

MAKING SAFETY MANAGEMENT SYSTEM FIT FOR HUMANS

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SUMMARY

This paper describes the journey and key steps that MTR Corporation has undertaken to make its Safety Management System fit for people. This approach is aimed at minimising safety and service incidents due to human error and enhancing its safety delivery in line with stakeholders' needs. In particular, it sheds light on the recently launched Human Factors (HF) integration programme which is a strategic initiative to upgrade its human factors organisation and processes and uplift the staff's awareness and competence in applying human factors in everyday activities. The following achievements are presented in this paper:-

- Establishing a formal human factors organization at both HQ and department levels
- Nurturing a team of some 30 human factors specialists at front line departments
- Implanting human factors considerations during the early design stage of new railway lines
- Ensuring proper human factors consideration in incident investigation
- Eliminating and reducing slips and lapses for safety critical operations
- Embedding non-technical system elements in Competence Management System
- Exporting good human factors practice to outside Hong Kong

Based on the experience gained to date, it is concluded that the critical success factors are to integrate human factors with the key safety management processes, engage the stakeholders, and involve workforce at all levels in the safety and human factors programme.

1 INTRODUCTION

MTR is operating a 218-km railway network in Hong Kong carrying 4.9 million passengers per day which is amongst the world's most heavily utilized metros. Making every passenger journey free of safety and service incidents due to human error is always a challenge impossible. This challenge is further compounded by a growing integrated network and organisation with increasing number of staff and the advent of sophisticated railway systems design with different trains and operating modes.

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. MTR started the human factors journey in 2005 with some HF initiatives and briefing sessions. After a few years' experience, we understood that managing human elements alone could not bring about a step change in safety performance and decided to spearhead an intensive human factors integration programme in 2011 with a view to enhancing and ingraining human factors considerations and good practices under all relevant organizations and processes.

In order to minimise the number of incidents caused by human error and to live up to the ever growing expectations of the public, MTR has been enhancing its human factors organization, process and toolkits as an integral part of its Safety Management System. This paper highlights the approach, benefits and lessons learnt gained in its human factors integration journey to date. The following topics and the experience are discussed in this paper using the Safety Management Model of MTR:-

- Upgrading Human Factors organisation and capabilities
- HF Integration Programme and objectives
- Integrating HF with key SMS processes
- Fostering a Safety First Culture through HF awareness, training, sharing and learning organisation
- Sharing good human factors practice widely

2 UPGRADING HUMAN FACTORS ORGANISATION AND CAPABILITIES

Strong management leadership and commitment is fundamental to the success of the programme. To steer the implementation of Human Factors in the Operations Division SMS, a dedicated Human Factors Management Committee (HFMC) has been established in 2006, as one of the six safety committees reporting to the Operations Division Safety Management Committee – Hong Kong. The HFMC is now supported by eight Human Factors Working Groups who are implementing the human factors process at the line departments.

One of the key strategic improvement actions is to raise the awareness and upgrade the capabilities of staff members in human factors through a series of training and education programme to all relevant staff. In addition, with the help of an external consultant, a “train the trainer” approach has been adopted to train up a team of 30 human factors specialists who belong to various line departments. The human factors specialists have been recently qualified and will be playing a pivotal role in the human factors process implementation through carrying out human factor studies and providing support to review human factors incidents and issues identified from incident investigation, design and maintenance processes, and major changes to organisation, process and equipment, etc.

The understanding and awareness of staff about the importance of human factors is also fundamental to the success of the programme. We educate the frontline staff members through lessons learnt from incidents to help them understand why humans make errors under different situations and environments and equip them with the necessary tools, skills and mindsets to reduce the chance of human errors at the critical moments especially when they are carrying out safety critical operations. This is achieved through a series of training and briefing sessions and promotions on human factors to the relevant staff members over a number of years.

A dedicated human factors and risk team has been established under the Safety & Quality Department in 2012 to provide dedicated support to the line departments and to establish our in-house capabilities in this important area.

3 HF INTEGRATION PROGRAMME AND OBJECTIVES

It is always difficult to target or quantify the benefits of a human factors programme as it is a journey rather than a one-off programme. In MTR, the management has not set any target reduction in the number of human errors and clearly articulated that the programme is aimed at minimising safety and service incidents due to human errors and continuously enhancing its safety delivery in line with stakeholders' needs. This has created a positive safety culture to staff members when embracing this programme.

4 INTEGRATING HF WITH KEY SMS PROCESSES

4.1 Integrating HF and SMS Processes

In order to minimise the occurrence of incidents due to human errors, human factors must be adequately considered in each and every safety barrier (slice of the Swiss Cheese Model) which helps prevent incidents from happening. To effect this, MTR strives to embed appropriate HF elements across the key processes of the Safety Management System (SMS). At the management system level, a new Safety Task on HF was incorporated in the Operations Division Safety Manual to set out the key principles and organisation arrangements.

A process for HF management has been developed, building on the well-established risk management process which is well known to and accepted by staff. A HF Issues Register has been established to collect and capture all the potential issues which could adversely affect human performance under different operating environments. A HF Issues Control Procedure was issued in 2008 which requires a HF study and analysis for any incident in which the underlying cause is related to human factors. With further efforts put in HF integration, a consultant confirmed in late 2007 that the Division's human factors system had achieved maturity Level-3 "Good Practice". Currently, we are working to foster a closer link between the HF and risk management processes through strengthening the interface between the HF Issues register and our risk management information system (ASRisk).

4.2 Integrating HF Study and Incident Review

In MTR, all incidents which are caused by human factors would require further investigation through a HF study in order to holistically review all performance shaping factors and possible measures to improve human performance.

All the incidents and undesirable events are now captured in our Operational Data Management System (ODMS) which was enhanced a few years ago to include human error taxonomy for capturing incident investigation and HF study results. HF study has now become an integral part of Management Investigations and Reviews.

In order to be qualified to carry out an incident investigation, all investigators have to be trained in basic HF concepts and HF in investigation. This ensures that they can understand the human error taxonomy and examine in detail human performance factors that could have contributed to the event. The PSF covers all possible causes of lapses and slips and systemic sources of the failure (e.g. component failures, design deficiencies of equipment and/or infrastructure, inadequate procedures, and lack of training).

4.3 Integrating HF and Workplace and Behavioural Safety and Safety Critical Operations

At the workplace, all job and environmental hazards are identified using a customised method (called Human HAZOP) where necessary to ensure that human related hazards are systematically identified and mitigated by relevant safety and protection measures. This has now become an integral part of Work Instruction review.

MTR has implemented a behavioural safety programme (BAPP) across all workplaces since 2000 with an aim of improving safety performance through observation of unsafe human behaviours by

peers. The principle of “NO Name, NO Blame and NO Reprimand” and the methodology used by the observers in conducting observation, recording and inputting observation data for analysis are being implemented successfully by the frontline staff and supervisor. Currently, 10 BAPP teams are running autonomously according to work nature or prevailing safety risks faced by each implementation group with facilitation support from the S&Q department. Through peer-to-peer behaviour observations and feedback provided by observers, BAPP has effectively reduced at-risk behaviours, fostered a proactive reporting culture and successfully involved the frontline staff in safety improvement. BAPP observers collect safety comment/concerns from observees or other peer workers and also report hazard/near miss identified. As a result, the BAPP reports will also help identify non-enabled behaviours which require further safety, risk or human factor study.

For operations activities, to avoid a single human error resulting in serious safety consequence, all safety critical operations such as manual train movement under a signalling system failure would necessitate additional controls such as fingering, risk-triggered commentary, independent check, and authorisation, etc. The effectiveness of these measures is regularly monitored by the Human Factors Working Group and new ideas are also introduced to cater for specific operating environment e.g. use of “shunting pen” (voice recorder) for depot train shunting.

4.4 Application of HF Considerations in Design

Asset or hardware failures are relatively easier to model scientifically and most of the risks arising can be mitigated by engineering solutions. Human failures, however, are much more difficult to predict and are now representing the greatest threat to complex and potentially hazardous systems.

At equipment level, human factors considerations in system and interface design such as ergonomics, human-machine-interface and indications and control layout, etc. were embedded in the design control procedure.

All safety critical and safety-related systems are carefully designed via the design control procedures and international standards. Alongside the system assurance process, the trained HF Specialists would also involve in the early design stage to take into account human capabilities and limitations, both physical and cognitive, and ensure that the tasks and workloads assigned to operators and maintenance staff are suitable. Prior to implementing a newly designed systems, awareness and/or training for operators and maintainers who interact with the system on a daily basis would be arranged.

4.5 Risk Management and Influencing Human Behaviours

MTR has been applying a fit-for-purpose risk strategy to deal with “High Frequency” and “High Consequence” risks respectively. For “High Frequency” risks like escalators, train door and platform gap related accidents, there is not too much room to enhance the technical systems and safety provisions. So our focus is to continue to influence passenger behaviours through different kinds of safety promotion, educations and the deployment of station assistants. In recent years, due to the changing passenger demographics, we have more elderly passengers and new travellers from Mainland China carrying large luggage into the network. As such, we have to employ a different set of safety campaigns and initiatives to educate them on the correct safe behaviours to protect themselves and others.

4.6 Managing Workforce Transition

MTR is embarking to a stage in which a certain percentage of staff will be retiring within the next 10 years and there will be many new joiners as a result. In order to manage the challenge of workforce transition, we have enhanced our competence management system for safety critical operations to ensure that both technical and non-technical skills are adequately addressed in the staff’s training, qualification and on-going assessment systems. We are also looking at age-related health issues and the testing regime e.g. hearing ability to ensure that our staff members are healthy and always fit to perform their intended duties.

4.7 Integrating HF, Competence & Safety Training

It is essential to take proactive steps to integrate HF into the competence management system throughout the recruitment, training, examination, on-job-training, qualification, refresher and assessment processes. This will ensure that the staff will be able to carry out the job as per the intended duties and minimise the potential for human error. HF awareness training has been provided for over 10,000 management and frontline staff since 2006. Staff awareness of HF has been raised through awareness programme such as “Smart Six”, followed on by Rail Resource Management which was introduced for Light Rail in 2010. We also regularly review our safety training requirements based on the human factors requirements and safety incidents to ensure that the relevant staff will receive the relevant training, practice and lessons during induction and on a regular basis.

5 FOSTERING A SAFETY FIRST CULTURE THROUGH HF AWARENESS, SHARING AND LEARNING ORGANISATION

Active leadership of the management and continuous driving of the safety first culture and continuous improvement through implementing the human factors programme by the human factors working groups and line departments are imperative. The Human Factors Management Committee is chaired by the Head of Operating and participated by senior managers from different departments including planning and development and new projects are involved to ensure that the lessons are transferred across to new railway lines.

Regular Human Factors workshops are organized to share experience and latest practice in human factors among the human factor practitioners. Some of the events are jointly carried out with the BAPP groups. We also share and discuss human factors knowledge and hot topics through our intranet which is part of our Learning Organisation framework to promote knowledge capturing, sharing and transfer.

All of the above are imperative in promulgating a proactive human factors culture across the divisions and thereby sustaining the success of the whole program.

6 SHARING GOOD HUMAN FACTORS PRACTICE WIDELY

Human errors are inevitable in everyday activities but MTR believes that they are all preventable by adopting a collective and systematic SMS and human factors approach to study their causes and prevent them from happening and recurring. In order to make the process live and effective, the lessons learnt and good practice in preventing mitigations should be studied, widely shared and implemented where practicable.

We also share our Hong Kong practices with our subsidiaries outside Hong Kong. Recently, our human factors working group members from Operating and Rolling Stock paid a visit to a depot overseas to provide human factors support to a post-incident review. The working group members successfully helped the colleagues identify the various causes of the human errors in that operating context and the underlying performance shaping factors. The good practices to prevent SPAD, improve the equipment identification and provide additional information to catch the Train Driver’s attention were also shared amongst the teams.

CONCLUSION

The critical success factors for making Safety Management System fit for humans are to systematically integrate and link up the relevant safety processes and ingrain human factors elements and considerations in all relevant parts of the SMS. MTR considers that these are extremely critical to make MTR the safest place to work and among the very best in safety performance globally in all our businesses.

It is essential to link up the various safety processes to make sure that the human factors issues identified from various sources and incidents are fed back to the asset management, risk management, corrective action, training, learning and education processes to mitigate the risk and prevent recurrence.

All relevant stakeholders must be engaged in the process. The safe behaviour of different passenger groups and changing demographics need to be regularly monitored, carefully analysed and then new ideas and measures need to be introduced and refreshed to influence their behaviour. Similarly, our staff's vulnerable activities, unsafe behaviours and the underlying performance shaping factors need to be analysed systematically. The lessons learnt and good practice in risk mitigations should be studied, widely shared and implemented where practicable.

Finally, active leadership of the management and continuous strive for safety first culture and improvement by the safety committees, human factors and BAPP working groups and line departments are all fundamental to sustaining the success of the whole program and the delivery of better safety and service performance.

APPENDIX 1:

APPROVAL TO PUBLISH PAPER



I, Nelson Ng, General Manager – Safety and Quality of MTR Corporation hereby give permission to the International Railway Safety Conference 2012 (IRSC 2012) to publish the paper titled Making Safety Management System Fit For Humans to be presented at the IRSC 2012 conference to be held at the St Pancras Renaissance Hotel, London, England on 8 - 12 October 2012.

In the following media (tick as appropriate):

- Copied to memory stick for distribution to conference delegates

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