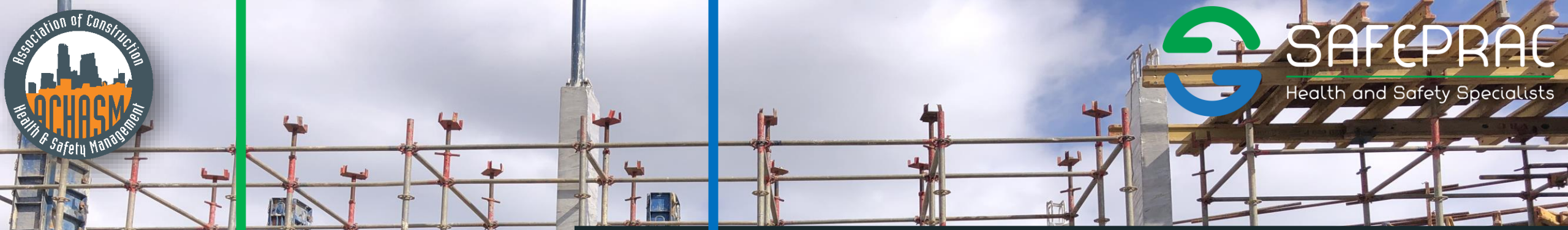

DEL - SOUTH AFRICAN NATIONAL CONSTRUCTION HEALTH AND SAFETY CONFERENCE 2024 (14-15 OCTOBER 2024)

MITIGATING STRUCTURAL COLLAPSE OF REINFORCED CONCRETE AND TEMPORARY WORKS DURING CONSTRUCTION: A PrCHSA APPROACH TO REALIZING "VISION ZERO"

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Agenda

1. Introduction
2. Understanding the Critical Role of Structural Safety
3. Primary Factors Leading to RC and Temporary Works Collapse
4. A Proactive Approach to Structural Collapse Prevention
5. Conclusion

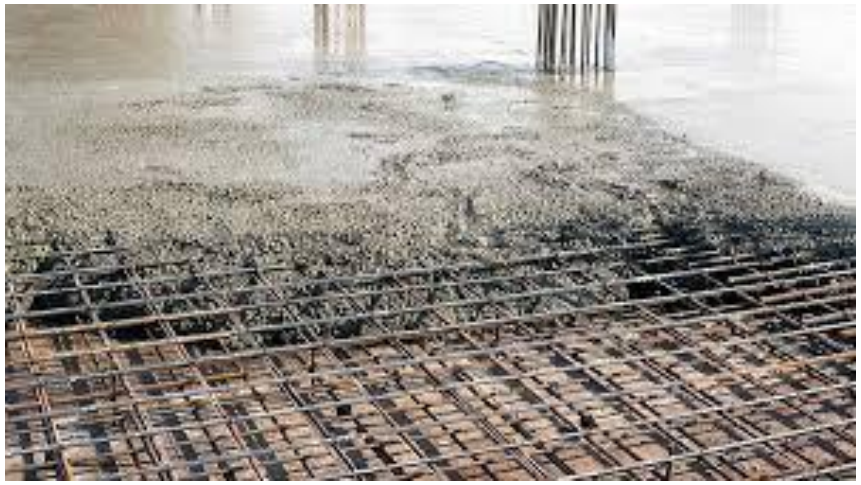
ASSOCIATION FOR CONSTRUCTION HEALTH AND SAFETY MANAGEMENT (ACHASM)

- Non-profit company
- Recognized SACPCMP Voluntary Association (VA)
- Established to provide all those working in the Construction H&S field with an advisory and representative body.
- Committed to promoting the professional interest of CHS Practitioners within the Built Environment, in terms of the Construction Regulations (2014).

1. Introduction (1)

A). What is Reinforced Concrete?

- Reinforced concrete, or reinforced cement concrete, is concrete with embedded steel bars, rods, or mesh to enhance its compressive strength, tensile strength, and ductility.



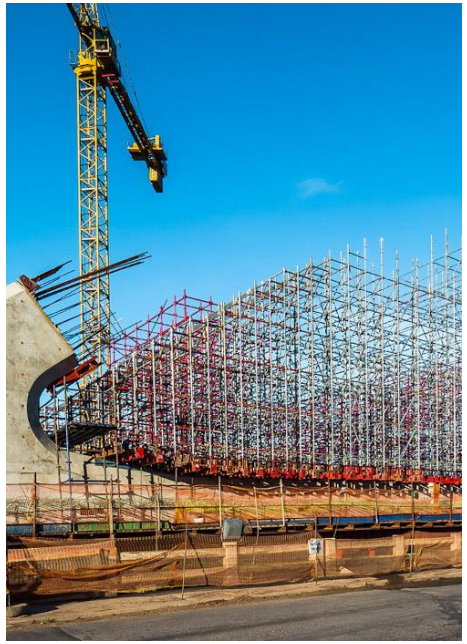
(Unknown)

(Kubukeli, 2024)

Continued….. (2)

B). What is Temporary works?

- It is "any **falsework**, **formwork**, **support work**, **scaffold**, **shoring** or **other temporary structure** designed to provide support or means of access during construction work" (CR)
- In essence it provides **stability**, "**safety**", and efficiency to ensure the structure is constructed according to plan.



(WES, n.d)

(WES, n.d)

Continued….. (3)

B). What is a collapse (RC & Temporary Works)?

- An unintended failure or breakdown of these elements during construction, resulting in partial or complete disintegration.
- The collapse can have severe consequences, posing significant risks to worker safety—including **injuries or fatalities**—as well as leading to project delays and financial losses.

(**Beacon Bay Hotel Collapse**)

(DispatchLive, 2015)

Continued….. (4)

In South Africa, we have a multitude of robust building codes, standards, legislation, and regulations. However, structural collapse(s) during construction still occur.

WHERE ARE WE FALLING SHORT?

(**George building Collapse**)

(IOL, 2024)

2. Understanding the Critical Role of Structural Safety

Continued….. (1)

- Understanding the critical role of structural safety involves recognizing the importance of temporary supports required to build and stabilize the RC structure **until it gains enough strength to be self-supporting**.
- "Temporary works are a **vital** and **safety critical part of every construction, building and civil engineering project**. Even so, they are only well understood by a handful of engineers."(Brits, 2016).
- The **continuing occurrence of collapses** in both structural components and temporary works highlights the urgent need for a proactive approach to addressing these issues.
- This presentation highlights **the importance of preventing structural collapses of reinforced concrete and temporary works** from the perspective of a Professional Construction Health and Safety Agent (Pr. CHSA).
- It also seeks to provide insights on best practices

3. Primary Factors Leading to RC and Temporary Works Collapse

Continued….. (1)

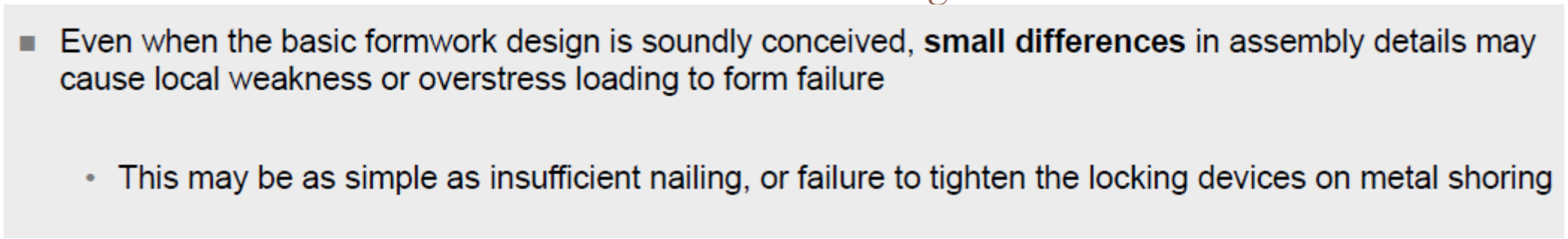
- The lack of early appointment of a PrCHSA during project stages 1 to 3 often results in missed health and safety input at design and technical meetings.
- A lack of documented safety considerations from the designer, such as a health and safety report or design HIRA.
- Poor coordination between the structural engineer and temporary works designer can lead to design misalignments, risking project stability and safety
- The appointment of CHSOs and CHSMs as agents falls below the CHSA competency level.

Continued….. (2)

- Inadequate structural inspections result from the absence of mandated structural engineer appointments, with specified intervals and format.
- The absence of detailed method statements from the contractor, coupled with insufficient oversight from the professional team, often stems from the mistaken belief that this responsibility falls solely on the contractor.
- Uncertainty and no clear guidelines concerning the temporary work designer's competency relative to complexity (CV, registration, training and qualification)
- Construction Managers lack design and technical competence related to structures

Continued….. (3)

- Continuous industry norm of temporary works designers only providing Drawings.(Drawings only are not sufficient).
- Low-quality or defective materials, such as cement, steel, and temporary works support work components, compromise the integrity of the construction.
- Premature stripping of support work,
- Lack of attention to formwork details or design:



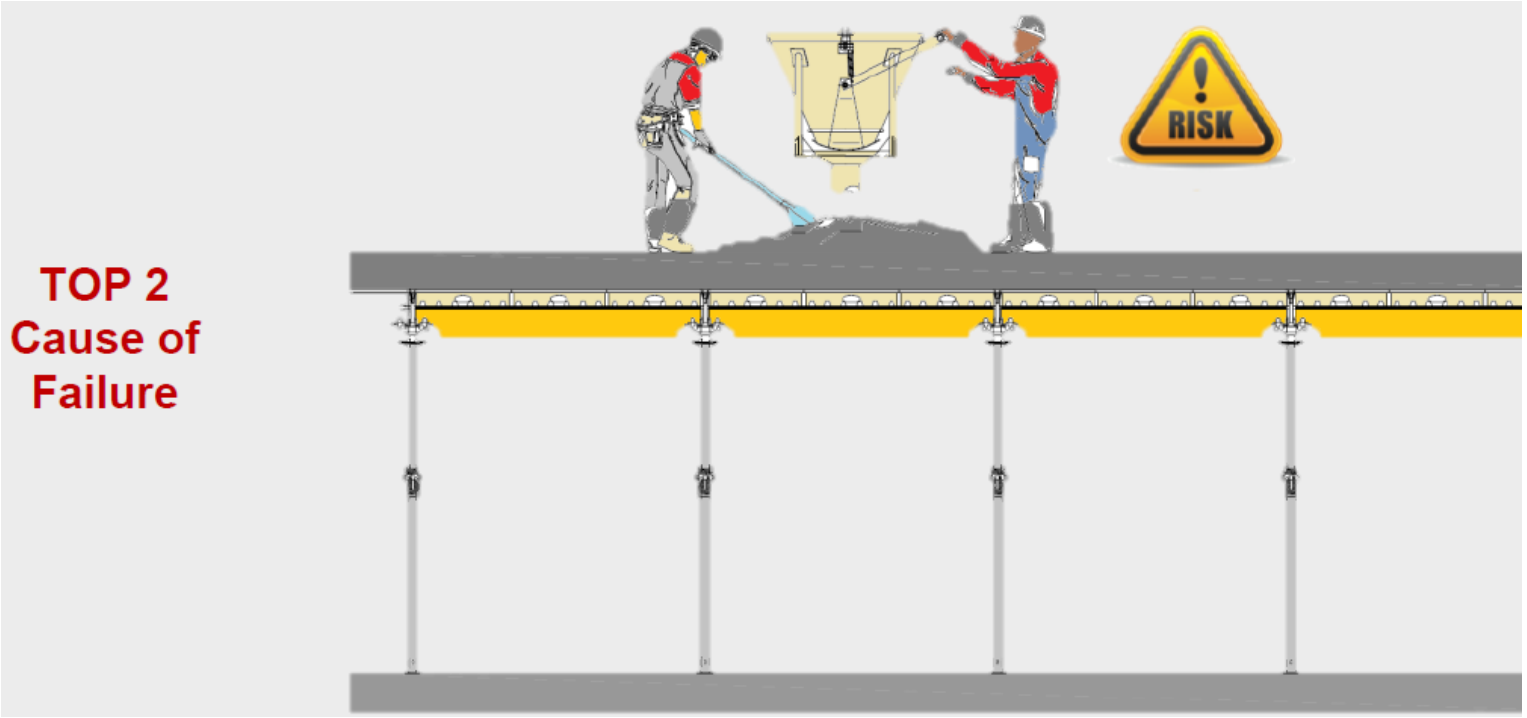
(Peri, 2016)

Continued….. (4)

(Kubukeli, 2024)

Continued….. (5)

- Inadequate control of concrete placement (heaping)



(Peri, 2016)

Continued….. (6)

- Premature loading of the formwork/ structures under construction:

Safeprac Site observation, 2024

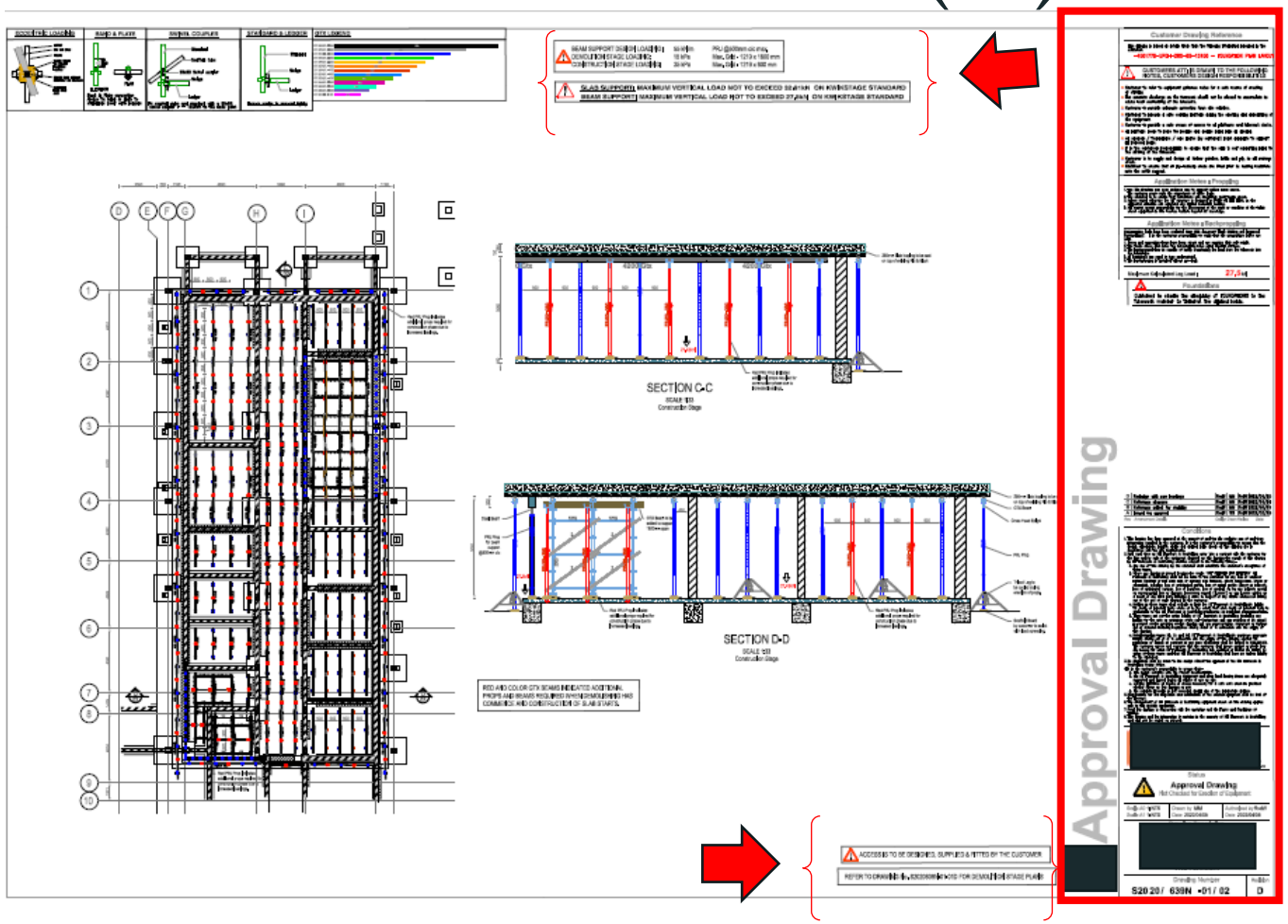
Continued….. (7)

- General poor practices (Inadequate bracing, unstable ground, sole boards, soleplates, not following the designs etc.):

(Kubukeli, 2022)

(Peri, 2016)

Continued….. (8)



Incorrect temporary works design drawings is issued and used for purposes other than their intended application.

Is it issued for:

- Information?
- Construction ?

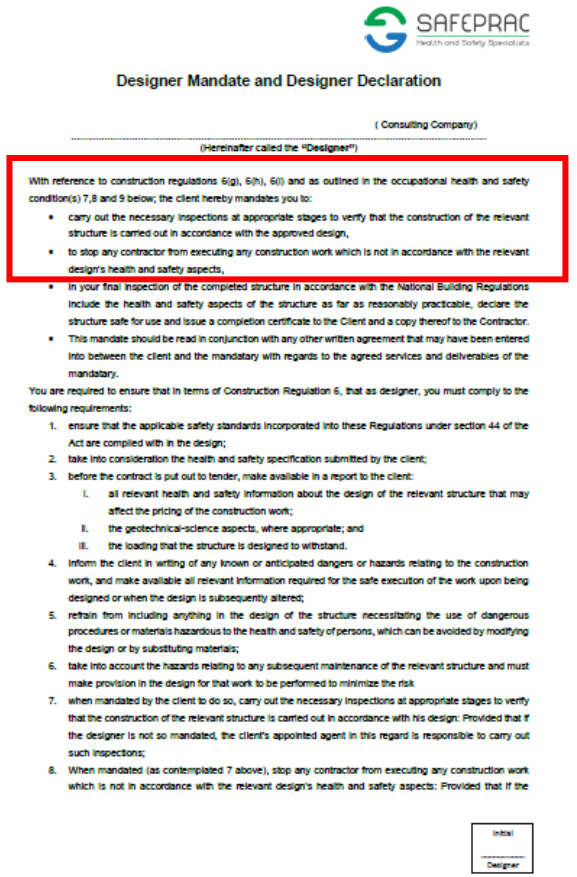
NB: the example is based on backdropping designs for demolition project.

4. A Proactive Approach to Structural Collapse Prevention

Continued….. (1)

- Appoint PrCHSA's in early stages of the project lifecycle.
- Mandate the designers to document and specify inspection intervals in writing based on project complexity and size.
- Ensure designer appointment correlates with other contractual agreements, such as PROCSA.
- Revise designer appointment and contractual agreement to include the increased frequency of inspections based on risk profile.
- Guide the client where interventions are insufficient concerning the scope.

Continued….. (2)



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Designer Mandate and Designer Declaration

(Consulting Company)

(Hereinafter called the "Designer")

With reference to construction regulations 6(g), 6(h), 6(i) and as outlined in the occupational health and safety condition(s) 7,8 and 9 below; the client hereby mandates you to:

- carry out the necessary inspections at appropriate stages to verify that the construction of the relevant structure is carried out in accordance with the approved design,
- to stop any contractor from executing any construction work which is not in accordance with the relevant design's health and safety aspects,
- In your final inspection of the completed structure in accordance with the National Building Regulations include the health and safety aspects of the structure as far as reasonably practicable, declare the structure safe for use and issue a completion certificate to the Client and a copy thereof to the Contractor.
- This mandate should be read in conjunction with any other written agreement that may have been entered into between the client and the mandatary with regards to the agreed services and deliverables of the mandatary.

You are required to ensure that in terms of Construction Regulation 6, that as designer, you must comply to the following requirements:

1. ensure that the applicable safety standards incorporated into these Regulations under section 44 of the Act are complied with in the design;
2. take into consideration the health and safety specification submitted by the client;
3. before the contract is put out to tender, make available in a report to the client:
   I. all relevant health and safety information about the design of the relevant structure that may affect the pricing of the construction work;
   II. the geotechnical-science aspects, where appropriate; and
   III. the loading that the structure is designed to withstand.
4. inform the client in writing of any known or anticipated dangers or hazards relating to the construction work, and make available all relevant information required for the safe execution of the work upon being designed or when the design is subsequently altered;
5. refrain from including anything in the design of the structure necessitating the use of dangerous procedures or materials hazardous to the health and safety of persons, which can be avoided by modifying the design or by substituting materials;
6. take into account the hazards relating to any subsequent maintenance of the relevant structure and must make provision in the design for that work to be performed to minimize the risk
7. when mandated by the client to do so, carry out the necessary inspections at appropriate stages to verify that the construction of the relevant structure is carried out in accordance with his design: Provided that if the designer is not so mandated, the client's appointed agent in this regard is responsible to carry out such inspections;
8. When mandated (as contemplated 7 above), stop any contractor from executing any construction work which is not in accordance with the relevant design's health and safety aspects: Provided that if the

Initial
Designer

With reference to construction regulations 6(g), 6(h), 6(i) and as outlined in the occupational health and safety condition(s) 7,8 and 9 below; the client hereby mandates you to:

- carry out the necessary inspections at appropriate stages to verify that the construction of the relevant structure is carried out in accordance with the approved design,

- The mandate should be read in conjunction with any other written agreement that may have been entered into between the client and the mandatary with regards to the agreed services and deliverables of the mandatary.

Note: If the designer is not so mandated, the client's appointed agent in this regard is responsible to carry out such inspections;

Continued….. (3)

- Structural engineer to provide temporary work designer (usually appointed by the contractor) all necessary structural design information such as;

❑ Structural drawings, and structural specifications.

- Structural engineer to review and verify the temporary works designer's designs and load calculations and ensure alignment with his designs.
- Ensure detailed method statements are drafted by competent persons and reference applicable design drawings.
- Structural engineer, H&S Agent and all other members of the professional team to provide oversight and comments on the method statement and read in conjunction with temporary work design

Continued….. (4)

- SWP's & HIRA's are in place and implemented.
- Ensure the structural engineer conducts a thorough structural inspection and documents the necessary approvals before proceeding with the next activity. e.g., verifying the rebar, spacing, and steel fixing etc., prior to concrete pouring.
- Effective coordination between the structural engineer and the temporary works designer is essential to determine the appropriate timing for stripping support work at specified percentages, based on achieved reinforced concrete strength as indicated by concrete lab test results.

Continued….. (5)

- The PrCHSA to ensure and verify prior commencement of any temporary works activities that:

❑ **Competent** temporary works designer is appointed in writing;

❑ Approved temporary works designs are in place,

❑ Appropriate temporary works designs are in place (issued for construction not for information),

❑ Verify temporary works designer appointment terms Re: full scope or Only CR 6(2)(a)-(d) (Providing temporary works design drawings only).

Continued….. (6)

- The PrCHSA to ensure and verify prior commencement of the temporary works activities that:

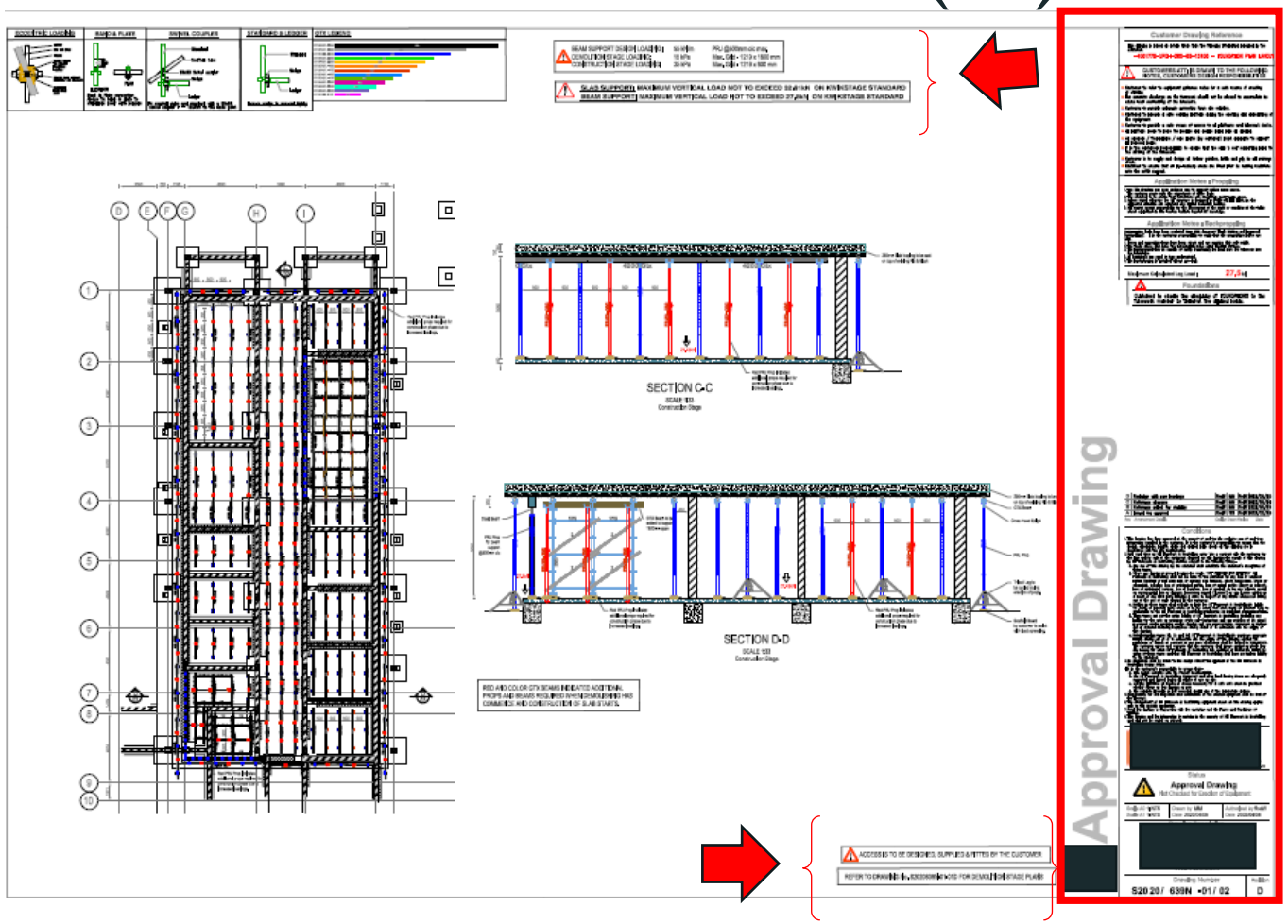
❑ Approved temporary works designs are in place,

❑ Appropriate temporary works designs are in place (issued for construction and not for information),

❑ Verify temporary works designer appointment terms Re: full scope or Only CR 6(2)(a)-(d) (Providing temporary works design drawings only).

❑ **Note: Duties in terms of CR 12.1 – Design, inspect and approve can be carried by different persons. (duties and competency verification is imperative)**

Continued….. (7)



Ensure appropriate temporary works designs are in place (approved and/issued for construction and not for information),

.

Is it issued for:

- Information?
- Construction ?

Does it include calculations, details, and specifications (demolition and construction stage)?

NB: the example is based on backdropping designs for a demolition and construction project.

Continued….. (8)

- Providing only a drawing is insufficient; each drawing must be accompanied by

❑ calculations, details, and specifications to qualify as a complete design.

❑ Conceptual sketches or drawings marked “Issued for Information” are not considered designs and do not require compliance.

❑ However, when drawings are “Issued/Approved for Construction,” all specified requirements must be included within the drawing or attached to it.

❑ The designer must also provide Sequencing (construction methodology) and SWP.

5. Conclusion

Conclusion (1)

- Definitive guidelines to determine temporary work designer, supervisor, and inspector (perhaps a complexity matrix to assess the level of competency required, i.e. tertiary qualification).
- Professional bodies such as ECSA to establish a registration category for temporary work designers.
- There is a need for subject matter experts to be appointed as opposed to general competency for specific or highly complex projects, i.e. demolition).

Continued….. (2)

- Professional registration bodies to outline the scope and limitations that accompany registration.
- Lack of accountability, which is directly linked to ethics in engineering.
- Ethics classes should be a prerequisite preceding professional registration (SAIOH require ethics courses to be taken).
- Although strong regulations are established, they are not being fully enforced, with essential documents frequently neglected.

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ANY QUESTIONS?

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