Identifying elements of poor construction safety management in China

C.M. Tam a,*, S.X. Zeng a,b, Z.M. Deng a

a Department of Building and Construction, City University of Hong Kong,
83 Tat Chee Avenue, Kowloon, Hong Kong
b Aetna School of Management, Shanghai Jiaotong University, Shanghai, PR China

Received 9 April 2002; received in revised form 23 April 2003; accepted 12 May 2003

Abstract

Construction is one of the most hazardous industries due to its unique nature. Measured by international standards, construction site safety records in China are poor. This paper aims to examine the status of safety management in the Chinese construction industry, explore the risk-prone activities on construction sites, and identify factors affecting construction site safety. The findings reveal that the behavior of contractors on safety management are of grave concern, including the lack of provision of personal protection equipment, regular safety meetings, and safety training. The main factors affecting safety performance include ‘poor safety awareness of top management’, ‘lack of training’, ‘poor safety awareness of project managers’, ‘reluctance to input resources to safety’ and ‘reckless operations’. The study also proposes that the government should play a more critical role in stricter legal enforcement and organizing safety training programs.

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Keywords: Construction; Occupational accident; Safety; Factor analysis

1. Introduction

All over the world, construction is one of the most hazardous industries due to its unique nature (Jannadi and Bu-Khamsin, 2002). Construction safety is always a grave concern for both practitioners and researchers. A number of causes influencing safety performance in the construction industry have been identified that include...
workers’ attitudes (Hinze, 1981); construction company size, safety policy, project coordination, and economic pressure (Hinze and Raboud, 1988); management training (Gun, 1993; Jaselskis and Suazo, 1994); and safety culture (Tam and Fung, 1998; Glendon and Stanton, 2000; Tam et al., 2001). Measures taken to prevent occupational injuries and improve safety performance have been extensively explored (Laufer and Ledbetter, 1986; Harper and Koehn, 1998). Some of these studies (Fellner and Sulzer-Azaroff, 1984; Mattila and Hyodynmaa, 1988; Laitinen and Ruohomaki, 1996) reveal that when goals are posted and feedback is given, the safety index is significantly higher than that when no feedback is given. Hakkinen (1995) advocated a training program called ‘one hour for safety management’ for top management. The application of the program was successful in drawing management’s attention to safety issues. One study indicates that 83% of projects achieve the zero accident goals after applying the ‘Zero Accident Program’ (Center to Protect Workers’ Rights, 1993; Hinze and Wilson, 2000).

As regards construction safety in China, the record is poor in terms of international standards. In 1999, 923 site accidents of Grade IV \(^1\) and above (each accident involves two fatalities; or 3–19 severe injuries; or 0.1–0.3 million RMB Yuan in direct economic losses) were recorded at countryside construction, in which 1097 construction workers lost their lives (China Statistical Yearbook of Construction, 2000). The total construction workforce was 24,286,000 in 1999, representing a rate of these Grade I–IV serious site accidents of 3.8 per 100,000 workers. The fatality rate in these serious accidents is 4.5 per 100,000 workers. This seriously underestimates the total fatality rate, as single fatalities are not all reportable. (It is estimated that the actual fatality for USA is 15.2 per 100,000 workers according to NIOSH, 2003.) This paper describes the findings from a structured questionnaire survey and interviews on safety management to the Chinese construction industry with the following objectives:

- to examine the status of safety management in the industry;
- to explore the risk-prone activities on construction sites;
- to identify the factors affecting construction site safety; and
- to propose suggestions for improving safety performance.

2. Background of construction safety in China

2.1. Role of government in construction safety

The Ministry of Construction takes the overall responsibility in overseeing the construction industry in China. It takes the leading role in implementing the new strategies and policies including preparing development programs, regulating con-

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\(^1\) The Regulation on Procedures for Reporting and Investigation into Serious Accidents in Construction was issued by the Ministry of Construction of China in 1989. According to the regulation, accidents on construction sites are classified into four grades as listed in Table 5.
struction markets and construction institutions, and monitoring construction safety. The role of the central Ministry is mirrored by the provincial construction departments and those of the independent municipalities. They are charged with the responsibility for construction safety (see Fig. 1).

Under powers in the relevant legislation on construction safety, such as ‘Construction Law’, ‘Inspection Standards for Construction Safety’ and ‘Inspection Standards for Labour Protection in Construction Enterprises’, the Ministry of Construction annually hires about 50 safety auditors to conduct nationwide safety audits. The scope of the audits includes the safety management system of the construction firms, labour protection measures, safety pitfalls on construction sites and so on in different provinces or major cities.

2.2. Safety management system of construction firms

Protection of labour from occupational diseases and accidents in the construction industry of China is defined by law; for example, for construction sites having 50 employees or more, main contractors have to nominate a full-time safety inspector; for sites with an area exceeding 10,000 m² there must be 2–3 safety inspectors; wherever the site exceeds 50,000 m², the main contractor has to establish a safety management team.

2.3. Construction project supervisors’ inspection on safety

Since 1989 China has begun adopting the ‘Construction Supervision Scheme’. One of the project-supervisor engineer’s responsibilities is to monitor construction safety.
Since the issuance of the ‘Regulation on Construction Project Supervision’ in 1996, the construction supervision scheme has been extensively practiced in China. According to the system, the role of the supervisors is to enhance construction supervision by introducing checks and control at various construction stages on behalf of the clients. Under clause 32 of the current Construction Law issued in 1997, the supervisors’ duties are to ensure construction works in compliance with the construction regulations, to supervise execution of the work, to monitor construction safety, to prepare supervision plans and to notify the government in the case of any violation of the relevant statutory legislations.

2.4. Types of ownership of construction firms

In China, all large construction firms were state-owned establishments under the traditional planned economy system. Since the adoption of the reform and opening policies in 1978, the traditional planned economy system has been gradually replaced by the market economy in China. A great number of peasants were liberated from traditional cultivation and farming works and organized themselves into rural-village-enterprises and rural construction teams (RCT). This was closely associated with the rapid economic expansion, which results in high volumes of construction activities and renders China the largest construction market in the world. As at 1999, the proportion of RCT has reached 51%, with that of state-owned enterprises (SOE) at 10%, urban collective-owned (UCO) at 26%, and others (including public-listed sharing-holding, foreign-funded enterprises) at 13% (see Fig. 2), which represents a great change in the form of ownership of construction enterprises in China.

Previous research has revealed that there is a relationship between sizes of firms and accident rates (Hinze and Raboud, 1988). A study by McVittie et al. (1997) indicated that accident rates decrease as the sizes of firms increase. The underlying factors include the degree of planning and organization in large firms versus that of small firms, the presence of in-house health and safety expertise or resources, the degree of unionization, access to and use of external support services relating to

![Fig. 2. Categories of construction firms of various ownerships in 1999.](image-url)
health and safety, levels of government inspection and the effects of economies of scale. Comparing SOEs with RCTs in China, the average numbers of employees are 735 and 150 respectively (China Statistical Yearbook, 2001). However the fatality rate for the former is three times that of the latter (China Construction Statistical Yearbook, 2000). This trend contradicts to the findings of McVittie et al. (1997), representing the exceptional behavior of construction safety in China. The fatality rate for SOEs was 6.0 per 100,000 workers and 2.0 for RCTs. This is closely associated with the operational nature of construction firms in China. Almost all Chinese construction firms of different sizes compete for similar jobs in the construction market and manage similar projects, which results in ‘excessive competition’ and thin profit margins, especially for large SOEs which need to maintain a sizable business turnover.

In spite of the well-defined roles of the above parties in construction safety, the safety performance on construction sites is still disappointingly poor in China. Occupational accidents have not been effectively prevented. When comparing the figures of 1998 and 1999, the serious accidents on construction site had increased by 21.2% while the number of fatalities had increased by 15.1%.

3. Root causes affecting safety performance

There are various factors influencing safety management in the construction industry. These factors can be grouped into people’s role, organization, management, technology, industrial relationship and so on. Due to differences in culture, management and the market structure, these factors have diverse influence on construction safety. The related literature to date on safety management is tabulated in Table 1, based upon a literature search in our libraries.

<table>
<thead>
<tr>
<th>Areas</th>
<th>Items</th>
<th>Relative researches</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Worker’s behaviour</td>
<td>Hinze (1981) and Yu (1990)</td>
</tr>
<tr>
<td>Technology</td>
<td>Technology control</td>
<td>Blank et al. (1997), Lingard and Holmes (2001) and Jannadi and Assaf (1998)</td>
</tr>
<tr>
<td>Industrial relationship</td>
<td>Market</td>
<td>Hinze and Raboud (1988) and Kartam et al. (2000)</td>
</tr>
<tr>
<td></td>
<td>Safety regulations</td>
<td>Gun (1993) and Seppala (1995)</td>
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</table>
4. Research methodology

Based on the above, a questionnaire survey was designed by incorporating 25 factors affecting construction safety. The objective of the survey is to explore the status of construction safety management in China. The survey was conducted in 200 large and medium-sized construction firms listed in the Dictionary of Quality System Certificated Enterprises. As ISO 9000 certified companies have embraced safety management in their quality systems, they should, theoretically, perform better in safety. The results of the survey can be expected, therefore, to give a better picture of safety management than in the average company. Structured questionnaire surveys and interviews were used to collect the necessary information and data. Questionnaires were sent to the safety representatives including safety inspectors, managers and directors, who were responsible for safety, of the construction firms listed in the Dictionary of ISO 9000 Certified Enterprises. The areas of investigation of the questionnaires are summarized as follows:

- safety management system;
- safety behaviors and safety measures;
- impact of site accidents on companies;
- factors affecting safety management; and
- government support.

Sixty completed questionnaires have been received, a response rate of 30%, an average response rate for the construction industry as construction firms are normally found not helpful in completing questionnaires. In addition, interviews were conducted with government officials of the construction departments in charge of construction safety, focusing on safety policies and procedures issued by the government, safety standards, and factors affecting safety on construction sites.

In the survey, all the 200 construction firms are ISO 9000 certified, representing a better picture of safety management than in the average company as described above. Among the 60 responded, they fall into two categories of ownership: 52 state-owned (87%) and eight public-listed sharing-holding enterprises (13%). Out of all the responding firms, 52 firms (87%) employ over 1001 people, four firms (6.5%) between 501 and 1000, and four firms (6.5%) below 500.

5. Results and discussion

5.1. Safety manual and procedures

The purpose of the safety manual is to communicate a firm’s safety policy, identify the safety factors, define responsibility and control the safety management system. As the backbone of the management system, the manual defines the safety procedures and instructions and identifies the specific requirements. The respondents were asked whether they have a safety manual and safety procedures. 62% of the re-
respondents claimed that they did not have documented safety manuals, while 38% had. With respect to the safety procedure, all the respondents said that they had documented procedures for safety management on construction sites, which formed part of the procedural process control (Clause 4.9) of ISO 9000: 1994. However, the majority of the respondents (92%) claimed that not every worker knew the procedure. That means they had a quality management system, which included and defined a safety procedure but not a structured safety management system supported with a safety manual.

5.2. Provision of personal protection equipment

The status of the provision of personal protection equipment (PPE) for workers is illustrated in Fig. 3.

Fig. 3 shows that the most common PPE provided are gloves, hard hats and eye goggles. However, many workers consider that hard hats are not convenient for their operations.

5.3. Safety meeting and training

Regular safety meetings are necessary for communicating safety information to all parties. 36% of the respondents claimed that they had regular safety meetings, and the others indicated that safety issues were discussed and presented at other meetings, such as construction planning meetings. However 87% argued that the top management seldom attended the safety meetings.

The respondents were asked whether they had provided safety training for the first-line workers. 24% of the respondents claimed the provision of systematic training; 65% offered occasional training; and the others (11%) rarely provided any training. In the construction industry, construction workers have high mobility and they switch from one company to another frequently. The transient nature of the

![Fig. 3. Personal protective equipment provided by contractors.](image-url)
construction workforce makes it difficult to train workers. The lack of effective labor training is a major concern in safety management.

5.4. Impact of site accidents

The questionnaire asked what the most significant impact of site accidents on construction firms was. The possible answers were ‘increase in cost’, ‘interrupted construction schedule’, ‘impairing reputation of firms’, ‘imposing psychological burden on workers’, and others. Fig. 4 shows the results.

Fig. 4 shows that 68% of the respondents considered ‘impairing reputation of firms’ as the most serious impact of site accidents. ‘Interrupted construction schedule’, ‘increase in cost’ and ‘imposing psychological burden on workers’ were indicated by 15%, 12% and 5% of the respondents respectively. That means the respondents were in general more concerned about the public view and image, rather than the internal distress of time, cost and labor.

5.5. Perceived probability of serious accidents on sites

Construction sites exhibit unique hazardous characteristics; for example, workers are crowded together on sites, operating at height and outdoors, with the use of heavy machine and equipment. The questionnaire explores the perceived probability of serious accidents on construction sites, which will lead to fatalities. The respondents were asked to choose the most probable serious site accidents (can be more than one from a list of accidents prepared by the authors) that may lead to fatalities and the results are shown in Fig. 5.

Fig. 5 indicates that ‘falling from height’ is considered most risky (92%) (Larsson and Field, 2002). The other accidents in descending order of perceived probability are ‘hit by falling materials’, ‘collapse of earthwork’, ‘use of heavy machine’, and ‘electrocution’. The results are comparable (with the exception of the ranking of

![Fig. 4. Impacts of site accidents.](image)
with the safety statistical data of the construction industry in China (as listed in Table 2). The results indicate that the frequencies of accidents correlate positively with fatalities and severe injuries with the exception of electrocution.

Table 2 shows that ‘falling from height’ scores high both in the accident and fatality records. The proportion of the accident reaches 50% of the total accidents, which is obviously higher than any other accidents. With respect to fatality, 524 construction workers (48%) lost their life due to falling from height in 1999 (see Table 3).

5.6. The OHSAS 18000 system

The respondents (all accredited with ISO 9000) were asked whether they had implemented the OHSAS (Occupational Health and Safety Assessment Series) 18000 system, a new international standard for the Chinese enterprises, for safety and
Although 50% of the respondents claimed that they were going to adopt the system, they were in fact adopting a wait-and-see attitude. The rest had not considered adopting it.

5.7. Relative importance of factors

The respondents were asked to provide their opinions on the importance of a list of 25 factors affecting construction site safety by scores from 1 to 5, where ‘1’ represents the least important and ‘5’ the most important. To determine the relative ranking of the factors, the scores were then transformed to importance indices based on the following formula (Tam et al., 2000):

\[
\text{Relative importance index} = \frac{\sum w_i}{A \times N}
\]

where \(w_i\) is the weighting given to each factor by the respondents, ranging from 1 to 5 and \(A\) is the highest weight (i.e. 5 in the study) and \(N\) is the total number of samples.

Based on Eq. (1), the relative importance index (RII) can be normalized to fall within 0–1. Table 4 shows the RII of each factor affecting construction site safety, according to the respondents.

The respondents ranked ‘poor safety awareness of firm’s top leaders’ and ‘poor safety awareness of project managers’ first and third, with a RII of 0.93 and 0.89. It indicates that leaders play a very important role in construction safety management. The top management sets up appropriate environments for safety by defining the safety policy and allocating resources. The attitude of the top leaders plays an important role in cultivating a good safety culture (Seppala, 1995). However, in practice, not all business leaders pay great attention to safety management because other business objectives such as profitability, schedule and quality are always competing for their time and resources (Hakkinen, 1995). This can be seen from the questionnaire response that only a small proportion of top management attended safety

Table 3

<table>
<thead>
<tr>
<th>Type</th>
<th>Fatality</th>
<th>Severe injury</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hole and edge</td>
<td>182 (35)</td>
<td>24 (18)</td>
</tr>
<tr>
<td>Scaffolding</td>
<td>133 (25)</td>
<td>51 (39)</td>
</tr>
<tr>
<td>Crane</td>
<td>78 (16)</td>
<td>13 (10)</td>
</tr>
<tr>
<td>Tower crane</td>
<td>35 (7)</td>
<td>9 (7)</td>
</tr>
<tr>
<td>Formwork</td>
<td>34 (6)</td>
<td>9 (7)</td>
</tr>
<tr>
<td>Construction machine</td>
<td>10 (2)</td>
<td>10 (7)</td>
</tr>
<tr>
<td>Earthmoving</td>
<td>7 (1)</td>
<td>3 (2)</td>
</tr>
<tr>
<td>Building demolition</td>
<td>7 (1)</td>
<td>–</td>
</tr>
<tr>
<td>Others</td>
<td>38 (7)</td>
<td>14 (10)</td>
</tr>
<tr>
<td>Total</td>
<td>524 (100)</td>
<td>133 (100)</td>
</tr>
</tbody>
</table>


* The figure in parentheses indicates the percentage of the total.
meetings. As contractors have to finish the work within a specified period of time, at an agreed price and at a certain standard of workmanship, most people focus on the immediate problems and view their top priorities as meeting the production schedule, quota and cost targets, and quality requirements. Only after achieving these objectives will they give some considerations to safety (Tam et al., 2001).

‘Lack of training’ is ranked second with a RII of 0.90. Training programs help personnel carry out various activities effectively, establish a positive safety attitude, and integrate safety with the construction and quality goals. In fact, the percentage of construction workers being trained is very low in China. Statistics reveal that only 3% of workers have been trained and certified, 7% trained under short-term programs, whilst 90% are without any training at all (Zhang, 2001). From the survey, there were only 24% of the respondents providing systematic training and 11% not even any training at all. In addition, one of the characteristics of the Chinese construction industry is the existence of a large number of peasant workers, who receive little education and are unskilled, untrained, and inexperienced (education levels of these workers are shown in Fig. 6).

They come from poor provinces and are ready to take up any jobs to earn a reasonable living for their families. Due to relatively low requirements for skills in construction, the industry has been overwhelmed with peasant workers.

Table 4
RII of factors affecting construction site safety

<table>
<thead>
<tr>
<th>Ranking</th>
<th>Factors affecting site safety</th>
<th>RII</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Poor safety awareness of firm’s top leaders</td>
<td>0.93</td>
</tr>
<tr>
<td>2</td>
<td>Lack of training</td>
<td>0.90</td>
</tr>
<tr>
<td>3</td>
<td>Poor safety awareness of project managers</td>
<td>0.89</td>
</tr>
<tr>
<td>4</td>
<td>Reluctance to input resources for safety</td>
<td>0.86</td>
</tr>
<tr>
<td>5</td>
<td>Reckless operation</td>
<td>0.86</td>
</tr>
<tr>
<td>6</td>
<td>Lack of certified skill labor</td>
<td>0.84</td>
</tr>
<tr>
<td>7</td>
<td>Poor equipment</td>
<td>0.82</td>
</tr>
<tr>
<td>8</td>
<td>Lack of first aid measures</td>
<td>0.81</td>
</tr>
<tr>
<td>9</td>
<td>Lack of rigorous enforcement of safety regulations</td>
<td>0.74</td>
</tr>
<tr>
<td>10</td>
<td>Lack of organizational commitment</td>
<td>0.71</td>
</tr>
<tr>
<td>11</td>
<td>Low education level of workers</td>
<td>0.68</td>
</tr>
<tr>
<td>12</td>
<td>Poor safety conscientiousness of workers</td>
<td>0.65</td>
</tr>
<tr>
<td>13</td>
<td>Lack of personal protective equipment</td>
<td>0.62</td>
</tr>
<tr>
<td>14</td>
<td>Ineffective operation of safety regulation</td>
<td>0.59</td>
</tr>
<tr>
<td>15</td>
<td>Lack of technical guidance</td>
<td>0.55</td>
</tr>
<tr>
<td>16</td>
<td>Lack of strict operational procedures</td>
<td>0.55</td>
</tr>
<tr>
<td>17</td>
<td>Lack of experienced project managers</td>
<td>0.54</td>
</tr>
<tr>
<td>18</td>
<td>Shortfall of safety regulations</td>
<td>0.53</td>
</tr>
<tr>
<td>19</td>
<td>Lack of protection in material transportation</td>
<td>0.53</td>
</tr>
<tr>
<td>20</td>
<td>Lack of protection in material storage</td>
<td>0.51</td>
</tr>
<tr>
<td>21</td>
<td>Lack of teamwork spirits</td>
<td>0.50</td>
</tr>
<tr>
<td>22</td>
<td>Excessive overtime work for labor</td>
<td>0.49</td>
</tr>
<tr>
<td>23</td>
<td>Shortage of safety management manual</td>
<td>0.48</td>
</tr>
<tr>
<td>24</td>
<td>Lack of innovation technology</td>
<td>0.43</td>
</tr>
<tr>
<td>25</td>
<td>Poor information flow</td>
<td>0.40</td>
</tr>
</tbody>
</table>
‘Reluctance to input resources for safety’ is rated as fourth, with a RII of 0.86. This is closely associated with the operational nature of construction firms in China. Almost all Chinese construction firms of different sizes compete for the same jobs in the construction market and manage similar projects, which results in ‘excessive competition’ and thin profit margins, sometimes even losses due to the unhealthy competition. The vicious circle hinders technology and productivity improvement, in which the state-owned construction firms are the direct victims (see Fig. 7).

Meanwhile the government policy has set a burden on SOEs, which need to shoulder extra welfare costs and retirement pension of workers that include social and welfare amenities.

Additionally, delay in payments is a common problem in China. In 1999, the value of arrears in payment reached 222,140 million RMB (Yuan) (27,090 million
US$), which was 19.1% of total construction output. This phenomenon is attributed to two main reasons. First, all construction firms can and are willing to tender for all kinds of jobs, which results in acute competition in the construction market. Under these circumstances, construction firms, which are desperate for jobs, will use their own funds or even borrow money from the banking system to start the project on behalf of the clients. Second, the operational environment for the Chinese state-owned construction firms is far from perfect. Although the National Construction Law was issued in November 1997, the existing legislative and regulatory frameworks are incomplete, and often, high-level government officials have the final say on any decisions. As a result, the clients and contractors are not equals. The legitimate interests of construction firms cannot be protected when they come into conflict with other higher-level benefits. As a result, it is not easy for construction firms to spare extra resources for safety management.

The respondents rated ‘reckless operations’ as fifth, with a RII of 0.86. According to China Statistical Yearbook of Construction, the reckless operations largely occur at building demolition. The number of fatalities resulting from reckless operations was 46 (4.19%) in 1999.

‘Non-certified skill labor’ is ranked sixth, with a RII of 0.84. In construction, some activities demand a high level of skill, such as tower crane and gantry operations, and framework and scaffold erection etc. In 1999, there were 102 (9.3%) and 46 (4.19%) fatalities resulted from gantry and framework erection respectively.

The respondents rated ‘poor equipment’ as seventh, with a RII of 0.82. In 1999, 95 fatalities (8.66%) resulted from the problems of construction equipment. Construction equipment is considered to be one of the weakest links in the Chinese construction industry. As there are no plant-hiring services offered in China, the construction firms have to own their own construction equipment. Most of equipment is not fully utilized, which places a heavy burden on firms. Although around 30% of construction equipment is old and obsolete, it is still being used because most state-owned firms lack money to replace it (Chen, 1997). As a result, site operations are still rather primitive due to the shortage of practical hand tools. The abundant supply of cheap labour further exacerbates the situation, causing the construction industry to lag behind in technology.

The respondents ranked ‘lack of first aid measures’ as eighth, with a RII of 0.81. In general, construction firms have no first aid measures for emergency in China. This is related to the factors on ‘lack of attention from leaders’ and ‘poor safety awareness of managers’.

The respondents ranked ‘non-rigorous enforcement of safety regulations’ ninth, with a RII of 0.74. While legislation on construction safety has been issued, administration still retains considerable powers, and government officials can influence legal enforcements in local areas (Ding et al., 2000). Violation of the safe construction law often goes unpunished. For example, the qualification and certification of company safety inspectors are stipulated by construction regulations; however, it is not uncommon for contractors to appoint people without the stipulated competency for safety management. Meanwhile many clients do not consider past safety records of contractors in the tender pre-qualification process of project procurement.
The respondents rated ‘lack of organizational commitment’ as tenth, with a RII of 0.71. Although all respondents claim they have organizational commitment, however, as indicated by an interviewee, an official of the Ministry of Construction, many contractors just put commitments on paper but actually behave differently (Ding et al., 2000). For a construction project, the project manager’s safety responsibility should at least cover the following (MacCollum, 1995):

1. preparation of a project safety plan;
2. review of plans and specifications to identify the location and the nature of potential hazards;
3. review of specifications to identify appropriate safety standards and special safety conditions;
4. requiring construction superintendents to prepare a written safety plan for each major phase of work, including hazard analysis for high-risk activities;
5. insisting upon immediate reporting of all injuries, deaths, and property damage as a result of accidents;
6. employment of qualified and certified safety inspectors and personnel.

Sometimes, the safety management system requires site supervision staff to carry out a lot of documentation paperwork which may create frustrations leading to completion of the inspection forms without making any inspections at all (Ding et al., 2000).

In addition, the current labour union does not play an active role in defending the rights of labour in the construction industry of China when compared with those in industrialized countries, which are powerful and can insist that contractors provide safe working conditions and safety equipment to protect their workforces’ rights and health (Kartam et al., 2000).

6. Demands for governmental support

The government should play an important role in safety management in the construction industry (Kartam et al., 2000). In this survey, respondents were asked to provide their opinions on an open-ended format on the ways that the government can support safety management. Fig. 8 shows the results.

Fig. 8 shows that 62% of the respondents indicated ‘financial aid’ as the major tool. However, according to an interviewee, an official in the Ministry of Construction in charge of construction safety, the provision of financial aid is not feasible under the current government policy. 31% of the respondents felt that government should carry out more effective inspection. Currently the inspections are not conducted effectively as it is impossible to have sufficient inspectors to visit all workplaces at all time and be there when new hazards arisen (MacCollum, 1995). Under current circumstances, the most feasible ways that the government can manage is the provision of support in safety training and a proper legal framework with stringent enforcement.
7. Conclusions

Construction is one of the most hazardous industries due to its unique nature. By international standards, the construction site safety record of China is poor. Every year there are about 1000 recorded fatalities in construction sites and a large number of reported occupational accidents; however, it is believed that the figures show only the tip of an iceberg with a large number of unreported fatalities and accidents (Table 5). The safety management in most Chinese construction firms is of grave concern as shown by the finding that:

- most contractors do not have a proper documented safety management system laid down clearly in the safety manuals;
- it is surprisingly to find that only a small percentage of contractors provides adequate necessary PPE for their workers;
- top management has a perfunctory attitude towards safety management as revealed from their seldom attendance to safety meetings; and
- Only a small number of contractors offer systematic safety training.

As shown in Fig. 4, most (68%) of the respondents considered ‘impairing reputation of firms’ as the most serious impact of site accidents whilst few of them (5%)

Table 5
Classification of serious accidents in construction in China

<table>
<thead>
<tr>
<th>Accident grade</th>
<th>Demarcation</th>
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<tbody>
<tr>
<td>I</td>
<td>Over 30 fatalities; or over 3.0 million RMB Yuan in direct economic losses</td>
</tr>
<tr>
<td>II</td>
<td>10–29 fatalities; or 1.0–3.0 million RMB Yuan in direct economic losses</td>
</tr>
<tr>
<td>III</td>
<td>3–9 fatalities; or over 20 severe injuries; or 0.3–1.0 million RMB Yuan in direct economic losses</td>
</tr>
<tr>
<td>IV</td>
<td>2 fatalities; or 3–19 severe injuries; or 0.1–0.3 million RMB Yuan in direct economic losses</td>
</tr>
</tbody>
</table>

Sources: Lei and Qian (1999).
considered ‘imposing psychological burden on workers’ as serious, which confirms the negative attitude of organizational management towards construction safety as described above. It definitely pleads for the government’s intervention by tightening up legal enforcement and punishment for any violation of safety practices.

Although there are many factors affecting contractors’ safety performance, the main factors perceived by the respondents are:

- poor safety awareness of firm’s top leaders;
- lack of training;
- poor safety awareness of project managers;
- reluctant to input of resources to safety; and
- reckless operations.

Based on the analysis, it can be concluded that the industry should be more active in organizing training programs for educating people and improving safety performance.

Regarding the destructive competition among construction firms, the government should take the following initiatives:

- regulating the market by dissecting the construction market into different strata, for example by registration of contractors under the categories of large, medium and small scaled projects; foundation, superstructure, site formation, drainage, civil works, etc. so as to reduce the number of contractors competing in certain sectors.
- establishing a proper tender evaluation system in which tender price only forms one of the evaluation criteria. Besides that, past performance on safety, quality and management attitude should be included.

References


