Strengthening the Risk Controls of High Risk Scenarios through Operations System Safety Assurance

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SUMMARY

MTR Corporation has spearheaded the development of a new methodology Operations System Safety Assurance (OSSA) to strengthen the review of the robustness of risk control measures in the operating railway. The risks and mitigation plans have been captured based on the experience and lessons learnt from operating railway incidents, new railway lines and asset upgrade works. Due to the diverse risk sources and ownership, the risks and controls for the same risk scenario are not often well documented with the same level of details rendering holistic analysis of risk controls both difficult and tedious.

With the expanding railway network and the advent of more sophisticated systems, the chance of having a high consequence risk due to a technical and/or human failure has increased. As a result, MTR has developed the OSSA framework for reviewing the adequacy of risk controls for high consequences risk scenarios. The approach adopts a bowtie structure to analyse the risk controls preventing the occurrence of an event and mitigating the consequences arising from an event separately. All the risk control measures are grouped and systematically benchmarked and their effectiveness is challenged by experts, laymen and benchmarking studies in order to determine the degree of robustness of the controls using a traffic light system.

The OSSA methodology has been refined and successfully applied to three railway accident scenarios including platform-train-interface, derailment and escalator accident. Apart from providing assurance that adequate control measures are in place, each OSSA study has generated many useful findings and recommendations to further enhance system design through application of new technology, human factors performance and integration of safety management processes.

1 INTRODUCTION

MTR is operating a 218-km railway network in Hong Kong carrying 5.1 million passengers per day which is amongst the world's most heavily utilized metros. Underpinning its Corporate Safety Policy, MTR Corporation is committed to fostering a Safety First culture and striving for continuous improvement across all of its businesses inside and outside Hong Kong. The safety and reliability performance of MTR Hong Kong Heavy Rail operations is among the very best internationally based on the COMET benchmarking results.

We have a well-established risk management system for managing our railway safety and service risks which is vertically integrated from project through to operations and asset upgrade and replacement. Throughout the past 20 years, MTR has been strengthening and enhancing its risk control system and system assurance framework for managing its expanding railway asset portfolio and associated operations.

There are currently around 2,500 risks which are owned and managed by some 50 risk owners. The risks and mitigation plans have been captured based on the experience and lessons learnt from operating railway incidents, new railway lines and asset upgrade works. Due to the diverse risk sources and ownership, the risks and controls for the same risk scenario are not often documented with the same level of details rendering holistic analysis of risk controls both difficult and tedious.

With the expanding railway network and the advent of more sophisticated systems, the chance of having a high consequence risk due to a technical and/or human failure has increased. During a safety strategy meeting in 2011, while we were reviewing several major railway accidents around the world, we asked ourselves the following question – "Are we managing our safety risks well"?

It was a simple question but it was difficult to answer with good and convincing justifications for all different types of risk scenarios. As a result, MTR spearheaded the development of a new methodology Operations System Safety Assurance (OSSA) to strengthen the review of the robustness of risk control measures for high risk scenarios in the operating railway.

2 METHODOLOGY

The objective of the OSSA framework is to establish a holistic approach to review the adequacy of risk controls for high consequences risk scenarios with the following three principles in mind:

- Drive continuous improvements in risk controls
- Better understand the arrangement of risk controls
- Provoke out-of-the box thinking

After evaluating various methods in safety and risk assessment such as fault tree analysis, event tree analysis and root cause analysis used in risk modelling, we decided to adopt the Bowtie structure to present and analyse all risk controls. The composite Bowtie structure helps us analyse risk controls or defenses holistically from two perspectives, those preventing the occurrence of an event and those mitigating the consequences arising from an event.



All the risk control measures are grouped and systematically benchmarked and their effectiveness is challenged by experts and benchmarking studies with other companies in order to determine the degree of robustness of the controls using a traffic light system.

In addition, we have introduced the concept of Bluesky workshop, finding the non-operations staff members to challenge the risk controls using a layman's perspective.

We invited staff members from Finance, Human Resources and Corporate Relations and the new graduate engineers to scrutinize the control measures with fresh pairs of eyes and suggest innovative measures.



Data Collection

Identify high consequence scenarios and possible key risk controls

Benchmarking

Identify good practices from other companies

Bluesky Workshop

Identify ideas "we never thought of "
 Views of "non-technical persons"

Focus Group Workshops

Structured identification and review robustness and adequacy of key risk controls with subject matter experts

3 IMPLEMENTATION

We started off with a pilot OSSA application using platform-train-interface risk scenarios as a proof-ofconcept validation involving a few line mangers. The framework was found to be effectiveness and practical and it was concluded that adoption of the framework is a value-adding exercise to the existing risk management practice as it provides a full picture of the current state of risk controls and highlights the strengths and areas for attention in the management of risk controls. Most importantly, the amount of effort required from the line sections is marginal.

The OSSA methodology has been refined and successfully applied to two railway accident scenarios including derailment and escalator accident. Apart from providing assurance that adequate control measures are in place, each OSSA study has generated many useful findings and recommendations to further enhance system design through application of new technology, human factors performance and further integration of safety management system with asset management and related processes.

The framework will be applied to facilitate the review of other high consequence risk scenarios in the coming years. It is also targeted to embed this framework into the existing risk management system.

4 BENEFITS

The OSSA framework defines a series of systematic processes to facilitate and guide the collection of information, and to review the adequacy and robustness of key controls for addressing risks that might result in passenger fatalities or major injuries, and likely lead to severe impact on MTR reputation.

The framework brings in two key benefits.

 Firstly, it provides an additional layer of assurance to senior managers to demonstrate that risk controls are well managed. By following the framework, strengths and weaknesses in the management of key risk control measures can be highlighted which serves as a basis for review and prioritization of actions to address areas of concern.



Secondly, the framework serves as a checklist for line manager and working levels to guide what
particular issues to consider carefully during risk transfer and risk identification processes. It also
demonstrates that efforts have been made diligently to control risks.

The OSSA outputs also subsequently trigger a number of improvement studies in our safety management system and its interfacing processes and also human factor projects to enhance those relatively weaker controls which heavily rely on human performance e.g. train despatch procedure.

5 LEARNING POINTS

The newly developed OSSA approach has proved to be holistic and pragmatic. To recap, the key success factors in the whole development and implementation process are:

- Obtaining a reasonable amount of input from line departments in order to obtain useful results
- Providing substantial facilitation support
- Carrying out focus group risk review workshops with the right people to collect and verify risk information effectively.
- Engaging non-operations colleagues for 'Blue Sky' workshop to identify new ideas

6 CONCLUSION

MTR has successfully developed and implemented the OSSA framework to holistically review the adequacy of risk controls for high consequence risk scenarios. It has become one of our regular and critical processes in driving continuous improvements in risk controls, fostering better understand the arrangement of risk controls and provoking out-of-the box thinking to reduce our risks to ALARP.