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Reducing Construction Fall Accidents in the Maintenance Sector: An Industry-Based Survey from Hong Kong

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ABSTRACT

The construction industry was identified as one of the most hazardous industries internationally. Of all the construction-related injuries, falls are the leading category of fatal accidents. This paper provides a summary of recommendations on preventing fall accidents in building repair and maintenance works from a collaborative research between the academia and the construction industry of Hong Kong. The research approaches of case study analyses, structured interviews, focus group meetings and questionnaire surveys were adopted. Eleven key areas were identified from the research for further improvement, including: 1) Safety education and training for external repair and maintenance works; 2) Refining the design of truss-out scaffold; 3) Continuous training for workers; 4) Pay-for-safety system; 5) Design for safety; 6) Inspection and monitoring; 7) Safety messages and publicity to flat owners and tenants; 8) Insurance for maintenance works; 9) Compulsory safety training for working at height; 10) Mandatory licensing system for minor works workers; and 11) Improve legal and regulatory framework.

Keywords: Accidents, Construction Safety, Fall of Person, Hong Kong, Repair and Maintenance.

1. INTRODUCTION

The construction industry was identified as one of the most hazardous industries internationally. Of all the construction-related injuries, falls are the leading category of fatal accidents. Although the number of industrial accidents in the construction industry has decreased from 11,925 in 2000 to 3,833 in 2004, fall of person from height has always represented a large proportion of the industrial accidents, particularly fatal accidents. The numbers of fatalities involving the fall of person from height were the highest in 2002 and 2003, which were 15 and 9 respectively (Labour Department, 2005). In 2004, fall of person from height represented just over 47% of the total number of fatal accidents in the construction industry (Chan et al., 2006d). This problem is further aggravated in cities, like Hong Kong in which buildings become dilapidated, and the increasing demand for repair and maintenance works has prompted an urgent need for construction safety research particularly related to working at height.

Abdelhamid and Everett (2000) believed that the unsafe working conditions on site are due to four causes: (1) management actions/inactions; (2) unsafe acts of worker or co-worker; (3) non-human-related events; (4) an unsafe condition that is natural part of the initial construction site conditions. Moreover, a fall is rarely the result of only one of these reasons and the actual risk faced by those who work at height is therefore dependent on the inter-relationships among the reasons (Malcolm, 2000). In fact, construction safety for repair and maintenance of existing housing stocks requires extra attention since this sector employs a large number of unskillful labour and is not subject to the same stringent safety regulations as in new construction (Chan et al. 2006a). One distinctive characteristic of cities nowadays is the large number of high-rise buildings. In Hong Kong, residential building repair and maintenance works rely heavily on the use of bamboo truss-out scaffold supported by steel brackets. However, the use of bamboo truss-out scaffold has been identified as a problematic area and the root cause of many recent fall accidents. In order to critically investigate and examine solutions to preventing fall accidents in building repair and maintenance works, a collaborative research effort has been established between the academia and the construction industry of Hong Kong to improve construction safety in the maintenance sector.

This paper provides a summary of recommendations on preventing fall accidents in building repair and maintenance works. The research framework outlining the aims and objectives will firstly be provided. Various research approaches, such as case study analyses, structured interviews, focus group meetings and questionnaire surveys will also be presented. Results from various research approaches will also be delivered to suggest recommendations on preventing fall accidents in terms of precautionary measures and the regulatory framework in Hong Kong.

2. RESEARCH FRAMEWORK AND APPROACHES

The study aims at improving construction safety involved in working at height for residential building repair and maintenance works (Chan et al. 2006a). It sets out to identify situations where such works are necessary and to investigate the causes of any associated accidents and problems. The selected objectives of the study as reported in the paper are:

- To investigate the causes of these accidents;
- To recommend precautionary measures so as to prevent the occurrence of the problem;
- To propose a viable regulatory framework to address the legal, economic, and social aspects of the problem.

The research combined the use of questionnaire surveys, structured interviews, focus group meetings and case studies to collect information and data on construction safety against fall of person from height accidents in residential building repair and maintenance works. The collected data contributed to the design of the technological solution and the conclusions and recommendations for the final report. The research framework is shown in Figure 1.

2.1. LITERATURE REVIEW

Literature on fall from height accidents in repair and maintenance works were extensively reviewed, including books, journals, magazines, newsletters, proceedings from conferences, workshops, seminars and other sources. Past and current practices of fall accidents were also documented. Further, information collected from the review exercise formed the basis of an instrument to conduct interviews, focus group meetings and questionnaires.

2.2 ANALYSIS OF STATISTICAL DATA

Statistical data of accidents in Hong Kong were collected from the Architectural Services Department and the Labour Department to identify the causes of accidents. Other attributes under investigation included age distribution, nature of injury, the body part injured and the type of work performed. The analyses from the statistics were used to verify the literature study conducted. The statistical data together with the literature review were combined to form the foundations for the interview questions, questionnaire survey and discussion topics in the focus group meetings.

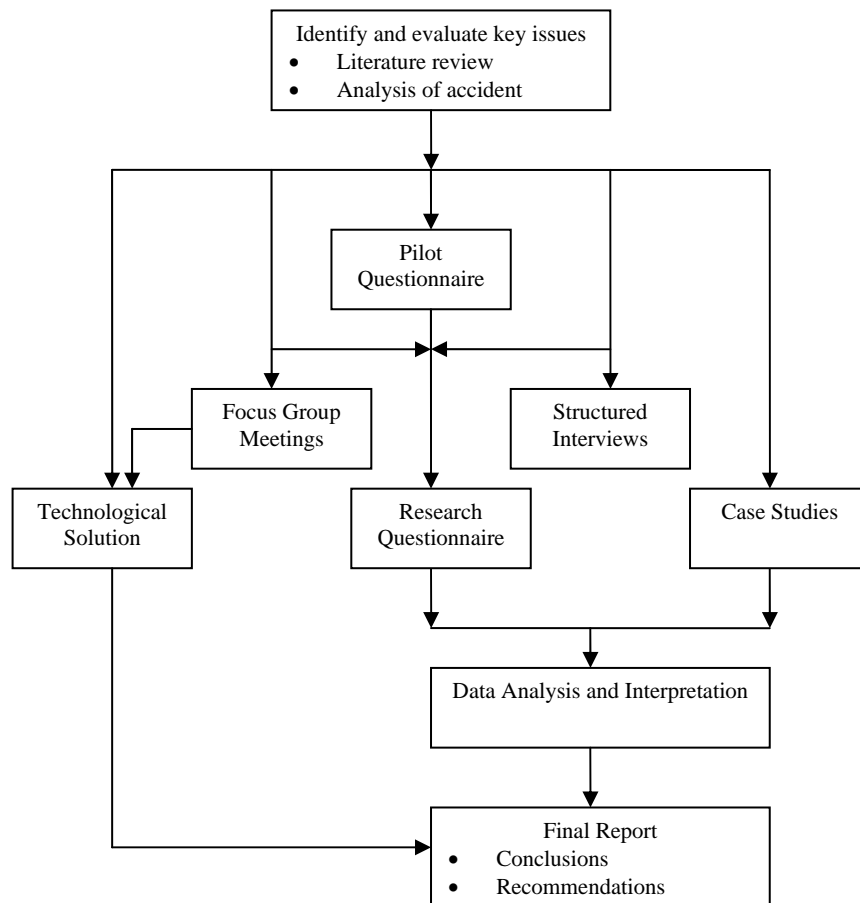


Figure 1 A flowchart of the overall research framework (Chan et al. 2006a)

2.3 CASE STUDIES

According to the statistics of the Labour Department, there were a total of twenty-two fatal industrial accidents associated with fall of persons from height in repair, maintenance, minor alteration and addition works from 2000-2004. To gain an in depth understanding of the causes of fall accidents and common failures in repair and maintenance works, details of the twenty-two cases were provided by the Labour Department to the research team, under an agreed undertaking and framework, for comparative analysis with a view to identifying the common causations and

features of the mishaps, drawing analogy on the rationale and recommending the appropriate preventive measures for the industry.

2.4 STRUCTURED INTERVIEWS

Face-to-face structured interviews were conducted with ten interviewees, representing relevant government departments, non-government organizations, property management companies and a Legislative Councillor. The interview questions were drafted based on the comprehensive literature review and analyses of statistical data. The topics covered in the interview included safety practices and management, causes of fall related accidents at workplace, practical solutions to construction safety for working at height and also the roles of concerned parties in construction safety.

2.5 FOCUS GROUP MEETINGS

Focus group meetings are a convenient, effective and fast way to collect a vast amount of information from a reasonable number of participants compared to the traditional one-to-one interview technique (Chan et al. 2006b). Four focus group meetings were conducted in this project. Two were conducted with participants from the workforce level and the other two with participants from the supervisory level. The participants were asked to discuss issues relating to safety for repair and maintenance works at height. The meetings aimed to seek reasons behind the causes of fall accidents in repair and maintenance works identified from the literature review, statistical data and case studies. In addition practical solutions were identified by the practitioners, which would help towards the design of the technological solutions. Questions for interviews and focus group meetings covered (1) Causes of fall related accidents; (2) Measures to reduce fall accidents; (3) Practical solutions to construction safety; and (4) Roles of concerned parties, responsibility and legislation.

2.6 QUESTIONNAIRE SURVEY

Two questionnaire surveys were conducted: (1) Industry based questionnaire; and (2) Flat owner/tenant questionnaire.

2.6.1 Industry based questionnaire

The industry based questionnaire was distributed to a number of construction organisations and property management companies. A total of 1,820 printed copies of the questionnaire were sent to these organisations and 581 copies were collected, which represented a response rate of approximately 32%. The industry based questionnaire covered seven sections which aimed to address the objectives of the research, including (1) Personal information of respondent; (2) Safety

education and training; (3) Accidents related to repair and maintenance; (4) Safety messages; (5) Safety attitude of repair and maintenance workers; (6) Legislation and responsibility; and (7) Practical solutions to reduce fall of person from height accidents. The quantitative data collected on ranking the strategies preventing fall from height accidents were analysed using the Statistical Package for the Social Sciences (SPSS).

2.6.2 Flat owner/tenant questionnaire

Occupants in the residential units are mostly known as the initiators for maintenance work, who engage the maintenance contractors to carry out the required works. As a result, such occupants play an important role of construction safety in maintenance works. In order to investigate the roles of owners and tenants in residential building repair and maintenance works, another set of questionnaire directed at flat owners / tenants was developed and was divided into three parts: (1) Biographical (or Personal) Information of the respondent; (2) Information of the residential building; (3) Conditions of maintenance and legal responsibilities. The questionnaire was distributed to different price rankings of residential units in Kowloon, Hong Kong Island and the New Territories recommended by major construction organizations and unions in Hong Kong. Finally, 314 valid questionnaires were collected for subsequent data analyses.

The number of fall accidents resulting from residential building repair and maintenance works has indeed drawn particular attention of the general public. With the high number of fall accidents particularly in building repair and maintenance, the current study was carried out to seek solutions in reducing fall from height accidents in residential building repair and maintenance works.

3. MAJOR FINDINGS FROM THE SURVEY

The literature review identified that the main causes of fall injuries were (1) Unsafe conditions; (2) Management inactions; and (3) Human-related factors (Chan et al. 2006c). Moreover, the use of bamboo truss-out scaffold was identified as a problematic area and the root cause of many recent fall accidents in Hong Kong. The statistical data collected from the government departments further support the need for the current study. The objectives were achieved using a combination of the various research techniques and the following reports major findings to address three of the five objectives set for the study (Chan et al. 2006e).

3.1 CAUSES OF FALL ACCIDENTS

Statistics of the Architectural Services Department showed that 'Fatigue/Exhaustion' was identified as the most influential personal factor of fall accidents, which accounted for one-third of fall injuries. The most unsafe action related to fall injuries was 'Adopting unsafe position or

posture', and 'Unsafe process or job methods' was the most unsafe condition in fall injuries. Statistics of the Labour Department showed that fatal accidents involving employers, self employed or illegal workers represented up to two-thirds of the total fatal accidents that occurred in repair and maintenance works. The findings reveal that these groups of people are very much prone to accidents and that more precautions should be carried out.

Analyses of the twenty-two case studies provided by the Labour Department indicated that the top three unsafe conditions/actions were all related to the equipment. Findings from the structured interviews showed that poor safety attitude, low safety awareness or lack of safety knowledge was the root cause of accidents in building repair and maintenance works. In the focus group meetings, one of the main causes of accidents identified was the tradition of 'the lowest bidder gets the job'. Many of the focus group participants felt that this tradition often means that safety is often compromised to reduce costs.

3.2 PRECAUTIONARY MEASURES

The popular precautionary measures suggested by the interviewees included a registration and licensing system for minor works or constructing bamboo truss-out scaffolds, continuous monitoring and frequent inspection, and that safety should be incorporated at the design stage of buildings. Findings from the focus group meetings showed that training and education for workers, contractors and individual flat owners/tenants was believed to be important. In addition, safety messages advertising the liability of flat owners/tenants were also suggested.

Findings from the industry based questionnaire indicated that the top three most favoured strategies for preventing fall from height accidents were: (1) For future building designs the designers should consider including facilities to ensure repair and maintenance safety, and hence reducing fall from height accidents; (2) Workers who work externally at height should be provided with specified safety training; and (3) A licensing system for workers working with the truss-out scaffold should be set up to reduce fall from height accidents.

3.3 LEGAL, ECONOMIC, AND SOCIAL ASPECTS

The unique nature of building repair and maintenance works such as small-scale and short duration should deserve more attention on legislative controls. Some respondents from the interviews and focus group meetings believed that there are insufficient statutory control exercised on residential building repair and maintenance projects, particularly for working at height. Some participants suggested developing a mandatory licensing system for repair and maintenance workers. From the industry based questionnaire survey, front-line workers agreed that the government should carry out

more inspections of workplace in order to reduce fall from height accidents. In addition, managers agreed that the government should prosecute and heavily penalize workers performing unsafe acts when working at height. Regarding the flat owner/tenant questionnaire survey, one-third of the respondents were not clear of their legal responsibilities in relation to building repair works. Well over half of the respondents did not purchase insurance for the repair works. Their views on the government's promotion on construction safety of building repair and maintenance were also rather negative. Based on the findings from the study, the following recommendations were suggested.

4. RECOMMENDATIONS FOR IMPROVEMENT

The recommendations for improvement should cover such areas as safety education and training, mandatory licensing system, preventive measures on the causes of fall accidents, and communication and regulatory framework (Chan et al. 2006e).

4.1 SAFETY EDUCATION AND TRAINING

The safety education and training should be offered to workers performing external repair and maintenance works at height on a mandatory basis. Workers should also be provided with continuous training to improve their safety attitude and hence reduce the occurrence of unsafe acts or procedures. Such safety training workshops and education should be targeted at staff of all levels including workers, supervisors, and managerial staff. Formal and structured safety training for workers working at height externally should indeed be considered to be made mandatory prior to allowing workers to work in these areas.

4.2 MANDATORY LICENSING SYSTEM

The compulsory safety training proposed should be accompanied by the issue of competency recognitions similar to the green card or silver card system. A mandatory licensing system should therefore be introduced for workers performing minor works. Similar to the recommendation for a mandatory licensing system for workers using the bamboo truss-out scaffold system, a mandatory licensing system for minor works would also be advantageous to the industry. But due to cost, time and acceptance from the industry, the mandatory system may only be possible to be introduced in the long-run. At present, self regulation among the workers is highly encouraged.

4.3 PREVENTIVE MEASURES ON THE CAUSES OF FALL ACCIDENTS

As a result of fatigue and exhaustion, a maximum number of work hours should be imposed which workers must not exceed so as to eliminate accidents. In addition, monitoring and inspection is required to make sure that employers oblige to the requirement. The legal requirement of eliminating illegal workers should also be enforced by more inspection and monitoring. Moreover, the implementation of safety management systems should be strengthened and extended to the residential repair and maintenance sector. 'The lowest bidder gets the job' practice should also be rectified as often safety precautions will be compromised if the bid is too low. Moreover, the 'Pay for safety' system should be formalized to make allowance for safety precautions so that the contractors and self-employed do not need to rush jobs in order to increase profit margins. The concept 'design for safety' should also be emphasized to consider and build in safety provisions at the design stage.

4.4 COMMUNICATION AND REGULATORY FRAMEWORK

More safety messages and publicity should be communicated to flat owners and tenants to alert them of their safety duties and liabilities in commissioning residential building repair and maintenance works. The government should also place more resources on promoting construction safety in residential repair and maintenance by providing more detailed guidelines, organising more safety training courses, increasing inspection and monitoring, and increasing incentive schemes such as the 'Pay for safety' system to reward and recognize good safety practices. It is encouraging to hear that the Minor Works Bill has been introduced this year to define small works. A registration system is also known to be underway. Such initiatives are considered essential in alleviating the safety problems in the maintenance sector of the construction industry.

5. CONCLUSIONS

This paper has presented the research framework and major findings of a current study on improving construction safety involving working at height for residential building repair and maintenance works. In fact, fall accidents can be prevented by adequate supervision, training, monitoring, advertisements, management, precautions and attention. In particular, this paper provided recommendations regarding the precautionary measures and advice to construction practitioners for decision making on construction safety in the maintenance sector. An initial design of a prototype has also been developed to improve the traditional practice of using bamboo truss-out scaffold. With the concerted efforts of various stakeholders in the industry, it is hoped that the findings and recommendations derived from this study can raise the awareness of the situation and motivate the

concerned parties to carry out the necessary measures to eliminate fall accidents in building repair and maintenance works.

6. ACKNOWLEDGEMENTS

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