

APS Practice Note Temporary Works



This practice note provides a comprehensive overview of temporary works and examines important safety implications to be considered with their use.

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Temporary works

Temporary works (TW) are the parts of a construction project that are needed to enable the permanent works to be built. Usually the TW are removed after use e.g. access scaffolds, props, shoring, excavation support, falsework and formwork, but sometimes the TW is incorporated into the permanent works e.g. haul road foundations, permanent formwork for suspended floors and crane or piling platforms, which may be used for hardstanding or road foundations.

1. Definitions

1.1 BS 5975:2019, Code of practice for temporary works procedures and the permissible stress design of falsework. Clause 5.1.1.1

"Temporary works can be described as providing an "engineered solution" that is used to support or protect either an existing structure or the permanent works during construction, or to support an item of plant or equipment, or the vertical sides or side-slopes of an excavation during construction operations on site or to provide access. It is used to control stability, strength, deflection, fatigue, geotechnical effects and hydraulic effects within defined limits. ...".

1.2 HSE SIM 02/2010/04, Management of temporary works in the construction industry.

"... An 'engineered solution' used to support or protect an existing structure or the permanent works during construction, or to support an item of plant or equipment, or the vertical sides or side-slopes of an excavation, or to provide access

The construction of most types of permanent works will require the use of some form of temporary works..."

1.3 Permanent works The Temporary Works Forum (TWf) Clients' guide to temporary works asks readers to consider the following also:

"... states of the permanent works which are temporary, loading conditions of the permanent works during construction or project execution which are not envisaged in the permanent condition, structures in states of modification or demolition ..."

2. What is BS 5975:2019?

This British Standard was first published in 1982. It reflected the recommendations of the Bragg Report and used, as the main reference document during the drafting stages, the report on falsework by the Joint Committee of the Concrete Society and the Institution of Structural Engineers. These two reports were published in the 1970s following a number of significant collapses and an apparent lack of authoritative guidance.

BS 5975: 2019 gives recommendations and guidance on the procedural controls to be applied to all aspects of temporary works in the construction industry. It also includes guidance on design, specification, construction, use and dismantling of falsework. This standard gives guidance on permissible stress design of all falsework.

Section 1 gives recommendations in relation to training and education.

Section 2 gives recommendations for procedures to ensure that temporary works are conceived, designed, specified, constructed, used and dismantled all in a safe and controlled manner suitable for all construction projects. These procedures include clauses relating to all roles involved in temporary works: clients, permanent works designers, temporary works designers, contractors (including construction management organizations), suppliers and manufacturers.

Section 3 (under review, Feb. 2022) covers the design of temporary works and in particular the design of falsework and relevant formwork.

How does it work?

BS 5975 takes an in-depth look at all the terms, definitions, abbreviations and symbols, as well as the latest legislation, concerning temporary structures and falsework. This standard also gives clear guidelines on the procedural control of temporary works, including the design, site supervision and loading.

The HSE website notes:

"SIM 02/2010/04 is currently being revised but this work is on hold pending publication of the next revision of BS 5975". This took place in 2019 and is currently being reviewed further (Feb. 2022).

It covers falsework in detail and looks at all the materials involved, such as steels, structural timber, softwoods, hardwoods, concretes and other scaffolding components. Other topics include foundations, soil testing and ground-water drainage.

The standard sets out three fundamental principles for controlling temporary works Clause 5.1.1.10):

- 1) All organizations have a duty to manage and control their work. This principle should be managed by the appointment of a “senior person”, defined by the term designated individual (DI), who should be appointed to prepare and manage the organization’s procedures.
- 2) The contractor is responsible for building the permanent works, and that includes any associated temporary works in order to construct the project.
- 3) One person should take overall responsibility for managing the temporary works.

This principle - that one person is to be appointed with overall responsibility for managing the temporary works on a site - was first established in the Bragg Report. A temporary works co-ordinator (TWC) should be appointed with overall responsibility for managing the temporary works on a site. This person should be appointed by the principal contractor and should be referred to as the “PC’s TWC”. NOTE The TWC can, if necessary, delegate certain day to day activities, such as site inspection, to a temporary works supervisor (TWS).

A TWC may be appointed by another contractor – a sub-contractor employed by the PC or a contractor employed directly by the client or a third party - to manage their temporary works but this individual should be responsible both to their own DI and the PC’s TWC (Clause 5.1.1.13).

A very useful summary of the control measures that should be used to ensure safety for all temporary works is given in Clause 5.1.2.

The risks associated with temporary works can be considered to arise from:

- their design;
- their construction and use; and
- the consequences of their failure.

Risks associated with design relate to the complexity of the design. Mitigation of design risk is addressed through the selection of the category of design check (Clause 13.7 and Table 2).

Risks associated with the construction, use and removal of the temporary works relate to such aspects as workmanship, materials, experience and manner of use. These are termed execution risks.

Risks associated with the consequence of failure of the temporary works come from the location of the temporary works, and what might be affected by the failure.

Execution risk and consequence of failure risk combine to form an implementation risk (see Clause 6.1.3.3).

Each organization should determine the level of control for each risk class of temporary works, depending on their experience (including that of operatives), competence and the location of the particular temporary works and the consequence of its failure (Clause 6.1.1.3). The approach to be taken when managing risk under each of the implementation classes should be defined in the company procedures (see Table 1).

3. Types of temporary works

PAS 8811: 2017 gives examples of temporary works - based on PAS 8812: 2016 - in six groups:

3.1 Group 1 – Falsework, formwork, simple advancing falsework/ formwork, access, protection

Falsework

- Support to a partially completed structure (e.g. in situ and precast concrete, steelwork during assembly)
- Propping
- Façade retention
- Needling
- Flying shores
- Gantries/cantilever
- Service bridges
- Structures providing stability during construction, alteration or demolition



Formwork

- Vertical (wall and column)
- Soffits
- Sloping
- Arches
- Cantilever soffits
- Permanent formwork



Simple advancing falsework/ formwork

- Formwork travellers (horizontal)
- Climbing formwork (vertical)
- Advancing/launching formwork



Access

- Tied scaffolds
- Freestanding scaffolds
- Gantries
- Special scaffolds (e.g. underslung scaffolds)



Protection

- Hoardings
- Protection fans
- Temporary roofs



3.2 Group 2 – Geotechnical

- Trench and excavation support
- Tower crane bases
- Piling/crane mats
- Retaining walls
- Earthworks
- Foundations
- Cofferdams
- Horizontal and inclined propping
- Underpinning
- Ground anchors
- Haul/site roads



3.3 Group 3 - Vehicle/pedestrian bridges, etc.

- Temporary bridges
- Propping trafficked bridges



3.4 Group 4 – Underground

- Tunnels/headings
- Shafts
- Chambers
- Tunnelling thrust pits



3.5 Group 5 – Marine

- Dolphins
- Access jetties
- Floating plant
- Temporary quay walls



3.6 Group 6 - Other temporary structures

- Bridge launching
- Heavy lift systems
- Moving of structures
- Protection decks
- Structural support to cranes or other lifting devices
- Erection gantries
- Hydraulic equipment
- Jacking



4. Consequences and causes of temporary work failures

Failure to adequately design, construct and maintain temporary works can lead to:

- collapse or failure of the temporary works
- structural failures and collapse of the permanent works
- uncontrolled ingress or egress of materials, spoil and water
- collapse of adjacent structures (buildings, transport systems, infrastructure)
- risk of single/multiple fatalities and serious injuries to workers and members of the public
- risk of significant delay and increased costs to construction projects
- significant financial and commercial risks to:
 - contractors
 - sub-contractors
 - designers
 - suppliers
 - clients

Causes

- Absence of or an inadequate temporary works procedure
- No temporary works coordinator (TWC) appointed
- Inadequate site investigation
- Geotechnical
- identification of underground services
- assessment of the structural condition of existing and/or adjacent buildings
- Inadequate or lack of:
 - design brief
 - temporary works design
 - appropriate level of checking of temporary works designs
- Lack of awareness on site of temporary works design assumptions
- Unavailability of temporary works equipment
- Inappropriate use of temporary works equipment
- Poorly constructed temporary works and/or absence of checking of adequate erection
- Unauthorised changes to an approved temporary works design
- Overloading of temporary works, i.e. failure to control loading or lack of awareness of the capacity of the equipment (e.g. acrow props)
- Inadequate communication of details of the temporary works design to the erectors
- Inadequate foundations for the temporary works
- Lack of adequate lateral stability for the temporary works]

5. Differences between permanent works and temporary works

Typically, there are several differences between permanent works and temporary works, notably:

Issue	Permanent Works	Temporary works
Serviceability stress levels	Low	High
Critical limit state	Usually 'ultimate'	Often 'serviceability' (deflection driven)
Current predominant codes	Limit state	Permissible stress
Robustness	High	Often low
Ratio imposed/dead load	Typically 50:50	Typically '10 to 1'; extreme patterns
Duration of use	60 to 120 years	Days, weeks or months; occasionally longer
Component types	Bespoke to project, always new	Suppliers' systems, often second hand, grouped, eccentrically loaded
Planning	Often widely negotiated; can take years	Quick; under site pressure
Published work, training, teaching and research	£bn industry	£m industry

Temporary Works design is part of the Pre-construction phase and the Principal Designer in collaboration with the Principal Contractor should engage with the TW designer to assess risk, significant risk and the impact of these on the design risk profile for the project.

Permanent works designers should address the buildability of the permanent works and identify, and make provision for, any temporary works and temporary conditions required by their design and their assumed method of construction.

The designer should liaise with the PD to provide all necessary information relevant to any temporary works of temporary condition(s) to the PC through the PD.

In relation to temporary works, the PD should ensure that:

- a) there is a coherent construction method which identifies all key temporary conditions and temporary works;
- b) the finally agreed construction method, sequence and temporary works are not deleterious to the permanent works design.

6. References

Key reference:

BS 5975:2019, Code of practice for temporary works procedures and the permissible stress design of falsework.

Information and resources:

1. Temporary Works Forum (TWf) - www.twforum.org.uk/resources
- a. TW21.043, v3, TWf Guidance: Collated list with links, <https://www.twforum.org.uk/viewdocument/twf-guidance-collated-list-with-l>
- b. TW13.032, Differences between permanent and temporary works, <https://www.twforum.org.uk/viewdocument/differences-between-permanent-and-t>
- c. TWf19.010, TWf Information Sheet No. 6 – The safe management of temporary works, <https://www.twforum.org.uk/viewdocument/twf-information-sheet-no-6-the-s>
- d. TW17.037, Principles for the management of temporary loads, temporary conditions and temporary works during the construction process, <https://www.twforum.org.uk/viewdocument/principles-for-the-management-of-te>
- e. TW20.128, TWf Information Sheet No. 12 - Competence of the Designated Individual (DI), <https://www.twforum.org.uk/viewdocument/twf-information-sheet-no-12-comp>
- f. TW21.094, TWf Information Sheet No. 14 - Considering temporary works early in a project: Reducing cost, improving buildability and reducing risk, <https://www.twforum.org.uk/viewdocument/twf-information-sheet-no-14-cons>
2. Temporary Works: Principles of Design and Construction, Second Edition, Edited by Pallett, P.F. and Filip, R., ISBN 978-0-7277-6338-9
3. BS EN 12812: 2008 Falsework. Performance requirements and general design (BSI)
4. PAS 8812: 2016, Temporary works. Application of European Standards in design. Guide (BSI)
5. PAS 8811: 2017, Temporary works. Major infrastructure client procedures. Code of practice (BSI)
6. The management of temporary works in the construction industry, SIM 02/2010/04, HSE, https://www.hse.gov.uk/foi/internalops/sims/constrct/2_10_04.htm
7. Investigation into aspects of falsework, HSE Contract Research Report 394/2001, https://www.hse.gov.uk/research/crr_html/crr01394.htm
8. The Construction Plant Hire Association (CPA) has some excellent topic specific guidance on piling, shoring, cranes, excavations etc on their website www.cpa.uk.net/publications
9. Temporary Works Update - www.temporaryworks.info
10. Temporary Works Flowchart to BS 5975:2019, <https://www.temporaryworksflowchart.com/>

Other resources

- Final Report of the Advisory Committee on Falsework (known as the 'Bragg Report') <https://www.cross-safety.org/sites/default/files/2021-03/final-report-of-the-advisory-committee-on-falsework-bragg-report.pdf>
NOTE: Published in 1975, but very relevant to temporary works today.
- Clients' guide to temporary works - Recommendations for Clients, their representatives, programme managers and others on the design and coordination of temporary works (TWf2014:02, December 2014), <https://www.twforum.org.uk/viewdocument/clients-guide-to-temporary-works>
NOTE: This still refers to CDM2007 but the principles set out are still relevant.
- Falsework, a joint report, TRCS 4, The Concrete Society and The Institution of Structural Engineers, July 1971, London, 52 pp ISBN 7210 0815 1

Acknowledgements

David Thomas, MSc, BSc (Eng), AKC, CEng, FICE, CFIOSH, MInstrRE

Director and Secretary, Temporary Works Forum, www.twforum.org.uk

Director, Heightsayfe Ltd, www.heightsayfe.com/

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APS 5 New Mart Place
Edinburgh EH14 1RW
T: 0131 442 6600
E: info@aps.org.uk



@apstalk



[linkedin.com/company/associationforprojectsafety](https://www.linkedin.com/company/associationforprojectsafety)

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