

The Institution of Engineers, Malaysia

IEM
REVISED POSITION STATEMENT
JAN 2015

PREVENTION OF COLLAPSE OF

PART A: SCAFFOLDING

AND

PART B: FALSEWORK

Prepared by

**THE CIVIL AND STRUCTURAL TECHNICAL DIVISION
THE INSTITUTION OF ENGINEERS, MALAYSIA**

**PAPER ON IEM REVISED POSITION STATEMENT:
PREVENTION OF COLLAPSE OF SCAFFOLDING AND FALSEWORK**

by

The Civil and Structural Technical Division of the Institution of Engineers, Malaysia

EXECUTIVE SUMMARY

Due to the frequent incidents of collapse of scaffolding and falsework, the Institution of Engineers, Malaysia (IEM) through its Civil and Structural Technical Division (C&S TD) formed a Position Paper Committee to formulate IEM revised view on this matter. This view supersedes the original IEM Position Paper of July 2005.

The C&S TD convened the first Committee Meeting to review the original paper in July 2013, after which more meetings were held to deliberate the issue. Highlights of the meetings held to revise the original paper are as follows:

- **Committee Members:** The Position Statement Committee members were by invitation. They comprised a group of broad-based professionals representing various professional bodies, government agencies, companies and individuals related to scaffolding, falsework, safety and the construction industries in order to achieve a balanced view. The full lists of the Members and their Organisations are listed in **Appendix E**.
- **Consensus Reached:** The committee members agreed that the main the causes of collapse include the lack of safety considerations at the design stage, improper or bad construction practice, usage of inferior materials, lack of enforcement and lack of maintenance.
- **Committee Recommendations:** To prevent or mitigate collapse of scaffolding and falsework, the committee made several recommendations, including the following:
 - Provision of sufficient funds for safety, health and environmental programme for each construction project.
 - Inclusion of items for safety, health and environment management requirement in the preliminaries of all construction contract documentations, as well as amendments to relevant local acts and regulations.
 - Updating guidelines and codes of practice.

- Having mandatory requirement for sufficient training for supervisory personnel and erection teams.
 - Having more stringent enforcement.
 - Providing additional guidelines.
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- **Conclusion by the Committee:** The objectives of the recommendations could be achieved if the related professional organisations, government agencies and the individual professionals involved could be persuaded to believe strongly that safety is the utmost concern in any construction work. For this to happen, continuous awareness activities on safety issues must be emphasised.

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1.0 WHAT IS IT ALL ABOUT?

There have been numerous reports in the media about failures of scaffolding and falsework. The main reasons could be attributed to the lack of attention on the safety aspects in the installation, maintenance and dismantling of scaffolding 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. In response to this concern and to address the problems associated with it, the Institution of Engineers, Malaysia (IEM) formed a special committee called the Position Paper Committee, which was given the mandate to study the causes of failures and to recommend suitable measures to mitigate these types of failures as well as to produce a Policy Statement that could be forwarded to the relevant authorities and agencies for appropriate actions to be taken.

1.1 Scaffolding and Falsework: What are they?

1.1.1 Scaffolding

What is scaffolding?

It is a temporarily provided structure on or from which a person performs various works in connection with an operation or work to which the Building Operations and Works of Engineering Construction Regulation applies. The scaffolding enables a person to obtain access to the work area and enables materials to be taken to any place at which such work is performed and includes any working platform, gangway, skip, ladder or step ladder, guard-rail, toe board or other safeguards and all fixings.

What is not considered as scaffolding?

Scaffolding does **NOT** include temporary structures used merely to support appliances, machines, other plants and equipment.

1.1.2 Falsework

What is falsework?

It is a temporary structure, which enables the permanent structure to be constructed while it is not self-supporting. The falsework is used as a short-term temporary structure, which must be dismantled after the permanent works have achieved the required strength.

What is not considered as falsework?

Falsework does NOT include permanent works, which are parts of a construction project that will be used and remain in position permanently. The construction of most types of permanent works will require the use of some form of falsework.

1.2 Understanding the Objectives and Issues

The Position Statement Committee's main objectives were to identify issues and problems as well as provide recommendations concerning scaffolding and falsework encountered in the local construction industry. The committee's tasks also included the formulation of a balanced view on the prevention of collapse of scaffolding and falsework.

The key issues identified by the committee are:

- i. **Lack of concern for safety:** There has been a lack of attention on the safety aspects in the installation, maintenance and dismantling of scaffolding and falsework, especially during the boom period in the last decade. Scaffolding and falsework safety must be seen as one of the major concerns in the industry. In a study conducted in the United States, it was found that about 65% (assumed similar for Asia) of construction workers will be working in one form of scaffolding or falsework, at one time or another.

- ii. **Violation of safety rules:** Existing legislations and guidelines have not been effective enough to produce satisfactory solution. Safety rules are frequently violated.
- iii. **Insufficient allocation of construction safety funds:** Funds allocated for construction safety in the construction budget are insufficient. This seems to be the norm in the industry.
- iv. **Lack of competent personnel:** The lack of competent supervisor/scaffolders/workers for supervision, erecting, maintaining and dismantling scaffolding and falsework is very apparent.

1.3 The Approach Taken

The Position Statement Committee took the following approach in formulating a balanced view on the prevention of collapse of scaffolding and falsework:

- 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.

1.4 Position Paper Committee: Who are the members?

The Civil and Structural Engineering Technical Division (C&S TD) of the Institution of Engineers, Malaysia (IEM) spearheaded the formation of the relevant committee in studying the issues raised. In forming the Position Statement Committee, various individuals and agencies related to the construction industry were invited to join the committee. These include:

- i. Practising Engineers and Industry Experts/Specialists.
- ii. The Public Works Department (JKR).
- iii. Professors from leading universities.
- iv. The Department of Safety and Health (DOSH).
- v. The Construction Industry Development Board (CIDB).
- vi. The National Institute of Occupational Safety and Health (NIOSH).
- vii. The Association of Consulting Engineers, Malaysia (ACEM).
- viii. The Master Builders Association Malaysia (MBAM).
- ix. The Malaysian Institution of Steel Industries Federation (MISIF).
- x. Manufacturers of Scaffolding and Falsework.

The full list of the IEM Position Statement Committee members is given in **Appendix E**.

2.0 WHAT EXACTLY IS THE PROBLEM? HOW DOES MALAYSIA PERFORM COMPARED WITH HIGHLY DEVELOPED COUNTRIES?

In the original Position Paper of July 2005, it was identified that the rise in the number of accidents related to scaffolding and falsework in Malaysia were primarily caused by:

1. Poor design.
2. Poor installation and dismantling.
3. Inferior materials.
4. Lack of maintenance.
5. Lack of enforcement.

This situation has been exacerbated by the increased number of construction projects and the influx of poorly trained unskilled foreign labour.

Comparing the Malaysian situation with highly developed countries with the lowest ratios in death and accidents per construction worker, the success factors of the highly developed countries were identified as follows:

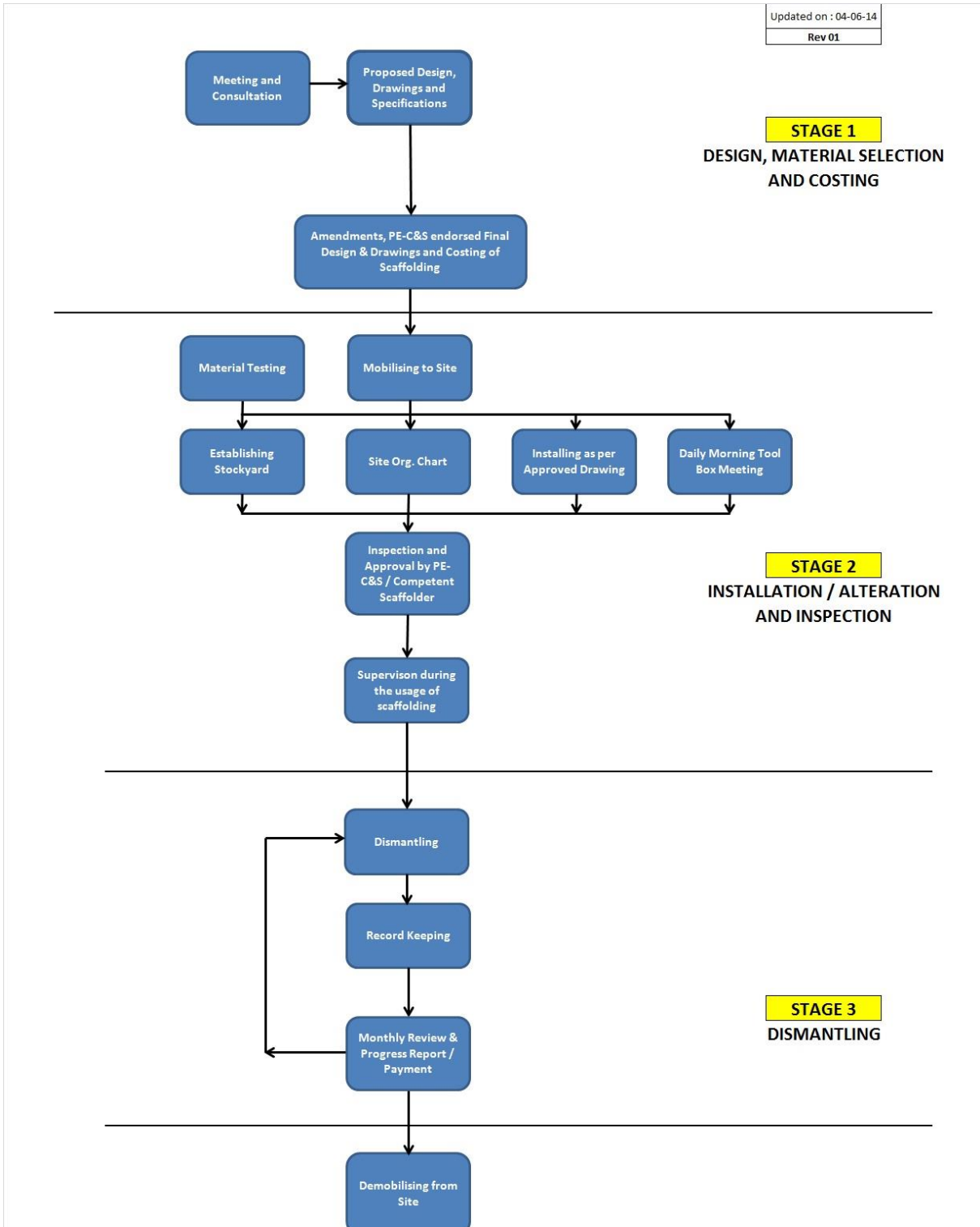
1. **Safety Outcomes** are clearly defined e.g. reduced work-related death, reduced exposure to hazards, improved hazard control, improved health and safety infrastructure, etc.
2. Safety targets have **Key Performance Index (KPI)** to measure the progress and success in achieving the goals.
3. The **Action Areas** to achieve Safety Outcomes are clearly defined:
 - a. **Health and safety by design** – all structures, plants and work processes are designed and managed to eliminate hazards and risks.
 - b. **Health and safety capabilities** – those providing work health and safety education, training, inspection, advice, etc. have appropriate capabilities.
 - c. **Leadership and culture** – leaders in the organisations and community foster a culture of actively improving work health and safety.
 - d. **Research and evaluation** – the results of research and evaluation are used as evidence and are disseminated to all with the aim of prioritising progress in areas of national interest.
 - e. **Responsive and effective regulatory framework** – the relationships between regulators and all those who work in health and safety are effective, constructive, transparent and accountable.

The gap between the Malaysian situation and the highly developed countries can be bridged through a systematic approach.

The Position Statement Committee has reviewed the process flows for scaffolding & falsework separately, as well as identified the Malaysian construction sector's key failure factors for both areas and recommended steps to mitigate them in the following sections.

PART A: SCAFFOLDING

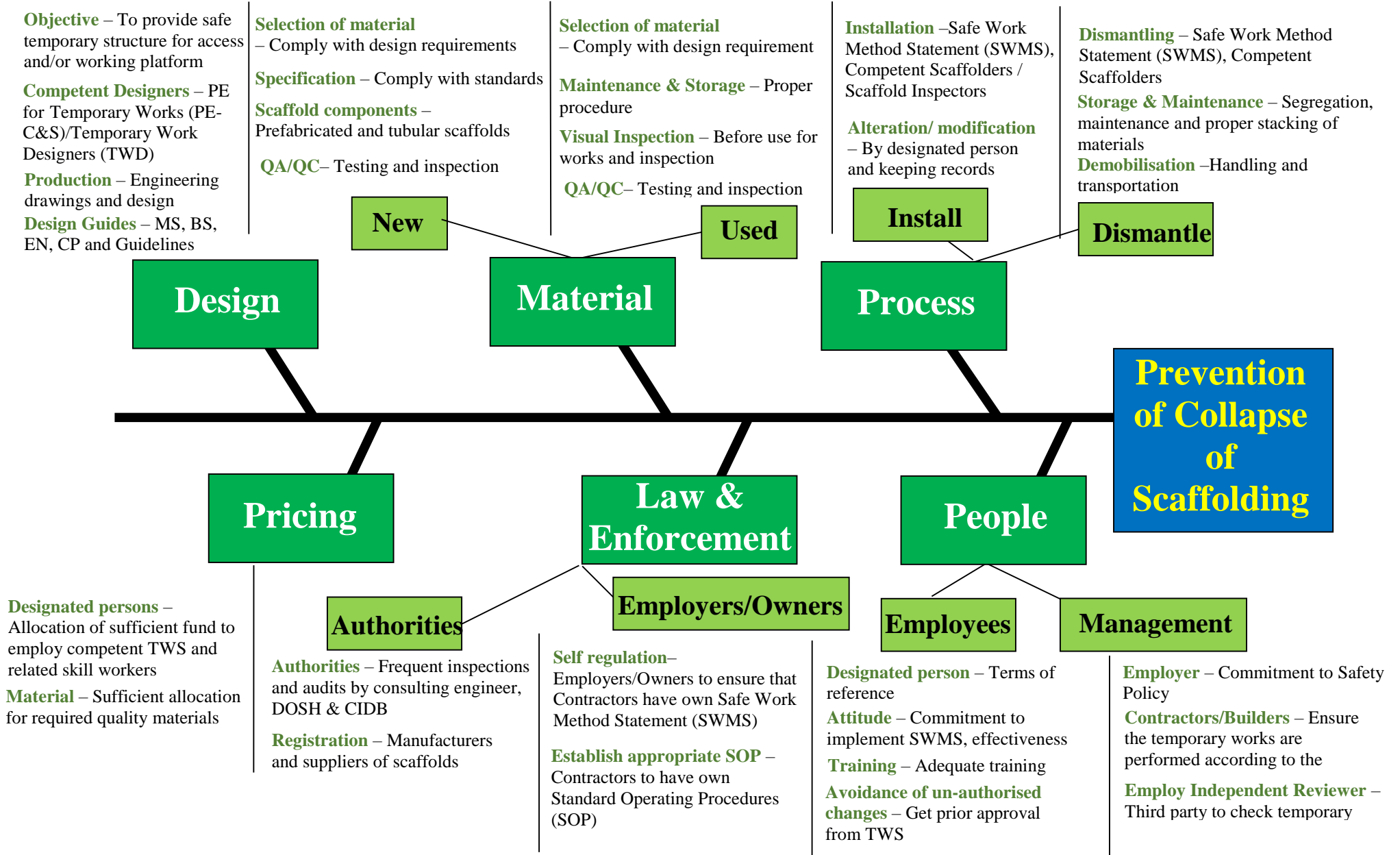
3.0 PROCESS FLOWCHART FOR DESIGN, INSTALLATION AND DISMANTLING OF SCAFFOLDING



4.0 HOW TO PREVENT COLLAPSE OF SCAFFOLDING?

The following Cause Effect diagram contains the recommendations to prevent collapse of scaffolds:

CAUSE EFFECT DIAGRAM FOR PREVENTION OF COLLAPSE OF SCAFFOLDING



5.0 WHAT ARE THE FAILURE FACTORS FOR SCAFFOLDING AND HOW TO ADDRESS THEM?

The failure factors for scaffolding in the Malaysian construction sector and the recommendations to address these factors are as follows:

FAILURE FACTORS AND RECOMMENDATIONS FOR SCAFFOLDING

	<i>Causes</i>	<i>Factor</i>	<i>Recommendation (Scaffold)</i>	<i>References / Remark/Action</i>
1	Design			
		<i>Purposes/Objectives – To provide safe temporary structure for access and/or working platform.</i>	<ol style="list-style-type: none"> 1. <i>Civil & Structural Consultant Engineers/Permanent Works Designers (PWD) to provide the input for the design concept, and the critical points of requirements (i.e. the ground condition, structural and construction loads, all RC layout plans, architecture sections/elevations, changes in design during construction stage).</i> 2. <i>Safe Work Method Statement (SWMS) should be provided by contractors for installation, maintenance and dismantling.</i> 3. <i>Professional Engineers (Civil & Structural with practising certificate) for Temporary Works (PE-C&S) / Temporary Works Designers (TWD) have a duty to ensure so far as reasonably practicable, that the structure is designed to take the loads as well as required safety precautions.</i> 	<p><i>MS 1462, Metal Scaffolding Part 1-4, BS EN 12810: 1&2 , BS EN 12811:1-3, BS 1139: 1-5</i></p> <p><u><i>Action by:</i></u> <i>Consultant/PWD, Contractors, TWD/PE-C&S.</i></p>

	<i>Causes</i>	<i>Factor</i>	<i>Recommendation (Scaffold)</i>	<i>References / Remark/Action</i>
		<p>Usage – Temporary structure to enable people to access and to perform job.</p>	<ol style="list-style-type: none"> 1. The design should include dead loads, imposed loads and environmental loads (wind load). 2. Design procedures: the design of scaffolds should be analysed and checked according to the following main criteria: <ul style="list-style-type: none"> - Structural strength of member and connections. - Lateral stability of the structure. - Overturning of the structure. - Positioning stability of the structure of scaffolds. 3. Briefing by TWD/PE-C&S should be conducted for the construction site personnel such as contractors and other trades workers. 4. Toolbox talk should include information on the design criteria and the safety aspects. 	<p><u>Action by:</u> TWD/PE-C&S.</p>
		<p>Competent Designer – Professional Engineers (Civil & Structural with practising certificate) for Temporary Works (PE-C&S) / Temporary Work Designers (TWD).</p>	<ol style="list-style-type: none"> 1. TWD/PE-C&S is a competent person to design the temporary works, for example, civil engineer experienced in structural design, to ensure that the scaffolds structure is capable of carrying the loads that will be applied to it. 	<p><i>Current Practice:</i> The prefabricated scaffolds (frame and modular scaffold) exceeding 15.0 m height, and the drawing and calculation should be verified and endorsed by Professional Engineer (Civil & Structural Engineering) (PE-C&S).</p>

	<i>Causes</i>	<i>Factor</i>	<i>Recommendation (Scaffold)</i>	<i>References / Remark/Action</i>
			<p>2. Any tubular scaffolds exceeding 15.0 m in height is recommended to be verified and endorsed by PE-C&S.</p>	<p>The design of tubular scaffolds exceeding 40.0 m height is to be verified and endorsed by PE-C&S.</p> <p>Code of practice for metal scaffolding safety by Occupational Safety & Health Labour Department of Hong Kong (March 2013).</p> <p><u>Action by:</u> TWD/PE-C&S.</p>
		<p>Production – Proper drawings and design.</p>	<p>1. The scaffolds design drawings (such as layout plans, elevations, sections, sole plate details, and details of tie to the adjacent structure if required) are preferable for better understanding of the intention of the TWD/PE-C&S.</p>	<p>Factories and Machinery Act 1967 (Act 139) Part X – Scaffolds, page 324-333.</p> <p><u>Action by:</u> TWD/PE-C&S.</p>
		<p>Design Guide – MS, BS, EN, CP and Guidelines.</p>	<p>1. National or international standards, Code of Practices (CP) and Guidelines should be adopted for the design of scaffolds structures.</p> <p>2. The current Safety Factor (SF) of 4.0 as required by DOSH for tubular scaffolds</p> <p>3. For other types of scaffolds, the SF should be 4.0.</p>	<p>Code of practice for metal scaffolding safety by Occupational Safety & Health labour Department of Hong Kong (March 2013.)</p> <p>Factories and Machinery Act 1967 (Act 139) Part X – Scaffolds, page 324-333.</p> <p><u>Action by:</u> TWD/PE-C&S.</p>

	<i>Causes</i>	<i>Factor</i>	<i>Recommendation (Scaffold)</i>	<i>References / Remark/Action</i>
2	Material			
	<i>a. New scaffold components</i>	<i>Selection of Materials – Comply with design requirement.</i>	<ol style="list-style-type: none"> <i>1. The TWD/PE-C&S should check with the contractor the preferred materials to be used and shall design accordingly.</i> <i>2. Alteration of the materials is not permitted without prior approval and verification of the design by the TWD/PE-C&S.</i> 	<i>Action by: TWD/PE-C&S.</i>
		<i>Specification – Comply with standards.</i>	<ol style="list-style-type: none"> <i>1. All materials specifications should comply with national and international standards (such as MS, BS, BS EN).</i> <i>2. Manufacturers and suppliers of scaffold elements and components should be registered with DOSH/CIDB.</i> <p><i>Manufacturers/suppliers to provide maintenance manual.</i></p>	<p><i>All Manufacturers/suppliers shall be registered with CIDB.</i></p> <p><i>Action by:</i> <i>Manufacturers/Suppliers, CIDB, DOSH, TWD/PE-C&S.</i></p>
		<i>Scaffold Components Design – Prefabricated (Frame and Modular) and tubular scaffolds.</i>	<ol style="list-style-type: none"> <i>1. All scaffolds components design should comply with national and international standards (such as MS, BS, BS EN).</i> 	<p><i>MS 1462, Metal Scaffolding Part 1-4, BS EN 12810: 1&2 , BS EN 12811:1-3, BS 1139: 1-5.</i></p> <p><i>Action by:</i> <i>Manufacturers/Suppliers, TWD/PE-C&S.</i></p>
		<i>QA/QC – Testing, inspection.</i>	<ol style="list-style-type: none"> <i>1. Manufacturers to provide test report by accredited laboratory on the product.</i> <i>2. Manufacturers user manual should include maintenance information for continuous re-use and the life time of materials.</i> <i>3. Manufacturers to provide marking on the scaffolds products/frames/components.</i> 	<p><i>MS 1462, Metal Scaffolding Part 1-4, BS EN 12810: 1&2 , BS EN 12811:1-3, BS 1139: 1-5.</i></p> <p><i>Action by:</i> <i>Manufacturers/Suppliers</i></p>

	<i>Causes</i>	<i>Factor</i>	<i>Recommendation (Scaffold)</i>	<i>References / Remark/Action</i>
	<i>b. Used scaffold components</i>	<i>Selection of Materials</i> – <i>Complied with design requirement.</i>	<ol style="list-style-type: none"> <i>1. The TWD/PE-C&S would check with the contractor the preferred materials for the scaffolds and design using the said materials for the scaffolds design.</i> <i>2. Alteration of the materials is not permitted without prior approval and verification of the design by the TWD/PE-C&S.</i> 	<p><u><i>Action by:</i></u> <i>Contractors, TWD/PE-C&S.</i></p>
		<i>Maintenance and Storage</i>	<ol style="list-style-type: none"> <i>1. Proper maintenance procedure (repair and refurbishment) and storage method should be adopted by the contractor/user/supplier.</i> 	<p><i>MS1462-1:2012, Clause 9, Page 15.</i> <u><i>Action by:</i></u> <i>Contractors</i></p>
		<i>QA/QC – Maintenance, inspection, testing & certification.</i>	<ol style="list-style-type: none"> <i>1. Used and refurbished scaffold materials should be well maintained and free of appreciative corrosion, cracks, dents and bends. Such materials should be inspected by a competent person, and tested to verify compliance with the load capacity of the materials.</i> <i>2. An inspection report for maintenance and repair should be kept.</i> 	<p><i>Code of Practice for Metal Scaffolding Safety Clause 6, Page 62.</i> <i>MS 1462-1:2012, Metal Scaffolding - Part 1 Clause 9, Page 15.</i> <u><i>Action by:</i></u> <i>Contractors</i></p>

	<i>Causes</i>	<i>Factor</i>	<i>Recommendation (Scaffold)</i>	<i>References / Remark/Action</i>
3	Processes			
	<i>a. Install</i>	<p>Installation</p> <ul style="list-style-type: none"> – Safe Work Method Statement (SWMS). – By Competent Scaffolders/Scaffold Inspectors 	<ol style="list-style-type: none"> 1. <i>Competent Scaffolders should receive full details of the scaffolds design, and clear any queries with the TWD before commencement of installation.</i> 2. <i>If there are any changes to the scaffold materials, Competent Scaffolders should inform TWD/PE-C&S to verify the use of the alternative material, and to issue revised design drawings and calculations.</i> 3. <i>Safe Work Method Statement (SWMS) to include installation and dismantling procedures. Information on covering for an opening will be provided to prevent the fall of persons and materials.</i> 4. <i>Inspection of temporary works should be carried out by Competent Scaffolders/Scaffold Inspectors (with Tagging System) prior to the usage of the scaffolds structure.</i> 5. <i>Continuous inspection of scaffold should be carried out by Competent Scaffolders/Scaffold Inspectors during the usage period of the scaffold structures.</i> 6. <i>All checklists/inspection report should be up-to-date, kept and available for verification at the site.</i> 	<p><i>Tagging System requirement by DOSH.</i></p> <p><i>Building operations and Works of Engineering Construction Safety Regulation 1986 (BOWEC) : Part X-Scaffolds, page 324-333.</i></p> <p><u>Action by:</u> <i>Contractors, Competent Scaffolders, Scaffold Inspectors, TWD/PE-C&S.</i></p>

	<i>Causes</i>	<i>Factor</i>	<i>Recommendation (Scaffold)</i>	<i>References / Remark/Action</i>
		<i>Alteration/Modification</i>	<ol style="list-style-type: none"> 1. The alteration works should be carried out by the designated person after consultation with the designer; the record to be verified by competent scaffold inspector. 	<p><u>Action by:</u> Contractors, Competent Scaffolders, TWD/PE-C&S.</p>
b. Dismantle		<i>Dismantling</i>	<ol style="list-style-type: none"> 1. The scaffolds structure should be dismantled by Competent Scaffolders according to the correct sequences and procedures. 2. Sufficient time should be allowed for the dismantling work to be conducted safely. 3. The scaffolds to be dismantled should be checked for their strength and stability beforehand. 4. All the stacked materials and debris placed on the scaffold should be removed prior to dismantling. 5. Components which can endanger the stability of the remaining structure should be removed unless necessary precaution has been taken, while tie and bracing should remain secured in position. 6. Dismantling sequence should be planned and that sequence of the dismantling sections of the scaffolds should be logical and determined with due consideration of the scaffolder's safety. Dismantling work should be carried out according to the plan. 	<p>Code of practice for metal scaffolding safety by Occupational Safety & Health Labour Department of Hong Kong (March 2013), page 62-64.</p> <p><u>Action by:</u> Contractors, Competent Scaffolders</p>
		<i>Storage & Maintenance – Segregation, maintenance and proper stacking of materials.</i>	<ol style="list-style-type: none"> 1. All dismantled scaffold materials should be properly segregated according to the individual components. 2. The materials must be inspected by Competent Scaffolders to ensure they are safe for re-use, free of appreciative corrosion, crack, dent and bend. The defective materials should be either disposed or repaired/refurbished prior to the next usage. Inspection report should be kept. 	<p>MS1462-1-2012, clause 9, page 15.</p> <p><u>Action by:</u> Contractors, Competent Scaffolders</p>

	<i>Causes</i>	<i>Factor</i>	<i>Recommendation (Scaffold)</i>	<i>References / Remark/Action</i>
			3. All usable materials should be properly stacked on the raised platform to avoid contact with soil/water.	
		Demobilisation – Handling and transport.	<ol style="list-style-type: none"> 1. Proper stacking method, loading and unloading methods should be adopted to reduce the defects and damages during handling and transportation of the scaffold materials. 2. Guidelines as per manufacturers’ recommendations should be implemented. 	<u>Action by:</u> Contractors, Competent Scaffolders
4	Budget/ pricing			
		Designated Persons – Allocation of sufficient fund to employ competent Temporary Works Supervisors (TWS) and related skill workers.	1. Provisions should be included in the contract documentation for employing competent Temporary Works Supervisors (TWS) and necessary assistants to supervise the scaffold works. Either a fixed preliminary sum should be allocated or a schedule of rates based on man months be included in the contract.	Building operations And Works of Engineering Construction Safety Regulation 1986 (BOWEC) : Part X- Scaffolds, page 324-333. Occupational Safety & Health requirements, JKR contract. <u>Action by: Contractors</u>
		Material – Availability of materials using non-compliance material.	1. Allocation of required funds for scaffolds should be made compulsory in the contract conditions. Contractors/builders are suggested to include sufficient funds for the requirement of all scaffold materials.	<u>Action by: Contractors</u>
5	Law/			

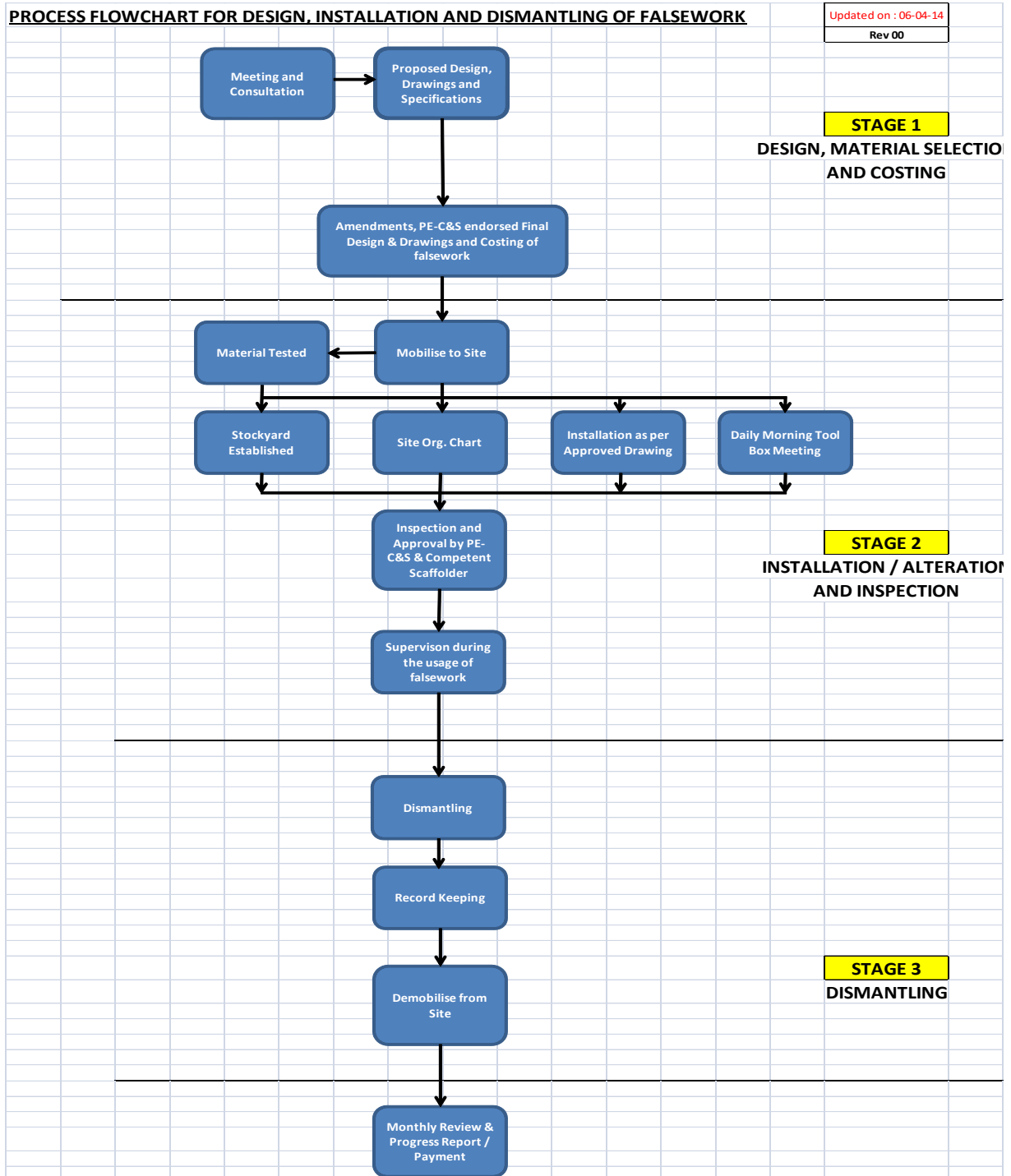
	<i>Causes</i>	<i>Factor</i>	<i>Recommendation (Scaffold)</i>	<i>References / Remark/Action</i>
	enforcement			
	<i>a. Authorities</i>	Authorities – Frequent inspections and audits by consulting engineer, DOSH & CIDB.	<ol style="list-style-type: none"> The consultant engineers/PWD, officers from DOSH/CIDB should have a weekly inspection for the scaffold structures at site and audit all scaffold reports, which have been prepared by TWS. 	<u>Action by:</u> Consultant/PWD, DOSH, CIDB.
	<i>b. Registration</i>	Registration – Manufacturers and suppliers must be registered.	<ol style="list-style-type: none"> The registration of manufacturers and suppliers of scaffold materials for sales and rental should be made compulsory with DOSH/CIDB. This will ensure the scaffold materials to be used at site will comply with the requirements of Standards/Code of Practice. The contractors/builders should use the registered and approved manufacturers' products. Heavy fine should be imposed by DOSH/CIDB on the following trades: <ol style="list-style-type: none"> Un-registered manufacturers and suppliers of scaffold materials. Contractors/builders if non-registered and if they use non-approved manufacturers' products. 	<u>Action by:</u> Manufactures/Suppliers, DOSH, CIDB.
	<i>c. Employer</i>	Self-regulation	<ol style="list-style-type: none"> All contractors/builders and sub-contractors should have their own Safe Work Method Statement (SWMS) for the scaffolds and the contents should be made known to all designated persons, such as Competent Scaffolders, Competent Carpenter, competent TWS, TWD/PE-C&S. 	<u>Action by:</u> Contractors, Competent Scaffolders, Competent Carpenter, competent TWS, TWD/PE-C&S.
		Establish Appropriate SOP	<ol style="list-style-type: none"> All contractors/builders and sub-contractors should have their own Standard Operating Procedures (SOP) for the scaffolds and the contents should be made known to all designated persons such as Competent Scaffolders, Competent Carpenter, competent TWS, competent TWE, TWD/PE-C&S. 	<u>Action by:</u> Contractors, Competent Scaffolders, Competent Carpenter, competent TWS, TWD/PE-C&S.

	<i>Causes</i>	<i>Factor</i>	<i>Recommendation (Scaffold)</i>	<i>References / Remark/Action</i>
6	People			
	a. Management	Employer – Provide safety policy.	1. The employer should ensure that the safety policy has been adopted and implemented by the consultants and all contractors/builders.	<u>Action by:</u> Employers, Contractors
		Contractors/Builders – Ensure the temporary works are performed according to the established procedures and standards.	1. The contractors/builders must ensure that the temporary works are performed according to the established procedures and standards.	<u>Action by:</u> Contractors
		Independent Reviewer/Auditor – Third party to ensure the controlling risk of temporary works.	1. An independent reviewer/auditor (can be the consulting engineer/other PE-C&S) should be employed to carry out third party review of the design of scaffolds and audit the completed scaffolds.	<u>Action by:</u> Contractors, Independent PE-C&S
	b. Worker	Designated Persons	1. The term Designated Persons refer to: i) Competent Scaffolders. ii) Scaffold Inspectors iii) Competent Carpenters. iv) Competent TWS. v) Competent TWD/Professional Engineers (Civil & Structural with practising certificate) (PE-C&S).	<u>Action by:</u> Contractors, Competent Scaffolders, Scaffold Inspectors, TWS, TWD/PE-C&S
		Attitude – Negligence & sabotage.	1. Through continuous safety briefing, provision of suitable welfare facilities and the overall policy of completing the works successfully, the morale of the workers and supervisory staff should be enhanced such that their co-operation is obtained, and negligence and possible sabotage acts could be avoided.	<u>Action by:</u> Contractors, Competent Scaffolders, TWS, TWD/PE-C&S
		Training – Insufficient training.	1. Currently, there is no training course for TWS. CIDB should provide training course for TWS, which could be endorsed in the Green Card.	<u>Action by:</u> Contractors, CIDB

	<i>Causes</i>	<i>Factor</i>	<i>Recommendation (Scaffold)</i>	<i>References / Remark/Action</i>
			<p><i>2. Employer should provide sufficient training for the proper handling of scaffolds, through the establishment of SOP and its effective implementation.</i></p>	
		<p><i>Avoidance of Un-authorized Alteration</i></p>	<p><i>1. Employing trained scaffold workers is necessary to ensure that they will understand the possible consequences of un-authorized alterations. The workers should also be instructed to report to TWS should there be any necessity to remove temporarily any scaffold components.</i></p> <p><i>2. Alteration of the materials and design is not permitted without prior approval and verification of the design by the TWD.</i></p> <p><i>3. If there are any changes to the scaffolds and formwork materials and designs, TWS should inform TWD to verify the use of the alternative material and change of design, to issue revised design drawings and calculation.</i></p>	<p><u><i>Action by:</i></u> <i>Contractors, Competent Scaffolders, TWS, TWD/PE-C&S</i></p>

PART B: FALSEWORK

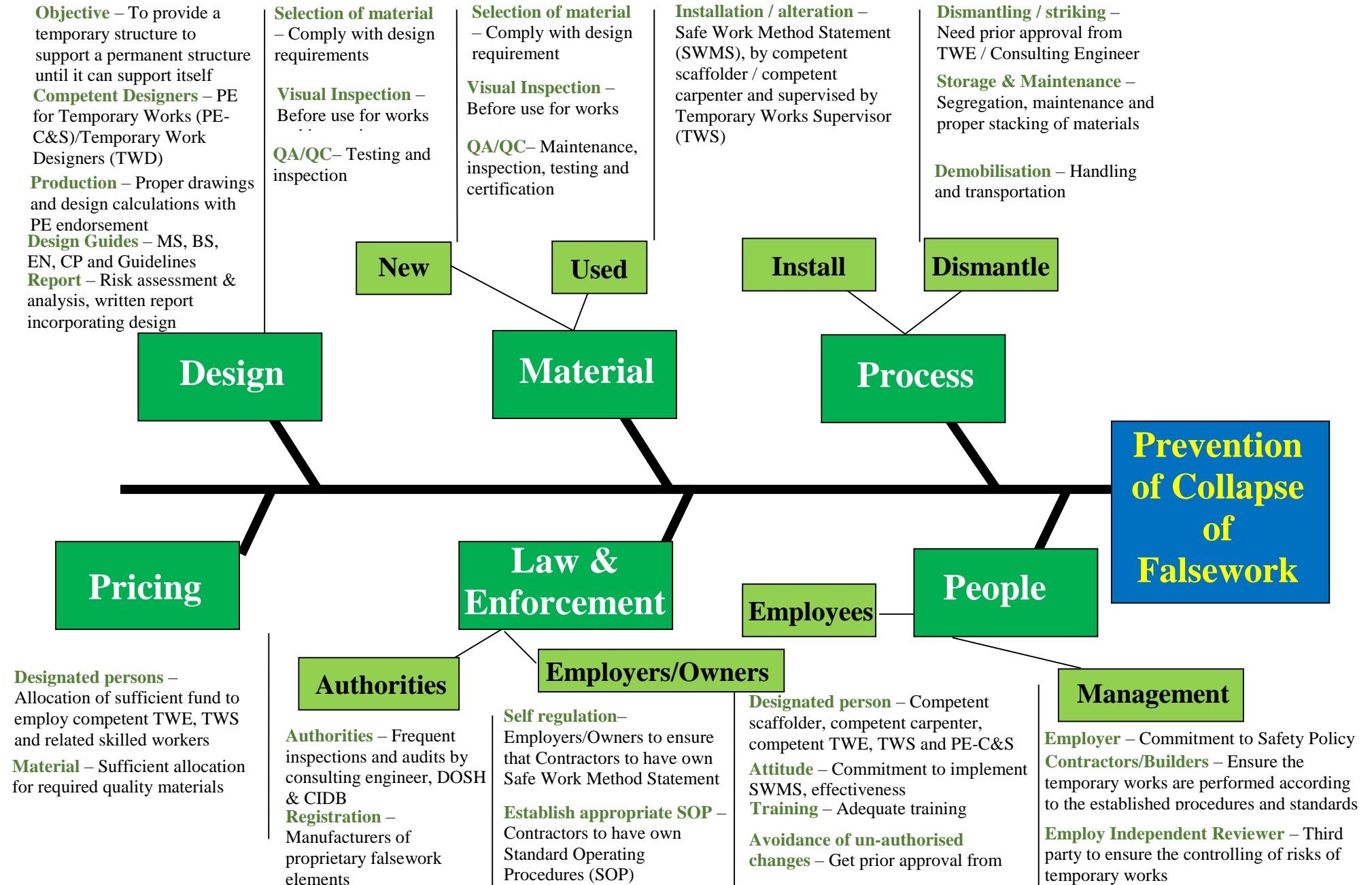
6.0 PROCESS FLOWCHART FOR DESIGN, INSTALLATION AND DISMANTLING OF FALSEWORK



7.0 HOW TO PREVENT COLLAPSE OF FALSEWORK?

The following Cause Effect diagram contains the recommendations to prevent collapse of falsework:

CAUSE EFFECT DIAGRAM FOR PREVENTION OF COLLAPSE OF FALSEWORK



8.0 WHAT ARE THE FAILURE FACTORS FOR FALSEWORK AND HOW TO ADDRESS THEM?

The factors that cause the collapse of falsework have been identified and the recommendations to address these factors are as shown below.

FAILURE FACTORS AND RECOMMENDATIONS FOR FALSEWORK

	<i>Causes</i>	<i>Factor</i>	<i>Recommendation (Falsework)</i>	<i>References / Remark</i>
1	Design			
		<i>Purposes/Objectives</i> – To provide safe temporary support structure.	<p>1. Civil & Structural Consultant Engineers/Permanent Works Designers (PWD) to provide the input for the design concept, and the critical points of requirements (i.e. the ground condition, structural and construction loads, all RC layout plan, architecture sections/elevations, changes in design during construction stage).</p> <p>1. Safe Work Method Statement (SWMS) should be provided by contractor to Temporary Works Designers (TWD)/ Professional Engineers (Civil & Structural with practising certificate) for Temporary Works (PE-C&S).</p> <p>2. TWD/PE-C&S have a duty to ensure so far as reasonably practicable, that the structure is designed to be without risks to the health and safety of persons in relation to the manufacture assembly, construction or use of the structure or the proper demolition or disposal of the structure.</p>	<p><i>BS 5975, Section 2, PWD, Clause 6.1.3, Page 21.</i></p> <p><i>BS 5975, Clause 17, Construction Load, Page 59.</i></p> <p><i>Draft CP : Formwork and Falsework by Safe Work Australia, Page 11.</i></p> <p><u>Action by:</u> <i>Consultant/PWD, Contractors, TWD/PE-C&S</i></p>
		<i>Usage</i> – Temporary structure to support the permanent structure until it can support itself.	<p>1. The design should include dead loads, imposed loads, environmental loads and accidental loads.</p> <p>2. Design procedures: the design of scaffold and false work should be analysed and checked according to the following three main criteria:</p> <p>i. Structural strength of member and connections.</p> <p>ii. Lateral stability of the structure.</p> <p>iii. Overturning of the structure.</p>	<p><i>Draft CP: Formwork and Falsework by Safe Work Australia, Page 15.</i></p> <p><i>BS 5975, Clause 19.4, Design, Page 117.</i></p> <p><u>Action by:</u> <i>Contractors, TWD/PE-C&S.</i></p>

	Causes	Factor	Recommendation (Falsework)	References / Remark
			<p>iv. Positioning stability of the falsework.</p> <p>2. Briefing by TWD should be conducted for the construction site personnel, such as contractors and other trades workers.</p> <p>3. Toolbox talk should include information on the design criteria and the safety aspects.</p>	
		<p>Competent Designer – Professional Engineer (Civil & Structural with practising certificate) for Temporary Works (PE-C&S) / Temporary Work Designer (TWD).</p>	<p>1. TWD/PE-C&S is a competent person to design the temporary works, for example, civil engineer experienced in structural design, to ensure that the falsework structure is capable of carrying the loads that will be applied to it.</p>	<p>Draft CP: Formwork and Falsework by Safe Work Australia, Page 14.</p> <p><u>Action by:</u> TWD/PE-C&S</p>
		<p>Design Guide – MS, BS, EN, CP and Guidelines.</p>	<p>1. National or international standards, Code of Practices (CP) and Guidelines should be adopted for the design of falsework structures.</p> <p>2. The factor of safety should be 2.0 as in BS 5975.</p>	<p>Draft CP: Formwork and Falsework by Safe Work Australia, Clause 16.9.4, Page 54.</p> <p><u>Action by:</u> TWD/PE-C&S</p>
		<p>Production – Proper drawings and design calculation with Professional Engineer (Civil and Structural Engineering) (PE-C&S) endorsement.</p>	<p>1. The falsework design drawings (such as falsework layout plans, elevations, sections, sole plate details, formwork details and details of tie to the adjacent structure if required) are preferable for better understanding of the intention of the TWD. This will help to control the falsework structure during its period of use.</p>	<p>Factories and Machinery Act 1967 (Act 139) Part III Concrete Works, Clause 28 General Requirement, page 412.</p> <p><u>Action by:</u> TWD/PE-C&S</p>
		<p>Report – Risk assessment & analysis, written report.</p>	<p>1. The TWD of the falsework structure or any parts of the structures to be constructed must give the employer a written report that specifies the hazards associated with the design of the structure and the control measures.</p>	<p>Draft CP: Formwork and Falsework by Safe Work Australia, R295, Page 11.</p> <p><u>Action by:</u> TWD/PE-C&S</p>
		<p>Include– Design of formwork.</p>	<p>1. The design of the falsework includes the design of formwork for wet concrete as well as major pre-cast concrete elements or steel sections.</p>	<p>Draft CP: Formwork and Falsework by Safe Work Australia, Page 15.</p> <p><u>Action by:</u> TWD/PE-C&S</p>

	<i>Causes</i>	<i>Factor</i>	<i>Recommendation (Falsework)</i>	<i>References / Remark</i>
2	Material			
	<i>a. New falsework materials</i>	<i>Selection of Materials</i> – Comply with design requirement.	<ol style="list-style-type: none"> 1. The TWD would check with the contractor the preferred materials for the falsework and design using the said materials for the falsework design. 2. Alteration of the materials is not permitted without prior approval and verification of the design by the TWD. 	<u>Action by:</u> TWD/PE-C&S
		<i>QA/QC</i> – Testing & certification.	<ol style="list-style-type: none"> 1. Manufacturer to provide test report by accredited laboratory on the product. 2. Manufacturer user manual should include maintenance information for continuous re-use and the life time of material. 	<u>Action by:</u> Manufacturers/Suppliers, Contractors, TWD/PE-C&S.
	<i>b. Used falsework materials</i>	<i>Selection of Materials</i> – Comply with design requirement.	<ol style="list-style-type: none"> 1. The TWD would check with the contractor the preferred materials for the falsework and design using the said materials for the falsework design. 2. Alteration of the materials is not permitted without prior approval and verification of the design by the TWD. 	<u>Action by:</u> Contractors, TWD/PE-C&S
		<i>QA/QC</i> – Maintenance, inspection, testing & certification	<ol style="list-style-type: none"> 1. If scaffold tubes and fittings are used as falsework materials, they should be checked and inspected by a competent person. The materials should be free of appreciative corrosion, cracks, dents and bends. 2. For other types of used and refurbished falsework, materials should be well maintained and free of appreciative corrosion, cracks, dents and bends. Such materials should be inspected by a competent person, and tested to verify compliance with the load capacity of the materials. 3. Manufacturer user manual should include maintenance information for continuous re-use and the life time of material. 	<p>Code of Practice for Metal Scaffolding Safety Clause 6, Page 62.</p> <p>MS 1462-1:2012, Metal Scaffolding - Part 1 Clause 9, Page 15.</p> <p><u>Action by:</u> Contractors</p>

	<i>Causes</i>	<i>Factor</i>	<i>Recommendation (Falsework)</i>	<i>References / Remark</i>
3	<i>Processes</i>			
		<p>Installation/Alteration</p> <ul style="list-style-type: none"> – Safe Work Method Statement (SWMS.) – By Competent Scaffolder /Competent Carpenter and supervised by Temporary Works Supervisor (TWS). 	<ol style="list-style-type: none"> 1. Temporary Works Supervisor (TWS) should receive full details of the falsework and formwork design, and clear any queries with the TWD before commencement of installation. 2. If there are any changes of the falsework and formwork materials, TWS should inform TWD to verify the use of the alternative material, to issue revised design drawings and calculation. 3. Safe Work Method Statement (SWMS) to include installation and dismantling process. 4. Inspection of temporary works should be carried out by competent scaffolder (with Tagging System), TWS/PE-C&S, who certify the falsework drawing prior to the usage of the falsework structure. 5. Continuous inspection should be carried out by the TWS during concreting of the approved location/area. 6. All checklists/inspection reports should be up-to-date, kept and available for verification at the site. 	<p>Tagging System requirement by DOSH.</p> <p>Building operations and Works of Engineering Construction Safety Regulation 1986 (BOWEC) : Part 3, Concrete Work, regulation 29 (3), page 412.</p> <p><u>Action by:</u> Contractors, Competent Scaffolders, Competent Carpenters, TWD/PE-C&S</p>
		<p>Dismantling/Striking – Need prior approval from TWD/PE-C&S/Consulting Engineer.</p>	<ol style="list-style-type: none"> 1. Written confirmation that the permanent structure is self-supporting and the falsework and formwork can be safely removed should be obtained from TWD/consulting engineer prior to commencement of dismantling processes. 2. For in-situ concrete structures, all or most of the formwork should be removed before the falsework is removed. 	<p>Draft CP: Formwork and Falsework by Safe Work Australia, Page 33& 34.</p> <p><u>Action by:</u> Contractors, Competent Scaffolders, Competent Carpenters</p>
		<p>Storage & Maintenance – Segregation, maintenance and proper stacking of materials.</p>	<ol style="list-style-type: none"> 1. All dismantled falsework & formwork materials should be properly segregated according to the individual components. 2. The materials must be inspected by TWS to ensure it is safe for re-use, free of appreciative corrosion, crack, dent and bend. The defective materials should be either 	<p>MS1462-1:2012, clause 9, page 15.</p> <p><u>Action by:</u> Contractors, Competent Scaffolders, Competent Carpenters</p>

	<i>Causes</i>	<i>Factor</i>	<i>Recommendation (Falsework)</i>	<i>References / Remark</i>
			<p><i>disposed or repaired/refurbished prior to the next usage. Inspection report should be kept.</i></p> <p><i>3. All usable materials should be properly stacked on the higher platform to avoid contact with water.</i></p>	
4	Budget			
		<p>Designated Persons – Allocation of sufficient fund to employ competent Temporary Works Supervisors (TWS) and related skill workers.</p>	<p><i>1. Provisions should be included in the contract documentation for employing competent TWS and necessary assistants to supervise the falsework & formwork. Either a fixed preliminary sum should be allocated or a schedule of rates based on man months be included in the contract.</i></p>	<p><i>Building Operations and Works of Engineering Construction Safety Regulation 1986 (BOWEC) : Part 3, Concrete Work, regulation 29, page 412.</i></p> <p><i>Occupational Safety & Health Bill, JKR contact.</i></p> <p><u>Action by:</u> Contractors</p>
		<p>Materials – Allocation of sufficient fund to provide materials.</p>	<p><i>1. Allocation of required funds for falsework should be made compulsory in the contract condition. Contractors/builders must include sufficient funds for the requirement of all falsework materials. This could be in the range of 5% or more in the case of cast in-situ RC structures.</i></p>	<p><u>Action by:</u> Contractors</p>
5	Law/enforcement			
	<i>a. Authorities</i>	<p>Authorities – Frequent inspections and audits by Consulting Engineer, DOSH & CIDB.</p>	<p><i>1. The consulting engineers and officers from DOSH/CIDB should have a weekly inspection for the falsework structures at site and audit all falsework reports, which have been prepared by TWS.</i></p>	<p><u>Action by:</u> Consultants/PWD, DOSH, CIDB</p>
	<i>b. Registration</i>	<p>Registration– Manufacturers and suppliers must be registered.</p>	<p><i>1. The registration of manufacturers and suppliers of falsework materials for sales and rental should be made compulsory with DOSH. This will ensure that the falsework materials to be used at site will comply with the requirements of Standards/Code of Practice.</i></p> <p><i>2. The contractors/builders should use registered and approved manufacturers' products.</i></p>	<p><u>Action by:</u> Manufacturers/Suppliers, DOSH, CIDB</p>

	<i>Causes</i>	<i>Factor</i>	<i>Recommendation (Falsework)</i>	<i>References / Remark</i>
			<p>3. Heavy fine should be imposed by DOSH on the following trades:</p> <p>iii) Un-registered manufacturers and suppliers of falsework materials.</p> <p>iv) Non-registered Contractors/builders and those using non-approved manufacturers' products.</p>	
	<i>c. Employer</i>	<i>Self-regulation</i>	<p>1. All contractors/builders and sub-contractors should have their own Safe Work Method Statement (SWMS) for the falsework and the contents should be made known to all designated persons such as competent scaffolder, competent carpenter, competent TWS, competent TWE, PE-C&S.</p>	<p><u>Action By:</u> Contractors, Competent Scaffolders, Competent Carpenter, Competent TWS, TWD/PE-C&S</p>
		<i>Establish Appropriate SOP</i>	<p>1. All contractors/builders and sub-contractors should have their own Standard Operating Procedures (SOP) for the falsework and the contents should be made known to all designated persons, such as competent scaffolder, competent carpenter, competent TWS, competent TWE, PE-C&S.</p>	<p><u>Action By:</u> Contractors, Competent Scaffolders, Competent Carpenter, Competent TWS, TWD/PE-C&S</p>
6	People			
	<i>a. Management</i>	<i>Employers/Owners – Provide safety policy.</i>	<p>1. The employer should ensure that the safety policy has been adopted and implemented by the consultants and all contractors/builders.</p>	<p><u>Action By:</u> Employers/Owners, Contractors</p>
		<i>Contractors/Builders – Ensure that the temporary works are performed according to the established procedures and standards.</i>	<p>1. The contractors/builders must ensure that the temporary works are performed according to the established procedures and standards.</p>	<p><u>Action By:</u> Contractors</p>
		<i>Independent Reviewer/Auditor– Third party to ensure the controlling risk of temporary works.</i>	<p>1. An independent reviewer/auditor (can be the consulting engineer/other PE-C&S) should be employed to carry out third party review of the design of falsework and audit the completed falsework.</p>	<p><u>Action By:</u> Contractors, Independent PE-C&S</p>

	Causes	Factor	Recommendation (Falsework)	References / Remark
	b. Worker	Designated Persons	<p>1. The term Designated Persons refers to:</p> <ul style="list-style-type: none"> i. Competent Scaffolders. ii. Competent Carpenters. iii. Competent TWS. iv. Competent TWD/Professional Engineers – Civil & Structural Engineering (PE-C&S.) 	<p>Action By:</p> <p>Contractors, Competent Scaffolders, Competent Carpenter, Competent TWS, TWD/PE-C&S</p>
		Attitude – Negligence & sabotage	<p>1. Through continuous safety briefing, provision of suitable welfare facilities and the overall policy of completing the works successfully, the morale of the workers and supervisory staff should be enhanced such that their co-operation is obtained, and negligence and possible sabotage acts could be avoided.</p>	<p>Action By:</p> <p>Contractors, Competent Scaffolders, Competent Carpenter, Competent TWS, TWD/PE-C&S</p>
		Training – Insufficient training.	<p>1. Currently, there is no training course for TWS. CIDB should provide training course for TWS, which could be endorsed in the Green Card.</p> <p>2. Employer should provide sufficient training for the proper handling of falsework through the establishment of SOP and its effective implementation.</p>	<p>Action By:</p> <p>Contractors, CIDB</p>
		Avoidance of Un-authorized Alteration	<p>1. Employing trained falsework workers is necessary to ensure that they will understand the possible consequences of un-authorized alterations. The workers should also be instructed to report to TWS should there be any necessity to remove temporarily any falsework components.</p> <p>2. Alteration of the materials and design is not permitted without prior approval and verification of the design by the TWD.</p> <p>3. If there are any changes of the falsework and formwork materials and design, TWS should inform TWD to verify the use of the alternative material and change of design, and to issue revised design drawings and calculation.</p>	<p>Action By:</p> <p>Contractors, Competent Scaffolders, Competent Carpenter, Competent TWS, TWD/PE-C&S</p>

9.0 CONCLUSION

The Position Statement Committee Institution of Engineers, Malaysia considers that safe practices in the construction environment are an absolute necessity in order for our industry to keep up with the nation's growth. The Committee has presented their findings in the form of a "Cause Effect Diagram" and "Failure Factors and Recommendations" tables for ease of understanding.

The recommendations given in this Position Paper have taken into account issues identified as contributing to the failure of scaffolding and falsework in our local construction industry such as allocation of funds, material quality, competency and enforcement.

These recommendations are practical and achievable if due consideration and commitment are obtained from professional organisations, local and government agencies and all stakeholders. Concerted effort is necessary and the IEM is ready and willing to assist in the implementation of the above recommendations, in the interest of good service to the society.

REFERENCES

1. British Standard BS 5975:2008 + A1:2011, Code of practice for temporary works procedures and the permissible stress design of falsework, British Standards Institution.
2. British Standard BS EN 12812:2008, Falsework – performance requirements and general design, British Standards Institution.
3. Code of Practice for Metal Scaffolding Safety, Occupational Safety and Health Branch, Labour Department, Hong Kong.
4. Draft Code of Practice, Formwork and Falsework, Safe Work Australia: <http://www.safeworkaustralia.gov.au/sites/SWA/model-whs-laws/model-COP/Documents/Draft-COP-December-2012/DRAFT-formwork-falsework-COP.pdf>
5. Factories and Machinery Act 1967 (Act 139), Regulations & Rules, as amended at 1st August 2013 (International Law Book Services).
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7. Malaysian Standard MS 1462-1:2012, Metal scaffolding – Part 1: Prefabricated scaffolds – Specifications for steel frame scaffolding (First revision), Department of Standards Malaysia.
8. Malaysian Standard MS 1462-2-1:2010, Metal scaffolding – Part 2: Tubular (Tube and coupler) scaffolds – Section 1: Specifications for steel tubes, Department of Standards Malaysia.
9. Malaysian Standard MS 1462-2-2:2010, Metal scaffolding – Part 2: Tubular (Tube and coupler) scaffolds – Section 2: Specifications for aluminium tubes, Department of Standards Malaysia.
10. Malaysian Standard MS 1462-2-3:2011, Metal scaffolding – Part 2: Tubular (Tube and coupler) scaffolds – Section 3: Specifications for steel and aluminium couplers, fitting and accessories, Department of Standards Malaysia.
11. Malaysian Standard MS 1462-3-1:2011, Metal scaffolding – Part 3: Prefabricated scaffolds – Section 1: Specifications for steel and aluminium modular system scaffolding, Department of Standards Malaysia.
12. Malaysian Standard MS 1462-3-2:2011, Metal scaffolding – Part 3: Prefabricated scaffolds – Section 2: Particular methods of structural design for steel and aluminium modular system scaffolding, Department of Standards Malaysia.

13. Malaysian Standard MS 1462-4-1:2013, Metal scaffolding – Part 4: Temporary works equipment – Section 1: Scaffolds – Performance requirements and general design, Department of Standards Malaysia.
14. Malaysian Standard MS 1462-4-2:2013, Metal scaffolding – Part 4: Temporary works equipment – Section 2: Information on materials, Department of Standards Malaysia.
15. Occupational Safety and Health Act 1994 (Act 514), Regulations & Orders, as amended at 15th November 2013 (International Law Book Services).
16. Singapore Standard CP 14:1996, Code of Practice for Scaffolds, Singapore Productivity and Standards Board.
17. The Construction (Design and Management) Regulations 2007, 2007 No. 320 Health and Safety, UK Stationery Office Limited.
18. Board of Engineers Malaysia (BEM) - Guidelines on “The Role and Responsibility of Professional Engineers for Temporary Works During Construction Stage”.

APPENDICES

APPENDIX A

DEFINITION OF TERMS

1) Scaffolding

Scaffolding 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 enables 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.

2) Falsework

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

3) Employers/Owners

Project proponents, Developers or Government agencies who develop a project.

4) Contractors

Include Main Contractors, Sub Contractors, Specialist Contractors, Tradesmen and other companies or their personnel carrying out the physical works at site.

5) Civil & Structural Consultant Engineer /Permanent Works Designer (PWD)

Professional Engineers with practising certificate registered with Board of Engineers Malaysia (BEM) who are the Submitting Person to the Authority.

6) Professional Engineers (Civil & Structural with practising certificate) for Temporary Works (PE-C&S)

Professional Engineers with practising certificate registered with Board of Engineers Malaysia (BEM) who are carry out the design, endorsement and supervision of Temporary Works (Scaffolding & Falsework).

7) Temporary Works Designers (PWD)

A competent person who are carry out the design of Temporary Works (Scaffolding & Falsework).

8) Temporary Works Supervisors (PWS)

A competent person who are carry out the supervision of Temporary Works (Scaffolding & Falsework) at site.

9) Competent Scaffolders/Scaffold Inspectors

A competent person registered with Department of Occupational, Safety & Health Malaysia (DOSH), who are carry out the works, supervision and inspection of scaffolding & falsework at site.

APPENDIX B

Collapse of Scaffolding



Collapse of Scaffolding



Collapse of Falsework



Collapse of Falsework



APPENDIX C
SCAFFOLDING CHECKLIST

Inspection No. : _____ Date : _____ Time : _____

Contractor : _____

Project & Add. : _____

Location : _____ Area : _____ Drawing No. : _____

No	Description	Yes	No	Remark
1	FOUNDATION			
	a) Scaffolding erected on firm ground			
	b) Ground properly compacted			
	c) Scaffolding not endangered by open excavation			
2	SOLE PLATES			
	a) Proper sole plates used			
3	BASE PLATES			
	a) Base plates are fitted to all standards			
4	ALIGNMENT OF SCAFFOLD			
	a) Standards or frames vertical			
	b) Ledgers and transoms levelled			
5	SCAFFOLDING COMPONENT CONNECTION			
	a) Connections are tightened and secured			
6	BRACING			
	a) Braces are tightened and secured			
7	WALL TIE			
	a) Wall Tie placed in position as per drawing			
8	WORKING PLATFORM			
	a) Working platforms are secured or locked			
9	LADDER/STAIR			
	a) Ladders/Stairs are securely attached to the scaffold			
10	GUARD-RAIL			
	a) Guard-rails are fixed and secured			

General comments:

--

Inspected by :

Received by :

Name :

Name :

Position :

Position :

FALSEWORK CHECKLIST

Inspection No. : _____ Date : _____ Time : _____

Contractor : _____

Project & Add. : _____

Location : _____ Area : _____ Drawing No. : _____

No	Description	Yes	No	Remark
1	FOUNDATION			
	a) Falsework erected on firm ground			
	b) Ground properly compacted			
	c) Falsework not endangered by open excavation			
2	SOLE PLATES			
	a) Proper sole plates used			
3	BASE PLATES			
	a) Base plates are fitted to all standards			
4	ALIGNMENT OF SCAFFOLD			
	a) Standards or frames vertical			
	b) Ledgers are fixed in position and levelled			
5	FALSEWORK COMPONENT CONNECTION			
	a) Connections are tightened and secured			
6	BRACING			
	a) Braces are tightened and secured			
7	TIE			
	a) Ties are placed in position as per drawing			
8	SOFFIT FORMWORK			
	a) Soffit Formwork is installed as per drawing			
9	RESHORING/BACK PROP			
	a) Reshoring/back prop is erected as per drawing			

General comments:

Inspected by :

Received by :

Name :
Position :

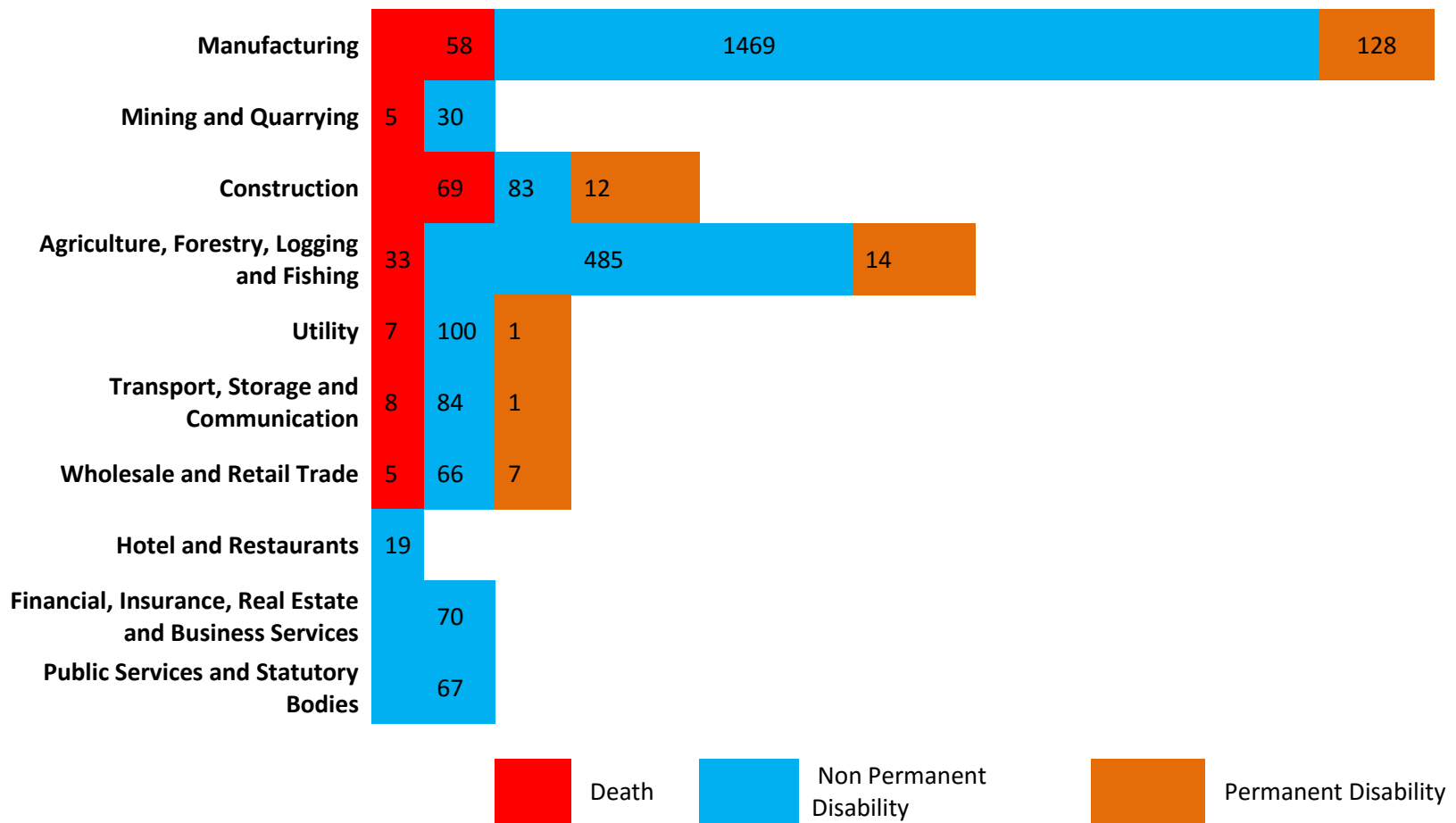
Name :
Position :

APPENDIX D

STATISTICS

OCCUPATIONAL ACCIDENTS STATISTICS BY SECTOR UNTIL DECEMBER 2013

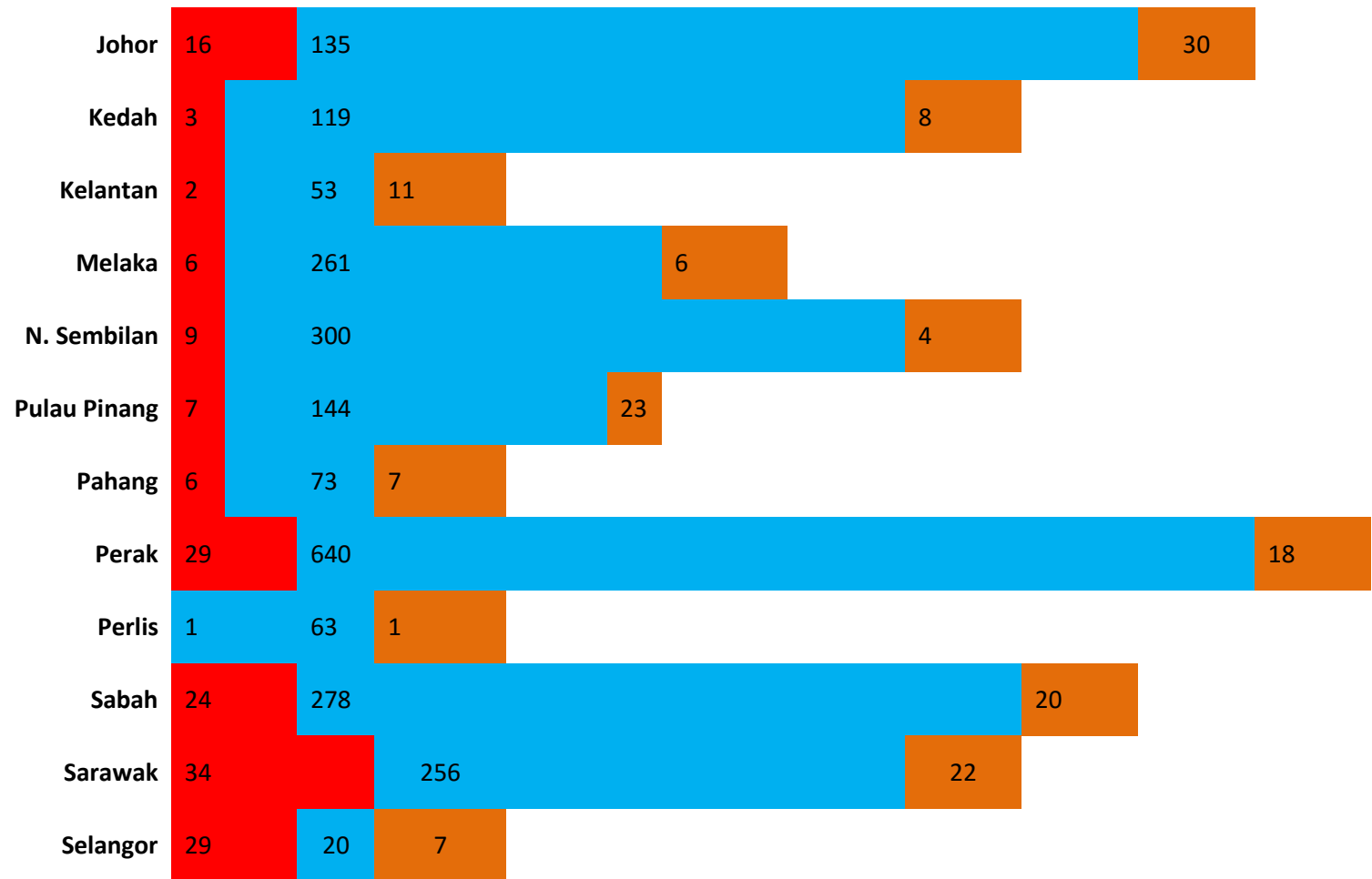
(From official website of Department of Occupational Safety and Health)

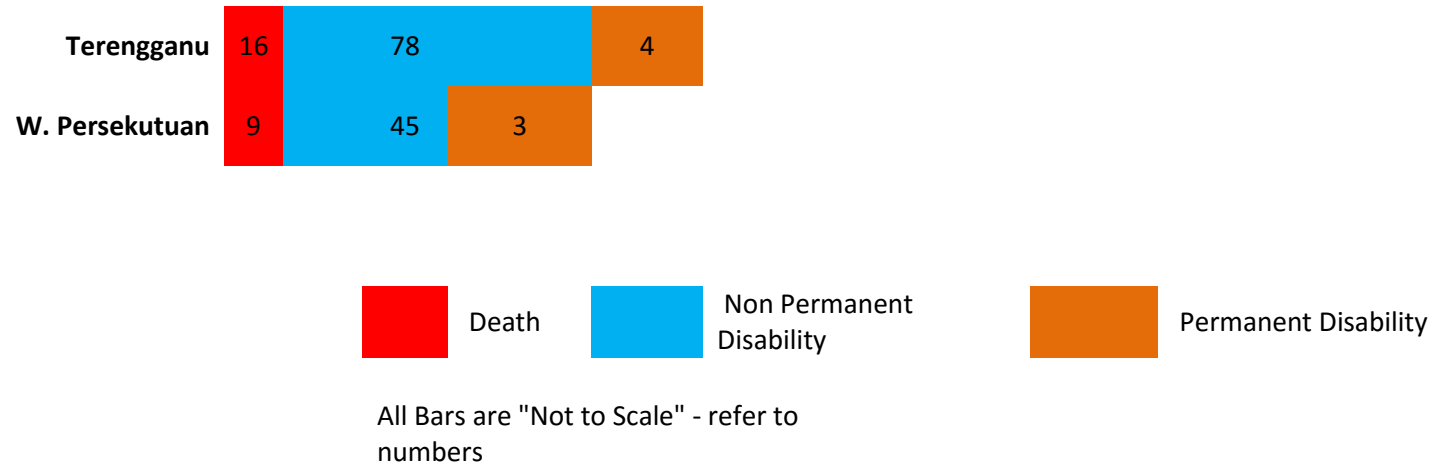


All Bars are "Not to Scale" - refer to numbers

OCCUPATIONAL ACCIDENTS STATE UNTIL DECEMBER 2013

(From official website of Department of Occupational Safety and Health)





APPENDIX E

LIST OF COMMITTEE MEMBERS

Ir. Lee Kee Bau (Chairman)	IEM
Ir. Hooi Wing Chuen (Deputy Chairman)	IEM
Ir. CMM Aboobucker	IEM
Dato' Ir. Dr. Abdul Aziz bin Haji Arshad	JKR
En. Kamaluddin bin Abdul Rashid	JKR
Ir. Abdul Rahman bin Salleh	JKR
Ir. Prof. Dr. Mohd. Zamin Jumaat	UM
En. Othman bin Jalil	DOSH
En. Sazali Che Amat	CIDB
Mr. Chuang Kuang Hong	CIDB
En. Mohd Kashfullah bin Razali	NIOSH
Engr. Ong Ka Thiam	MBAM
Mr. Philip Chong	MISIF
Mr. Ng Kian Hin	MISIF
En. Mohammad Albakri bin Tajuddin	Industry
Ir. Seth Lim Sow Wu	Industry