload
Recognising limitations	Assistance is requested without hesitation, eg., to deal with a difficult or abnormal situation

ANNEX C: SAFETY CULTURE SELF-ASSESSMENT

National RRM Project
Self-assessment of Readiness for RRM

This questionnaire has been adapted from an earlier survey developed by Professor James Reason for the purpose of evaluating the nature and strength of an organisation's safety culture.[13] It is offered here as a tool to assist AROs in assessing their own readiness to introduce Rail Resource management, based on the premise that the safety culture characteristics described in the questionnaire are closely aligned to the factors that will influence the success of RRM.

A scoring process and table for interpreting scores is given at the end of the questionnaire. It is not suggested that a particular score be used to make 'Go – No go' decisions about proceeding with RRM. Rather, the questionnaire results should be interpreted qualitatively, and used to identify aspects of organisational culture that should be attended to prior to or concurrently with the implementation of RRM.

INSTRUCTIONS:

Circle one of the available options at the right of each item, where:

YES = This is definitely the case in my organisation (scores 1)
? = "Don't know," "maybe" or "could be partially true" (scores 0.5)
NO = This is definitely not the case in my organisation (scores zero).

1.	**MINDFUL OF DANGER:** Top managers are constantly mindful of the human organisational factors that can endanger their operations.	Yes	?	No
2.	**ACCEPT SETBACKS:** Top management accepts occasional setbacks and nasty surprises as inevitable. They anticipate that people will make errors and ensure employees are trained to detect and recover from them.	Yes	?	No
3.	**COMMITTED:** Top managers are genuinely committed to safety and provide adequate resources to achieve this goal.	Yes	?	No
4.	**REGULAR MEETINGS:** Safety-related issues are considered at high-level meetings on a regular basis, not just after some bad event.	Yes	?	No
5.	**EVENTS REVIEWED:** Past events are thoroughly reviewed at top-level meetings and the lessons learned are implemented as global reforms rather than local repairs.	Yes	?	No
6.	**IMPROVED DEFENCE:** After some mishap, the primary aim of top management is to identify the failed system defences and improve them, rather than to seek to divert responsibility to particular individuals.	Yes	?	No
7.	**HEALTH CHECKS:** Top management adopts a proactive stance toward safety. That is, it does some or all of the following: takes steps to identify recurrent error traps and remove them; strives to eliminate the workplace and organisational factors likely to provoke error; brainstorms new scenarios of failure; and conducts regular "health checks" on the organisational process known to contribute to mishaps.	Yes	?	No

continued …

13 The questionnaire was presented by Professor Reason at the Manly 2000 Symposium of the Australian Aviation Psychology Association. A version of the questionnaire that can be completed and automatically scored on the internet can be found on the Transport Canada website: http://www.tc.gc.ca/civilaviation/systemsafety/Brochures/tp13844/menu.htm

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8.	**INSTITUTIONAL FACTORS RECOGNISED:** Top management recognises that error-provoking institutional factors (under-staffing, inadequate equipment, inexperience, patchy training, bad human-machine interfaces, etc.) are easier to manage and correct than fleeting psychological states, such as distraction, inattention and forgetfulness.	Yes	?	No
9.	**DATA:** It is understood that the effective management of safety, just like any other management process, depends critically on the collection, analysis and dissemination of relevant information.	Yes	?	No
10.	**VITAL SIGNS:** Management recognises the necessity of combining reactive outcome data (i.e., the near miss and incident reporting system) with active process information. The latter entails far more than occasional audits. It involves the regular sampling of a variety of institutional parameters (scheduling, budgeting, fostering, procedures, defences, training, etc.), identifying which of these vital signs are most in need of attention, and then carrying out remedial actions.	Yes	?	No
11.	**EMPLOYEES ATTEND SAFETY MEETINGS:** Meetings relating to safety are attended by employees from a wide variety of departments and levels.	Yes	?	No
12.	**CAREER BOOST:** Assignment to a safety-related function (quality or risk management) is seen as a fast-track appointment, not a dead end. Safety functions are accorded appropriate status and salary.	Yes	?	No
13.	**MONEY VS. SAFETY:** It is accepted that commercial goals and safety issues can come into conflict. Measures are in place to resolve such conflicts in an effective and transparent manner.	Yes	?	No
14.	**REPORTING ENCOURAGED:** Policies are in place to encourage everyone to raise safety-related issues (one defining characteristic of a pathological culture is that messengers are “shot” and whistleblowers are dismissed or discredited).	Yes	?	No
15.	**TRUST:** The organisation recognises the critical dependence of a safety management system on the trust of the workforce – particularly in regard to reporting systems. A safe culture – that is, an informed culture – is the product of a reporting culture that, in turn, can only arise from a just culture.	Yes	?	No
16.	**QUALIFIED INDEMNITY:** Policies relating to near miss and incident reporting systems make clear the organisation’s stance regarding qualified indemnity against sanctions, confidentiality, and the organisational separation of the data-collecting department from those involved in disciplinary proceedings.	Yes	?	No

17. **BLAME:** Disciplinary policies are based on an agreed (i.e., negotiated) distinction between acceptable and unacceptable behaviour. It is recognised by all staff that a small proportion of unsafe acts are indeed reckless and warrant sanctions but that the large majority of such acts should not attract punishment. The key determinant of blameworthiness is not so much the act itself – error or violation – as the nature of the behaviour in which it was embedded. Did this behaviour involve deliberate unwarranted risk-taking or a course of action likely to produce avoidable errors? If so, then the act would be culpable regardless of whether it was an error or a violation.	Yes	?	No
18. **NON-TECHNICAL SKILLS:** Line management encourages their employees to acquire the mental (or non-technical) as well as the technical skills necessary to achieve safe and effective performance. Mental skills include anticipating possible errors and rehearsing the appropriate recoverable recoveries. Such mental preparation at both individual and organisational levels is one of the hallmarks of high-reliability systems and goes beyond routine simulator checks.	Yes	?	No
19. **FEEDBACK:** The organisation has in place rapid, useful and intelligible feedback channels to communicate the lessons learned from both the reactive and proactive safety information systems. Throughout, the emphasis is upon generalising these lessons to the system at large.	Yes	?	No
20. **ACKNOWLEDGE ERROR:** The organisation has the will and the resources to acknowledge its errors, to apologise for them and to reassure the victims (or their relatives) that the lessons learned from such accidents will help to prevent their recurrence.	Yes	?	No

INTERPRETATION:

Higher scores on this checklist indicate that an organisation has more of the attributes associated with a good safety culture. A high score does not provide a guarantee of immunity from accidents or incidents however. Even the "healthiest" institutions can still have bad events. But a moderate to good score (8-15) suggests that you are striving hard to achieve a high degree of robustness while still meeting your other organisational objectives. The price of safety is chronic unease: complacency is the worst enemy.

Score	Safety Status	Implications for RRM
16 – 20	So healthy as to be barely credible	More than ready – RRM will fit well with existing culture
11 – 15	You're in good shape, but don't forget to be uneasy	Ready for RRM, which should help bridge gaps in safety practices
6 – 10	Not too bad, but there's still a long way to go	Consider other safety culture enhancements pre-RRM
1 – 5	You are very vulnerable	RRM will conflict with existing culture and be of limited value now
0	Jurassic Park	RRM will fail at this time

ANNEX D: RAIL SAFETY BEHAVIOURAL MARKER SYSTEM

Category	Element	Behavioural Markers
1. LEADERSHIP	**Accountability**	Clarifies roles and responsibilities for routine and abnormal situations
	Decisiveness	Takes decisive action when informed of a situation affecting safety
	Maintaining standards	Intervenes if team members do not apply appropriate rules or procedures
	Monitoring performance	Ensures others follow standard procedures and complete safety-related tasks correctly
	Promoting participation	Encourages team members to contribute to task planning and completion
	Situational leadership	Takes a leadership role if the situation requires
	Authority Gradient	Fosters an optimal authority gradient within the team

Category	Element	Behavioural Markers
2. TASK MANAGEMENT	**Concentration**	Focuses attention and manages distractions, especially in high workload situations
	Cross-checking	Monitors and cross-checks actions of other team members
	Delegation	Manages workload by delegating safety-critical and routine tasks
	Flexibility	Reviews existing plans and modifies them when necessary
	Managing automation	Manages automated systems and controls effectively
	Prioritising action	Prioritises actions to manage multiple tasks and high workload
	Time management	Discusses time constraints with other team members when managing workload

Category	Element	Behavioural Markers
3. TEAMWORK	**Assisting others**	Provides assistance or advice to other team members
	Considering others	Considers the workload of other team members before interacting with them
	Developing others	Enhances team awareness of safety by sharing experiences eg. Incidents and near misses
	Positive atmosphere	Establishes open communication and effective working relationships with others
	Preventing conflict	Puts professional or personal biases aside to promote cooperation
	Resolving conflict	Uses interpersonal skills to defuse arguments and resolve conflict
	Using available resources	Seeks advice from other team members and sources

Category	Element	Behavioural Markers
4. COMMUNICATION	**Assertiveness**	Expresses concerns about safety strongly and persistently
	Briefing	Shares information and operational plans with others prior to shift/task
	Debriefing	Debriefs critical events to improve the way they are handled next time
	Ensuring understanding	Confirms understanding at the end of a briefing or debriefing
	Inquiry	Asks questions if uncertain to clarify understanding
	Keeping others informed	Passes on relevant information to keep other team members up to date
	Providing clear information	Gives clear and unambiguous instructions, information and explanations
	Radio procedures	Uses correct radio protocol
	Shift handover	Conducts a proper hand-over to another person or team for critical operational tasks eg., at the end of shift

Category	Element	Behavioural Markers
5. RISK MANAGEMENT	**Exercising caution**	Exercises particular caution under unusual or demanding conditions
	Handling competing goals	Balances deadlines (eg., on-time-running requirements) with safety considerations
	Judgement	Carries out tasks in accordance with procedures unless exceptional circumstances render this unsafe
	Managing pressure	Follows rules and procedures (doesn't take short cuts) even if under pressure
	Planning for threats	Exchanges information with other team members on how potential hazards or abnormal situations will be managed
	Risk assessments	Stops, assesses risk and plans before unusual or difficult tasks
	Safe operation	Operates equipment safely in accordance with rules and limits
	Safety focus	Shows concern for safety in operational preparation and planning

Category	Element	Behavioural Markers
6. SITUATIONAL AWARENESS	**Alertness**	Shows vigilance when approaching known hazards
	Anticipation	Identifies potential problems from available information
	Awareness of systems	Monitors, reports and acknowledges changes in train/vehicle instruments/control systems (two driver operations)
	Road knowledge	Uses a "mental model" of the operating environment as a basis for action
	Removing uncertainty	Resolves uncertainty by seeking further information
	Verification	Verifies assumptions and/or expectations before proceeding

Category	Element	Behavioural Markers
7. DECISION MAKING	**Define the problem**	Gathers and analyses all relevant information to help understand the problem
	Consult others	Asks for others' opinions and suggestions before deciding what to do
	Consider options	Uses available time to consider all options, not just the most obvious alternative
	Weigh up risks	Discusses potential risks for each alternative being considered
	Review consequences	Reviews outcome of decisions to ensure solution was effective

Category	Element	Behavioural Markers
8. EMERGENCY MANAGEMENT	**Evaluating risk**	Regularly re-assesses risk when dealing with emergency situations
	Intuitive decision making	Applies training and experience to instinctively carry out most important actions in an emergency
	Providing support	Reassures others, helps them remain calm in an emergency
	Safety action	Takes action to protect passengers and other rail workers from further danger in an emergency

Category	Element	Behavioural Markers
9. SELF-MANAGEMENT	**Composure under pressure**	Shows composure in managing emergency or other demanding situations
	Fitness for work	Reports for work fit for duty, ie. well rested and stress free
	Managing fatigue	Recognises effects of fatigue in self and others and takes appropriate action to manage this
	Self control	Maintains effectiveness under stress or periods of high workload
	Recognising limitations	Requests assistance without hesitation, eg., to deal with a difficult or abnormal situation

ANNEX E: RRM TRAINING NEEDS ANALYSIS

RRM Training Needs Analysis – Rating Form

INSTRUCTIONS

These instructions describe a process for undertaking a Risk-Based Training Needs Analysis for Rail Resource Management (RRM). Although it is expected that there is a widespread need for RRM in the Australian Rail Industry, the same training will not be required by all rail safety workers. The process described here will help organisations intending to use the basic RRM training materials to:

a. Develop a profile of training priorities for an individual rail safety worker role, designed to reduce risk associated with human performance;

b. Identify training gaps, ie., where relevant training is not currently provided;

c. Customise an RRM training syllabus; and

d. Evaluate possibilities for joint training.

It is recommended that this analysis be undertaken by one or more subject matter experts who, individually or collectively, meet the following criteria:

- Are familiar with the nature and objectives of RRM;
- Have current knowledge of the job requirements and context of the role in question; and
- Understand the human factors associated with safety events in their own organisation.

The process for defining training needs involves the following three steps:

Step 1 Choose the rail safety worker role for which the Training Needs Analysis is to be conducted. The Generic Safety Activity Rating Form below has nine GSA categories and example tasks developed for rail safety workers. Read through the Elements and behaviour associated with each category and determine whether each example activity is relevant to the position being analysed. Effectively this is answering the question: "Is this task, activity or responsibility a required part of the rail safety worker's role, or if not, would it be desirable for the worker to undertake this activity?" Cross out GSAs that are not relevant to the position. If there are other GSAs that should be trained in your organisation as part of RRM, add these to the list.

Step 2 Work through the list of relevant GSAs and rate the importance of each activity. The importance of an activity can be defined as a combination of:

c. The impact of the activity on a safety outcome, and

d. The frequency with which the task is undertaken.

The definitions of Impact and Frequency are shown in Table E-1. Activities that are more frequently undertaken, and have a more direct impact on safety represent areas of risk if adequate training has not been provided.

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TABLE E-1 MATRIX FOR EVALUATING THE IMPORTANCE OF GENERIC SAFETY ACTIVITIES IN A RAIL SAFETY WORKER ROLE

		IMPACT	
		Indirect	**Direct**
FREQUENCY	**Low**	These tasks are undertaken occasionally and do not in themselves have a direct or immediate impact on safety. *Example: A train guard establishing a good working relationship with a driver.*	These tasks are only required infrequently but have a direct impact on safety. *Example: Requirement for a rail worker to protect passengers from further danger after an incident (eg., derailment).*
	High	These tasks are undertaken regularly and have an indirect impact on the safety of people or infrastructure. *Example: Situational awareness of non-urban train staff in monitoring the behaviour of passengers.*	Tasks that are undertaken regularly and directly influence the safety of people or infrastructure. *Example: Requirement for a train driver to be vigilant when approaching known hazards.*

Mark one of the right-hand columns to indicate the Importance Level of each GSA, based on the combinations of Frequency and Importance described at the top of the column. For example a GSA that is required very frequently on the job but has only indirect impact on safety would be rated as Importance Level 2. After rating all GSAs in the Category, count the frequency with which each Importance level is marked and record these in the row marked "Count". Next multiply the frequency count by the weighting shown at the bottom of each column and record the result. Finally add up the four Totals and record this score in the box marked Raw Score. So that training priorities can be compared across GSA categories, this Raw Score must be averaged to account for the fact that different Categories contain different numbers of GSAs. Divide the raw score by the number of Elements and multiply the result by 10. Record the Priority Scores for each GSA Category in Table E-2 at the end of the form.

Step 3 Review the training priorities listed in Table E-2 and determine training gaps, that is, the extent to which training is a high priority need but is not currently provided. It is understood for example that some rail operators already conduct training in fatigue management, communication, or aspects of teamwork that could provide the competence necessary to meet the requirements of particular GSA Categories. Organisational risk associated with human error can be reduced by providing RRM training in areas where the training priority has been assessed as high.

When evaluating whether appropriate training is currently provided it is important to use the standard of RRM training as the benchmark for comparison. That is, to be considered RRM training, not only must the prescribed competencies be addressed, but the training should be delivered in a way that focuses on operational safety, is practical and relevant for participants, and employs an interactive, adult learning approach. For example, training on fatigue that simply presented technical information on rosters, hours of work and fatigue scores without inviting discussion about what these mean in practice and how fatigue relates to safety, would not qualify as RRM training.

GENERIC SAFETY ACTIVITY RATING FORM
Section 1.Leadership

Category	Element	Example Tasks	Importance Level 1 Low Frequency/ Indirect Impact	Importance Level 2 High Frequency/ Indirect Impact	Importance Level 3 Low Frequency/ Direct Impact	Importance Level 4 High Frequency/ Direct Impact
1. LEADERSHIP	**Accountability**	Clarify roles and responsibilities for routine and abnormal situations				
	Decisiveness	Take decisive action when informed of a situation affecting safety				
	Maintaining standards	Intervene if team members do not apply appropriate rules or procedures				
	Monitoring performance	Ensure others follow standard procedures and complete safety-related tasks correctly				
	Promoting participation	Encourage team members to contribute to task planning and completion				
	Situational leadership	Take a leadership role if the situation requires				
	Authority Gradient	Foster an optimal authority gradient within the team				
		(Add other Generic Safety Activities relevant for your organisation)				
Number of Elements 7		Count				
		Multiply by weighting	1	2	3	4
		TOTAL				
			(Add TOTAL scores above) ➡		Leadership **Raw Score**	
			(= Raw score divided by number of elements, multiplied by 10)		Leadership **Priority Score**	

GENERIC SAFETY ACTIVITY RATING FORM
Section 2. Task Management

Category	Element	Example Tasks	Importance Level 1 Low Frequency/ Indirect Impact	Importance Level 2 High Frequency/ Indirect Impact	Importance Level 3 Low Frequency/ Direct Impact	Importance Level 4 High Frequency/ Direct Impact
2. TASK MANAGEMENT	**Concentration**	Focus attention and manage distractions, especially in high workload situations				
	Cross-checking	Monitor and cross-check actions of other team members				
	Delegation	Manage workload by delegating safety-critical and routine tasks				
	Flexibility	Review existing plans and modify them when necessary				
	Managing automation	Manage automated systems and controls effectively				
	Prioritising action	Prioritise actions to manage multiple tasks and high workload				
	Time management	Discuss time constraints with other team members when managing workload				
		(Add other Generic Safety Activities relevant for your organisation)				
Number of Elements 7		Count				
		Multiply by weighting	1	2	3	4
		TOTAL				
			(Add TOTAL scores above) ➡		Task Management **Raw Score**	
			(= Raw score divided by number of elements, multiplied by 10)		Task Management **Priority Score**	

GENERIC SAFETY ACTIVITY RATING FORM
Section 3. Teamwork

Category	Element	Example Tasks	Importance Level 1 Low Frequency/ Indirect Impact	Importance Level 2 High Frequency/ Indirect Impact	Importance Level 3 Low Frequency/ Direct Impact	Importance Level 4 High Frequency/ Direct Impact
3. TEAMWORK	**Assisting others**	Provide assistance or advice to other team members				
	Considering others	Consider the workload of other team members before interacting with them				
	Developing others	Enhance team awareness of safety by sharing experiences eg. Incidents and near misses				
	Positive atmosphere	Establish open communication and effective working relationships with others				
	Preventing conflict	Put professional or personal biases aside to promote cooperation				
	Resolving conflict	Use interpersonal skills to defuse arguments and resolve conflict				
	Using available resources	Seek advice from other team members and sources				
		(Add other Generic Safety Activities relevant for your organisation)				
Number of Elements 7		Count				
		Multiply by weighting	1	2	3	4
		TOTAL				
			(Add TOTAL scores above) ➡		Teamwork **Raw Score**	
			(= Raw score divided by number of elements, multiplied by 10)		Teamwork **Priority Score**	

GENERIC SAFETY ACTIVITY RATING FORM
Section 4. Communication

Category	Element	Example Tasks	Importance Level 1 Low Frequency/ Indirect Impact	Importance Level 2 High Frequency/ Indirect Impact	Importance Level 3 Low Frequency/ Direct Impact	Importance Level 4 High Frequency/ Direct Impact
4. COMMUNICATION	**Assertiveness**	Express concerns about safety strongly and persistently				
	Briefing	Share information and operational plans with others prior to shift/task				
	Debriefing	Debrief critical events to improve the way they are handled next time				
	Ensuring understanding	Confirm understanding at the end of a briefing or debriefing				
	Inquiry	Ask questions if uncertain to clarify understanding				
	Keeping others informed	Pass on relevant information to keep other team members up to date				
	Providing clear information	Give clear and unambiguous instructions, information & explanations				
	Radio procedures	Use correct radio protocol				
	Shift handover	Hand-over an operational task to another person or team eg., at the end of shift				
Number of Elements 9		Count				
		Multiply by weighting	1	2	3	4
		TOTAL				
			(Add TOTAL scores above) ➡		Communication **Raw Score**	
			(= Raw score divided by number of elements, multiplied by 10)		Communication **Priority Score**	

GENERIC SAFETY ACTIVITY RATING FORM
Section 5. Risk Management

Category	Element	Example Tasks	Importance Level 1 Low Frequency/ Indirect Impact	Importance Level 2 High Frequency/ Indirect Impact	Importance Level 3 Low Frequency/ Direct Impact	Importance Level 4 High Frequency/ Direct Impact
5. RISK MANAGEMENT	**Exercising caution**	Exercise particular caution under unusual or demanding conditions				
	Handling competing goals	Balance deadlines (eg., on-time-running requirements) with safety considerations				
	Judgement	Carry out tasks in accordance with procedures unless exceptional circumstances render this unsafe				
	Managing pressure	Follow rules and procedures (don't take short cuts) even if under pressure				
	Planning for threats	Discuss with other team members how potential hazards or abnormal situations will be managed				
	Risk assessments	Stop, assess risk and plan before unusual or difficult tasks				
	Safe operation	Operate equipment safely in accordance with rules and limits				
	Safety Focus	Show concern for safety in operational preparation and planning				
Number of Elements 8		Count				
		Multiply by weighting	1	2	3	4
		TOTAL				
			(Add TOTAL scores above) ➡		Risk Management **Raw Score**	
			(= Raw score divided by number of elements, multiplied by 10)		Risk Management **Priority Score**	

GENERIC SAFETY ACTIVITY RATING FORM
Section 6. Situational Awareness

Category	Element	Example Tasks	Importance Level 1 Low Frequency/ Indirect Impact	Importance Level 2 High Frequency/ Indirect Impact	Importance Level 3 Low Frequency/ Direct Impact	Importance Level 4 High Frequency/ Direct Impact
6. SITUATIONAL AWARENESS	**Alertness**	Show vigilance when approaching known hazards				
	Anticipation	Identify potential problems from available information				
	Awareness of systems	Monitor, report and acknowledge changes in train/vehicle instruments/ control systems (two driver operations)				
	Road knowledge	Use a "mental model" of the operating environment as a basis for action				
	Removing uncertainty	Resolve uncertainty by seeking further information				
	Verification	Verify assumptions and/ or expectations before proceeding				
		(Add other Generic Safety Activities relevant for your organisation)				
		(Add other Generic Safety Activities relevant for your organisation)				
Number of Elements 6		Count				
		Multiply by weighting	1	2	3	4
		TOTAL				
			(Add TOTAL scores above) ➡		Situational Awareness **Raw Score**	15
			(= Raw score divided by number of elements, multiplied by 10)		Situational Awareness **Priority Score**	25

GENERIC SAFETY ACTIVITY RATING FORM
Section 7. Decision Making

Category	Element	Example Tasks	Importance Level 1 Low Frequency/ Indirect Impact	Importance Level 2 High Frequency/ Indirect Impact	Importance Level 3 Low Frequency/ Direct Impact	Importance Level 4 High Frequency/ Direct Impact
7. DECISION MAKING	**Define the problem**	Gather and analyse all relevant information to help understand the problem				
	Consult others	Ask for others' opinions and suggestions before deciding what to do				
	Consider options	Use available time to consider all options, not just the most obvious alternative				
	Weigh up risks	Discuss potential risks for each alternative being considered				
	Review consequences	Review outcome of decisions to ensure solution was effective				
		(Add other Generic Safety Activities relevant for your organisation)				
		(Add other Generic Safety Activities relevant for your organisation)				
Number of Elements 5		Count				
		Multiply by weighting	1	2	3	4
		TOTAL				
			(Add TOTAL scores above) ➡		Decision Making **Raw Score**	
			(= Raw score divided by number of elements, multiplied by 10)		Decision Making **Priority Score**	

GENERIC SAFETY ACTIVITY RATING FORM
Section 8. Emergency Management

Category	Element	Example Tasks	Importance Level 1 Low Frequency/ Indirect Impact	Importance Level 2 High Frequency/ Indirect Impact	Importance Level 3 Low Frequency/ Direct Impact	Importance Level 4 High Frequency/ Direct Impact
8. EMERGENCY MANAGEMENT	**Evaluating risk**	Regularly re-assess risk when dealing with emergency situations				
	Intuitive decision making	Apply training and experience to instinctively carry out most important actions in an emergency				
	Providing support	Reassure others, help them remain calm in an emergency				
	Safety action	Take action to protect passengers and other rail workers from further danger in an emergency				
		(Add other Generic Safety Tasks relevant for your organisation)				
		(Add other Generic Safety Tasks relevant for your organisation)				
Number of Elements 4		Count				
		Multiply by weighting	1	2	3	4
		TOTAL				
			(Add TOTAL scores above) ➡		Emergency Management **Raw Score**	
			(= Raw score divided by number of elements, multiplied by 10)		Emergency Management **Priority Score**	

GENERIC SAFETY ACTIVITY RATING FORM
Section 9. Self-Management

Category	Element	Example Tasks	Importance Level 1 Low Frequency/ Indirect Impact	Importance Level 2 High Frequency/ Indirect Impact	Importance Level 3 Low Frequency/ Direct Impact	Importance Level 4 High Frequency/ Direct Impact
9. SELF-MANAGEMENT	**Composure under pressure**	Show composure in managing emergency or other demanding situations				
	Fitness for work	Report for work fit for duty, ie. well rested and stress free				
	Managing fatigue	Recognise effects of fatigue in self and others and take appropriate action to manage this				
	Self control	Maintain effectiveness under stress or periods of high workload				
	Recognising limitations	Request assistance without hesitation, eg., to deal with a difficult or abnormal situation				
		(Add other Generic Safety Activities relevant for your organisation)				
		(Add other Generic Safety Activities relevant for your organisation)				
Number of Elements 5		Count				
		Multiply by weighting	1	2	3	4
		TOTAL				
			(Add TOTAL scores above) ➡		Self-Management **Raw Score**	
			(= Raw score divided by number of elements, multiplied by 10)		Self-Management **Priority Score**	

TABLE E-2 SUMMARY OF TRAINING PRIORITIES FOR POSITION OF _____

Training Needs Analysis			Training Gap Analysis
Task Category	**Priority Score**	**Priority Ranking**	**Level of training currently provided**
1. Leadership	25	1	Nil
2. Task Management	16	5	Some
3. Teamwork	8	9	Nil
4. Communication	14	6	Provided
5. Risk Management	17	4	Some
6. Situational Awareness	18	3	Nil
7. Decision Making	12	8	Some
8. Emergency Management	24	2	Nil
9. Self-Management	13	7	Provided

ORIGINAL GENERIC TASK ACTIVITIES

Note: Items added or modified since development of original Generic Task Activities (see Interim Report) are indicated.

RRM CATEGORY	Theme	Task Description
1. LEADERSHIP	Accountability	Clarify roles and responsibilities for routine and abnormal situations
	Decisiveness	Take decisive action when informed of a situation affecting safety
	Maintaining standards	Intervene if team members do not apply appropriate rules or procedures
	Monitoring performance	Ensure others follow standard procedures and complete safety-related tasks correctly
	Promoting participation	Encourage team members to contribute to task planning and completion
	Situational leadership	Take a leadership role if the situation requires
	** Authority Gradient (New theme)	Foster an optimal authority gradient within the team

Category	Element	Task Description
2. TASK MANAGEMENT	Concentration	Focus attention and manage distractions, especially in high workload situations
	Cross-checking	Monitor and cross-check actions of other team members
	Delegation	Manage workload by delegating safety-critical and routine tasks
	Flexibility	Review existing plans and modify them when necessary
	Managing automation	Manage automated systems and controls effectively
	Prioritising action	Prioritise actions to manage multiple tasks and high workload
	Time management	Discuss time constraints with other team members when managing workload

Category	Element	Task Description
3. TEAMWORK	**Assisting others**	Provide assistance or advice to other team members
	Considering others	Consider the workload of other team members before interacting with them
	Developing others	Enhance team awareness of safety by sharing experiences eg. Incidents and near misses
	Positive atmosphere	Establish open communication and effective working relationships with others
	Preventing conflict	Put professional or personal biases aside to promote cooperation
	Resolving conflict	Use interpersonal skills to defuse arguments and resolve conflict
	Using available resources	Seek advice from other team members and sources

Category	Element	Task Description
4. COMMUNICATION	**Assertiveness**	Express concerns about safety strongly and persistently
	Briefing	Share information and operational plans with others prior to shift/task
	Debriefing	Debrief critical events to improve the way they are handled next time
	Ensuring understanding	Confirm understanding at the end of a briefing or debriefing
	Inquiry	Ask questions if uncertain to clarify understanding
	Keeping others informed	Pass on relevant information to keep other team members up to date
	Providing clear information	Give clear and unambiguous instructions, information and explanations
	Radio procedures	Use correct radio protocol
	Shift handover	Hand-over an operational task to another person or team eg., at the end of shift

Category	Element	Task Description
5. RISK MANAGEMENT	**Exercising caution**	Exercise particular caution under unusual or demanding conditions
	Handling competing goals	Balance deadlines (eg., on-time-running requirements) with safety considerations
	Judgement	Carry out tasks in accordance with procedures unless exceptional circumstances render this unsafe
	Managing pressure	Follow rules and procedures (don't take short cuts) even if under pressure
	Planning for threats	Discuss with other team members how potential hazards or abnormal situations will be managed
	** **Recognising limitations (Moved to Self Management)**	
	Risk assessments	Stop, assess risk and plan before unusual or difficult tasks
	Safe operation	Operate equipment safely in accordance with rules and limits
	Safety focus	Show concern for safety in operational preparation and planning

Category	Element	Task Description
6. SITUATIONAL AWARENESS	**Alertness**	Show vigilance when approaching known hazards
	Anticipation	Identify potential problems from available information
	Awareness of systems	Monitor, report and acknowledge changes in train/vehicle instruments/control systems (two driver operations)
	Road knowledge	Use a "mental model" of the operating environment as a basis for action
	** **Removing uncertainty (New theme)**	Resolve uncertainty by seeking further information
	** **Verification (New theme)**	Verify assumptions and/or expectations before proceeding

Category	Element	Task Description
7. DECISION MAKING	**Define the problem[1]**	Gather and analyse all relevant information to help understand the problem
	**** Consult others (previously 'Consultation')**	Ask for others' opinions and suggestions before deciding what to do
	Consider options [1]	Use available time to consider all options, not just the most obvious alternative
	Weigh up risks (previously 'Considering risk')	Discuss potential risks for each alternative being considered
	Review consequences[1]	Review outcome of decisions to ensure solution was effective

1 Minor title changes only

Category	Element	Task Description
8. EMERGENCY MANAGEMENT	**Evaluating risk**	Regularly re-assess risk when dealing with emergency situations
	Intuitive decision making	Apply training and experience to instinctively carry out most important actions in an emergency
	Providing support	Reassure others, help them remain calm in an emergency
	Safety action	Take action to protect passengers and other rail workers from further danger in an emergency

Category	Element	Task Description
9. SELF-MANAGEMENT	**Composure under pressure**	Show composure in managing emergency or other demanding situations
	Fitness for work	Report for work fit for duty, ie. well rested and stress free
	Managing fatigue	Recognise effects of fatigue in self and others and take appropriate action to manage this
	Self control	Maintain effectiveness under stress or periods of high workload
	**** Recognising limitations (Taken from Risk Management)**	Request assistance without hesitation, eg., to deal with a difficult or abnormal situation

ANNEX F: RRM ATTITUDES QUESTIONNAIRE (RRMAQ)

Example Rail Resource Management Attitudes Questionnaire

The RRMAQ is an example of the type of questionnaire used in aviation and other industries to measure attitudes related to safety.

Surveys customised to the industry context and culture are frequently used to assist with implementation of Resource Management training. The results from the questionnaire can be used in a number of ways associated with Rail Resource Management training:

- To help design and⁄or refine RRM course content, by suggesting organisational issues of greatest relevance;
- To identify commonly-held attitudes amongst workers that may be incorrect and therefore threaten safety;
- To provide baseline data on worker attitudes and organisational issues that can be compared with data obtained after an RRM program has been implemented.

If such a survey is used, it is important to include the following information in the survey instructions:

- Why the questionnaire is being used, for example explaining how it will support the design of the RRM syllabus.
- The fact that responses to the survey are **confidential** and that names are not required on the questionnaire. It is possible however to use a personal coding system that maintains confidentiality but allows the results of subsequently administered questionnaires to be compared to an individual's initial responses.
- How to approach the questionnaire, for example, answering questions honestly without thinking about them too long.
- The arrangements for returning the completed questionnaire, including confidentiality procedures, deadline, etc. Surveys of this nature can also be completed online to reduce the need for data entry. Where the level of trust may be low in an organisation and there is suspicion about respondents being identified, survey administration, analysis and reporting or results can be assigned to an external agency.

Typically some background Information in collected from respondents such as position in the organisation, length of experience, etc. This enables comparisons to be made when the data are analysed across these categories, and helps to better target the content and outcomes of RRM training.

14 This questionnaire has been adapted from the Flight Management Attitudes Questionnaire (FMAQ), developed by Professor Robert Helmreich and his colleagues at the University of Texas Human Factors Research Project (see Helmreich, Merritt, Sherman, Gregorich & Wiener, 1993).

RRMAQ

Rail Resource Management Attitudes Questionnaire

This survey asks your opinions about various aspects of your work. The questionnaire has been designed as part of the project to develop Rail Resource Management (RRM) training materials for the Australian rail industry. RRM is a new program aimed at improving safety by helping rail workers understand the ways in which factors such as teamwork, communication, and recognising and dealing with errors can help prevent incidents and accidents. The results of the survey will help design the RRM course to include the most relevant topics for your operations.

The success of this survey depends on your contribution, so it is important that you answer questions as honestly as you can. There are no right or wrong answers; the questions are seeking your personal observations and attitudes. It is not necessary to think about the questions for long - the first answer that comes to mind is usually the best one.

Your responses to the survey are **confidential** and your name is not required on the questionnaire.

Some basic information is requested about you and your position so that we can compare the opinions of different groups (Drivers with Controllers for example). Please complete these basic details in the section below.

Background Information

1. Gender (M or F) ☐
2. Years in the rail industry ☐
3. Position: Driver ☐
   Other Train Crew[15] ☐
   Signaller ☐
   Controller ☐
   Track Worker ☐
   Other ☐
4. Years in current position ☐

15 Generic label for other "on-board" train crew, including Guards, Conductors, etc.

RRMAQ

Part A – Work Attitudes

Place a tick in one of the five columns to the indicate the extent to which you agree with each of the following statements: "Disagree Strongly"; "Disagree"; "Neutral"; "Agree"; or

		Disagree Strongly	Disagree	Neutral	Agree	Agree Strongly
1.	I like my job.					
2.	The people I work with listen to others' opinions and suggestions before deciding what to do.					
3.	Employees are willing to challenge somebody else who they think may be acting in an unsafe way.					
4.	Team performance issues tend to be addressed as and when they arise.					
5.	People I work with comply with rules and procedures.					
6.	Even when fatigued, I perform effectively at critical times during my working hours.					
7.	I am more likely to make judgement errors when working under pressure.					
8.	It is better to agree with other team members than to voice a different opinion.					
9.	Team leaders I work with make an effort to create an atmosphere where all workers feel part of the team.					
10.	I let other people I work with know when my workload is becoming (or about to become) excessive.					
11.	I feel adequately trained to use all available resources (including other workers, supervisors, etc.) in handling difficult or demanding situations.					
12.	Team members should inform colleagues about any problems that could affect their fitness for work.					
13.	I am less effective when stressed or fatigued.					
14.	A truly professional employee does not make mistakes.					
15.	Employees always relay important information to others as it becomes available.					
16.	Good communication and co-ordination are as important as technical proficiency.					
17.	People I work with are willing to receive constructive advice or suggestions from their colleagues.					
18.	I sometimes feel under pressure to cut corners rather than act safely.					
19.	My opinions are not valuable to crew who are more senior, or have more experience than me.					
20.	I have a good understanding of how other employees will act in an emergency or abnormal situation.					
21.	Team leaders are reluctant to call on other workers for assistance, even when they are able to help.					
22.	I have been provided with all the safety-related training I require.					
23.	Before commencing a difficult or unusual task, I consider potential problems which may occur and think about how I could solve them.					
24.	Team leaders currently provide sufficient information (eg., about work conditions & special requirements) to other workers before commencing a task.					
25.	I am proud to work for this organisation.					

		Disagree Strongly	Disagree	Neutral	Agree	Agree Strongly
26.	People in charge of staff carrying out safety-related activities have the leadership knowledge and skills they need.					
27.	Rules and procedures should not be broken, even when an employee thinks it is in the company's best interests.					
28.	There is a good level of cooperation and teamwork between train crews and non-train staff.					
29.	People I have worked with make an effort to put aside interpersonal conflicts to work as a team.					
30.	Other workers use all opportunities to offer assistance to reduce the team leader's workload in an emergency or demanding situation.					
31.	A truly professional employee can leave personal problems behind when at work.					
32.	It is important to avoid negative comments about the procedures and techniques of other team members.					
33.	My decision making ability is as good in emergencies as it is in routine operational conditions.					
34.	I am embarrassed when I make a mistake in front of other people.					
35.	Written procedures are necessary for all operational situations.					
36.	My concentration is as good in the middle of the day as it is in the middle of the night.					
37.	People I work with take the initiative to complete necessary tasks without being instructed.					
38.	I have received adequate training in working with others to handle abnormal and emergency situations.					
39.	Debriefs are always conducted after a significant event to avoid a mistake or incident next time.					
40.	Supervisors who encourage suggestions from team members are not good leaders.					
41.	Personal problems can adversely affect my performance.					
42.	My performance is not adversely affected by working with an inexperienced or less capable team member.					
43.	I often share my knowledge and experience with others, even if this means that a task takes more time.					
44.	People I work with make an effort to create an atmosphere where everyone feels part of a team.					
45.	It is very clear to everybody who will take control and make decisions in emergency and abnormal situations.					
46.	Shift or other handovers are routinely carried out and in a very professional way.					
47.	Morale is high in my work area.					
48.	People I work with use correct radio protocols/procedures.					
49.	Our operations managers listen to us and care about our concerns.					
50.	I know the proper channels to use if I have concerns about safety practices.					
51.	I feel comfortable going to a senior manager's office to discuss problems or operational issues.					
52.	My suggestions about safety would be acted upon if I expressed them to management.					
53.	Management fully supports my daily efforts as an operational crew member.					
54.	I am encouraged by my supervisors and co-workers to report any unsafe conditions I may observe.					
55.	This company has a positive safety culture.					
56.	I am regularly assessed on the important parts of my safety-related duties, eg. responding to emergencies					
57.	Our training has prepared everyone to work as a well-coordinated team.					

Part B – Leadership Styles

The following table describes four different leadership styles. Please read through the descriptions of each style, then answer the two questions below.

Style A	Leader usually makes decisions promptly and communicates them to subordinates clearly and firmly. Expects them to carry out the decisions loyally and without raising difficulties.
Style B	Leader usually makes decisions promptly, but, before going ahead, tries to explain them fully to subordinates. Gives them the reasons for the decisions and answers whatever questions they may have.
Style C	Leader usually consults with subordinates before reaching decisions. Listens to their advice, considers it, and then announces the decision. Expects all to work loyally to implement it whether or not it is in accordance with the advice they gave.
Style D	Leader usually calls a meeting of subordinates when there is an important decision to be made. Puts the problem before the group and invites discussion. Accepts the majority viewpoint as the decision.

Please think of your own specific work situation when answering the next two questions:

Which one of the above leadership styles would you most prefer to work under?	Style
In this organisation, which style do you find yourself most often working under?	Style

Thank you for your cooperation.

ANNEX G: SAMPLE PARTICIPANT EVALUATION QUESTIONNAIRE

RRM Course Number: **Date:**

This questionnaire has been designed to seek your views about the RRM course you are attending. Your opinions will provide valuable feedback for the purpose of improving the course for future participants.

This form is anonymous, so please feel free to make candid constructive comments. Only group data will be incorporated in summary reports of questionnaire responses.

For the following items, you are asked to express your opinion by placing a cross (✗) in one of the boxes from 1 ("Disagree strongly") to 5 ("Agree strongly") after each statement.

1	2	3	4	5
Disagree Strongly	**Disagree**	**Neutral**	**Agree**	**Agree Strongly**

Part A – Impressions of each module and major activity:

Part A of the questionnaire asks you to comment on each of the course sessions or major activities. Please complete the relevant items *immediately after* each session or activity concludes.

Session 1: Introduction & Course Overview	1	2	3	4	5
Key messages in the session were **understandable**					
The **training material** was clear and well designed					
The information and activities in the session were **interesting**					
The ideas presented were **relevant to my operational duties**					
The session content was sufficiently **practical** (not too theoretical)					

Session 2: Leadership	1	2	3	4	5
Key messages in the session were **understandable**					
The **training material** was clear and well designed					
The information and activities in the session were **interesting**					
The ideas presented were **relevant to my operational duties**					
The session content was sufficiently **practical** (not too theoretical)					

1	2	3	4	5
Disagree Strongly	Disagree	Neutral	Agree	Agree Strongly

Session 3: Case Study	1	2	3	4	5
Key messages in the session were **understandable**					
The **training material** was clear and well designed					
The information and activities in the session were **interesting**					
The ideas presented were **relevant to my operational duties**					
The session content was sufficiently **practical** (not too theoretical)					

Session 4: Task Management	1	2	3	4	5
Key messages in the session were **understandable**					
The **training material** was clear and well designed					
The information and activities in the session were **interesting**					
The ideas presented were **relevant to my operational duties**					
The session content was sufficiently **practical** (not too theoretical)					

Session 5: Teamwork	1	2	3	4	5
Key messages in the session were **understandable**					
The **training material** was clear and well designed					
The information and activities in the session were **interesting**					
The ideas presented were **relevant to my operational duties**					
The session content was sufficiently **practical** (not too theoretical)					

Session 6: Communication	1	2	3	4	5
Key messages in the session were **understandable**					
The **training material** was clear and well designed					
The information and activities in the session were **interesting**					
The ideas presented were **relevant to my operational duties**					
The session content was sufficiently **practical** (not too theoretical)					

1	2	3	4	5
Disagree Strongly	Disagree	Neutral	Agree	Agree Strongly

Session 7: Risk Management	1	2	3	4	5
Key messages in the session were **understandable**					
The **training material** was clear and well designed					
The information and activities in the session were **interesting**					
The ideas presented were **relevant to my operational duties**					
The session content was sufficiently **practical** (not too theoretical)					

Session 8: Situational Awareness	1	2	3	4	5
Key messages in the session were **understandable**					
The **training material** was clear and well designed					
The information and activities in the session were **interesting**					
The ideas presented were **relevant to my operational duties**					
The session content was sufficiently **practical** (not too theoretical)					

Session 9: Decision Making	1	2	3	4	5
Key messages in the session were **understandable**					
The **training material** was clear and well designed					
The information and activities in the session were **interesting**					
The ideas presented were **relevant to my operational duties**					
The session content was sufficiently **practical** (not too theoretical)					

Session 10: Emergency Management	1	2	3	4	5
Key messages in the session were **understandable**					
The **training material** was clear and well designed					
The information and activities in the session were **interesting**					
The ideas presented were **relevant to my operational duties**					
The session content was sufficiently **practical** (not too theoretical)					

1	2	3	4	5
Disagree Strongly	**Disagree**	**Neutral**	**Agree**	**Agree Strongly**

Session 11: Self-Management	1	2	3	4	5
Key messages in the session were **understandable**					
The **training material** was clear and well designed					
The information and activities in the session were **interesting**					
The ideas presented were **relevant to my operational duties**					
The session content was sufficiently **practical** (not too theoretical)					

Session 12: Consolidation Exercise and Conclusion	1	2	3	4	5
Key messages in the session were **understandable**					
The **training material** was clear and well designed					
The information and activities in the session were **interesting**					
The ideas presented were **relevant to my operational duties**					
The session content was sufficiently **practical** (not too theoretical)					

Please complete Parts B and C overleaf at the end of the course …

Part B – To be completed at the end of the course

1. Overall impressions of the RRM course:	1	2	3	4	5
The course **objectives** were clear and well defined					
The course was **interesting** to attend					
The **content** was relevant to my operational duties					
The course allowed a sufficient level of **interaction**					

2. Professional usefulness:	1	2	3	4	5
This course was **useful** for me **professionally**					
The course helped me develop relevant **job skills**					
Other people in my organisation **would benefit** from this course					

3. Training organisation and logistics:	1	2	3	4	5
The **training venue** was appropriate and comfortable					
The **equipment** was adequate					
Facilities were appropriate					

4. Facilitation of the course:	1	2	3	4	5
The facilitators presented the course well					
The time allowed for the topics was well distributed					
Planning of the day/s was managed well					
The atmosphere in the group was constructive					

Part C – Comments & Suggestions:

Please comment on any aspect of the RRM course:

The RRM course would be improved if …

Thank you for your contribution

ANNEX H: METHODS USED FOR CRM EVALUATION

TABLE H – 1 RESULTS FROM A STUDY CARRIED OUT BY ABERDEEN UNIVERSITY INTO METHODS USED BY UK AVIATION OPERATORS TO ASSESS CRM EFFECTIVENESS (based on 113 UK Air Operators)

Evaluation method	% of respondents using this method
Reactions	
reaction sheet	26
oral feedback/debriefing	74
Attitudes	
company specific questionnaire	13
cockpit/flight management attitude questionnaire (CMAQ/FMAQ)	8
other (informal oral feedback)	79
Knowledge	
multiple choice test	12
written exam	12
oral feedback	76
Behaviour	
behavioural marker system	23
technical checklist	18.5
informal feedback	58.5
Organisation	
company climate survey	10
safety performance	22
incident reporting	23
business performance	13
confidential reporting	17
technical performance	8
other (all training audits)	7
360° appraisal	1

TABLE EXTRACTED FROM:

Civil Aviation Authority. (2003). *CAP 737: Crew Resource Management (CRM) Training. Guidance for Flight Crew, CRM Instructors and CRM Instructor-Examiners.* London: CAA Safety Regulation Group.

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MORE INFORMATION

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Rail Safety Regulators' Panel

INDEPENDENT TRANSPORT SAFETY AND RELIABILITY REGULATOR

pts Public Transport Safety Victoria

Victoria The Place To Be