

1.0 INTRODUCTION

There have been numerous reports in the media about failures of scaffolds and falseworks. The main reasons could be attributed to the lack of attention on the safety aspects in the installation, maintenance and dismantling of these scaffolds and falsework, especially during the boom period in the last decade. Prevention of failures or collapses is necessary because they normally resulted in human fatalities or bodily harm. Property damage, delays and loss of revenue for the companies involved are also normally unavoidable as a result of these failures. The Institution of Engineers, Malaysia in response to this concern and to address the problem, formed a special committee to study the causes of failures and to recommend suitable measures to mitigate these types of failures and to come out with a Policy Statement that could be forwarded to the relevant authorities and agencies to effect suitable actions.

1.1 The Issues

The followings are the issues pertaining to the problems encountered in the industry, relating to scaffolds and falseworks,

- i. Scaffolds and falseworks' safety must be seen as one of the major concerns in the local construction industry. In a study conducted in the United States, it was found that about 65% of construction workers will be working in one form of scaffolds or falseworks at one time or another.
- ii. Existing legislations and guidelines have not been effective enough to produce satisfactory solution. Safety rules are frequently violated.
- iii. Insufficient allocation of funds for construction safety in the construction budget seems to be the norm;
- iv. Lack of competent personnel for erecting, maintaining, and dismantling scaffolds and false work is very apparent.

1.2 Objectives of the Position Paper Committee

The main objective of the position paper committee is to formulate an IEM's view in the prevention of collapse of scaffoldings and false works. This will be carried out through the following approaches,

- i. Obtaining views, inputs and feedbacks on the matter from a broad-based group of individuals and organisations, involved in the construction industry.
- ii. Reviewing relevant literatures.
- iii. Conducting forums to discuss the issues.

1.3 Composition of the Members of Position Paper Committee

The Civil and Structural Engineering Technical Division of the Institution of Engineers Malaysia (C&S) was requested to spearhead the relevant committee in studying this issue. In forming the Position Statement Committee, various individuals and agencies related to the construction industry were invited to join the committee. These include,

- i. The Department of Safety and Health(DOSH)
- ii. The National Institute of Occupational Safety and Health(NIOSH)
- iii. The Construction Industry Development Board(CIDB)
- iv. The Association of Consulting Engineers, Malaysia(ACEM)
- v. The Master Builder Association of Malaysia(MBAM)
- vi. The Malaysian Institution of Steel Industries Federation(MISIF)
- vii. Practicing Engineers
- viii. Manufacturers of Scaffolds and Falseworks.

The list of the IEM Position Statement Committee members is given in Appendix A.

2.0 BACKGROUND

From the literature review carried out numerous examples of accidents related to scaffolds and falseworks can be cited. To highlight some examples, the followings were felt worth quoting,

- i. Collapse of falsework at a hotel development project at KL Sentral on the 13th. December 1999. Six people were injured. Cause of collapse was scaffolds were not constructed in accordance with the drawings prepared by the Professional Engineer.
- ii. Fatal fall of a worker from a mobile scaffold at 'Dewan PUSPANITA, Lot JKR 5171, Jalan Hose' on 15 March 1999. Cause of accident was that the scaffold was not constructed by competent personnels.
- iii. Falsework accident at 'Project Cadangan Pembinaan 24 tingkat pejabat & 5 tingkat Wisma AIA, lot 250, Seksyen 49, Jalan Ampang' on the 27th. February 1998. One worker working under a false work died as a result of being hit by a falling part from the falsework.

3.0 REVIEW OF AVAILABLE LITERATURES

The following Malaysian Acts and Regulations and International Codes of Practice that are related to the issue were studied and discussed to establish the proposals for good practice.

3.1 Acts and Regulations

Listed below are the Acts and Regulations related to scaffolds and falsework that were studied and reviewed by the Committee.

- i. Factories and Machinery Act 1967 - Part IV.

Areas reviewed: Reporting of Accidents and dangerous occurrences; the power of conducting enquiry and investigation
- ii. Factories and Machineries (Building Operations and works of engineering Construction) (Safety) Regulations 1986.
- Part III Areas reviewed: Construction of concrete works
- Part X Areas reviewed: Construction of scaffolds
- iii. Occupational Safety and health Act 1994 (Act 514) - Part IV
Areas reviewed: General provisions on safety and health based on the concept of self-regulation.

3.2 Malaysian Standards

MS 1462: 1999 Specification for Steel Frames tubes and fittings used in tubular scaffolding

3.3 Singaporean Standards

- i. SS 311: 1994 Specification for Steel Tubes and Fittings used in Tubular Scaffoldings
- ii. SS 280: 1984 Specification for Frame Scaffolding
- iii. SS CP 14: 1996 Code of Practice for Scaffolds

3.4 Japanese Industrial Standards

- i. JIS A 8951:1985 Japanese Industrial Standard for Tubular Steel Scaffolds
- ii. JIS G 3444:1999 Carbon Steel Tubes for General Structural Purposes

3.5 British Standards

- i. BS 1139:1990 Metal Scaffolding
- ii. BS 2482: 1981 Specification for Timber Scaffold Boards
- iii. BS 5973: 1993 Code of Practice for Access and working scaffolds and special Scaffold Structures in Steel
- iv. BS 5974: 1990 Code of Practice for Temporarily Installed Suspended Scaffolds and access Equipment
- v. BS 5975: 1996 Code of Practice for Falsework
- vi. BS 4074: 1982 Specification for Metal Props and Struts

4.0 CAUSES OF COLLAPSE AND FAILURES OF SCAFFOLDS AND FALSEWORKS

The followings are identified causes of collapse and failures of scaffolds and falseworks,

- i. Lack of considerations in the design and specifications. (Poor or insufficient design)
- ii. Improper construction practice. (Non-provision of all necessary or recommended structural, construction and safety elements. Works carried out on ad-hoc basis. No planning or design)
- iii. Inadequate training for construction workers for erection ,maintenance and dismantling of false works and scaffolds. (Lack of safety awareness among workers)
- iv. Inclusion of inferior material as scaffolds and falseworks.
- v. Lack of regular maintenance and inspection of these erected temporary structures
- vi. Accident s which occurred out of negligence of on-site personnels.

5.0 FACTORS CONTRIBUTING TO THE FAILURES

The followings are contributing factors to failures of scaffolds and falseworks,

- i. Lack of enforcement by relevant authorities.
- ii. Lack of concern for the safety of workers and the public by management and other relevant bodies.
- iii. Inadequate supervision and quality or safety checks not implemented during erection and use
- iv. Lack of erection drawings before erection
- v. Insufficient allocation of fund for safety and health training programmes for workers involved in constructions.

6.0 RECOMMENDATIONS

PROCEDURES	ACTION
<p>6.1 Amendments to Relevant Local Acts and Regulations</p> <p>Local Acts and Regulations need to be amended to include sufficient provisions on safety requirement on scaffolds and falseworks. It is recommended that Acts and By-Laws be amended in the following matters,</p> <ol style="list-style-type: none"> i. Submission for temporary works related to scaffolds and falsework is required where they are more than 6 m in height. ii. The Responsibility of the submitting person on safety issues, need to be highlighted. iii. Requirement of regular inspection on temporary works is necessary. iv. Mandatory registration of the suppliers with DOSH is required. v. Mandatory registration of scaffolds and falseworks' products is also needed. 	<p><u>Lead Agency:</u></p> <p><u>Ministry of Housing and Local Governments.</u></p> <p><u>Other Agencies:</u></p> <p>Ministry of Human Resources</p>
<p>6.2 More Stringent Enforcement</p> <p>Enforcement should not be restricted to accident or failure of the scaffolds and formworks. It is recommended that:</p> <ol style="list-style-type: none"> i. Enforcement should be carried out on a regular basis to ensure that scaffolds and falseworks are constructed in accordance with sound engineering practice. ii. The Project Manager of the respective project should verify records of all regular inspections by persons approved by DOSH. This should be included in the regular report to be submitted to the relevant authority. 	<p><u>Lead Agency:</u></p> <p><u>DOSH</u></p> <p><u>Other Agencies:</u></p> <p>DOSH and Local Authorities</p> <p>ACEM, IEM, PAM, MBAM, REHDA</p>
<p>6.3 Mandatory Requirement for Sufficient Training for Supervisory Personnel and Erection Teams</p> <p>The required training on erection, alteration, maintenance and dismantling of scaffolds, falsework, ladders, etc. is necessary for construction workers and supervisory personnel. Such training could be provided by DOSH, NIOSH, CIDB, MBAM and even</p>	<p><u>Lead Agency:</u></p> <p><u>DOSH</u></p>

<p>other accredited organisations. Competency Certificate could be issued and this may be made as a requirement for erectors of scaffolds and falsework. Training is also required on the safety aspects of such structures and hazard preventive measures. This action is to ensure that sufficient trained personnel in these areas are available in the industry.</p> <p>Although there is a requirement that trained scaffolder should supervise the erection and dismantling, this requirement is yet to be fully enforced, because of lack of trained scaffolders. We recommend that Contractual Conditions of Contracts prepared by CIDB, PAM, IEM etc. should include clauses on training the workers or supervisory personnel for the erection, dismantling and maintenance of scaffolds, falsework, ladders, hoists, trestles etc.</p>	
<p>6.4 Inclusion of Item for Safety, Health and Environment Management Requirement in the Preliminaries of all Construction Contract Documentation</p> <p>Currently requirements for safety and health are not itemized as one item in every project. There are various items related to safety in the current lists of preliminaries in some projects. Furthermore, in some documents there is no inclusion at all for this item. It is recommended that one item be included in the Preliminaries of all construction projects for Safety, Health and Environment Management.</p>	<p><u>Lead Agency:</u> ISM</p> <p><u>Other Agencies:</u> Regulatory agencies and consultants.</p>
<p>6.5 Updating Guidelines and Standard Code of Practices as Necessary</p> <p>Currently there is one Malaysian Standard which is product-based, viz. MS 1462:1999. Specification for Steel Frame Scaffoldings. All other design and construction of scaffolds and falseworks are designed to other Overseas' Standards. It is recommended that a Code of Practice for Access Scaffolds, Working Scaffolds and Special Scaffolds Structures be drafted. This will include the Steel Tube Scaffolds, Timber Scaffolds and Scaffolds made from other materials.. Such Code of practice could also include details of loadings, construction methods, and quality checklists for erection, dismantling and maintenance.</p> <p>The guidelines on Occupational Safety in Construction Works, which is prepared by DOSH also need to be expanded.</p>	<p><u>Lead Agency:</u> SIRIM</p> <p>SIRIM</p> <p>DOSH</p>

<p>6.6 Provision of Sufficient Fund for Safety, Health and Environmental Programme for Each Construction Project</p> <p>Developers and contractors shall be required to provide sufficient fund for safety and health during construction stages. In order for this to be effective, it is recommended that the Bill of Quantities included in the tender documentation shall provide sufficient details on safety, health and environmental requirements.</p> <p>At present although some tender documents provide for quoting for items related to safety and health, many contractors do not quote sufficient sum for this requirement. Subsequently during the construction stage, they are unable to provide even basic protective equipment for workers' safety. One of their excuses is that the tender quotations are very competitive. Organisations such as CIDB and DOSH could suggest a percentage allocation for safety and health matters for each category of construction projects, as per value of the project, based on their previous experience of well-managed projects.</p>	<p><u>Lead Agency:</u> MBAM</p> <p><u>Other Agencies:</u> MBAM, REHDA, ACEM and IEM</p> <p>CIDB, DOSH, PAM, ACEM and IEM</p>
<p>6.7 Additional Guidelines</p> <p>Organizations such as IEM, ACEM, CIDB, and MBAM together with DOSH could consider undertaking publications jointly or individually guidelines on safety and health, based on current priority. Some of the recommended titles are,</p> <ol style="list-style-type: none"> i. Worked Examples on the Design of Scaffolds using MS 1462: Certified Scaffold Frames. ii. Guidelines for Proprietary Metal Frame Scaffolds which at least include the following sub-topics, <ol style="list-style-type: none"> a. Part 1 Initial Planning and Design b. Part 2 Erection and Quality Checks c. Part 3 Maintenance d. Part 4 Dismantling, Storage and Preservation e. Part 5 Training on Erection, Maintenance, Alteration and Dismantling iii. Safe Working Practices on scaffolds which at least should include the followings, <ol style="list-style-type: none"> a. Timber scaffolds – construction, maintenance and dismantling guidelines. b. Safe use of scaffolds as working platforms 	<p><u>Lead Agency:</u> IEM</p> <p><u>Other Agencies:</u> ACEM and CIDB</p> <p>SIRIM and CIDB</p> <p>DOSH and NIOSH</p>

<ul style="list-style-type: none"> c. Access to higher working platforms d. Safety nets – guidelines for fixing and maintenance e. Safety in falseworks for in-situ beams and slabs f. Safety in falseworks for overhead bridges and structures 	
<p>6.8 More Commitment by Supervisory Staff</p> <p>The committee is of the view that if there is more commitment by Supervisory Staff such as engineers, designers, construction superintendents, builders, project managers, quantity surveyors, safety and health officers, many of the practical problems on construction sites could be arrested. This commitment to safety, health and environment will help to implement all the necessary requirements for safety and health at the planning, design, and tender stages where requirement for provision for funds could be envisaged.</p> <p>The same commitment should also be continued during the construction, monitoring, reporting and corrective action phases during the implementation and closing stages.</p>	<p><u>Lead Agency:</u></p> <p><u>NIOSH</u></p> <p><u>Other agencies:</u></p> <p>IEM, ACEM, CIDB, DOSH, engineers, supervisory staffs, project managers, quantity surveyors and health officers</p>

7.0 CONCLUSIONS

The Institution of Engineers, Malaysia considers that safe practice in the construction environment is an absolute necessity. The recommendations given in this Position Paper are practical and could be achieved if due consideration and agreement can be obtained from professional organisations, local and government agencies. Concerted effort is necessary and the members of the Institution should be more than willing to implement such guidelines and regulations in the interest of good service to the society.

APPENDIX A

LIST OF COMMITTEE MEMBERS

Assoc. Prof. Ir. Dr. Mohd. Zamin Jumaat (Chairman)	IEM
Ir. Tu Yong Eng (Secretary)	IEM
Ir. CMM Aboobucker	IEM
Ir. Hooi Wing Chuen	IEM
Ir. Seth Lim Sow Wu	IEM
Ir. Lee Kee Bau	IEM
Mr. Ke Geok Chuan	DOSH
Mr. Azman Sah Sabali	NIOSH
Mr. Raslim Salleh	CIDB
Ir. Dr. Abdul Majid Dato' Abu Kassim	ACEM
Ir. Ho Hak Kiew	MBAM
Mr. Andrew Pak Soon Hock	MISIF
Mr. Ko Beng Hooi	MISIF

APPENDIX B

DEFINITION OF TERMS

Scaffold.

Scaffold is defined as any temporary structure on or from which a person works in connection with an operation or work. It also includes any temporary structure which enables a person to obtain access to or which enable materials to be taken to any place at which such work is performed and include any working platform, gangway, skip, ladder or step ladder which does not form part of such structure together with any guard-rail, toe board or other safeguards and all fixings but does not include any lifting appliances or lifting machine. It is used merely to support such an appliance or such a machine as to support other plant or equipment.

False work

False work is a temporary structure, which enables the permanent structure to be constructed while it is not self-supporting.