An Examination of the Regulated Requirement for Canadian Railway Safety Management Systems

SMS Report No 0703

Conducted in Support of the Railway Safety Act Review

by

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T8080-07-0041

August 2007
EXECUTIVE SUMMARY

On February 20, 2007, the Minister of Transport, Infrastructure and Communities announced the appointment of a four-member Advisory Panel to assist him in conducting a review of the Railway Safety Act (RSA). The Advisory Panel consulted a wide range of stakeholders to identify potential policy issues. Concurrently, a number of specialist studies were commissioned to assist in the analysis of the policy issues. The current study focused on safety management systems (SMS) – a requirement of federally regulated railways in Canada since March 2001.

The objectives of the study were to determine the degree to which the rail industry adheres to the SMS requirements; assess the validity of the approach for rail safety; and identify issues that have arisen in the implementation of SMS.

The study was completed by:

- reviewing legislation and regulations, and government and industry documents;
- conducting interviews with seventeen representatives of Transport Canada, railway companies, industry associations and labour organizations;
- examining occurrence and other data; and
- conducting a review of studies, literature and best practices of the SMS of other safety-critical industries.

The study concluded that performance-based SMS regulations are a valid regulatory approach for the Canadian railway industry. Such a regulatory strategy – one in which the industry demonstrates that it continuously and proactively manages the hazards and safety-risks to which it is exposed – offers significant advantage over the traditional, prescriptive approach to safety regulation. However, the initiative to regulate SMS as a cornerstone of the performance-based regulatory program needs to be re-examined, and the program restructured and likely redirected. This will result in a considerable shift in the roles, responsibilities and activities of the Canadian railway industry and Transport Canada. To succeed, the industry and the regulator will need to work closely to develop a relationship of respect and trust, where there is a common appreciation for the role SMS play in reducing the likelihood of an accident, and where there is an open and purposeful exchange of safety-related information. This will require improvements to the current relationship between the Canadian rail industry and Transport Canada.

The report contains eleven high-level recommendations to address deficiencies in:

- the performance-based regulatory program;
- Transport Canada’s capability to oversee the rail industry’s safety performance;
- the conduct of risk assessments;
- current methods to evaluate SMS and measure safety performance; and
- safety culture.
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1. INTRODUCTION

1.1 Background

The Railway Safety Act (RSA), which came into effect in January 1989, was designed to advance rail safety in Canada. It was expressly intended to provide a modern regulatory framework, together with a streamlined regulation development and approval process; and provide railway companies with greater freedom to manage their operations safely and efficiently. The most recent amendments in 1999 resulted in a number of changes, not least of which was the authority to require railways to implement safety management systems (SMS). Since then, significant changes have occurred in the railway industry. These changes have, since 2002, coincided with an increase in railway accidents and main-track train derailments. Although Transport Canada has taken considerable safety enforcement action across Canada over the past years, there is a view that the current regulatory framework does not provide the full set of tools to effectively deal with the emerging issues. There is also a view that the current regulatory framework needs to be modernized and better aligned with safety legislation in place for other modes of transport in Canada. For these reasons, the Minister of Transport appointed a panel of four part-time members to review the RSA. The panel’s mandate is to examine ways to improve safety and safety culture within the rail industry.

The panel has consulted a wide range of stakeholders, and continues to hold meetings across Canada to hear the views of individuals and groups. The submissions are being summarized so that potential policy issues can be identified. Meanwhile, a number of studies of key issues have been commissioned to assist in the analysis of the policy issues identified in the submissions and consultations.

The current study focussed on SMS – a requirement of federally regulated railways in Canada since March 2001.

1.2 Objective

The objective of the study of SMS was to examine the regulatory requirements for SMS in the context of Transport Canada’s overall approach to the regulation of rail safety, and specifically to:

- determine the degree to which industry is adhering to the SMS requirements;
- assess the validity of the approach for rail safety;
- identify issues that have arisen in the implementation of SMS for rail safety; and, as required
- propose potential solutions.

1.3 Method

Six lines-of-inquiry were developed by the Panel Secretariat to guide the study.

1. Transport Canada processes for the development, approval, monitoring, inspection and audit of company’s SMS plans were examined. Transport Canada’s capacity to provide guidance to the industry on implementing SMS was assessed. The conduct of SMS audits was evaluated as part of its monitoring and compliance role.

2. The implementation of SMS by the railway industry against the regulatory requirements was examined and assessed.

3. The strengths and weaknesses of the current approach to SMS were determined, and the validity of the SMS-approach for rail safety was examined.
4. The RSA was examined to determine whether it provides adequate tools for the regulator to ensure compliance with SMS requirements.

5. The appropriateness of Transport Canada’s SMS requirements for short-line (small) railway companies was assessed.

6. The department’s approach to SMS for rail safety was compared with benchmarks (such as SMS in aviation, marine and the nuclear energy industry) to identify best practices that might be suitable for the Canadian railway industry.

The study was completed by:

- reviewing legislation and regulations, and government and industry documents;
- conducting interviews with seventeen representatives of Transport Canada, railway companies, industry associations and labour organizations;
- examining occurrence and other data; and
- conducting a review of studies, literature and best practices of other industries that employ SMS.

The persons interviewed are listed in Appendix A. The documents, studies and literature that were reviewed for this project are listed in Appendix B.

1.4 Report Structure

The remainder of the report is structured as follows:

- Section 2 presents an overview of the regulatory program as it applies to SMS in the Canadian rail industry;
- Section 3 describes how SMS are intended to reduce the likelihood of accidents;
- Section 4 discusses key policy issues regarding the application of the SMS regulations in the rail industry; and
- Section 5 presents the study conclusions and observations regarding possible improvements.
2. SMS AND THE CANADIAN RAIL INDUSTRY

2.1 Introduction

This section presents an overview of the regulatory requirement for SMS, as context for the discussion of their efficacy in Section 4.

When the RSA was introduced in 1985, it was regarded as the foundation for the first performance-based regulatory program in the Canadian transportation sector. Amendments to the Act that came into effect on June 1, 1999 authorized the creation of regulations respecting the development and implementation of SMS by railway companies. Pursuant to the amended provision [47.1 (1)], the Railway SMS Regulations required companies to document, implement and maintain SMS, and came into force in March 31, 2001.

The regulations were developed with significant industry input. The regulations did not replace any existing regulations, rules or standards. Rather, they were intended to produce a new, systematic approach to manage safety to complement the existing regulatory framework.

The public policy goal of the regulations is to minimize public and employee fatalities and injuries associated with railway operations, reduce property damage resulting from railway accidents, and reduce the impact of railway accidents on the environment. They are developed on the premise that these three outcomes can be achieved by requiring railways to adopt more strategic, comprehensive, proactive and systematic approaches to managing safety.

2.2 Definition and Description

An SMS is defined by the RSA as:

“...a formal framework integrating safety into day-to-day railway operations and includes safety goals and performance targets, risk assessments, responsibilities and authorities, rules and procedures, and monitoring and evaluation processes”.

Section 2 of the regulations (reproduced in Appendix C) specifies twelve components of an SMS that, as a minimum, a company’s SMS is required to demonstrate.

The regulations were intended to be a strong instrument to achieve the objectives of the RSA, and in particular, in placing responsibility for “railway companies to ensure the safety of their operations.” They enable the management and measurement of safety-risks to be at the core of future rail operations.

There are 31 federally-regulated railways subject to SMS regulations, three of which are class 1 railways. Federal-provincial Memorandums of Understanding (MOUs) between Transport Canada and the provinces of Ontario, New Brunswick and Nova Scotia result in sixteen provincial railways being subject to the SMS regulations.

The function of a typical regulated SMS is depicted in figure 2.1.

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1 The objectives of the Act are to:
   (a) promote and provide for the safety of the public and personnel, and the protection of property and the environment, in the operation of railways;
   (b) encourage the collaboration and participation of interested parties in improving railway safety;
   (c) recognize the responsibility of railway companies in ensuring the safety of their operations; and
   (d) facilitate a modern, flexible and efficient regulatory scheme that will ensure the continuing enhancement of railway safety.

2 Extracted from an internal TC presentation and used with permission. TC contact: D. Iezzi, Director Audit & Quality Assurance, Rail Safety.
2.3 Regulatory Program for Railway SMS

2.3.1 Transport Canada Program Structure

The new program was introduced to reflect current roles and responsibilities within Transport Canada. Program development is the responsibility of Transport Canada Headquarters in Ottawa, and program delivery that of each Transport Canada region. A Director and assistant assumed the responsibility for developing the SMS program in addition to their previously existing responsibilities; and each region received resources for two persons to implement the new SMS regulatory program. Resources specifically dedicated to safety analysis were not allocated, a point that is taken-up later in 4.4. The existing functions in Rail Safety continued (i.e. the three Branches continued to perform their mandate in much the same way as the past, principally employing inspections to identify non-compliance with regulations, rules and standards).

2.3.2 Initial SMS Submission

Under the SMS regulations, a new railway company wishing to obtain a Certificate of Fitness contacts the Canadian Transportation Agency (CTA), and is informed of the federal Rules and Regulations, including those pertaining to SMS. The company may contact the Transport Canada point-of-contact, and the usual practice is for the CTA to advise Transport Canada Headquarters that the company’s application for the Certificate of Fitness is pending.
Not later than sixty days in advance of start-up, the company submits information in accordance with section 4.(1) of the Railway SMS Regulations. The information is reviewed and forwarded to the region(s) in which the company will operate. The information describes future aspects of the company’s SMS, and includes such things as:

- the company’s safety policy;
- the company’s safety performance targets and the associated safety initiatives to achieve the targets;
- a description of the risk management processes and risk control strategies;
- a description of the data that will be collected for the purpose of assessing its safety performance; and
- a list of the documents that will describe how the company will meet its obligations to operate an SMS.

The regional representative liaises with the company, and upon issue of the Certificate of Fitness, the company is entered into the risk-based monitoring system. Under the current regulatory program, there is no requirement for Transport Canada to “approve” a company’s SMS plan.

2.3.3 Annual SMS Submissions

Not later than March 1 of every year, a railway company must submit to the Minister the following information in respect of the preceding calendar year:

- any revisions made to the information submitted earlier regarding their SMS;
- its safety performance relative to its safety targets;
- its accident rates; and
- the safety targets for the calendar year in which the submission is made.

2.3.4 SMS Audits

Traditionally, Transport Canada’s prescriptive regulatory program has focussed on conducting inspections of the railway industry; yet most management systems are measured by audits. Therefore, the introduction of the SMS regulations required Rail Safety to develop audit processes. There has been an evolution of SMS audit processes as the principal instrument in the Railway SMS compliance-monitoring program. Initially, the audit process was conducted in two-parts: a “pre-audit”, which principally examined documents to determine the degree to which the SMS met the regulated requirements “on paper”; after which, a “verification audit” was conducted on-site. Each part was conducted as a full audit, and resulted in formal reports with findings, which many (within TC and the industry) found to be cumbersome. Various initiatives have been attempted in the intervening years, some yielding more success than others. For instance:

- combined audits were considered (i.e., pre-audits and verifications audits conducted as one process);
- preliminary procedures for “focussed audits” were developed to assess a particular (hence focussed) area/issue or component of a company’s SMS at any level or function of the company; and
- two audit checklists – one for smaller and one for larger companies – were developed.

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3 In other words, the submission is reviewed for potential to comply with the regulated requirement, and not to assess whether it is either appropriate, nor whether it will be effective.

4 For instance, ISO 9001 (quality management system), 14001 (environment management system) and 18001 (occupational health and safety management system) all rely on audit processes as principal measures of compliance.
Significant effort went into developing processes, guides, checklist and documents to audit railway SMS\(^5\). Additionally, a number of protocols were developed in some of the regions. Audits were conducted of companies’ SMS, while the traditional branches continued to emphasize technical inspections. Audits (even of national companies) were conducted by each region, leading to instances of duplication or inconsistency\(^5\). More recently, an integrated audit process has been developed that will involve a single audit team made up of Transport Canada inspectors with different functional expertise. These audits will employ one or more of the regulated SMS components to structure the audit. When technical or operational findings indicate deficiencies in the company’s SMS, these issues will be explored, and if appropriate, findings pertaining to the SMS will be made. Integrated audits have emerged in-part because of the strong focus on integrated activities in the current Rail Safety strategic plan\(^7\). Some of the desired outcomes include the breakdown of “silos” of technical expertise that predictably have formed in each branch; efficiencies gained through coordinated activities; enhanced skill sets; and improvements in safety culture.

2.3.5  Integrated and Systems Approach

In June of 2007, an Integrated Rail Safety Oversight Model (illustrated in figure 2.2)\(^8\) was approved to aid Rail Safety in integrating its activities. The focus “will be on assessing the existence and adequacy of a company’s documented safety systems and standards (at all levels) and verifying the company’s compliance with these (acceptable) documented practices, processes, procedures and standards\(^9\). Although the model targets a single company’s safety management, it also depicts a strategy for overseeing the rail industry at a national level.

Figure 2.2 – Integrated Rail Safety Oversight Model

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\(^6\) Recently, agreement has been reached that audits of national railways will be convened by the Director General, Rail Safety in Ottawa, and draw on national and regional resources as appropriate.


There are four key components to the model: risk-based business planning; monitoring; enforcement and compliance; and railway performance analysis and assessment.

1. **Risk-based business planning** provides for a standardized approach to plan and prioritize Rail Safety activities based on the analysis of risk. It will apply to regional and national activities. It will result in risk being assessed on a national basis and not on a program-only basis as is currently the case. The policies and procedures for this component have been finalized.

2. **Monitoring** involves the implementation of activities identified in the business planning process, or as the result of risk analyses or assessments conducted by Rail Safety. Monitoring will mainly employ audits and inspections. The scope of an audit will be determined by the findings of the risk analysis or assessment, and for instance may include geographic determinations, functions, or specific types of operations or companies. An audit may be conducted to periodically review a company’s operation. Inspections will gather intelligence, sample a company’s safety management, or validate or verify information obtained during an audit. The procedures for this component are nearing completion.

3. **Enforcement and compliance** involves the more traditional regulatory tools to respond to issues of non-compliance, threats or immediate threats. The procedures for this component have been drafted.

4. **Performance analysis and assessment** is a key component of the model. It draws on data from the monitoring and enforcement components and other sources to measure the performance of individual companies and aspects of the rail industry nationally. The results of the analysis guides future management direction regarding policies, rules and regulations, and business planning priorities. Work to develop policies and procedures for this component are just being started.

The performance analysis and assessment component will be key to the successful function of the model and risk-based business planning process. It will employ data from a database that is currently under development. This database – the Railway Safety Integrated Gateway (RSIG) – will store information from the regions and headquarters that is presently available only on a functional basis. It is intended that the data will be categorized to reflect risk, and indicators of the safety performance of companies, industry sectors and the rail industry. A discussion of the analytical and assessment function and the associated requirements for data is found in Section 4.
3. SMS AND ACCIDENT PREVENTION

3.1 Introduction

Accident prevention activities are strongly influenced by the contemporary understanding of accident causation. Understanding of accident causation has evolved in the past five decades, sometimes subtly, other times dramatically\textsuperscript{10}. SMS have emerged in part as the result of an improved understanding of accident causation – not just in railways, but in most safety critical industries, where humans operate technical systems (i.e. increasingly complex equipment) in a resource-driven environment.

In the recent past, accident prevention focused on 'dependability' – of persons, machines and organizations. It was believed that complete reliability could be designed into an operation. The more critical the consequences of an unwanted failure, the stronger or the more redundant the defences could be built, thereby “producing” the necessary degree of reliability. Regulations, standards and rules codified the defences, and formalized the mitigation. Not surprisingly, ‘safety’ analysis focused on ‘failure’ analysis\textsuperscript{11}. Consequently, measures of safety performance also focused on failures, which provided negative and lagging indicators – such as accidents, incidents, equipment failures, system outages, etc. After an accident, standards, procedures or processes were often buttressed or reworked, sometimes with the unwitting effect of transferring the “cause” of a future accident to the next weakest link in the unanticipated chain-of-events.

The work in recent decades of a wide group of practitioners and theorists has significantly changed this understanding of accident causation\textsuperscript{12}. The diversity of their backgrounds is truly remarkable, including: engineers (e.g. William Hammer); ecologists (e.g. Kenneth Watt); sociologists (e.g. Barry Turner, Dianne Vaughan, Ron Westrum); organizational theorists (e.g. Charles Perrow, Karl Weick); political scientists (e.g. Scott Sagan); software engineers (e.g. Nancy Leveson); policy makers (e.g. William Leiss, Scott Snook) and psychologists (e.g. James Reason, Nick Pigeon). From their work, a “new” understanding of accident causation has emerged: organizational decisions and cultures are often at the root of modern catastrophes. Conditions inherent in operating and managing tightly-coupled, well-defended, complex technical systems are fraught with predictable pitfalls. The reasons are many. Safety regulations and system requirements can be obsolete even before they are implemented; corporate decisions are made with incomplete anticipation of their consequences on the operational or organizational systems they will impact; policies for system procurement are driven by economic exigencies; organizational and operational changes are introduced that “produce” and “transfer” unidentified hazards throughout an industry; operational procedures are misinterpreted, or are “worked-around” to enable compatibility with existing operational conditions; processes “creep” from their intended direction; and regulatory agencies, managers, system designers and operational staff hold unattainable expectations for the performance of humans, and of technical systems.

The interactions of people, equipment and organizations are extremely complex, and they occur in a dynamic environment. Although standards and rules continue to form the necessary foundation to mitigate risk, “deficiencies” in their combined performance cannot necessarily be viewed as failures of the defences, but predictable characteristics of a complex operating environment. Building a new procedure, or developing a new regulation or standard to “re-butress” the defences will not necessarily reduce risk. Indeed, if it is not appropriate mitigation, or if it is not well integrated with existing procedures, it may increase risk. The notion of attaining complete “reliability” from humans

\textsuperscript{11} When the first risk analysis methods were developed – techniques such as fault tree analysis (FTA) and failure modes and effect analysis (FMEA) – they focused exclusively on predicting “failures” of technical systems. Over the years, many have been adapted to accommodate the analysis of “hazards” and not just failures, but when applied, they continue to reflect a perspective of accident causation that seeks to optimize system reliability and reduce the probability of “system failure”.
and the equipment they operate, in a dynamic environment that is continuously under pressure from resource-driven organizations, has been forever shattered. To many, this change in “world view” has been symbolized by James Reason’s now-famous “Swiss Cheese” model of accident causation.\(^\text{13}\) (figure 3.1).

**Figure 3.1 – Reason’s Model of Accident Causation**

The change in understanding of accident causation has resulted in changes in accident prevention programs, techniques and activities. Some programs seek to formally incorporate human and organizational factors. Others go further and amalgamate methods originating in system safety engineering and risk management with techniques to address human and organizational factors. Although failure analysis is still at the centre of designing reliable equipment and technical systems, attention has increasingly focused on ‘hazards’ and their consequences (risks). Traditional definitions have been adjusted to function with Reason’s model of accident causation. The following definitions illustrate.

- **hazard** - the condition or circumstance that could lead to a loss of life or property
- **risk** - the consequence of a hazard, measured in terms of severity and likelihood
- **mitigation** - the measures taken to eradicate the hazard, or to reduce the likelihood or severity of one or more risks
- **system safety deficiency** - the circumstances that permit hazards of a like nature to exist

### 3.2 SMS that Reduce Safety-risk

This forms the basis for managing safety-risks in a formal SMS. The assumption underlying SMS is that hazards – the conditions that could lead to loss, whether they are based in the human condition, the equipment, the operational setting, or the organizational context – are predictable, and can be identified and managed proactively. What is needed are mechanisms to:

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• consistently identify the key hazards associated with any operation;
• assess the relative significance of each of the key or system hazards (or their combination), so that defences appropriate to the operating environment and the resultant risks can be developed and implemented;
• manage these defences (usually policies, procedures, practices) as rigorously as possible to obtain maximum reliability from people, equipment and the organization;
• provide feedback on where “breaches-in-the-defences” exist and the means to assess their relative significance; and
• continuously measure the results of the risk mitigation activities, whether they relate to the day-to-day operation, or to the strategic direction of the company.

These mechanisms are the basis for many SMS that have emerged in the last decade. With reference to figure 3.2, system hazards are high-level hazards that are generic to a company’s operation. System hazards are generally mitigated by regulations, rules, standards, policies or procedures. A company needs to identify the system hazards associated with its operations so it can reduce the exposure to the hazards, and to reduce the likelihood that they will lead to a catastrophic loss.

Figure 3.2 – SMS as Formal Accident Prevention

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14 Even a cursory examination of Section 2 of the Railway SMS Regulations in Appendix C illustrates how the twelve components of an SMS that have been prescribed for Canadian railways serve to meet the requirements listed in the paragraph above.
15 This is equally applicable to the rail industry as it is other transportation modes, nuclear energy, petro-chemical industries, etc.
Hazards-in-the-defences are the circumstances that can cause the mitigation (i.e. regulations, rules, standards, policies or procedures) to be less than optimal. They are breaches in the defences, or 'holes' in the mitigation as depicted in figure 3.2.

SMS align preventative activities with contemporary understanding of accident causation, seeking optimal reliability from people, equipment and organizations (the development of "cheddar cheese" as depicted in the center of figure 3.2), while searching out and managing the "holes" that make up the "swiss cheese" of reality (the right component of figure 3.2).

Besides being better attuned to reality, the benefits of such an approach to accident prevention are numerous. SMS are comprehensive, dealing with all aspects of an operation and an organization and not just the technical and operational aspects, as in the past. System safety deficiencies that cause hazards-in-the-defences are often rooted in the development or implementation of rules or polices or procedures, far-removed from the day-to-day operation. SMS make safety management explicit, and therefore lead to improved decision-making, and the management and measurement of resource expenditures. It is proactive: safety can be consistently designed into the future operations (or reorganizations) of a company. With time, the accumulative effect of such techniques – the successes and the 'mis-starts' – can enable companies to “learn” about their operation, their organization, their management. Properly analyzed, companies can improve their safety management and safety performance, while achieving operational and business efficiencies. Techniques imbedded in an SMS enable a company to "customize" its mitigation to suit the hazards and risks it is actually experiencing, rather than just blindly complying with standards. A company’s safety management activities can be explained – to stakeholders, shareholders, board members, unions, even regulators. Customized safety management can lead to mitigation that exceeds the regulated or prescribed minima; to an exemption from one or more rule or standard; or to activities or procedures to "bridge" the deficiencies in performance that often exist as gaps between different and co-existing rules, regulations and standards.

SMS were first introduced by companies that were leaders in their safety-critical industry. They did so not because of a regulated requirement, but because of the need to better manage the hazards and risks to which they were exposed. Gradually, various regulatory agencies have been moving towards encouraging or requiring that the industries they oversee operate SMS.

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16 Which were not adequately addressed by strict adherence to prescribed regulatory requirements or standards.
4. DISCUSSION

4.1 Introduction

Almost everyone consulted during the study – persons from the railway companies, unions and Transport Canada – believed that regulating SMS had improved safety management in the Canadian rail industry. It was opined that progress in some companies had been remarkable; in others, uneven; and in others, uncertain.

The issues that emerged during the study are examined in this section. Most are inter-related, with common themes that weave in and out of the sub-sections. Consequently, Section 5 distils the key issues and presents a number of high-level recommendations.

4.2 General: SMS in the Canadian Rail Industry

4.2.1 Introduction

The Railway SMS Regulations that came into effect on March 31, 2001 were the first of their kind in the Canadian transportation sector.

4.2.2 Performance Requirements

The performance requirements of an SMS are described in general in 3.2 (pages 10 and 11).

4.2.3 What was Observed

The following observations were made during the study.

- Section 2 of the Railway SMS Regulations presents a complete list of the necessary components for an SMS.
- Although the regulations are intended to make SMS the cornerstone of the performance-based RSA, they are adjuncts that have not been well integrated with a regulatory program that has been essentially prescriptive.
- There was contradictory information regarding the quality of SMS in the rail industry. Some representatives of the railway industry stated that most companies employed SMS before the regulations came into force in 2001; that the main effect of the regulations was to require the industry to more fully document their SMS policies, procedures and activities. Others, including representatives from some rail companies and Transport Canada, believed that it is still early in the evolution and application of SMS in the Canadian railway industry.
- The degree of maturity of SMS varies widely across the industry, and in some cases, within a single company. This was true of large railway companies and short-line companies.
- The industry and many from Transport Canada continue to focus on adherence to rules and prescribed standards to manage risk. This results in a tactical, inspection-oriented approach to measuring safety and safety management.
- Most railway SMS in Canada are process-based. Transport Canada considers them compliant if the processes and management systems specified in the SMS regulations are demonstrated to exist.
- Most of the people interviewed believed that the weakest component of most companies’ SMS is in the management of human and organizational factors.
4.2.4 Analysis

Generally, two distinctive types of SMS have emerged in safety-critical industries. One derives from earlier SMS that were developed in the mid-1980s and early 1990s, principally in the mineral-extraction and process industries. These industries had little or no tradition of quality assurance or quality management. The emerging SMS sought improvements in the consistency of operators' behaviour to reduce the number of industrial injuries and deaths, and damage to the environment.

Today, these management systems focus on operator adherence to standards and procedures; the reporting of events and losses; the quantification of risk; and the reliance on processes to achieve improvements in management performance – processes that are at the core of most occupational, safety, health and environmental management systems. The focus is on ‘management systems’. The target is the behaviour of the individual operator. The underlying assumption is that improvement in reliability (the ‘means’) yields improvements in safety performance (the ‘ends’). The intended outcomes are enhanced reliability of product or service delivery and a reduction of “failures”, as measured by accidents and incidents, deaths and injuries. The approach to risk and risk management is often linear: it is assumed that modifying personnel behaviour will result in safer service delivery.

The second type of SMS emerged in industries with a stronger history of quality assurance and management – industries such as the nuclear energy industry and aviation. Most companies in these industries had pre-existing quality assurance programs and other mechanisms to achieve reliability in the operation and maintenance of technical systems, and consistency in human performance.

These types of SMS tend to adapt a systems safety approach to risk management that emphasizes proactivity in the reduction of risk and the measurement of performance. SMS in these companies approach risk and risk management not just from a linear perspective, seeking to reduce the incidence of ‘failures’, but with an increased appreciation of the role that human factors, organizational factors and safety culture play in a company’s safety performance. Attention on ‘management systems’ is more implicit; the focus on safety performance more explicit.

The railway SMS that were examined during this study generally shared the characteristic of the first of these two types of SMS. The focus is on process, rather than performance. Attention is on operator behaviour and equipment reliability. The emphasis lies on enhanced reliability rather than explicitly directed improvements in safety performance. The understanding and management of risk is linear, and not conducive to a systems approach to understanding and managing risk. The results are measured principally by negative and lagging indicators of performance.

The implications are discussed more fully in the remainder of this section. Two general observations are highlighted below.

- The potential to integrate safety management (risk-based decision-making and the associated allocation of resources) with other management systems within the company is significantly inhibited if a company’s SMS is of the first type. Consequently, the commercial benefits and regulatory efficiencies often associated with an SMS are not easily achieved.

- A process-based, reliability-driven approach to safety management does not fully align with the current understanding of accident causation, and is less conducive to a performance-based regulatory program. The implications are discussed in 4.3, 4.6 and 4.8.

4.3 Performance-based SMS Regulations

4.3.1 Introduction

It has been the policy of successive Canadian governments since the late-1980s to encourage the development of performance-based regulatory programs. A performance-based approach to the
management of safety enables a company to explicitly demonstrate that it is fully knowledgeable of the hazards to which it is exposed\textsuperscript{17}; that it has the mechanisms to comprehensively and systematically manage these hazards proactively in ways that are appropriate to the associated risks; and that there are systems in place to continuously evaluate the effectiveness of the company’s risk management activities. A performance-based approach extends beyond mere compliance with safety standards.

Performance-based SMS are key to providing companies with the flexibility to manage safety in accordance with the size and complexity of their operation, and to integrate proactive safety management into their business and management processes.

Performance-based SMS regulations are the means by which the Canadian rail industry can progress beyond a traditional, prescribed regulatory program – a program that can be expensive (to the industry and Transport Canada), and that increasingly is less aligned with contemporary understanding of the conditions that cause accidents. Performance-based regulations for SMS enable railway companies to demonstrate explicitly to Transport Canada the nature and rationale for their safety-risk management activity – including their adherence to industry standards and rules – and their safety performance.

4.3.2 Performance Requirement

The following are the requirements for a performance-based regulatory program. There needs to be:

- Agreement by the industry and Transport Canada regarding the (performance) goals and objectives of the regulatory program;
- A shared understanding regarding accident causation and prevention, so that the elements of the SMS (hence the basis for the regulatory program) are purposefully structured;
- A willingness by each railway company to demonstrate explicitly how its activities improve safety performance, and thereby contribute to the achievement of the performance-based goals and objectives of the regulatory program;
- A focus on proactive safety management that \textit{explicitly} maps safety goals to planned activities: from the allocation of resources (inputs) to activities (outputs) and the performance outcomes (leading and lagging indicators of safety performance);
- Measures of performance within the industry and Transport Canada that extend beyond compliance with standards and processes; and
- Consistent evaluation by Transport Canada of the safety performance of individual companies, and over time, of the complete railway industry.

4.3.3 What was Observed

The following observations were made during the study.

- Generally, there is common conceptual understanding amongst the industry and Transport Canada regarding a performance-based approach to managing and regulating safety. However, there is no consensus regarding industry’s obligation to demonstrate how it manages safety; and in particular, regarding Transport Canada’s day-to-day activities to oversee the safety performance of individual companies and the industry.
- There is considerable hesitancy on the part of many railway companies to demonstrate explicitly all aspects of their SMS.

\textsuperscript{17} Not just technical, operational and environmental hazards, but also those relating to human and organizational factors.
• When reviewing a company’s SMS, Transport Canada generally seeks evidence of compliance with the regulated SMS requirements, rather than information regarding the performance of either the SMS or the company.

• As discussed in 2.3.5, Transport Canada is currently adopting a more “systems approach” to measure a company’s safety performance. The planned activities (in monitoring) will continue to focus on compliance with rules, regulations and standards. No work has yet started to systematically use the related data to develop higher-level indices of safety performance.

4.3.4 Analysis

The implementation of a performance-based regulatory program has challenged regulatory agencies around the world\(^\text{18}\). This is in part because most safety-critical industries are steeped in a strong tradition of prescriptive requirements, and because the language of legislation, while seeking strategic outcomes, tends to measure processes\(^\text{19}\). In some other jurisdictions, “regulatory goals have been incorporated into the language of the rule, specifying the desired level of performance and allowing the …[entity being regulated] … to decide how to achieve that level”\(^\text{20}\).

The performance goal (and therefore, the expectation of industry) has not been explicitly articulated in the RSA or the Canadian railway SMS regulations. Consequently, the desired “performance” of the regulations is at best implicit\(^\text{21}\). To illustrate: a goal in some non-rail industries is for a company’s SMS to reduce safety-risks to a level as low as reasonably practicable. This is a performance goal – one that requires a company to demonstrate explicitly that it employs mechanisms\(^\text{22}\) to systematically identify and appropriately manage the hazards to which it is exposed. The company must demonstrate that:

• it identifies hazards on an ongoing basis;
• assesses the risks and allocates resources appropriate to the severity and likelihood of those risks;
• tracks and analyses the effectiveness of the mitigation; and when appropriate,
• modifies its activities and strategies to more effectively mitigate risk.

Only in this way can the company demonstrate that it is achieving its safety goal. Because it is a company-wide performance goal, proactive safety management must be conducted throughout the company at a day-to-day operational level, and at the strategic and organizational level. Diverse safety-risk management activities are demonstrably integrated, prioritized, assessed and measured. The goal dictates the functionality of the SMS. The nature of the operation and the organization (i.e. the hazards to which it is exposed) directly and explicitly determines the nature of the company’s SMS, and the other activities it employs to manage risk.

If the Canadian RSA or the SMS regulations specified a performance goal, most of the requirements of a performance-based program listed in 4.3.2 would be met: the company would need to demonstrate on an ongoing basis that it employs an SMS to proactively manage and measure the safety-risks associated with its operations. Such an SMS would need to integrate technical and operational standards, rules and procedures with corporate policies and procedures for safety.

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\(^\text{19}\) It is a classic case of regulating what can be regulated, not because it is the best indicator of performance, but because it is all that there is to measure. Adapting an old adage: one regulates what one can measure.

\(^\text{20}\) Coglianese et al.

\(^\text{21}\) The range of understanding is significant. Auditing for compliance suggests that successful performance is demonstrated if the company simply complies with the SMS regulations. But this is a proxy measure (the validity of which might be strongly debated) of a company’s actual safety performance – the actual performance goal the SMS regulations seek to influence.

\(^\text{22}\) And not just “has” mechanisms.
management. The third objective of the RSA contained in section 3 (c) could be changed from a general statement of expectation\(^{23}\) to an explicit and measurable safety goal:

“... recognize the responsibility of railway companies to reduce the safety-risks associated with their operations to a level as low as reasonably practicable”

In the absence of such a performance goal embedded in the RSA or the regulations, Transport Canada does not evaluate a company’s SMS plan to determine whether its safety management is appropriate or effective.

4.3.5 For Further Consideration

Embedding a performance-based goal in the RSA or regulations would require each company to demonstrate the functionality of the mechanisms it employs to proactively manage its safety-risks. A short-line company could present a risk-based rationale for an SMS that might differ considerably from that of another, larger company. However, the short-line SMS (and the regulation of it) would be appropriate to the hazards and risks associated with its operation.

As noted in 4.3.2, such a performance-based regulatory program cannot occur without widespread agreement by industry and Transport Canada on the cause of accidents, and on how an SMS works to reduce safety-risks. Transport Canada must take the initiative to work with the industry to develop a transparent and effective performance-based regulatory program. This is further explored in 4.6 and 4.8.

4.4 Transport Canada’s Implementation of the Regulatory Program

4.4.1 Introduction

As noted in Section 2, Transport Canada’s implementation of the SMS-based regulatory program has undergone a number of changes since 2001. The evolution from a prescriptive to a performance-based program has been uneven across the country and across areas of functional speciality.

4.4.2 Performance Requirement

As noted in 4.3, the regulatory will be effective when companies regularly demonstrate the functionality of their SMS and its effect of safety performance. TC will oversee the industry by sampling, validating, and supplementing the company’s internal measures of safety performance. The relationship will be one characterized by active sharing of safety-related information.

The requirements for a performance-based regulatory program have been described in 4.3.2. A mature program will:

- Minimize duplication by the industry and Transport Canada, and result in the ready sharing of data, information and performance measures;
- Enable Transport Canada to operate an oversight program that is based on the risks experienced by the companies or the different industry sectors, so Transport Canada’s resources can be concentrated where they will be most effective;
- Result in companies providing Transport Canada with their long-, middle- and short-term plans for assessing their own safety performance (e.g.; internal plans to conduct inspections, audits, evaluations and risk assessments of their operations), so Transport Canada can coordinate its oversight activity to supplement or validate companies internal activities; and

\(^{23}\) The current objective reads: “recognize the responsibility of railway companies in ensuring the safety of their operation”.
• Result in each company providing Transport Canada with the results of its internal analyses and assessment of safety data, so Transport Canada can analyse information from across the industry and provide feedback regarding best practices or areas of apparent system safety deficiency.

4.4.3 What was Observed

Transport Canada has been undergoing a transition from an inspection-based to an audit-based program.

The following observations were made during the study.

• There was universal agreement within the industry and Transport Canada that Rail Safety is insufficiently resourced (regarding staff numbers and skill sets). This has impeded the transition to the new, risk-based, performance-based oversight program centered on SMS.

• The rail industry is generally reluctant to share information with Transport Canada, in part because of suspicion that the information will be misunderstood or for fear that the information will be “misused against” them24. This is key, and is examined more fully in 4.6 and 4.8.

• The division of responsibility for program development at Transport Canada Headquarters and program delivery in the regions impaired the coordinated introduction of SMS across the industry.

• Until recently, the regulatory oversight of SMS has been conducted as a separate function within Rail Safety.

• Transport Canada audits are “process audits” which, as noted in 3.2, assume that measure of ‘process’ are appropriate surrogate measures of ‘performance’.

• The risk-based oversight model (figure 2.2) that is currently being implemented offers considerable promise for establishing regulatory priorities and coordinated oversight activities, nationally and regionally. If the model is well implemented well, this risk-based approach could integrate the SMS requirements with other regulatory activities and go a long way to break down the functional silos identified in Rail Safety.

• The risk-based oversight model requires the systems analysis of safety-related data and information. To-date, full-time resources have not been earmarked to perform this analytical function. This is key and is examined in more detail in 4.6.

• There is considerable difference of understanding within Rail Safety regarding an assessment protocol (currently under development) that uses the SMS components as the framework for auditing and inspecting railway companies.

• Some persons from the industry expressed concern that Transport Canada may dictate the specific processes that industry must employ to meet the requirements of the SMS regulations. They believed this would impede the integration of SMS with other management systems (e.g. health and safety, environmental, quality management systems, etc.).

• Some persons expressed concern about the bureaucratic nature of Transport Canada’s oversight of SMS, and the potential for Transport Canada audit findings to be ‘politicized’ within and outside the company.

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24 Hale has noted rail companies around the world do not tend to be explicit about safety, or share information. He searched on the internet pages of four major operators in four countries. In only one of the four did he find anything explicit about safety that was available to the public. Hale 2000.
4.4.4 Analysis and Further Consideration

Transport Canada has not yet succeeded in implementing a performance-based regulatory program. There is need for Transport Canada to:

- Make the necessary changes in the Act, Regulations and Transport Canada policies to build the foundation for a truly performance-based program (see 4.3.5).
- Articulate a performance-based regulatory goal so the necessary regulatory functions and activities can be determined, roles and responsibilities can be identified, and a suitable organizational structure can be created. An appropriate goal would be: to oversee the Canadian Rail industry’s ongoing reduction of safety-risks to a level as low as reasonably practicable. This is discussed further in 4.6.
- Develop functional flow charts to map roles and responsibilities – within the industry, and within Transport Canada (see 4.6). This will aid in determining the appropriate degree of “bureaucracy” required for industry to demonstrate their safety performance explicitly to Transport Canada. It will also become the basis for protocols obliging industry to provide safety-related information to Transport Canada, and for Transport Canada’s use of such data.
- Liaise closely with the Canadian rail industry to jointly develop a strategic (e.g. a 5-year) plan with annual objectives and ‘reportables’ for the development and transition to a performance-based regulatory program, characterized by many of the features described in 4.3.2 and 4.4.2.
- Create an analytical function to advise senior management in Transport Canada on safety performance indicators (see 4.6). This office will employ information from numerous sources to analyse and evaluate safety-related information regarding “system performance”, whether the system is one company, a category of companies, or the complete rail industry. This is explored in more detail in 4.6.5.
- Develop evaluation techniques to supplement audit and inspection techniques.

4.5 Risk Assessments

4.5.1 Introduction

A risk assessment is an explicit means to forecast and mitigate hazards and safety-risks. Risk assessments have their origins in engineering system safety. They have been traditionally used to design optimum reliability in the delivery of a service and to minimize failures, breakdowns or accidents. In the past decade, many industries have adapted risk assessment techniques to identify and manage hazards associated with human and organizational factors. A risk assessment is often employed before introducing change (operational, technical or organizational); or when evaluating ongoing safety performance25. A risk assessment can be conducted at a very high level (e.g., to complete a ‘safety-risk profile’ of a company and the services it provides); at a moderately high level (e.g., when assessing an operation, a change in the delivery of a service, or the amalgamation of two companies); or at a detailed level (e.g. when designing a modification to equipment; when acquiring equipment; or when obtaining exemptions to regulatory requirements). It is used to consistently identify hazards, determine the severity and likelihood of the associated risks, and in this way, guide the development of mitigation strategies that are appropriate (in cost and complexity) to the risks that need to be managed. An effective risk assessment can result in the development of performance indicators to measure future safety performance. There are various forms of risk assessments to suit the complexity, or the safety significance, of the system being assessed26. For instance, a formal risk

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25 See Leiss (2005) who advocates the need to assess incremental change in risk management. See also Snook (2000).

assessment conducted by just two or three operational personnel from a small company can be completed in several hours.

Risk assessments, when conducted transparently in ways that involve the affected stakeholders, can be the basis for “reasoned public dialogue, wise risk management, and sensible priority-setting in the allocation of resources…” 27.

4.5.2 Performance Requirements

For risk assessments to be an effective part of a company’s SMS, they need to take account of the hazards and risks related to not just technical and operational factors but also human and organizational factors. They need to be:

- proactive where appropriate;
- explicit;
- transparent;
- adaptable to assess very complex or rudimentary systems;
- credible, and therefore trusted; and
- employed consistently as part of the company’s way of designing, implementing and delivering the services it provides.

4.5.3 What was Observed

The following observations were made during the study.

- There is disagreement between the railway industry and Transport Canada as to when a risk assessment is warranted. Most companies employ them only when a change is contemplated, and even then, not all changes are subjected to risk assessments. Generally, rail companies do not employ risk assessments to assess the ongoing performance of their services or programs.
- Canadian railway companies do not generally develop safety-risk profiles of their operations.
- The industry generally conducts risk assessments of technical systems, and to a lesser degree, operational systems. Therefore, the hazards and risks they identify during risk assessments focus more on technical and operational factors and less on human and organizational factors.
- A small sample of risk assessments conducted by the rail industry and TC were examined during the study. Almost all were event-based (rather than hazard-based), and employed adapted, linear, fault-type analyses. These techniques draw on relatively simple deductive (rather than inductive) methods, and are not well suited to identify hazards based in human and organizational factors. It is customary in other safety-critical industries to employ inductive risk assessments when introducing change. An inductive process identifies all possible hazards, after which the risks are assessed and mitigation developed. This results in a thorough assessment of the risks associated with the change and well-informed decisions regarding the necessary mitigation.
- There is no guidance specifically designed for small companies to conduct and report safety-risks assessments.

• There was widespread agreement within the industry and Transport Canada that despite the significant advances in the conduct of risk assessments achieved in recent years, there remains much room for improvement.

4.5.4 Analysis

The rail industry’s conduct of risk assessments is fragmented. Some change initiatives are accompanied by a risk assessment, and others are not. This results in uneven proactive safety management – within a company, and across the industry. The predominant use of deductive, event-based risk assessments results in a simplified approach to risk management, which in-turn underestimates the safety-risks in railway operations. The focus on technical and operational factors leads to risk mitigation strategies that do not take appropriate account of the organizational context in which humans err or equipment fails. In short: many of the risk assessments being conducted within the Canadian rail industry do not address the conditions that are known to increase risk and to cause accidents.

System-level safety-risk assessments are key to customizing the SMS of individual companies, so the specific hazards they experience can be managed appropriately and effectively. When these types of risk assessments are completed, a company safety-profile can be created. The profile documents the risk mitigation strategies employed to manage the key hazards. The SMS is explicitly structured to manage the human, technical and organizationally based hazards to which the company is exposed. The company can demonstrate to its stakeholders the mechanisms it employs to continuously identify and address deficient risk mitigation. Because a safety-risk profile is hazard- and risk-based, and because it is documented and regularly updated, regulatory bodies can use the company’s profile to judge whether the company manages its safety-risks appropriately, and to determine areas that may warrant regulatory intervention. The profile, the company’s SMS and its safety management activity can be evaluated to determine the “safety health” of the company. Risk assessments and the profiles they form become the basis for a performance-based regulatory program.

4.5.5 For Further Consideration

The rail industry needs to consistently conduct risk assessments, not just when technical changes are being introduced, but when organizational or business changes are planned. The rail industry can draw on numerous examples in Canada and elsewhere of companies and regulatory bodies that require risk assessments to focus on human and organizational factors during corporate change initiatives28. Furthermore, railway companies needs to periodically conduct risk assessments to measure the ongoing appropriateness and effectiveness of their safety management activities29.

The regular use of safety-risk profiles throughout the rail industry would allow railway companies – whether short-line operators or the larger companies – to operate an SMS consistent with the size, the complexity and the safety-risks associated with their operation. Each company’s SMS would include the components specified in the Rail SMS regulations, but the degree of detail and documentation would differ from company-to-company depending on the ‘risk consequences’ of each company’s operations.

There are a number of initiatives underway within Transport Canada Rail Safety to make their regulatory oversight program more risk-based. One involves profiling the railway companies, although the focus apparently is on “compliance profiling” rather than the more explicit “safety-risk profiling”.

28 T. Kelly “Managing the safety risks related to significant organizational change” in Proceedings of the Tenth International Symposium on Aviation Psychology (Columbus, Ohio: Ohio State University, 1999), 507-511. For example, NAV CANADA has implemented policies that require hazard analyses and risk assessments to be conducted before change initiatives are introduced. See also: Nuclear Energy Agency, Organisation for Economic Co-operation and Development. "Managing and regulating organisational change in nuclear installations". CSNI Technical Opinion Paper No. 5, France, 2004. ISBN 92-64-02069-1.

29 Snook (2000).
The latter could be achieved if all performance-indicators of a company – incidents, accidents, audit findings, inspection findings, hazard reports, equipment outages, etc. were translated/transformed into common risk management terminology\(^{30}\), so that all aspects of a company’s safety performance could be analyzed. Transport Canada could compare the “safety health” of a single company or a number of companies over time. Key safety issues would be identified and targeted, and potential system safety deficiencies (within the company, industry or the regulatory program) anticipated or verified. Such profiling is being employed by some companies and regulatory bodies outside the railway industry (e.g. the nuclear energy industry, and more recently, within the Swiss Civil Aviation Authority)\(^{31}\).

The Canadian rail industry is in need of guidelines for risk assessments that, in addition to those currently available:

- provide direction in inductive risk assessments that are suited for identifying and managing hazards and system safety deficiencies based in human and organizational factors; and
- can be employed by non-specialist staff, particularly in small, short-line companies.

Representatives from the rail industry and Transport Canada could develop such guidelines jointly, perhaps with the assistance of a third-party such as the Canadian Standards Association.

Risk assessments are conducted by very small companies in other industries. For example, business aircraft operating in Canada and other jurisdictions are required to conduct risk assessments as part of their SMS. Flight departments are often only comprised of a few persons who have had no prior experience in formal risk management. Practical guidelines have been developed and used with success for several years. They are “user-friendly”; contain checklists and “tips”; and provide consistency in risk management within the company and the business aviation community\(^{32}\).

Risk assessments can involve employees, managers, stakeholders and even the public in processes that affect a company’s safety management activities. Such active participation in safety management enhances understanding about risk and risk management, engenders trust, and improves safety culture and ultimately, safety performance. William Leiss amongst others has noted that there is general societal mistrust regarding risk assessments that can best be addressed by involving and communicating with the public on issues related to risk. To fail to do so “represents a business risk which may grow to significant proportions\(^{33}\). This is discussed in 4.8.

### 4.6 Roles and Responsibilities

#### 4.6.1 Introduction

The introduction of performance-based SMS regulations necessitated a significant shift in the traditional roles and responsibilities of industry and Transport Canada.

#### 4.6.2 Performance Requirements

For the regulatory program to function effectively, there needs to be:

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\(^{30}\) In other words, determining whether the information indicates a hazard or a system safety deficiency, and if so, the exposure and risk associated.


\(^{33}\) Leiss 1999.
• Recognition within the industry and Transport Canada that railway companies are fully responsible to their customers, stakeholders (including among others, communities and the public) and shareholders for managing the safety-risks associated with the services they provide to a level as low as reasonably practicable;

• Recognition within the industry and Transport Canada that Transport Canada is responsible to the Government of Canada and the public for overseeing that the rail industry manages its safety-risks to a level as low as reasonably practicable;

• Agreement that the ‘burden of proof’ is with the industry to provide the “safety case” that supports the safety management decisions they make, the resources they allocate, and the activities they conduct; rather than with Transport Canada to demonstrate that industry’s activities are ‘dangerous’;

• Sensitivity by Transport Canada that they not unnecessarily constrain the industry’s choice of actions, impose inappropriate demands on a company or the industry, and not undermine the industry as it fulfills its responsibilities;

• Respect by the industry for the legitimacy of Transport Canada’s role to oversee the safety performance of the industry, and to maintain its regulatory detachment;

• Little or no duplication in roles and responsibilities, within Transport Canada, and between Transport Canada and the industry;

• The means to measure safety performance and the achievement of a company’s safety goals with increasing use of audits, safety analyses and evaluation techniques; and

• A capability within Transport Canada to analyse safety-related data and information to advise senior management regarding regulatory priorities.

4.6.3 What was Observed

The observations relating to this issue are reported throughout Section 4. In general, it was noted that there are different understandings of the roles and responsibilities of the industry and the regulator in a performance-based regulatory program. These differences can likely be attributed to changes in the manner that the SMS regulations have been implemented and regulated since 2001; and to the effects of a compliance-dominated safety culture that continues to prevail in industry and Transport Canada.

4.6.4 Analysis

In a performance-based regulatory environment, railway companies are responsible for tactically and strategically demonstrating to Transport Canada that they proactively manage safety, and measure their performance. They must be forthcoming. As noted in 4.3, there must be agreement by the industry and Transport Canada regarding the information that needs to be shared, why it is being shared, and how Transport Canada will employ it. It was observed that industry is reluctant to provide certain types of essential information to Transport Canada, in part because such information may appear “incriminating”.

Transport Canada had no experience in performance-based regulatory programs before the RSA. Persons from industry and Transport Canada stated some of the major hurdles to establishing effective roles and responsibilities originated within the department.

• Considerable differences of understanding regarding SMS and the regulatory program continue to prevail in Rail Safety, across functions and regions.

• Internal support for the initiative to regulate SMS has been uneven at all levels of the hierarchy.

• Disparate regional activities have impeded the design and implementation of the new regulatory program.

• Transport Canada has revamped its regulatory program, tools and activities on several occasions.

4.6.5 For Further Consideration

As noted in 4.3 and 4.4, there is need to conceptualize, then chart, the respective goals and objectives of the Canadian railway industry and Transport Canada industry in a future performance-based regulatory program. From this, high-level roles, responsibilities and activities by industry and Transport Canada need to be documented. Additionally, protocols need to be developed that explicitly articulate the rail industry’s responsibility for demonstrating to TC that they proactively manage safety-risks, measure their performance, and take timely action to address system safety deficiencies.

Transport Canada then needs to determine the manner by which it can most efficiently and effectively fulfill its mandate, and design its organization to support the activities conducted by Headquarters and the regions. It is fully expected that such an undertaking will result in whole-scale change of activities, and a need to develop new skill sets to conduct regulatory oversight35.

One such new role is just surfacing. There is need for a centrally located office in Rail Safety that can amass and analyse safety-related data and information from across the country. This function is depicted as “Railway Performance Analysis Assessment” in the Integrated Rail Safety Oversight Model (figure 2.2). Apparently, no consideration has been given to form a single office to perform this function. Consequently, the analyses and assessments will be conducted as required by each of the technical branches.

If such a centralized office were formed, its mandate would be to advise senior management regarding high-risk companies and safety issues specific to industry sectors; and to provide feedback on the efficacy of Transport Canada’s oversight activities. There are precedents for such an Office. The Mosansky Commission into aviation safety in Canada recommended in 1991 that an internal, independent safety office be formed to advise the then Assistant Deputy Minister of Aviation on policy-issues resulting from safety analyses that identified system safety deficiencies in the Canadian aviation industry. More recently, the Office of Safety Risk Management was formed in the Swiss Federal Office of Civil Aviation (FOCA) to analyse regulatory and other safety-related data to help inform senior management decisions regarding priorities for regulatory oversight36. Many companies from various safety-critical industries have established an independent, internal office to advise the most senior levels of the company on the safety performance of individual functions and of the company as a whole.

To be effective, the centralized office would need to manage a national database containing relevant safety-related information. The data would come from such sources as regional and national audits, inspections and evaluations; incident and accident investigations; service deficiencies; hazard reports; public complaints; industry safety studies; coroner reports; company safety plans and reports; risk assessments; and specialist research reports. Such a database – RSIG – is currently under

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35 This was a finding of a study conducted for Transport Canada, Civil Aviation. See: SMS Aviation Safety Inc. Reference document to aid in developing SMS-related competencies for TCCA managers and staff. SMS report no. 0601, rev. 1.0, Transport Canada Civil Aviation, Ottawa, July 2006.

development. The data for RSIG needs to be consistently collected and examined so that hazards and system deficiencies can be identified, hazard exposure established, and safety significance assessed before being entered into the database. This will enable information from different functions, companies, geographic locations, etc. to be evaluated cross-sectionally and longitudinally to produce risk-based measures of safety management and safety performance. The findings would guide the risk-based business planning process, so that regulations, policies or priorities could be developed, changed or fine-tuned.

4.7 Safety Measurement

4.7.1 Introduction

Safety measurement is an important element of a functioning SMS – particularly a performance-based SMS. A company needs to know that its ongoing risk mitigation activities are appropriate and effective; and that the resources it expends are tracked, analysed and evaluated. Similarly, Transport Canada needs clear indicators that individual companies, segments of the industry, and the industry as a whole, are managing safety-risks appropriately and effectively.

4.7.2 Performance Requirement

Some of the key objectives of the SMS regulations include integrating safety management with the management of day-to-day operations, and making the rail industry more proactive, strategic and systematic in its approach to managing safety. To achieve these objectives, the railway industry in general needs measures that:

- are proactive (leading) rather than reactive (lagging);
- focus on hazards as well as risks (figure 3.2);
- account for human and organizational factors as well as technical and operational factors;
- are directly relevant to safety performance, not just processes;
- provide feedback to inform the day-to-day decisions (tactical) and assist in setting priorities for the middle- and long-term commitment of resources (strategic);
- are common across different programs or functions throughout a company;
- are common throughout the industry;
- are easily and efficiently collected;
- are undisputed; and
- have validity over time.

Transport Canada needs measures similar to those listed above. As noted in the section above, it needs to be able to employ the data to systematically establish short- and long-term regulatory priorities.

4.7.3 What was Observed

The following observations were made during the study.

- Measures are almost exclusively reactive or lagging. For instance, section 3(1) of the Railway SMS Regulations requires companies to report to TC the accidents and incidents, fatalities and injuries they have experienced. Target levels of safety submitted annually by companies almost always report forecasts of anticipated losses.
• Section 3.(2) of the SMS regulations enables the Minister to “request a railway company to collect, maintain and submit specified performance or safety data regarding the effectiveness of its safety management system and its safety performance”. However, there was no agreement amongst those interviewed regarding the conditions by which the Minister would make such a request; what would constitute appropriate data; or how it would be evaluated – particularly data to measure the effectiveness of a company’s SMS.

• Transport Canada and the rail industry tend to rely on measures of compliance as surrogate measures of safety performance. This contradicts current thinking in accident prevention, as discussed in Section 3. Too often companies within safety-critical industries around the world demonstrate strong processes and compliance with standards, only to experience an accident. Compliance is only a first step in risk management and risk reduction, especially when companies are experiencing commercial pressures, significant organizational change, or conflicting goals and objectives. TC’s move towards integrated audits emphasizes process auditing. Such audits are often labour intensive, and are based on questionable assumptions about the relationship between management processes and system performance.

• There is very little discussion within Transport Canada or the industry about employing evaluation techniques to augment audits and inspections.

• Companies do not employ a systems’ approach to measure and manage their safety performance.

• It appears that the railway industry is waiting for Transport Canada to determine future measures of safety performance.

4.7.4 Analysis

The use of lagging performance measures is not unique to the rail industry, and in-fact, is common to most safety-critical industries. When used as global indicators (such as the number of employee deaths, disabling injuries and minor injuries per 200,000 hours worked, in accordance with s.3 of the SMS regulations) they can be used to track general trends over time, and to conduct limited comparisons between functions within a company, or between companies. They lack the specificity to guide day-to-day decision-making. When examined in detail, the information tends to be descriptive rather than predictive, and because it provides little explanatory value, it forces analysts and managers to make assertions regarding “causes”. In many cases, the attributed cause is seldom more than an unrecognized hypothesis. Therefore, subsequent measures to prevent similar occurrences are usually speculative (since they sanction activity to address untested hypotheses) and assumption-laden (consciously or otherwise). When the “solutions” are technical, they can be expensive. It is almost always impossible to measure whether the preventative activities have had the expected effect37.

Often, databases are project- or program-specific, leading to “silos” of information that can be neither employed across domains within a company, nor used in meaningful system analyses. Consequently, most safety databases in the rail industry and most other safety-critical industries cannot be employed to understand system safety, or to measure safety performance. This is equally true of the databases operated by regulatory agencies. It is for this reason that it was suggested in 4.6.5 that RSIG be enhanced to enable cross-functional, system-wide analysis of the safety performance of the Canadian rail industry.

A significant problem is one of momentum. Data collection, warehousing and analysis are expensive, and represent years of investment. They often represent the only available history of past safety performance. Consequently, measurement programs are often shaped by the data that have been traditionally collected, rather than the data that are required. It becomes a case where “best” practices inhibit rather than enhance. Because most measurement programs are not structured to enable the

systematic identification of hazards and system deficiencies, nor the prioritization of safety-risk data, data are collected unevenly, often understood inappropriately, and applied inconsistently.

It may be true that a company or industry can’t manage what it doesn’t measure. But it is equally true that poor measures will certainly result in poor management, and poor performance.

4.7.5 For Further Consideration

Developing effective measures of safety management and safety performance will be one of the most significant challenges to face the industry and Rail Safety.

An industry-wide measurement program should be developed at the same time that the goals, objectives and responsibilities for the performance-based program are being developed by TC and the rail industry (see 4.6.5). The projects may also be useful to cultivate improvements in safety culture throughout the industry, the need for which is discussed in 4.8.

Safety measurement must be purposeful. The collection of more and more data only obscures the route to success. Therefore, appropriate data must be selected, analysed and applied. A number of initiatives from around the world offer promise. Most involve risk profiling (see 4.5), so that the hazards and risks specific to a single company can be identified, and a diagnosis of the safety “health” of the company documented, risk-based priorities set, actions taken and the results measured. This is the first important step in making safety management – and safety measurement – proactive. The safety management of a company is customized to address the specific technical, operational and organizational hazards experienced by that company. The appropriateness and effectiveness of the safety management activity is then measured as proactive, proxy measures of safety performance. In this way, a measurement framework is developed that provides ongoing leading indicators of the company’s achievement of its safety goal, and of its safety performance.

As noted earlier, there are various initiatives within Rail Safety to profile some elements of railway companies’ safety performance. These projects need to be consolidated and applied in a consistent manner if the national program is to be risk-based.

Other organizations and agencies have developed tools to evaluate SMS. For instance, the International Business Aviation Council (IBAC) as part of its IS-BAO (International Standard for Business Aircraft Operations) Program has for some years required companies to operate an SMS. Using three indicators, the evaluator(s) determine(s) the degree to which the SMS requirements – hence the foundation of the SMS – are in place; the degree to which the SMS is being used throughout the organization to direct the company’s safety management activities; and the degree to which safety management activities have been internalized to form the values and culture of the company’s executives, managers and employees. Characteristically, deficiencies will vary across the company (functionally and hierarchically), each one impacting day-to-day activities and the achievement of the company safety goal in different ways, and with different effect. Similarly, remedial measures will vary. Over time, progress in safety management and safety culture will be demonstrated as the company continuously reduces the safety-risks that result from the services it provides. Another example is provided by Serco, a UK-based service delivery company that provides a number of diverse safety critical services in countries around the world. Serco’s Corporate Assurance Group has developed an easy-to-use self-assessment tool to conduct cross-sectional and longitudinal analyses of companies’ SMS and safety performance. The single assessment tool yields results that traditionally would require numerous inspections, audits and surveys of a company’s safety culture.

38 Hale notes: Indicators “… must be linked to a very clear set of models or frameworks about how the safety management system works, so that all concerned can see at a glance what aspects the indicators are measuring. This is not easy in complex systems…” Hale, 2000.

39 These indicators measure the ‘soundness’, appropriateness’ and ‘effectiveness’ of a company’s safety management activities.

40 Rail services, nuclear energy, nuclear weapons, aviation services, prison guard services, to name just a few.
4.8 Safety Culture

“Few things are so sought after, and yet so little understood”
- James Reason, 1997 (in discussing safety culture)  

4.8.1 Introduction

This study has demonstrated that an SMS is an important mechanism to achieve a company’s safety goal. However, a positive safety culture is equally important. A company’s values enhance, and are enhanced by, the safety management activities it undertakes, and therefore by its SMS. There are numerous definitions of safety culture, and for this study, the following was employed:

The safety culture of an organization is the product of individual and group values, attitudes, competencies and patterns of behaviour that determine the commitment to, and the style and proficiency of, an organization’s health and safety programmes. Organizations  

Mature and integrated SMS drive a company’s activities, and these common practices forge the behavioural norms of persons at all levels of the company. The SMS becomes the means for collective learning, system improvements and enhanced safety performance. However, until an SMS matures, there is need to consciously cultivate the safety culture. This must involve senior managers, managers and company employees. Numerous studies indicate that a prescriptive, rules-based environment stifles sharing and learning, and negatively impacts the culture of participation required to proactively manage safety  

The preceding comments regarding a company’s SMS also apply to safety culture within the rail industry. There is need to engineer an environment that promotes the sharing of safety-related information throughout the industry, and with its stakeholders.

4.8.2 Performance Requirement

The following summarizes the performance requirement for a positive safety culture within a company and within the railway industry:

- Shared perceptions of the importance of safety;
- Confidence in the efficacy of preventative measures;
- Recognition that mitigation can never be fully effective, so information is actively sought, valued and used to improve risk management activity and mitigation;
- Recognition that such feedback needs to come from all sources, including those internal to the company, employee associations, other industry stakeholders, the public, Transport Canada and other safety agencies; and
- Recognition that information needs to flow unimpeded in an environment of trust and respect, so it can be validated and assessed for its safety significance.

4.8.3 What was Observed

The following key observations were made during the study.

• Most persons interviewed (from Transport Canada and the industry) acknowledged the need for more complete and/or effective employee involvement. A number of senior persons from rail companies conceded that the industry had not adequately involved employees and their representatives in the development and operation of SMS.

• The rail industry is characterized by an environment of significant mistrust. Examples of such widespread mistrust were found within individual companies, between rail companies, between Transport Canada and the rail industry, and within Transport Canada (amongst some functions, and between some regions and Headquarters).

• There was a commonly held view that some companies are much more actively engaged in implementing SMS, and that these companies are developing a positive safety culture that encourages managers, employees and employee representatives to participate in the company’s SMS.

• A number of persons stated that in some companies, a positive safety culture is hampered by line managers who are pressed to meet production goals, and who rely on more traditional management methods of command and control. It is believed that such managers are concerned about being viewed as “lenient”. Their behaviours reinforce a “punishment culture” and detract from the development of a positive safety culture.

4.8.4 Analysis

Deficiencies in safety culture underlie many of the findings reported throughout Section 4, and in particular those pertaining to the development of a performance-based regulatory program, the roles and responsibilities of industry and Transport Canada, the conduct of risk assessments, and the explicit measurement of the safety performance of companies and the industry.

Many observers of the railway industry around the world believe this will be one of the most difficult challenges facing the industry. “The contrast between the rule-bound and the participative cultures could hardly be greater. It will be many years before railway companies will be able to realize such a shift, but it is an essential one in becoming a learning organization…. Rail companies need to look at this dilemma of the place of rules in their culture”44.

4.8.5 For Further Consideration

A number of recommendations have been proposed in Section 4 that, if implemented, will enhance safety culture throughout the Canadian railway industry. First and foremost, there needs to be complete agreement regarding accident causation, so that the industry’s safety management activities and the regulatory program that oversees these activities “make sense”. A series of exploratory safety conferences co-hosted by Transport Canada and the rail industry may be an effective means to build this understanding, which in turn will aid in the joint development of the performance-based regulatory program, the determination of appropriate roles and responsibilities, and public safety planning and reporting. Successes in such strategic activities will build trust and respect, thereby aiding in the development of protocols to exchange safety-related information, and of processes to audit SMS and evaluate safety performance.

It is imperative that employees and their representatives be more actively involved in the development and operation of railway SMS. Similarly, the railway industry needs to forge effective communications with communities and other stakeholder groups. As William Leiss has noted:

Informed public understanding of risk factors is the key to achieving broad support for and trust in risk management strategies, and this in turn depends upon an abundance of good risk communication practice45.

45 Leiss, 1999.
5. CONCLUSION AND OBSERVATIONS

"If we put together all of the trends ... [in safety management today] ... they add up to a revolution in the way safety is, or should be, managed in railway companies compared to a decade ago. The keywords are: systems thinking, explicit risk comparisons, integrated management systems across different types of harm, continuous concern for safety from management, participation from operational levels and finally the need to develop into a learning organization in order to manage safety in a changing world"46.

5.1 Conclusion

There are very few performance-based SMS that are regulated anywhere in the world. Those that have been attempted have universally experienced difficulty during start-up and implementation. Nevertheless, such a regulatory strategy − one in which the industry demonstrates that it continuously and proactively manages the hazards and safety-risks to which it is exposed − offers significant advantage over the traditional, prescriptive approach to safety regulation. Performance-based programs are well suited to regulating safety-critical industries that are subject to significant technological, operational and organizational change in a commercial setting.

Performance-based SMS regulations are a valid regulatory approach for the Canadian railway industry. However, the initiative to regulate SMS as a cornerstone of the performance-based regulatory program needs to be re-examined, and the program restructured. This will result in a considerable shift in the roles, responsibilities and activities by the Canadian railway industry and Transport Canada. To succeed, the industry and the regulator will need to work closely to develop a relationship of respect and trust. The relationship can be founded on a common appreciation that SMS reduce the likelihood of accidents.

5.2 Summary of Observations

The following consolidates suggestions put forward in Section 4.

1. There is need for the regulated requirements of SMS to be explicitly performance-based. This can be done in a number of ways. One of the four objectives of the RSA, described in section 3 (c) of the Act, could be amended so that railway companies must demonstrate they continuously reduce their safety-risks to a level as low as reasonably practicable. Alternatively, the SMS regulations could be amended to require a railway company to operate an SMS that “reduces the safety-risks associated with the services they provide to a level as low as reasonably practicable”. In either case, companies would demonstrate that they actively employ mechanisms to identify, manage and measure the hazards and risks associated with their operations. Although small and large companies would share the same strategic safety goal, each company would customize their SMS to reflect the size, complexity and nature of the hazards associated with its operation. Such a performance-based goal would focus the industry on demonstrating to Transport Canada the functionality of the twelve specified requirements, rather than merely proving that the twelve required components are in-place.

2. Transport Canada and the Canadian rail industry should develop a performance-based regulatory framework, from which respective roles and responsibilities can be charted and documented. This would lead to protocols regarding the industry’s obligation to share safety-related information with the regulator.

3. Transport Canada, after articulating its regulatory objective vis-à-vis the rail industry’s SMS, should conduct a functional analysis to determine the activities that are appropriate for its oversight program, and make the necessary changes to its organization and the skills of its managers and staff.

4. The Rail Safety Directorate of Transport Canada should formally identify a specialized function for safety analysis. This centralized office would report to the Director General, and measure the industry’s and Transport Canada’s performance, tactically and strategically. The information would provide Transport Canada senior management with advice regarding high-risk companies and industry sectors, while providing feedback on the efficacy of Transport Canada oversight activities. The results of the studies would be shared with the Canadian railway industry.

5. The industry should employ company safety-risk profiles to design and modify company SMS, and to assign priorities to ongoing risk mitigation activities. Such a profile would enable a company to customize its SMS and accident prevention activities to match the size and complexity of its operation.

6. Transport Canada should coordinate and implement internal initiatives to profile the safety-risks of companies and industry sectors as part of their risk-based business planning process.

7. Transport Canada and the Canadian railway industry should work together to develop guidelines and techniques that:
   - aid in the identification, analysis and management of human and organizational factors;
   - involve stakeholders (including the public) in understanding and assessing rail-related safety risks;
   - aid companies in choosing and conducting inductive and deductive methods to assess safety-risks; and
   - aid small railway companies in conducting risk assessments as part of their safety management activities.

8. Canadian railway companies should conduct periodic risk assessments or safety studies of their ongoing safety management activities to proactively identify circumstances in which risk mitigation strategies are no longer appropriate or effective.

9. Because measuring safety performance requires that the appropriateness and effectiveness of risk mitigation activities be assessed, Transport Canada and the rail industry should develop and employ evaluation techniques to supplement existing audit and inspection processes.

10. Transport Canada and the Canadian railway industry should work together to:
    - develop guidelines and protocols to proactively measure safety performance; and
    - develop and promote the use of tools to measure safety culture.

11. Transport Canada and the Canadian rail industry will need to work together for an extended period to implement many of the initiatives noted above. They should jointly prepare a strategic plan with clear goals and objectives to assist in the coordination of activities and the expenditure of resources. Public annual reports would hold organizations and companies accountable for achieving goals and objectives, and would improve communication with the Canadian public on matters related to proactive safety management. Such joint activity might lay the groundwork for improved safety culture throughout the industry and Transport Canada.
APPENDIX A – PERSONS INTERVIEWED

James Allen
Chief Executive Officer
Ottawa Central Railway

Sam Berrada
Assistant Vice-President
Safety & Occupational Health
Canadian National Railway

Martin Boulanger
Manager, Safety Systems Overview
Quebec Region, Rail Safety
Transport Canada

Luc Bourdon
Director General
Rail Safety
Transport Canada

Walter Carlson
Director, Equipment and Operations
Rail Safety
Transport Canada

T.M. Coghlan
Director, Engineering Branch
Rail Safety
Transport Canada

Ken Deptuk
National Advisor
Teamsters Canada

Gerald Gauthier
Director, Industry Liaison
The Railway Association of Canada

Greg Guitard
Manager, Railway Equipment
Equipment and Operations Branch
Rail Safety
Transport Canada

David Iezzi
Director, Audit & Quality Assurance
Rail Safety
Transport Canada

Mike Lowenger
Vice-President Operations and Regulatory Affairs
The Railway Association of Canada

Kevin McKinnon
Director, Regulatory Affairs
The Railway Association of Canada

Tim Secord
Canadian Legislative Director
United Transportation Union

Karen Swol
Director, Program Analysis and Performance
Rail Safety
Transport Canada

Neil Ward
Director, Integrated Risk Management
VIA Rail Canada

Don Watts,
Senior Manager, Regulatory Affairs
Canadian National Railway

Louis Wilson
Secretary-Treasurer
Teamsters Canada

Railway Conference Maintenance of Way
Employees Division
A. Government Documents


______. *Railway Safety Management System Regulations.*


______. *SMS Audit Verification Report Checklist:*

- Using Generic Evaluation Factors
- Interview Guide
- Using Mapping Note Summaries (May 1, 2003)
- No Evaluation Factors (May 9, 2003)

Transport Canada, Prairie & Northern Region. *Presentation to the Railway Safety Act Review.*
B. Other References


Kelly, Terry. “Managing the Safety Risks Related to Significant Organizational Change” in *Proceedings of the Tenth International Symposium on Aviation Psychology* (Columbus, Ohio: Ohio State University, 1999), 507-511.


Part 1: Assessing and developing the competence of senior management teams in strategic safety management; and

Part 2: Reviewing and developing the safety performance of managers.


APPENDIX C – RAILWAY SMS REGULATIONS, S.2

2. A railway company shall implement and maintain a safety management system that includes as a minimum, the following components:

(a) the railway company safety policy and annual safety performance targets and the associated safety initiatives to achieve the targets, approved by the senior company officer and communicated to employees;

(b) clear authorities, responsibilities and accountabilities for safety at all levels in the railway company;

(c) a system for involving employees and their representatives in the development and implementation of the railway company's safety management system;

(d) systems for identifying applicable
   i. railway safety regulations, rules, standards and orders, and the procedures for demonstrating compliance with them, and
   ii. exemptions and the procedures for demonstrating compliance with the terms or conditions specified in the notice of exemption;

(e) a process for
   i. identifying safety issues and concerns, including those associated with human factors, third-parties and significant changes to railway operations, and
   ii. evaluating and classifying risks by means of risk assessments;

(f) risk control strategies;

(g) systems for accident and incident reporting, investigation, analysis and corrective action;

(h) systems for ensuring that employees and any other persons to whom railway company grants access to its property, have appropriate skills and training and adequate supervision to ensure they comply with all safety requirements;

(i) procedures for the collection and analysis of data for assessing the safety performance of the railway company;

(j) procedures for periodic internal safety audits, reviews by management, monitoring and evaluations of the safety management system;

(k) systems for monitoring management-approved corrective actions resulting from the systems and processes required under paragraphs (d) to (j); and

(l) consolidated documentation describing the systems for each component of the safety management system.
The Context

The period since the 1996 implementation of the Canada Transportation Act has seen significant change in the railway industry. One important result of the legislation was an increase in the amount of low-density track that was transferred to other railways. For instance, between 1996 and 1999, CN and CP transferred more than 8,500 km of rail lines to other operators. As a consequence, the number of short-line railways in Canada has increased markedly.

Currently, there are approximately 60 railways operating in Canada other than CN and CPR\(^47\).

The Diversity

While the railways are commonly referred to as being in one of two categories - Class 1, or short-line – that dichotomy does not represent the diversity in the types and complexities of railway operations in Canada. Ironically perhaps, this diversity is expressed in the variety of classification systems used or proposed by Transport Canada. For example, the Policy Branch uses a classification system based on company revenues:

- Class I – annual revenues greater that $250 million
- Class II – annual revenues less than $250 million
- Class III – Switching operations or the operation of bridges and tunnels. Holds whether the carrier is involved in freight or passenger operations.

However, within the Rail Safety Directorate, different branches use classification systems to suit their needs.

The Equipment Branch uses the following categories:

- Federal Class 1
- Federal Short-line
- Provincial
- Short-line
- Commuter Rail
- Tourist Excursion
- Rail Tours

The Operations Branch applies the Canadian Transportation Agency (CTA) classification, which is the same as the Policy Branch, based on Revenues.

The Engineering Branch does not classify railways, but grades track from 1 to 5, based on the type and usage.

Finally, the office responsible for managing the Rail Safety Directorate Safety Management System (SMS) program has proposed that seven categories be used to compare safety performance, based on railway size and exposure to risk.

\(^47\) The actual number was hard to establish, given the lack of agreement amongst various source documents.
Table D-1: Proposed Railway Classification

<table>
<thead>
<tr>
<th>Type</th>
<th>Category Name</th>
<th>Number of Companies</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Class One (CN, CP)</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>Large Freight (&gt;100,000 annual train miles)</td>
<td>12</td>
</tr>
<tr>
<td>3</td>
<td>Small Freight (&lt;100,000 annual train miles)</td>
<td>21</td>
</tr>
<tr>
<td>4</td>
<td>Switching Terminals</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>Class One Passenger (VIA Rail)</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>Other Passenger</td>
<td>4</td>
</tr>
<tr>
<td>7</td>
<td>Tourist Excursion Trains</td>
<td>3</td>
</tr>
</tbody>
</table>

The Railway SMS Regulations are silent as to different types of railway, framing the regulatory requirements simply as applying to the “railway company”.

The objective of an effective classification process is to “simplify” reality, often for the purposes of administering a program. Consequently, the simplification (or abstraction) should reflect “reality”, just as the “means” should achieve the “ends”. In the case of short-line operators, if there is to be a classification process:

- it should reflect – and not obscure – the diversity of operations; and
- it should be risk- and performance-based, as the goal of the SMS regulations is improve safety performance of all federally-regulated rail companies.

The Concerns

The most common concern expressed to Transport Canada Rail Safety on the part of short-line railways relates to their perception of the amount of resources it takes to develop an SMS for their operation, and then to sustain it. (It is noteworthy that similar concerns were expressed to this study team by some of the largest carriers.) Notwithstanding this very real concern for small organizations, it is perhaps paradoxical that in Transport Canada Rail Safety’s view, at least some of the short-line railways have produced the most effective SMS programs that Transport Canada has seen to date.

The SMS regulations specify reporting requirements that are based on metrics that are more appropriate to large operations. That is, the occurrence rates for employee deaths, disabling injuries and minor injuries, is required to be expressed using a denominator of “200,000 hours worked by the employees of the railway company”, and the rate for reportable train and grade crossing accidents is to be reported using a denominator of “million train miles”. For some smaller companies these denominators may be neither realistic nor helpful, given their volume of operation. Furthermore, a single event can skew short- and long-term performance measures.

Conclusion

The above discussion suggests that a simple dual-requirement SMS program [i.e., a set of requirements for CN/CP/VIA and a set for short-line (small) railway companies] does not reflect the diversity of the railway industry. If different requirements are considered, then the requirements should vary to match the diversity. Extreme caution needs to be exercised when selecting the dimension along which the program requirements should vary, in that, for example, the size of a railway operation does not necessarily predict the risks that it undertakes. There are some very small operations that carry a significant number of passengers, or that operate in very hazardous environments. A single accident could result in catastrophic loss – to the company, the environment,
the Canadian rail industry, the national economy, even the Government of Canada. In these cases, the need for a comprehensive and robust SMS remains high. It is for this reason that there are recommendations in the report to make SMS requirements hazard- and risk-based, and to employ risk profiles to design an SMS to suit the complexity and size of the operation.

A modification to the reporting requirements to reflect more applicable metrics could be made without a wholesale change in the regulatory requirements for SMS.

Additionally, it is noted that many operations are owned by the same organization. This may provide for some efficiencies in developing or sustaining SMS programs across member companies.

In summary: a more effective implementation of the SMS program, as discussed and proposed in this report in a wider context, would obviate the need for modifications to the SMS regulations for short-line (small) railway companies.