BOARD OF ENGINEERS MALAYSIA

GUIDELINES NO: 001

THE ROLE AND RESPONSIBILITY OF PROFESSIONAL ENGINEERS FOR TEMPORARY WORKS DURING CONSTRUCTION STAGE

In exercise of the powers conferred by paragraph 4(1)*(f)* of the Registration of Engineers Act 1967 [*Act 138*], the Board of Engineers Malaysia hereby determines The Role And Responsibility Of Professional Engineers For Temporary Works During Construction Stage as stated herein below.

1.0 Introduction

In the construction industry, temporary works are required in erecting permanent works under the contractor's responsibility. Temporary works are defined as parts of the works that allow or enable construction of, protect, support or provide access to, the permanent works and which might or might not remain in place at the completion of the works. Relating to this, there were many incidents of mishaps, failures and weaknesses in Temporary Works leading to collapse of structures and accidents at site that are hazardous to public safety. Some incidents have even caused fatalities and injuries to the public and workers at site.

The Board of Engineers Malaysia (BEM) holds the view that these failures can be avoided and wishes to remind all Professional Engineers of their role and responsibility on Temporary Works to ensure that the safety and interest of the public and workers at site are safeguarded.

Although Temporary Works are mainly the Contractor's responsibility, it is however important that Professional Engineers involved in the project either as Owner, Consultant or Contractor play an active role in ensuring its safety. In view of this, BEM is publishing this "Guidelines on the Role and Responsibility of Professional Engineers for Temporary Works during Construction stage" as a guide to all professional engineers involved in temporary works.

The design of Temporary Works shall be given the same due respect as that of the design of Permanent Works by Professional Engineers.

Note: For the purpose of this guideline, the definition of Stakeholders are as follows:

i. **Contractor** = Include Main Contractor, Sub Contractor, Specialist Contractor, Tradesmen and any other companies or their personnel carrying out the physical works at site.
ii. **Consultant** = Professional Engineers registered with the Board of Engineers Malaysia (BEM) who are the Submitting Person (Qualified Person) to the Authority and Specialists and Professional Engineers (including specialist) whose names appear in the drawings used for tender or construction.
iii. **Owner** = Project proponent, Developer or Government agencies who develop a project.
iv. **Professional Engineer for Temporary Works (PETW)** = Refer to the Professional Engineer (PE) registered with the Board of Engineers Malaysia (BEM) and with a Practicing Certificate in force. They can be employed by Contractor to carry out the design, endorsement and supervision of Temporary Works that required the PE's certification.

2.0 Acts and Code of Practice

Registered engineers designing and supervising Temporary Works in construction shall familiarize themselves with the following to ensure compliance to the laws and design practices.

Act

- Occupational Safety and Health Act 1994 (Act 514)
- Factories and Machinery Act 1967 (Act 139)
  - Factories and Machinery (Notification, Certificate of Fitness and Inspection) Regulations, 1970
  - Factories and Machinery (Building Operations & Works of Engineering Construction) (Safety) Regulations, 1986 (BOWEC)
- Registration of Engineers Act 1967 (Revised 2007)

Code of Practice

- BS5975:2008+A1:2011 "Code of Practice for Temporary Works Procedures and The Permissible Stress Design of Falsework"
- Malaysian Standard MS 1462-1:2012, Metal Scaffolding – Part 1: Prefabricated scaffolds – Specifications for steel frame scaffolding (First revision), Department of Standards Malaysia.
- 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
- 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
- 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
- Malaysian Standard MS 1462-3-1-2011, Metal Scaffolding– Part 3: Prefabricated scaffolds – Section 1: Specifications for steel and aluminium modular system scaffoldings, Department of Standards Malaysia
- 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 scaffoldings, Department of Standards Malaysia
- 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
- Malaysian Standard MS 1462-4-2-2013, Metal Scaffolding– Part 4: Temporary Works equipment – Section 2: Information on materials, Department of Standards Malaysia

Guidelines

- Guidelines for public safety and health at construction sites , DOSH 2007
- Guidelines for the prevention of falls at workplaces
- Guidelines on trenching for construction safety
- Guidelines on occupational safety and health in tunnel construction

3.0 Legal Provision

Registered Engineers are reminded of certain laws that regulate the profession and the construction industry as follows:

(A) Regulation 24 (Code of Professional Conduct) under the Registration of Engineers Act 1967 states that;

"A registered Engineer in his responsibility to his employer, client or the profession shall have ***full regard to the public interest."***

The purpose of the Registration of Engineers Act 1967 is to safeguard public interest, welfare, health and property. The registered Engineer may be charged by the Board if he is found to have failed to discharge his duty in the event there are mishaps or failures in temporary works under his care. This is irrespective of whether the Engineer is the Consultant or the Contractor.

(B) Section 258(1) of the Uniform Building By-Laws 1984 which states that;

*"In the event of any failure to any building or part of the building, whether in the **course of construction** or after construction, the **qualified person** who:-*

(a) submitted the plans, drawings or calculations for such building;

(b) supervised the setting out of such building;

(c) certified that the setting out was carried out in accordance with the approved site plan;

(d) supervised the construction of such building;

(e) certified that the proper supervision of such building as carried out;

***shall within one week** of the occurrence of such failure or such further period as may be specified by the local authority within whose jurisdiction such building is situated ;-*

(aa) report such failure;

(bb) explain the cause of such failure; and

*(cc) if such failure occurred **during construction of such building**, state the remedial action taken."*

The qualified person may be the Architect or Professional Engineer who has submitted plans to the local authority and is in charge of the supervision of the works. The onus is on the qualified person to undertake the above task with due diligence.

(C) Penalties as mentioned in the Street, Drainage and Building Act 1974 under Section 71 (Penalty for failure of building or earthworks);

*"Where any building or part of a building fails, whether in the **course of construction** or after completion, or where there is any failure in relation to any earthworks, or part of any earthworks, whether in the course of the carrying out of the earthworks or after completion thereof, and the course of such failure is due to any one or more of the following factors:-*

*(a) misconstruction or **lack of proper supervision during construction**;*

(b) misdesign or miscalculation; or

*(c) misuse of such building or part of such building, or such earthworks or part of such earthworks, the **person responsible** for :-*

(aa) such misconstruction or such lack of proper supervision;

(bb) such misdesign or miscalculation;

(cc) such misuse

shall be liable on conviction to a fine not exceeding five hundred thousand ringgit or to imprisonment for a term not exceeding ten years or both."

The Act targets a wider range of stakeholders whereby the "person" includes a company, a partnership, a body corporate and sole proprietorship. As such, engineer working as Consultants or Contractors should be fully aware of this burden of liability.

Apart from the local authorities that regulates the construction site, the Department of Occupational Safety and Health (DOSH) regulates the site during construction. As spelt-out under the Factories and Machinery Act 1967, a construction site is treated as a "factory" and hence it requires the approval of DOSH before construction can proceed. The submission for approval for this purpose is the responsibility of the Contractor.

Registered Engineers as defined in the Registration of Engineers Act 1967 (revised 2007) play a major role in the Contractor's organization whereby they not only supervise the temporary works but at times are also involved in their design. Hence they are also liable under the Street, Drainage and Building Act 1974 and Registration of Engineers Act 1967 if they fail to discharge their duties as required of them.

(D) Under the Factories and Machinery (Building Operations and Works of Engineering (Construction) (Safety) Regulations 1980 or BOWEC, certain design of Temporary Works requires the certification by the Professional Engineer, among these are:

Regulation 28(1) (General Requirements)
*"Formwork and reshores shall be **certified structurally safe by a Professional Engineer** and shall be properly braced or tied together so as to maintain position and shape."*

Regulation 30(5) (Concrete Work)
*"Where the formwork structure is designed by a Professional Engineer, he shall be **responsible for the supervision** of the construction and the stability of such structure".*

Regulation 43(2) (Catch platforms)
*"Such platform shall be **designed by a Professional Engineer and certified for safety** prior to erection."*

Regulation 75 (Design and drawings of scaffolds to be approved)

*"(1) Every metal tube scaffold exceeding 40 meters in height and every other scaffold exceeding 15 meters in height shall be constructed in accordance with the **design and drawings of a Professional Engineer.** All other metal tube scaffolds shall have their designs and drawings approved by the Chief Inspector.*

(2) A copy of the design and drawings of the structure shall be submitted to the Chief Inspector for his records prior to the erection of the structure.

(3) A copy of the design drawings certified by the Professional Engineer shall be made available at the worksite for inspection by an Inspector."

Regulation 112 (Stability of structures)
*"Where there is any question of stability of structures adjoining or over areas to be excavated, such structures shall be supported where necessary by underpinning, sheet piling, shoring, bracing or other means made **or erected according to the design of a Professional Engineer to prevent injury to any person."***

Regulation 116(1) (Trench excavation)
*"Pilings, shoring and bracing used in trench excavation to protect employees against falling or sliding materials shall be of adequate strength. Where the trench is to be excavated exceeds 4 meters in depth, such protection shall be **constructed in accordance with the design and drawings of a Professional Engineer."***

Regulation 124 (Piling)
*"Where there is any question of stability of structures adjoining areas to be piled, such structures shall be supported where necessary by underpinning, sheet piling, shoring, bracing or other means **in accordance with the design of a Professional Engineer to prevent injury to any person."***

Registered engineers are reminded to review BOWEC in detail and implement these requirements as required by law.

4.0 Classification of Temporary Works

The Temporary Works is classified into three main classes, namely:

Class 1 : Minor Temporary Works
Class 2 : Major Temporary Works
Class 3 : Temporary Works that form part of Permanent Works

4.1 Class 1: Minor Temporary Works:

Class 1 Temporary Works (Minor) are temporary works that when subject to any failures, defects or losses of serviceability, **would unlikely** affect the public and workers safety and life. Other than those already listed below, the Consultant and Contractor shall discuss and itemize the temporary works for each project prior to construction.

Class 1 Temporary Works will not require professional engineer's endorsement but still subject to compliance with other relevant guidelines, laws and Act (e.g. DOSH, etc.).

Examples of Class 1 Temporary Works are:-

i) Excavation or Trenching shallower than 1.5m in all direction with slope steeper than 27 degrees with no stockpiling of materials adjacent to the excavation.
ii) Temporary Cut slopes (excluding those in soft clay) not more than 5m high and gentler than 27 degrees.
iii) Temporary Fills of Soil and rock that are backfilled to form a bund, embankment or platform with not higher than 1.5m.
iv) Scaffolding / Falseworks that are lower than 3m high supporting low load and with no public or workers beneath it.

4.2 Class 2 : Major Temporary Works:

Class 2 Temporary Works (Major) are temporary works that when subject to any failures, defects or losses of serviceability **would likely affect** public and workers safety and life. The Consultant and Contractor shall discuss together and determine the temporary works that fall into this class. As Class 2 Temporary Works carry similar level of risk to life as permanent works, it therefore shall be given same respect on safety as that of Permanent Works.

Class 2 Temporary Works shall be designed, endorsed and supervised by a Professional Engineer for Temporary Works (PETW). Owner and Consultant shall state and specify clearly in the tender and contract document to the Contractor that the Contractor shall have Professional Engineer for Temporary Works (PETW) to design, endorse and supervise the Class 2 Temporary Works. It shall be the responsibilities of the Consultant who are the submitting person (qualified person) to the Local Authorities or other Government agencies (e.g. JKR, etc.) and as designer of Permanent Works, to ensure the Contractor comply with these requirements to safe guard public interest and safety.

Examples of Class 2 Temporary Works are but not limited to:-

i) **Scaffolding / Falseworks :** Scaffolding / Falseworks covers any form of construction methods and materials used to support the construction of structure / buildings and for pouring of concrete or machineries or for workers. The works includes supply, installation, maintenance, ensuring of foundation and structural stability, and the removal of the scaffolding.

ii) **Temporary Excavations**: Temporary excavation that does not fall under Class 1 or Class 3.

iii) **Temporary Cut Slopes**: temporary cut slope that does not fall under Class 1 or Class 3

iv) **Temporary Fills** : temporary fills that does not fall under Class 1 or Class 3.

v) **Demolition Works** : Demolition or removal of any obstruction and old construction works which can be either man-made or natural.

vi) **Pre-stressing Works** : Works required to form pre-stressed structural elements.

vii) **Crane foundation**: The design and construction of the foundation to support a static tower crane.

viii) **Temporary strutting and bracing for excavations** : The temporary strutting and bracing used at site to support the retaining wall for excavation.

ix) **Temporary ground anchors** : Temporary ground anchors used at site to support the temporary and permanent retaining wall for deep excavations or for cut slopes or excavations.

x) **Load Testing of Foundation and Buildings** : Includes setting up of system for load testing such as kentledge, ground anchors, soil nails, steel beams, truss or concrete blocks, reaction system, jacking system, etc.

xi) Temporary structures that when subject to any failures, defects or loss of serviceability could affect public and workers safety and life.

4.3 Class 3 : Temporary Works that form part of Permanent Works

Temporary Works that form part of Permanent Works are temporary works that are hazardous to life in which any failure, defect or loss of serviceability **would seriously affect** the public and workers' safety and life. The Class 3 temporary works are works that form part of the Permanent Works (e.g. basement retaining wall, top down construction, temporary cut slopes that later become part of the permanent slopes, tunneling, etc.). The Consultant shall determine the temporary works in construction that fall into this class. As Class 3 Major Temporary Works carry similar level of risk to life as permanent works, they shall then be given the same respect in regards to safety as Permanent Works.

Class 3 Temporary Works that form part of Permanent Works shall be designed, endorsed and supervised by the Consultant, who is the submitting person (qualified person) to the Local Authorities or other Government agencies (e.g. JKR, etc.). The Consultant shall ensure that the design of the Class 3 temporary works (includes analyses, calculations, drawings and specifications) shall be structurally stable with sufficient details for construction and buildable by Contractor with considerations of construction sequence at site and safe. The design, calculations, reports and drawings of Class 3 temporary works shall be endorsed by the Consultant and to be submitted to the Authorities. Only Professional Engineer registered with BEM in their respective discipline with the relevant experiences on similar works shall carry out the works to safe guard public interest and safety.

The Contractor can propose alternative design if the method of construction is to be modified or changed but he must engage a Professional Engineer for Temporary Works (PETW) to design, endorse submit the alternative design (with calculations, drawings, specifications, method statement, work procedures, etc.) to the Consultant. The Professional Engineer for Temporary Works (PETW)) who endorses the alternative design of these temporary works shall be responsible and liable for the design and supervision of the alternative design. The Consultant shall be responsible to review the design concept by the PETW. Only the alternative design that has been reviewed and approved by the Consultant is allowed to be constructed at site.

Examples of Class 3 Temporary Works that form part of Permanent Works are:-

i) **Scaffolding / Falseworks that form part of the Permanent Works:** Scaffolding / Falseworks that form part of the Permanent Works covers any form of construction methods and materials used to support the construction of structure / buildings and for

pouring of concrete or machineries, for workers and public. The works including supply, installation, maintenance, ensure foundation and structural stability, and removal of the scaffolding.

iii) **Cut Slopes (that form Permanent Slopes):** Soil or rock slopes that form the Permanent slopes.

iv) **Strengthening measures of slopes (that form Permanent Slopes):** soil nails, ground anchors, rock strengthening measures for permanent slopes and retaining walls.

v) **Retaining Wall:** all types of permanent retaining wall (e.g. rubble wall, crib wall, gabion wall, reinforced concrete wall, reinforced soil wall, sheet pile wall, soldier pile wall, contiguous bored pile wall, secant pile wall, diaphragm wall, barrette wall, etc.) that also function during temporary stage.

vi) **Strutting and bracing for excavations that form part of the Permanent Works:** The permanent strutting and bracing used at site to support the retaining wall for excavation.

vii) **Permanent Embankment, Bund or Fill:** For permanent embankment, bund and fill.

viii) **Ground Treatment that form part of the Permanent Works:** Ground treatment works (e.g. stone columns, excavate and replace, prefabricated vertical drains, piled embankment, embankment construction stages) that form part of the Permanent Works.

ix) Temporary structures and works that form part of the Permanent Works, that when subject to any failures, defects or loss of serviceability could affect public and workers safety and life.

5.0 Role and Responsibility of Professional Engineers on Temporary Works

The Professional Engineers who are entrusted with the design of the Temporary Works shall ensure the following:

1) He must practice within the discipline of engineering he is registered with BEM.

2) He must only practice on works that he has the necessary experiences and competence to safeguard public safety and interest.

3) A Professional Engineer with Practicing Certificate in force can be engaged by Contractor or Owner to design, endorse and supervise the Class 2 and Class 3 Temporary Works.

4) He shall design and supervise the Temporary Works according to the relevant standards, code of practice and good engineering practice.

5) There shall be adequate numbers of qualified and experienced Professional Engineer's representatives at site (Temporary Works Site supervising personnel) to supervise the Temporary Works full time. This supervisory staffs are responsible to the Professional Engineer who design and endorse the Temporary works. These supervising staff shall be independent from the Contractor's staff in carrying out the Temporary Works

6) No physical works shall be allowed to proceed on the Class 2 and Class 3 temporary works unless all the design which include but are not limited to construction drawings, specifications, method statements and construction procedures have been properly endorsed and approved by Professional Engineers, and with supervision team ready at site.

7) It is the responsibility of the Consultant who is the submitting person (qualified person) of the project to the Local Authorities to ensure that the project comply with the guidelines on temporary works. Any temporary works of Class 2 and Class 3 category without

proper documentations (e.g. drawings, specifications, method statement, etc.) and proper full time supervision and inspection shall not be allowed to be carried out.

(BEM- 313th Meeting /21st August 2015)

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