TITLE OF PAPER: Organizational and Cultural Impacts on Safety

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The Canadian rail industry is generally performing well both at the economic level and the safety level. This is despite the stresses and strains of organizational restructuring, work force reductions and technical changes which have occurred over the last 20 years. The purpose of this paper is to consider how the rail industry can continue to enhance safety while coping with an ever-changing business environment. Several case studies will be presented to illustrate the unforeseen effects business decisions can have on the level of risk involved in operating a railway and emphasize the importance of a proactive approach to identifying risks and managing safety.

These case studies illustrate the potential effects of change at a number of levels. Firstly, two cases will be presented where changes to train marshalling and a movement to longer trains increased the risk of derailments due to train handling. Secondly, two cases will be described where the increased use of contractors resulted in reduced safety at level crossings during construction operations. Finally, two cases will be presented which illustrate the problems the old railway “stovepipe” culture can present when managing safety. Stovepiping implies that employees stay in one functional area throughout their career, with little learning of, or interaction with, people and tasks related to the other functional aspects of the business, and not taking account of the effect of external changes on their area.

New ways of operating put an onus on both managers and employees to take a broad perspective of their business if their work is going to be performed safely. For effective risk management to occur, a commitment to awareness of safety issues and competence to participate in the safety management process must be developed at all levels of the organization. Such principles are embodied in quality and safety management processes and are critical success factors in industry’s move towards the implementation of safety management systems.

Changes to train length and marshalling

Since 1995, average main line tonnage per freight train has increased by around 30-40 percent and average train lengths by almost as much. Since most of the principal main lines in Canada are single track, sidings (passing loops) have had to be extended to accommodate this change. Axle loads have also increased by up to nine percent.

With these changes, because in-train forces are greater than before, many crews find train handling more difficult. Consequently, there is an increased risk of derailment due to in-train forces, while the greater train size increases the severity of the consequences of any derailment. To add to the impact of increased length and weight, another complication is the innovation of destination block marshalling which was introduced in a major way, several years ago. This type of marshalling consists of railcars (wagons) distributed on a train in the order in which they are to be delivered. This can lead to the situation where a block of loaded railcars can be followed by one of empties and then by another block of loaded railcars. While destination block marshalling expedites train operations and logistics, it can also cause serious train handling and in-train force problems, since loaded railcars will run-in faster than empty cars when braking.

The risks presented by these operational practices were illustrated during a crossing accident which occurred in 2001 at Drummond, New Brunswick. Three young men stalled their car on a private level crossing just before the arrival of a 10,000 ton, 9,000 foot (2,700 metre) train. They evacuated the car and ran to safety. At the same time, the train crew saw the car on the crossing and applied the emergency brake. The train was negotiating a series of horizontal curves and the in-train forces resulted in a major derailment. Unless a toggle switch is actuated in the cab at the same time, the braking action only propagates from the head end (front) of the train, rather than at both the head and tail end. In this case, there was no actuation of the toggle switch.

Safety issues identified in this case include the effect of the rail industry’s increase in the operational task load on train crews without a commensurate increase in safety technology, and the train being marshalled without compensatory train handling training.

The same year, in Mallorytown, Ontario, a 9,500 foot (2,900m), 12,000 ton freight train, travelling at 45mph (72km/h) had just received a hot-bearing alarm when a train-initiated emergency brake application occurred, resulting in a similar situation to the one described above. The in-train forces in both cases were estimated at over 500 tonnes and contribute both to the derailment and its severity.

Since these occurrences, the railway has taken steps to install automatic head and tail end systems when the emergency brakes are applied. Although it is not possible to say with certainty that these derailments would have been prevented is such action had been taken earlier, these occurrences illustrate the importance of a thorough risk assessment when operational changes are undertaken for sound business reasons.

Use of contractors during construction operations at level crossings

In 1999, fibre-optic cable installation was taking place along railway rights-of-way across Ontario. This involved work taking place at hundreds of level crossings in the province. The work was done by contractors who generally had no knowledge of rail operations or highway construction. While many cable conduits could be installed by drilling under the roadway, there were cases where rock had to be excavated. In these cases, flagpersons were assigned to protect the road approaches to the crossings. Where there were automated crossing signals, these signals continued to operate as designed when trains were operating over them.

One occurrence took place in June, 1999 where the railway had allocated full responsibility to the contractor for highway flagging. Because there was blockage of one of the two highway lanes, and because the road approaches were on horizontal curves, there were flag persons stationed 100 metres away from the crossing on each road approach, but none actually at the crossing. Although the contractor had requested the road authority to temporarily close the road, that request was declined because of the potential need for emergency vehicles to use the highway. This is a typical position taken by road authorities in Canada. Additionally, when works at level crossings are underway, if there is no need to slow the trains, they are typically instructed by the railway foreman to continue at track speed.

A VIA Rail passenger train was approaching the crossing when a flag person had not yet turned his sign from “slow” to “stop”. As a result, three highway vehicles passed by and moved towards the crossing. The crossing signals (flashing lights and bell) were then activated by the approaching train but ignored by the drivers. The lead vehicle was struck by the train and the two occupants were killed by the impact of the passenger train, which was travelling at 82mph (132km/h).

A similar event occurred about 18 months later when, at another Ontario crossing, construction crews were setting up the site for another fibre optic cable installation. There was a truck obstructing one set of crossing signals (flashing lights and bell) and traffic cones diverting southbound cars into the northbound lanes. Upon the approach of a VIA passenger train, a worker for a subcontractor saw an approaching car and, from the far side of the crossing, waved at it to stop. It slowed down, arriving on the crossing at the same time as the train, which was travelling at 62 mph (100km/h). The three occupants were killed.

These two accidents raise a number of issues: the necessity to keep all roads open when a half day closure can remove all rail safety related issues; the competence of contractors, subcontractors and sub-subcontractors to address the realities of crossing safety; and the requirement to consider the risks to road users when determining appropriate train speeds through construction zones. From an organizational perspective, these accidents illustrate the need for a clear, unambiguous process within the organization to consider such questions and anticipate risks in time for mitigating action to be taken.

Safety actions taken following these occurrences include the requirement for additional flag persons to be stationed beside a crossing if the other flaggers are some distance away, and the development of a guideline by the Railway Association of Canada for the flagging of crossings where construction work is underway. At one of the two crossings, short-arm gates were installed to enhance protection of the crossing.

Stovepipe approach result in safety issues being unresolved

Two occurrences clearly illustrate the need for everyone within the organization to take a proactive approach to safety. The first involves a broken drawbar on the CN main line. The occurrence was precipitated by a jury-rigged brake hose repair, which led to the failure of the hose followed by a train-initiated emergency brake application. The resultant in-train forces caused a drawbar to break and the train to separate. The broken drawbar (coupler) fell between the rails and the train crew advised the rail traffic controller (RTC) of the problem. However, the RTC confused the coupler with a knuckle, which is much smaller part of the coupling system (couplers weigh about 250kg; knuckles about 27kg). The RTC, who was newly hired and trained, had no hands-on experience of the various coupler components. The railway had just revised and streamlined its hiring and training procedures, reducing the training from three weeks to one, with no tours of mechanical workshops.

From the RTC's perspective, there appeared to be no reason for concern as a knuckle between the rails would not be liable to interfere with traffic passing over it. This conclusion was supported by the fact that the train had cleared over it once when the damaged railcar had been set-off. Other rail employees in the vicinity of the derailment were aware of the fact that it was a coupler, but the attitude of some appeared to be "somebody else will remove it" and others were not aware that it was lying between the rails. A VIA passenger train was subsequently routed over the track. It struck the coupler, while travelling at 97mph (156km/h), and sustained approximately $250,000 damage to its undercarriage.

In the second occurrence, a large steel bulkhead door fell off a rail transporter onto an adjacent track. The welds holding the door hinges had failed, precipitating the accident. The door was supposed to be locked in place, but a door stop as well as the door brackets and locking pin were missing. A piece of pipe had been used for an undetermined time as a substitute locking pin. The impact of the 450kg door striking the adjacent track resulted in a displacement of the rails, with the subsequent derailment of a passing train.

There were no explicit rules or regulations on maintenance and inspection of components, such as above deck fittings on trains. While various employees working with this equipment were aware of the substitute pipe, they did not consider it a serious issue as they followed the more prescriptive stated requirements of the inspection and safety rules and overlooked the problem.

These occurrences clearly demonstrate the impact that training and supervision can have on the ability of the system to manage unforeseen situations. In addition, they illustrate the problems associated with the dangers of performance based regulation and stovepiping and the need for the involvement of everyone within the system in the management of safety and risk.

Discussion

In all of these cases, operational decisions and practices contributed to a gap in safety defences. Although all businesses have a primary mandate to be profitable, that does not mean that it has to be at the expense of safety. The above cases clearly illustrate operational decisions which had an unanticipated impact on safety. Internal management and reward systems can increase risk by emphasizing the need for production over safety and by limiting the responsibility of individuals to specific areas.

The railway business in the 21st century cannot afford to be ruled by traditional attitudes. Shrinking work forces and constant change require that both management and labour share responsibility for safety across all functional areas.

Conclusions and Recommendations

1. Any operational or organizational change can have safety ramifications. Because of this, resources should be devoted to thinking through possible problems and finding solutions to mitigate risks.

2. Everyone in the system must be involved in the management of risks. Increasing delegation of authority to contractors, subcontractors and others outside the organization can erode organizational safety defence barriers unless contractors are completely involved in the management of safety.

3. The operation of a railway involves a number of functional areas. The effective management of safety requires communication across functional boundaries if safety problems are to be properly monitored and fixed quickly.

4. Railway management and labour both have to be involved in the management and monitoring of risk.

5. Cutting back on training and supervision can eventually reach a point where the return on investment is negative. People at all levels of the organization must have the competence to contribute effectively to the identification and mitigation of risk.