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**Rail Human Factor Training: Adaptation of Crew Resource  
Training in KCRC to Enhance Modern Railway Safety**

A thesis presented in partial fulfilment of the requirements  
for the degree of

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## **Abstract**

Abstract of thesis entitled:

### **Rail Human Factor Training: Adaptation of Crew Resource Training in KCRC to Enhance Modern Railway Safety**

Authored by Tak Sum Tsang

Recent world headline disasters such as the September 11 attacks, 2005 London transport bombings and 2003 Daegu Subway arson attacks sent a strong warning to all nations that mass-transit systems are highly susceptible to arson or terrorist attacks with catastrophic consequences. Whilst it may be impossible to ever eliminate all forms of threats, one thing remains clear- the effectiveness of crew response to emergency situations can make a key difference between a minor incident and a full blown disaster.

Staff effectiveness relies upon corporate awareness, training and investment into safety. Even a state-of-the-art system requires suitably matched and experienced staff for smooth, efficient and incident-free operation.

Unfortunately, incident reports reveal consistently that about 70% of aviation and railway incidents have roots in human factors, highlighting the need to invest in

effective, safety-oriented training to expose staff to operational and emergency situations in order to minimise or mitigate human error consequences.

In aviation, crew resource management (CRM) was developed to address this need. CRM's effectiveness in improving teamwork, communication and staff response to emergency results in its popularity in the medical, nuclear, and military sectors. Although some work had begun to modify CRM for the railway industry, none yet existed in China or Hong Kong. Having observed the effectiveness of CRM and line oriented training (LOT) in aviation, this work documents the introduction of CRM and LOT in Hong Kong in the West Rail (WR) division of the Kowloon-Canton Railway Corporation (KCRC).

One-hundred-and-twenty drivers, station and traffic controllers from WR took part in a three days CRM training program. The program used lectures, video aided training facilities (VAT) and integrated training facilities (ITF) to expose staff to CRM and safety related concepts. ITFs were used in LOT programs to simulate emergency and abnormal operation scenarios to test and train ability of teams to handle such situations. Feedback was provided by computer, video and voice records, and trainer comments.

The effectiveness of the training program was tested in an emergency drill in conjunction with Hong Kong police, fire and hospital services by comparison of a control group and the CRM trained group to evaluate the program effectiveness. It was observed that the CRM group displayed better incident handling capabilities, stronger teamwork and communication throughout the exercise. When analysing incidents, CRM trained members were able to recall and consider more factors of human performance.

As the instituted CRM program is still in its infancy, more time is required to prove its effectiveness. It is believed that even in this short introduction period it has raised staff awareness of safety and human factors, and improved overall teamwork and performance in WR. Now that WR serves as a knowledge portal to the rest of KCRC divisions, it is envisioned that CRM will be extended to other KCRC rails. In later years it may also broaden to intercity rails to Mainland China to improve staff performance. An effective CRM program will be the key to minimise impact and consequences if one day disaster does strike.

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## **Chapter 1. Introduction**

Recent world headline disasters such as the September 11 attacks, 2005 London transport bombings, and 2003 Daegu Subway arson attacks sent a strong warning to all nations that mass-transit systems are highly susceptible to arson or terrorist attacks with catastrophic consequences. Whilst it may be impossible to ever eliminate all forms of threats, one thing remains clear— the effectiveness of crew response to emergency situations can make a key difference between a minor incident and a full blown catastrophe.

Any railway system in operation involves a number of interacting mechanical and engineering components under the control of human input. Human operators are responsible for assimilating information under varying temporal and environmental conditions; following conditional rules or their personal experience to make such inputs.

The safety and efficiency of the railway and the quality of responses to incidents are therefore inseparably linked with the alertness and capabilities of human operators.

Despite its importance, the ergonomic and human factors of rail safety has only received attention in recent years where railway agronomists from RSSB Standard

Board (RSSB, 2000) shed some insight to understand and devise relevant human factor work methods and practices. The sustained attention in recent years meant that the government, media, railway industries and general public had also begun to research and focus on human factors when evaluating railway safety and relevant case studies. In this context, the finding of human error should initiate the investigation for error provoking conditions and not end the investigation.

The influence and awareness of such factors lead the decision by train operating companies (TOC) to specifically enforce human factor training. Such training is focused on incident response, equipping staff to respond correctly to unexpected incidents, improving their crowd control and evacuation skills in case of fire or terrorist attacks (Bird, 1974).

## 1.1 Background on CRM

The concept of human factor may be relatively new to railway management, but have already been extensively researched and reformed in the aviation industry (Morgan, Olson, Kyte, Roop, & Carlisle, 2006). The collective inputs and suggestions from many such studies resulted in a new approach to pilot training in hopes of reducing pilot error. It is now common to find crew resource management (CRM) and line oriented training

(LOT) programs on pilot mental studies (ICAO, 1998 Human Factor Training Manual) showing improved performance and stress adaptations.

As both railway and aviation industries share many similar characteristics and demands, it can be expected that adopting similar training strategies in the railway industry may help develop better training and safety programs for train drivers and traffic controllers. Such a program could improve the efficiency of crew response to any emergencies and reduce the consequences of human errors in the railway sector

## 1.2 Outline and Scope

The work in this thesis outlines one such training plan for railway by adapting methods already employed in the aviation industry. The form and structure of the aviation training program, its suitability for the railway industry as well as the integration of such a program onto existing railway training programs will be analysed. The program was trialled at the Kowloon Canton Railway Corporation (KCRC) West Rail in Hong Kong to evaluate its effectiveness.