BOARD OF ENGINEERS MALAYSIA

BEM HYBRID MINI CONVENTION 2021

Online

3S_Safety in Site Supervision

Speaker:
Ir. K. Sundraraj
Chairman,
BEM Professional Practice Committee

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Outline of Presentation

3S-SAFETY in SITE SUPERVISION

SAFETY IS EVERYONE'S RESPONSIBILITY

1. Introduction
2. Temporary Works / Site Failures
3. Falsework - Prevention Of Collapse
4. Beam Launching

Reference
- Guidelines For Public Safety And Health At Construction Sites (1ST Revision 2007) by DOSH.
- Safety Handbook for Construction Site Workers',published by the Labour Department.
- "Guidance Notes: Safety at Work (Falsework – Prevention of Collapse)", published by the Labour Department.

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INTRODUCTION

RULES & REGULATIONS

INTRODUCTION
Legislative Framework

- ***Why the construction industry in Malaysia important?***
  a) Remains one of the largest in Malaysia, creating employment to around 1.4 million people which represents 6% of total employment;
  b) Plays a significant part in the **economic growth** of the country as it contributes RM14.3 billion to GDP.
  c) Susceptible to **high risk of accident occurrence** resulting in injuries and fatalities to the public and workers.

- ***What are the main legislative framework in Malaysia construction industry?***
  a) Factories and Machinery Act 1967(FMA 1967), Amendment 2006 and Factories & Machinery (Building Operations & Works of Engineering Construction) (Safety) Regulations 1984,

  b) Occupational Safety and Health Act 1994 (OSHA 1994),

  c) Occupational Safety and Health in Construction Industry (Management) OSHCIM 2017 (Guidelines- to be passed as Act)

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INTRODUCTION
Legislative Framework

a) Factories and Machinery Act 1967(FMA 1967), Amendment 2006 and Factories & Machinery (Building Operations & Works of Engineering Construction) (Safety) Regulations 1984

- **Provisions for safety,**
- **Site Safety Supervisors** Appointment,
- **Precautionary measures** for construction activities,
- Machinery which is **high risk to operate.**

b) The Occupational Safety and Health Act 1994 (OSHA) w.e.f. **24 February 1994 (Act 514).**
Imposed nationwide safety standards for General industry and Construction

- **Safety & Health standards**,
- **Standards for inspections**, investigations, record-keeping requirements, and enforcement procedures.

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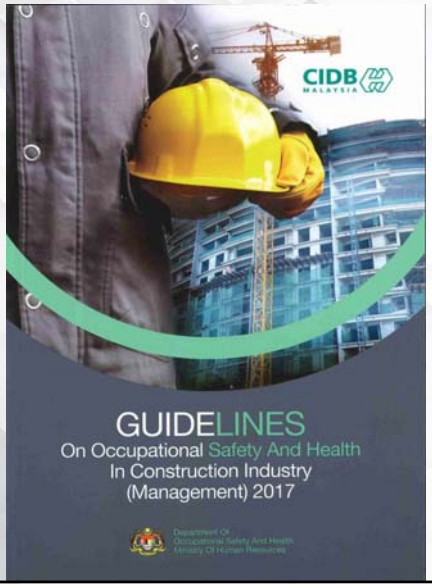
INTRODUCTION
Guidelines on OSHIM 2017



WHY OSHCIM?

- DOSH has several Legislation & Guidelines on public safety namely, "**Guidelines for Public Safety and Health at Construction Sites, 2007"**
- The **Guidelines on Occupational Safety and Health in Construction Industry (Management) (OSHCIM) 2017** provides practical guidance to the client, designer and contractor on the management of safety, health and welfare when carrying out construction projects of a structure.
- The objective of managing OSH in design is to maximize the opportunity to **eliminate hazards and reduce risk** in the design, through the early consideration of how and where the structure will be built, used, cleaned, maintained, repaired and eventually demolished.

Reference
Department of Occupational Health & Safety website
'https://www.dosh.gov.my/index.php/construction-safety/oshcim

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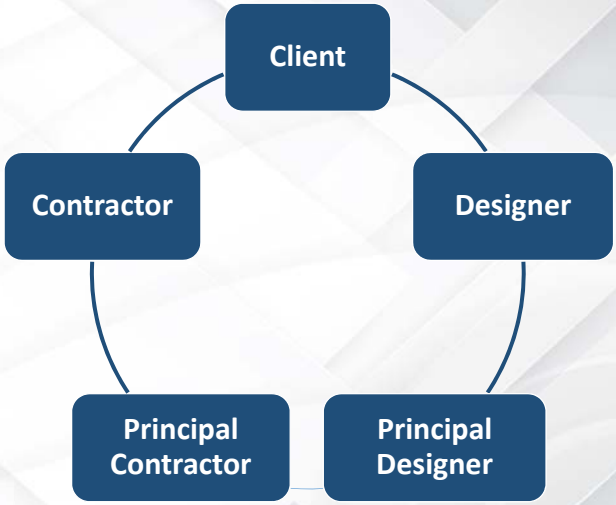
INTRODUCTION
Guidelines on OSHIM 2017

OSHCIM Contents

- Main contents in the Guidelines include introduction, client, designers, contractors, construction work information, references and appendices.
- Main duty holders are principal designer, principal constructor and client.
- Main principles of OSHCIM include HIRARC and general principle of prevention, competency, cooperation, communication and documentation.

KEY DUTY HOLDERS
CONSTRUCTION PROJECT TEAM



Reference
Department of Occupational Health & Safety website
'https://www.dosh.gov.my/index.php/construction-safety/oshcim

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INTRODUCTION
CIS Scaffolding & Falsework

CIS 22: 2020
SAFE USE OF SCAFFOLDING IN CONSTRUCTION

- The CIS22 focuses on the methods of **safe use of scaffolding** in construction, which addresses the applicable requirements under the Factories and Machinery Act 1967 (Building Operations and Works of Engineering Construction - BOWEC) (Safety) Regulation 1986, the CIDB Act 520 (Amendment 2011) and the Malaysian Standards MS 1462 series on scaffolding.

CIS 23: 2018
SAFE USE OF FALSEWORK AND FORMWORK IN CONSTRUCTION

- This **CIS 23** provides guidance for the **safe use of falsework and formwork** in construction, which addresses the various statutory requirements i.e. OSHA Act 1994 (Act 514), Factories And Machinery Act 1967, CIDB Act 520 (Amendment 2011), Board of Engineers Guideline No. 001 and BS 5975:2008 (Code of Practice for temporary works procedures).
- This CIS also highlights the **professional responsibilities** of the Professional Engineer for Temporary Works (PETW) on design and supervision of the falsework and formwork, as well as the responsibility the Designated Person under the contractor in procurement, erection, inspection, maintenance, alteration and dismantling of the falsework and formwork.

Being revised in 2021

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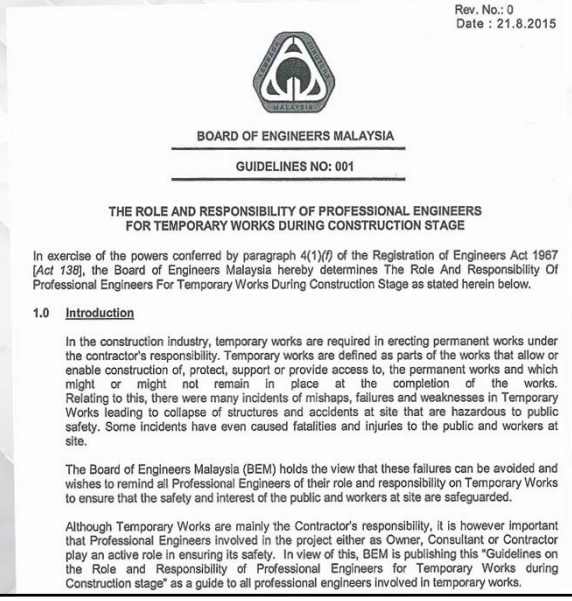
TEMPORARY WORKS
BEM Guidelines No. 001/2015



Rev. No.: 0
Date : 21.8.2015

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.

- BEM is a **statutory body** to protect the public through legislative control so that the practice of engineering, which has bearing on public interest, safety and health are carried out by Professional Engineers (PEs) registered with BEM.
- BEM **Guidelines on the role and responsibility of the Professional Engineers for temporary works at the Construction stage** (BEM Guideline No. 001(2015)).
- 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.

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TEMPORARY WORKS
BEM Guidelines No. 001/2015

THE ROLE AND RESPONSIBILITIES OF PE FOR TEMPORARY WORKS DURING CONSTRUCTION STAGE

- Temporary works are classified into three (3) main classes as follows:

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

- **Class 1: Minor Temporary Works**

Temporary works that when subject to failures, defects or serviceability loss, would **unlikely affect the safety** of public and workers.

Class 1 Minor Temporary Works can be **designed and supervised by Contractor or engineer who is not a professional engineer** subject to compliance with other relevant guidelines, laws and Act (e.g. DOSH, etc.)

Examples of Class 1 Temporary Works are:-
- **Excavation/trenching** < 1.5m depth with slope> 27 deg.
- Temporary **cut slopes** < 5m high and slope > 27 deg.
- no public movement underneath. Temporary **Fills** to from bund/embankment < 1.5m high
- **Scaffolding/Falsework** < 3.0m high supporting low load

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TEMPORARY WORKS
BEM Guidelines No. 001/2015

THE ROLE AND RESPONSIBILITIES OF PE FOR TEMPORARY WORKS DURING CONSTRUCTION STAGE

➢ **Class 2: Major Temporary Works**

Temporary works that when subject to failures, defects or serviceability loss, would **likely affect the safety and life** of public and workers.

Works shall be designed, endorsed and supervised by a **Professional Engineer for Temporary Works (PETW)**. It shall be responsibility of **Consultant** to ensure the Contractor comply with requirements to safe guard public interest and safety.

Examples of Class 2 Temporary Works are:-
- **Scaffolding/Falsework** used to support construction of structure/ buildings.
- **Excavation/trenching** that does not fall under Class 1 nor 3 including strutting and bracing.
- Temporary **cut slope** that does not fall under Class 1 nor 3 & ground anchor
- Temporary **Fills** that does not fall under Class 1 nor 3,
- **Demolition works/ Prestressing Works**,
- **Crane foundation**
- **Load Testing** of Foundation and Buildings

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TEMPORARY WORKS
BEM Guidelines No. 001/2015

THE ROLE AND RESPONSIBILITIES OF PE FOR TEMPORARY WORKS DURING CONSTRUCTION STAGE

➢ **Class 3: Temporary Works that form part of Permanent Works**

Temporary works that form part of Permanent Works that are hazardous to life when subject to failures, defects or serviceability loss, would **seriously affect the safety and life** of public and workers.

Works shall be designed, endorsed and supervised by **Consultant** to safe guard public interest and safety.

Examples of Class 3 Temporary Works are:-
- **Scaffolding/Falsework** that form part of Permanent Works and used to support construction of structure/ buildings.
- **Cut slope** that form the Permanent slopes.
- **Strengthening measures** of slope and permanent **retaining structures**.
- Permanent **Embankment, Bund or Fill**.
- **Ground Treatment works**.

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TEMPORARY WORKS
DOSH Surat Arahan Pelaksanaan Perintah Khas KP Bil 1 Thn 2020

JABATAN KESELAMATAN DAN KESIHATAN PEKERJAAN MALAYSIA
DEPARTMENT OF OCCUPATIONAL SAFETY AND HEALTH MALAYSIA
KEMENTERIAN SUMBER MANUSIA
MINISTRY OF HUMAN RESOURCES
Aras 1,3,4 & 5, Blok D4, Kompleks D
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Rujukan Kami: JKKP DP 127/656/1-2 KLT. 1 (7)
Tarikh: 26 Oktober 2020

Kepada:

Pengurus
Semua tempat kerja yang berkaitan

Tuan,

SURAT ARAHAN BAGI PELAKSANAAN PERINTAH KHAS KETUA PEMERIKSA BILANGAN 1 TAHUN 2020 PENGURUSAN KESELAMATAN STRUKTUR SEMENTARA (PERANCAH, ACUAN DAN PENYANGGA)

Adalah dengan hormatnya perkara di atas adalah dirujuk.

2. Dimaklumkan bahawa surat arahan ini dikeluarkan oleh Jabatan Keselamatan dan Kesihatan Pekerjaan (JKKP) bagi memberi panduan kepada pengurus yang terlibat dalam pengurusan atau operasi bagi struktur sementara terutamanya perancah, acuan dan penyangga di tempat kerja.

3. Surat arahan ini adalah untuk memperjelas kehendak khusus Perintah Khas Ketua Pemeriksa Bilangan 1 Tahun 2020. Selain daripada itu, pengurus juga mempunyai tugas dan kewajipan umum di bawah Akta Kilang dan Jentera 1967 [Akta 139] dan juga Akta Keselamatan dan Kesihatan Pekerjaan 1994 [Akta 514].

4. Oleh itu, surat arahan ini dikeluarkan untuk memberi maklumat dan penerangan kepada semua pengurus yang terlibat dalam pengurusan atau operasi struktur sementara terutamanya perancah, acuan dan penyangga yang akan digunakan di tempat kerja seluruh Malaysia sepertimana dinyatakan pada **Lampiran 1: Panduan bagi Pelaksanaan Perintah Khas Ketua Pemeriksa Bilangan 1 Tahun 2020: Pengurusan Keselamatan Struktur Sementara (Perancah, Acuan dan Penyangga)**

5. Oleh yang demikian, Jabatan berharap pengurus dan pekerja-pekerja yang terlibat akan dapat melaksanakan tugas dan kewajipan sepertimana yang telah dinyatakan dengan menyeluruh, di semua tempat kerja bagi memastikan objektif untuk mengurangkan kejadian berbahaya dan kemalangan berhubung dengan struktur sementara terutamanya melibatkan perancah, acuan dan penyangga akan tercapai.

Sekian, terima kasih.

"BERKHIDMAT UNTUK NEGARA"

Saya yang menjalankan amanah,

(IR. HJ. OMAR BIN MAT PIAH)
Ketua Pengarah
Jabatan Keselamatan dan Kesihatan Pekerjaan
Malaysia

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Rules, Regulations & Guidelines
Chief Inspector Special Order No. 1 Year 2020

Chief Inspector Special Order No. 1 Year 2020 on the **Safety Management of Temporary Structure (Scaffolding, Formwork and Falsework)** issued on 26th October 2020 by Department off Occupational Safety and Health (DOSH),

- **Duties of Manager** – person employed in any service involving the management or operation of, or attendance on, or proximity to, any machinery or process carried on in any place of work (appointed by main contractor)
- Any person who fails to comply with any order lawfully given by an Inspector shall be guilty of an offence and shall on conviction be **liable to a fine not exceeding RM 200,000 or to imprisonment for a term not exceeding 5 years or to both.**

PERINTAH KHAS KETUA PEMERIKSA
BILANGAN 1 TAHUN 2020
PENGURUSAN KESELAMATAN STRUKTUR SEMENTARA (PERANCAH, ACUAN DAN PENYANGGA)

Pada menjalankan kuasa yang diberikan oleh subseksyen 27(1) Akta Kilang dan Jentera 1967 [Akta 139], Ketua Pemeriksa Kilang dan Jentera mengeluarkan perintah khas yang berikut:

1. Dalam Perintah ini, melainkan jika konteksnya menghendaki makna yang lain:

(a) **Pengurus** adalah orang yang diambil kerja dalam mana-mana perkhidmatan yang melibatkan pengurusan atau pengendalian bagi, atau penjagaan ke atas, atau kedekatan kepada, mana-mana jentera atau proses yang dijalankan dalam mana-mana tempat kerja;

(b) **Orang yang ditetapkan** ertinya seorang yang kompeten yang dilantik oleh majikan untuk menjalankan apa-apa kerja penyeliaan atau pemeriksaan atau melaksanakan apa-apa tugas atau kewajipan yang telah ditetapkan oleh Peraturan-Peraturan Kilang dan Jentera (Kendalian Bangunan dan Kerja-Kerja Binaan Kejuruteraan) (Keselamatan) 1986.

2. **Pengurus** hendaklah memastikan:

(a) pelantikan Jurutera Profesional, orang yang ditetapkan dan pekerja-pekerja lain bagi menjalankan tugas-tugas yang dinyatakan di dalam Bahagian III dan X, Peraturan-Peraturan Kilang dan Jentera (Kendalian Bangunan dan Kerja-Kerja Binaan Kejuruteraan) (Keselamatan) 1986;
(b) pekerja-pekerja yang dilantik di bawah Perintah 2(a), mematuhi kehendak perundangan;
(c) prinsip-prinsip yang diakui umum tentang amalan yang baik dan selamat diamalkan;
(d) sistem permit menjalankan kerja (permit-to-work) dilaksanakan;
(e) penyediaan perunukkan masa, bahan, bajet dan sumber lain yang sesuai dan mencukupi;
(f) tiada perancah boleh digunakan sebelum diperiksa dan dipastikan selamat oleh orang yang ditetapkan; dan
(g) dokumen dan rekod-rekod berkaitan struktur sementara (perancah, acuan, dan penyangga) dikemaskini dan disimpan di tempat kerja untuk tujuan pemeriksaan pada bila-bila masa.

3. **Pengurus** hendaklah memastikan bahawa Jurutera Profesional:

(a) membuat apa-apa reka bentuk dan lukisan, ujian, pemeriksaan, penyediaan maklumat dan langkah-langkah pengendalian struktur sementara yang wajar; dan
(b) menyelia pembinaan dan kestabilan struktur sementara yang direka bentuk olehnya adalah selamat.

4. **Pengurus** hendaklah memastikan bahawa orang yang ditetapkan:

(a) memeriksa semua bahan yang digunakan mengikut standard yang ditetapkan, sada sebarang kecacatan dan selamat untuk digunakan;
(b) menyelia secara terus kerja-kerja struktur sementara mengikut reka bentuk yang ditetapkan semasa ia dibina, diubah dan ditanggalkan;
(c) menyelia secara terus kerja-kerja penyanggaan semula struktur sementara secara menyeluruh mengikut reka bentuk yang ditetapkan;
(d) menjalankan pemeriksaan secara menyeluruh ke atas struktur sementara semasa dan selepas pembinaan; dan
(e) memeriksa perancah dalam tempoh setiap tujuh hari, atau setiap kali perancah terdedah kepada keadaan cuaca atau insiden yang mungkin menjejas keteguhan atau kestabilannya atau telah menyebabkan mana-mana bahagiannya teranjak.

Penalti

Mana-mana orang yang melanggar perintah khas ini adalah melakukan suatu kesalahan dan boleh didakwa di bawah seksyen 8(g) Akta Kilang dan Jentera 1967 [Akta 139] dan jika disabitkan kesalahan boleh didenda tidak melebihi dua ratus ribu ringgit atau dipenjarakan selama tempoh tidak melebihi lima tahun atau kedua-duanya.

HJ. IR. OMAR BIN MAT PIAH
Ketua Pemeriksa
Jabatan Keselamatan dan Kesihatan Pekerjaan
Mac 2020

TEMPORARY WORKS/ SITE FAILURES

TEMPORARY WORKS
Permanent Works Vs Temporary Works

WHAT IS TEMPORARY WORKS ?

- The BS 5975 Code of practice for temporary works procedures and the permissible stress design of falsework defined temporary structures as "those parts of the structures that allow or enable construction of, protect, support or provide access to, **permanent structures** and which might not remain in place at the completion of the structures".
- 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.

DIFFERENCE BETWEEN PERMANENT WORKS & TEMPORARY WORKS?

- Permanent works are shown in construction drawings that after completion of the project, are permanently at site.
- Temporary works are works that **enable construction of the permanent works** permanent works construction and which might or might not remain in place at the completion of the works.
- The design of **Temporary Works** shall be given the **same respect** as due to the design of **Permanent Works** by Professional Engineers.

SITE FAILURES
LRT Project, Klang, Selangor
One dead, four injured in LRT3 construction site mishap

NEW STRAITS TIMES
By New Straits Times - July 29, 2021 @ 5:19pm

29th July 2021 Klang, Selangor: One foreign worked died while four others were injured by falling debris when scaffolding at a construction site along the Jalan Langat Light Rail Transit (LRT) 3 track in Bandar Bukit Tinggi collapsed this afternoon.

It is understood that the incident occurred at 2.15pm.
Klang Selatan district police chief Assistant Commissioner Shamsul Amar Ramli said four of the foreign workers involved were Bangladeshi while one was Indonesian.

Rescuers had earlier managed to pull out four workers from the rubble. They reportedly sustained light injuries. However, police later confirmed that the trapped worker had died.

It was understood that the **scaffolding around the structure gave way** as the construction workers were **pouring wet cement** into one of the **columns**, which resulted in the collapse.

Falseworks Collapse

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SITE FAILURES
DASH Project, K. Lumpur
Highway project slab (falsework) collapses at NKVE, two injured

FMT Reporters- June 19, 2021

19th June 2021 PETALING JAYA: A concrete slab of an interchange under construction collapsed from a height of 12m this evening, resulting in injuries to two construction workers.

The Selangor fire and rescue department said both were Bangladeshi men, aged between 20 and 40 years old. They were carrying out construction work close to the concrete
Slab when the slab gave way. The victims were taken to Sungai Buloh Hospital for treatment.

Before **Falseworks Collapse** ***After***

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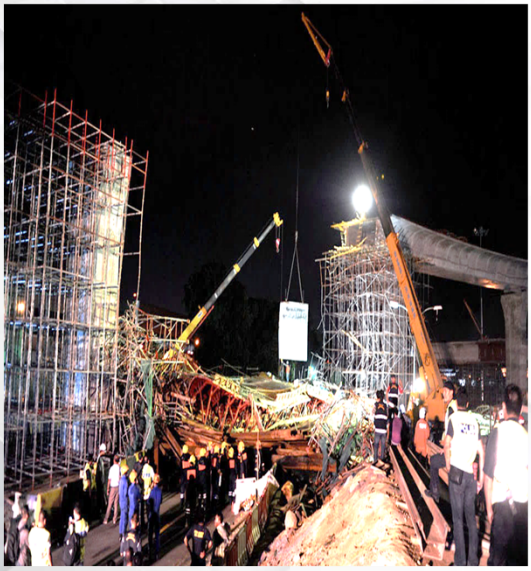
SITE FAILURES

Penang Second Bridge, Penang

Penang Second Bridge Collapse: 3 Injured, 1 Dead

hype
7 June 2013
By Lainey



7th June 2013 PENANG: Three people were injured while at least one person died after a **30-metre wide ra**mp of the under-construction Second Penang Bridge in Batu Maung collapsed at about 7:15pm last night.

Jambatan Kedua Sdn Bhd (JKSB) public relations and communications department deputy manager Azizi Azizan said the collapsed portion is part of Package 3A of the Second Penang Bridge project. He said the incident occurred while concrete pouring works were ongoing.

***"It collapsed when the scaffolding supporting the area gave way"*,** he said.

Falseworks Collapse

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SITE FAILURES

SUKE Project, Kuala Lumpur

2 dead, 3 injured in MRR2 highway bridge collapse

FMT Reporters- March 3, 2021

3rd March 2021 Kuala Lumpur: Police tonight confirmed that two women died after a scaffolding at the construction site of a flyover, collapsed onto the van they were in. The **five occupants were trapped** for a few hours in the incident along the MRR2. The driver and two other women escaped with injuries. All five were locals.

Highway concessionaire said the accident occurred when an **"overloaded trailer" crashed into a scaffolding at the site.**

"The trailer is not involved or linked to the construction of thein the Sungai Besi-Ulu Klang Expressway in any way," Meanwhile, Kuala Lumpur Traffic Investigation and Enforcement Department chief Zulkefly Yahya said police have detained the driver of the trailer to facilitate investigations.

Falseworks Collapse

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SITE FAILURES

SUKE Project, Kuala Lumpur
3 killed in yet another construction site mishap

FMT Reporters- March 22, 2021

Launcher Crane Collapse

22nd March 2021 Kuala Lumpur:
Three workers fell to their death after a section of **launcher crane** at a highway construction site in Kuala Lumpur **toppled over**, crushing a car, this morning.

The KL Fire and Rescue Department said the **driver of the car was seriously injured** as steel from the crane crushed the vehicle.

The **three workers were confirmed dead** at the scene with two of them falling on to the road from a height of about 36.5m, while the third worker, who was stuck on the scaffolding, was also pronounced dead by the rescue personnel.

Oct 2021: The two contractors involved in the SUKE project have been **fined a total of RM300,000** for failing to ensure site safety that resulted in a fatal accident on March 22.

CIDB also recommends that the contractor have a **safety audit done by a third party on the safety of the project, working methods and operation and management of the construction site.**

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INTRODUCTION

FALSEWORK
- PREVENTION OF COLLAPSE

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FALSEWORK - PREVENTION OF COLLAPSE

Falsework & Scaffolding

What is the difference between Falsework and Scaffolding ?

- **Falsework** is defined as any temporary construction used to support vertical loads for a structure until it becomes self-supporting. It includes temporary **support structures** for formwork used to mould concrete to form a desired shape.
- **Scaffolding** to **give workers access to the structure** being constructed, and shoring which is temporary structural reinforcement used during repairs.

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FALSEWORK - PREVENTION OF COLLAPSE

PREVENTION OF COLLAPSE OF FALSEWORK

- Responsibilities
- Design Stage
- Construction Stage
- Dismantling Stage

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FALSEWORK - PREVENTION OF COLLAPSE
1. Responsibilities

Who is responsible for the construction of Temporary Works at site ?

- The OSH legislation i.e. the **Chief Inspector Special Order No. 1 Year 2020** on the Safety Management of Temporary Structure (Scaffolding, Formwork and Falsework), places the duty to **Manager**, who is employed by the Contractor, in management or operation of scaffolding, formwork and falsework to ensure the safety and health.
- Under the regulations/guidelines, Contractor shall engage a qualified and experienced **Professional Engineer for Temporary Works (PETW)** to design, endorse and supervise construction of temporary works and falsework.
- The **Supervision Consultant (SC)** can also be engaged to be **PETW** to carry out the temporary works.
- The Contractor shall engage a **Designated Person (DP)** to check erected works thoroughly for issuance of **Ready to Load Certificate** to the S.O. The BOWECS Regulations also require **DP** (Concrete) to carry out supervision during installation and during concrete pouring

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FALSEWORK - PREVENTION OF COLLAPSE
1. Responsibilities

IS ICE RESPONSIBLE FOR TEMPORARY WORKS?

FAQ (BEM Website):

As an Independent Checking Engineer (ICE) to carry out checking of all design works by the Submitting Person (PEPC who are the Design Consultant for the Project), am I responsible to check on Temporary works by Contractor?

BEM :

1. No. ICE is not responsible for Temporary Works.
2. ICE scope of works shall be clearly stated in appointment letter.
3. By default, the ICE shall carry out check on the analyses and design of permanent works submitted by the submitting person only.
4. ICE can also highlight to the Submitting Person on any missing or lacking of the design of the permanent works.
5. Unless otherwise stated in the scope of works, temporary works are not within the scope of works of ICE in terms of design or construction

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FALSEWORK - PREVENTION OF COLLAPSE
2. Design Stage

- ***Competent Professional Engineer for Temporary Works (PETW)***
  The PETW, engaged by the Contractor, should have **adequate training, experience and competence** in structural mechanics and geotechnics.
- ***Drawings and Specifications***
  PETW should prepare a **set of instructions** in the form of drawings and specifications specifying the framing, construction details (especially for connections), methods of erection, sequence of erection, standard of materials and workmanship, and method statement for dismantling**.**
- ***Engineering Justifications***
  The framing of structural members and details of construction should be justified in accordance with **recognized engineering principles** to meet the loads to which the falsework may be subjected which include vertical and lateral loads.

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FALSEWORK - PREVENTION OF COLLAPSE
2. Design Stage

- ***Site Conditions***
  The PETW should study and inspect the **site conditions** such as ground conditions, topographic features, earth slope characteristics, ground water data and standard of workmanship achievable before incorporating them in the design.
- ***Structural Steel Works***
  Use structural steel in accordance with the **Code of Practice** for the Structural Use of Steel or an equivalent international standard.
- ***Lateral Stability***
  The provision of adequate **lacing and bracing** to prevent the falsework from **buckling or sway** should be adequately provided in compliance with engineering principles and clearly shown in the drawings to illustrate the PETW's intentions.

  The framing of falsework should give a **robust and stable** structure, especially near vehicular traffic, which should withstand the effects of **impacts or vibrations** and avoid leading to collapse of major structure. To avoid accident, adequate **headroom, lighting, warning signs and signals and impact protection measures** should be provided.

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FALSEWORK - PREVENTION OF COLLAPSE
2. Design Stage

- ***Cantilever Members***
  The end portion of a prop protruding beyond lacing member should be considered as **cantilever member.** Such end portion often occurs at the **top or at the base of a prop**.

  If a prop has an extensible portion at the end, the joint between the extensible portion and the prop itself allows a little **angular movement.**

- ***Fastenings to Concrete or Masonry***
  All fastenings to concrete or masonry for structural uses Should be designed in accordance with recognized **engineering principles** and the **manufacturer's recommendations**. The construction details and instructions for use should be clearly specified in the drawings and specifications.

- ***Loading Sequence***
  Sequence of placing loads *on the falsework including loads due to temporary storage and prestressing should be planned and taken into account in the design stage.*

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FALSEWORK - PREVENTION OF COLLAPSE
2. Design Stage

- ***Foundations***
  All props of falsework should be adequately supported without risk of **undue displacement**.

  Points of contact between the props and underlying works should comprise **baseplates** connected to the feet of the props, resting on distribution members.

- ***Method Statement for Erection / Dismantling Falsework***
  The methods for erecting and for dismantling the falsework should be included in the drawings in a clear and understandable form.

  Such a method statement should include :-
  (a) **detailed design and drawings** endorsed by PETW,
  (b) details of the methods in **each stage** of erection / dismantling;
  (c) **sequence** of erection / dismantling;
  (d) **plant and equipment** to be used;
  (e) details of **working platforms** and access routes; and
  (f) details of **anchorage** if any.

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FALSEWORK - PREVENTION OF COLLAPSE
3. Construction Stage

- ***Method Statement, Drawings and Specifications***
  To realize the **PETW's intentions**, the contractor including the site management personnel should the Method Statement, drawings and specifications for the falsework before commencing erection.

- ***Competent Supervision***
  Site management personnel and workman in falsework construction should be competent and trained to fully understand the contents of the drawings/ specifications for the falsework, especially the sequence of erection which should strictly be adhered to.

  The **Designated Person (DP)** and **PETW's supervisor** should give adequate supervision on the falsework and to check the as-constructed falsework against the drawings and specifications.

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FALSEWORK - PREVENTION OF COLLAPSE
3. Construction Stage

- ***Prevailing Site Conditions***
  Site conditions change from time to time. Deviations from the PETW's intentions discovered on site should be resolved with PETW. The contractor (DP) should not change the design without the PETW's agreement.

- ***Complying with Good Practices***
  If any method of working or construction detail is not expressed in the drawings and specifications, the contractor should follow the good practices recommended by relevant **codes of practices**, such as BS 5975. Connections between members of different materials should be treated with great care.

  The contractor should also ensure that the workmen at work use suitable personal protective equipment

- ***Lacing, Bracing & Wedging***
  Falsework will not be safe without adequate lacing, bracing and wedging. Follow all the details shown in the drawings and specifications.

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FALSEWORK - PREVENTION OF COLLAPSE
4. Dismantling Stage

- ***Competent Dismantling Supervisor***
  The supervisor should have **sufficient technical knowledge and management skills**, and be able to read and understand the method statement for dismantling the falsework.

  The contractor should provide **continuous supervision** on all dismantling operations.

- ***Dismantling Operation***
  In dismantling falsework, the followings should be observed:

  (1) No part of the falsework should be disturbed until the permanent works have attained the **self-supporting strength** and **stability**.

  (2) **Bracing members** should be removed **as late as practicable** unless otherwise specified in the method statement.

  (3) Dismantling falsework by **deliberate collapse** involving removal of key structural members causing complete collapse of a space frame should **not be allowed.**

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BEAM LAUNCHING

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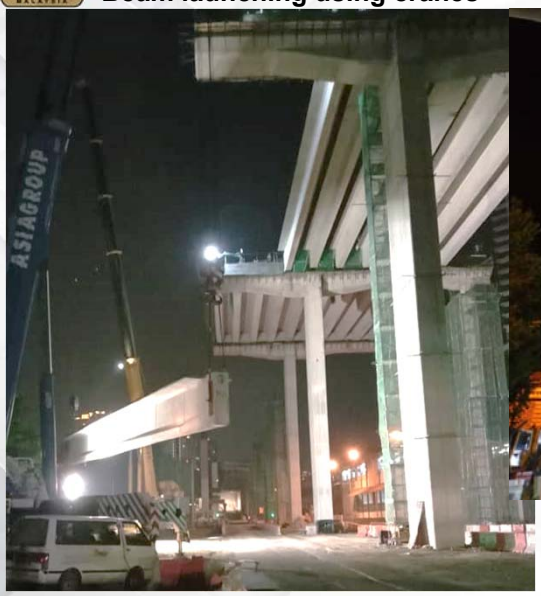
BEAM LAUNCHING
Crane Launching
Beam launching using cranes



Photos by Ekovest S/B

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BEAM LAUNCHING
Launching Girder
Beam launching using steel launcher

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BEAM LAUNCHING
Pujut Incident (Dec 2019)

BORNEO POST online
THE LARGEST ENGLISH NEWS SITE IN BORNEO

Dec 13, 2019

Two injured after girder beams collapse at Pan Borneo Highway in Pujut, Miri

MIRI: **Five girder beams** of the Pujut Link component of Work Package Contract (WPC) 11 of the Pan Borneo Highway project which would make up a section of a bridge have **collapsed.** It was suspected that the incident occurred during the welding process, with **beams toppling and damaging the crane and prime mover below**.

A photo of the collapsed section of the bridge.
Photo source: JKR Miri

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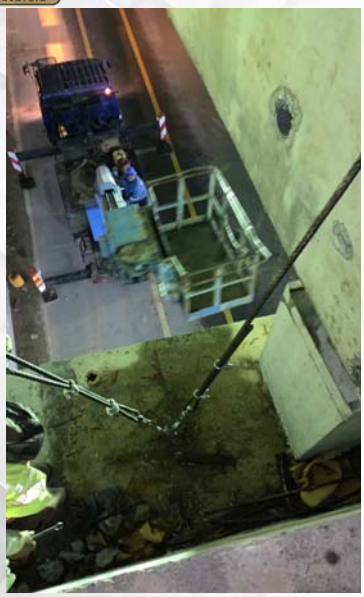
BEAM LAUNCHING
Wire Strand Bracing



T Beam Bracing- DASH Project

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BEAM LAUNCHING
Single Support Portal Type:

DUKE3 Expressway (Section 2) Photo by Ekovest S/B

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BEAM LAUNCHING
Beam Collapse Reasons

What are the possible reasons beam collapse during launching?

- **Collapse** of an erection girder/crane
- **Accidental knocks** by crane/machinery during launching.
- **Beam siting plinth** not level causing bearings to be inclined or bulging,
- **Excessive bowing or hogging** of beams sitting on bearings
- **Lack of reinforcement** or beam width section to resist lateral stress during launching.

*Safe construction of a bridge requires proper coordination, delegation and exchange of information. Many failures are caused just due to **improper erection process**. Designers should work closely work with detailing engineer and contractors to ensure proper detailing and preparation of working drawings.*

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THANK YOU

Committed to Engineering Excellence

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