MASTERING
TEMPORARY WORKS

Best-Practice Management, Design & Company Procedures

aligned with BS 5975-1:2024 and BS 5975-2:2024

VOLUME 2 — DESIGN & COMMON TYPES

Chapter 6 Design Principles, Eurocode comparison, and worked examples
Chapter 8 Common Temporary Works Types — management & design in practice

Temporary Works Consulting

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Use of this Volume

Relationship to Volume 1

This is Volume 2 of a three-volume set. Volume 1 covered the foundation — introduction, legal framework, roles, management procedure and risk. This volume takes the reader into design principles and the common temporary works types that every site will encounter. Volume 3 will cover the flagship company procedure writing guide, case studies, future trends and the full library of templates.

Readers are assumed to be familiar with the role definitions, risk framework and register concepts introduced in Volume 1. Where they are cross-referenced, references take the form 'Volume 1, Chapter 3.3' and similar.

Copyright reminder

This volume is the original editorial work of Temporary Works Consulting. It paraphrases, interprets and illustrates the requirements of BS 5975-1:2024 and BS 5975-2:2024, and draws on parallel guidance including BS EN 12812, BS EN 1991, BS EN 1993, BS EN 1997, BS EN 1993, TG20:21, BR470, and TWf publications. No clause text, table or figure is reproduced verbatim. Full licensed copies of the relevant British Standards and guidance must be held by the reader.

Use of worked examples

Chapter 6 contains four worked examples. Every numerical input in these examples is explicitly illustrative and flagged as such. The examples are teaching material. They are not a design for any real project. On real projects, all loads, material properties, geotechnical parameters and geometry must be determined from the actual site investigation, design brief and specification, and the full design — including checks and outputs — must be delivered by a competent Temporary Works Designer in accordance with BS 5975-2:2024 or an equivalent Eurocode approach, and independently checked to the appropriate category.

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Chapter 6 — Design Principles, Eurocodes and Worked Examples

Chapter summary

BS 5975-2:2024 gives designers a choice: permissible stress (Clause 9) or limit state with partial factors (Clause 8). Both are valid, but they must not be mixed within a single design. This chapter sets out the principles of each, compares them to the Eurocodes, explains the load combinations that apply before, during and after loading, and gives four fully worked illustrative examples covering propping, falsework, trench support and crane outrigger pads. It closes with working platforms to BR470 and residual-risk guidance.

6.1 General design considerations — loading, stability, materials

Every temporary works design must start from three questions. What is carrying load? What could cause it to fail or become unstable? How will it actually be built, used and dismantled on site? BS 5975-2:2024 is written around these questions; the Eurocodes cover the first two with more formality but leave the third largely to the designer's judgement. A competent temporary works design engages with all three.

6.1.1 Loading

Loads on temporary works are rarely uniform and rarely static. A falsework soffit carries the self-weight of the wet concrete (which does not set instantly and behaves as a fluid while being placed), plus live construction loads from operatives, plant and materials, plus lateral loads from concrete pumping and pouring, plus wind (working or maximum depending on whether the pour is in progress), plus any imposed load from the permanent works as construction progresses. A propping scheme picks up whatever the permanent works is temporarily releasing, which may be a fraction of the dead load, or may be an imposed live load as occupied floors above are disturbed. An excavation support picks up active earth pressure from the ground, surcharge from plant and stored material, and potentially groundwater pressure.

Four practical principles apply across all loading cases:

- Never assume a single 'design load'. Temporary works see a sequence of loads at different stages. Each stage must be considered — before loading, during loading and after loading at a minimum, and usually in more detail for complex schemes.
- Always include a minimum horizontal disturbing force. BS 5975-2:2024 retains the 2.5 per cent lower bound originally introduced by Bragg in 1975. Even if no identifiable horizontal load exists, at least 2.5 per cent of the vertical load is taken as a horizontal disturbing force. For schemes in exposed locations, actual wind and other horizontal loads will routinely exceed this.
- Include dynamic and impact effects realistically. Concrete pouring, plant movement, lifting operations and traffic loads all have dynamic components. BS 5975-2:2024 gives specific guidance; where site activity is particularly dynamic (for example, trackless vibratory plant on a platform, or concrete pumping at pressure), specialist input is warranted.
- Do not forget construction tolerance and imperfections. A nominally vertical falsework frame erected within the permitted 1/200 verticality tolerance still generates a notional

sway force of 1 per cent of the vertical load. Permissible stress design absorbs this within the 2.5 per cent minimum; limit state design treats it explicitly.

6.1.2 Stability

Three stability checks apply to almost every temporary works scheme. First, member stability — each strut, beam, tie and connection must resist its internal forces. Second, overall stability — the scheme as a whole must resist overturning, sliding and horizontal translation under the worst load combination, typically with a factor of safety of 1.5 on overturning (1.67 where self-weight is uncertain). Third, interface stability — where the temporary works interacts with the permanent works, with other temporary works, with the ground, or with plant, each interface must be verified.

Stability failures in practice almost always trace to one of four causes. An assumed restraint that is not actually present (the classic 'top-restrained' falsework where the restraint depended on a slab that had not yet been poured or had not achieved strength). A sequence where a critical member is removed before its load path has been replaced. Wind or lateral load greater than assumed, often because the cladding or netting was added after the design. And accidental impact, typically from crane loads or plant.

6.1.3 Materials

BS 5975-2:2024 Clause 5 covers materials. Temporary works designers routinely specify steel, timber, aluminium, proprietary falsework, scaffold tube and fittings, and plywood formwork. Each has its own working values and factors of safety under permissible stress, and its own characteristic values and material factors under limit state. A few recurring traps:

- Timber strength depends heavily on moisture content, load duration and species. Do not assume a general 'timber' value — specify the grade and reference the standard (for example, BS EN 338 C24 softwood).
- Scaffold tube is a specific product. Condition assessment is part of any design using site tube.
- Proprietary falsework must be used within the supplier's stated limits. BS 5975-2:2024 is explicit that the safe working values given by the supplier are the applicable capacities, not general handbook values.
- For HV and substation temporary works, consider material behaviour under fault conditions and induced voltages. Steel scaffolding, for example, can carry significant induced voltage from adjacent live conductors. This is covered further in Chapter 8.10.

6.2 Permissible stress design and limit state design under BS 5975-2:2024

Figure 6.1 — Permissible stress and limit state design — conceptual comparison.

BS 5975-2:2024 retains permissible stress design as the historical and still-dominant method for UK falsework. Clause 9 of Part 2 sets out the approach: actual, unfactored loads are applied to the structure, and the resulting stresses must be less than or equal to permissible stresses, where permissible stresses are derived from failure stresses divided by a factor of safety. The result is expressed as a 'safe working load' or 'allowable load' — a single number that a site team can easily interpret.

BS 5975-2:2024 also adds limit state design, explicitly, in Clause 8. This brings the standard into alignment with the Eurocode family and with BS EN 12812:2008 (falsework performance classes), and is available for all falsework, not only for Class A. Under limit state design, the design action Ed (calculated using partial load factors applied to characteristic actions) must be less than or equal to the design resistance Rd (calculated using material characteristic strengths divided by material partial factors). Ultimate limit state (ULS) governs strength and stability; serviceability limit state (SLS) governs deflections.

The two methods are parallel. Either can be used for any falsework in the UK. They must not be mixed in a single design — switching between permissible stress and limit state mid-calculation defeats the internal consistency of each method. The design brief must state which approach the designer will use, and the checker must check on the same basis.

6.2.1 Which to choose?

In practice the following considerations drive the choice:

- Traditional falsework using proprietary equipment with established permissible stress capacities — stay with permissible stress. It is familiar, faster, and interfaces naturally with supplier data.
- Bespoke steel or concrete temporary works where the permanent works is being designed to Eurocodes — use limit state. Material and partial factors then align with the permanent works side of the calculation, and temperature, settlement, post-tensioning and other actions have a consistent treatment.

- International projects where limit state is the expected method — use limit state. Most Eurocode jurisdictions, and AS/NZS approaches in Australia and New Zealand, treat limit state as the default.
- Novel or complex schemes where accidental actions, disproportionate collapse or progressive collapse must be considered — use limit state, as it provides the explicit framework for accidental load combinations.

6.3 Comparison with Eurocodes — scope, philosophy and practical interfaces

The Eurocodes provide a comprehensive design framework for permanent structures and, through BS EN 12812:2008 and related documents, for falsework. The interface between BS 5975-2:2024 and the Eurocodes deserves specific attention because temporary works designers are increasingly expected to work across both.

Aspect	BS 5975-2:2024	Eurocodes (e.g. BS EN 1990, 1991, 1993, 1997, 12812)
Scope	Falsework specifically; principles applicable to other TW	All structural design; falsework covered via BS EN 12812 Class A/B
Design method (default)	Permissible stress (Clause 9) with limit state (Clause 8) as alternative	Limit state only
Load factors	Single FoS on material capacity	Partial factors γF on actions; γM on materials
Wind loading	Simplified method; references BS EN 1991-1-4 for detail	BS EN 1991-1-4 full method
Minimum lateral load	2.5% of vertical load (permissible); 1% erection tolerance (limit state)	Class-dependent notional sway per BS EN 12812; typically ~1%
Material factors	Implicit in permissible stresses	Explicit (e.g. $\gamma M0$, $\gamma M1$ for steel)
Accidental actions	Covered by impact clause	Explicit accidental load combinations in BS EN 1990
Soils / geotech	References BS EN 1997	BS EN 1997-1 and national annex
Disproportionate collapse	Addressed qualitatively; refer specialist guidance	Explicit — Annex A of BS EN 1991-1-7

6.3.1 Practical interface issues

Where a temporary works scheme touches or supports permanent works that were designed to Eurocodes, three interface issues come up repeatedly:

- Load transfer at interface. If the permanent works designer has provided characteristic loads from a Eurocode analysis, the temporary works designer must either use characteristic values directly (under permissible stress, with an applied FoS) or factor them (under limit state). Either is valid; what matters is consistency.
- Partial demolition and residual capacity. Where a partially-demolished permanent structure is holding up temporary works (or vice versa), the residual capacity of the permanent structure must be assessed using whatever code the permanent structure was designed to,

with appropriate allowance for damage, age and deterioration. This is typically a matter for a Cat 3 temporary works design with peer review.

- Pre-stress release and stage construction. Post-tensioned structures and precast erection sequences impose staged loads on temporary works that may differ from the final state. BS 5975-2:2024 includes post-tensioning as an action in Combination 3 and references BS EN 1992 for concrete.

6.4 Load combinations — before, during and after loading

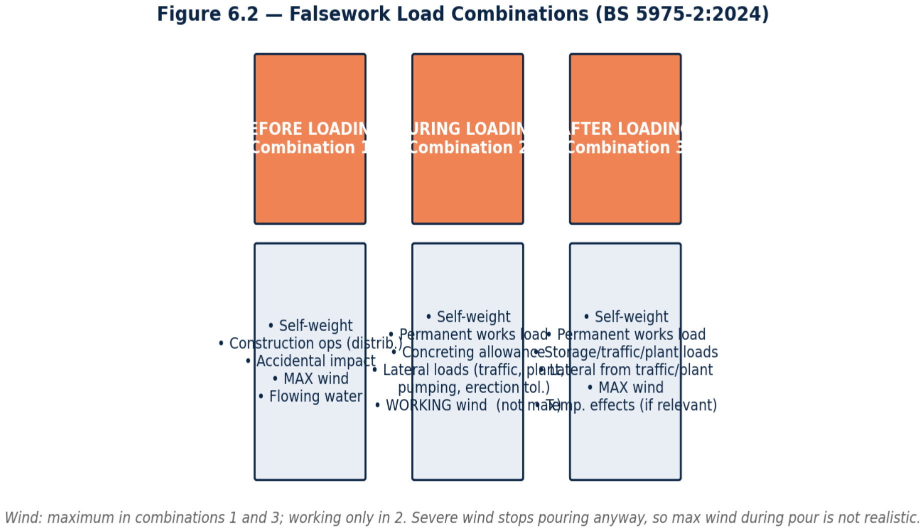

Figure 6.2 — The three principal load combinations for falsework.

BS 5975-2:2024 defines three load combinations for falsework, each representing a distinct stage. The same concept applies to most other temporary works, with adjustments for the specific load sources.

- Combination 1 — before loading. The falsework is erected but the permanent works is not yet placed. Dominant actions: self-weight of the falsework, construction operation loads (distributed), possible accidental impact from crane loads, and maximum wind. Flowing-water effects where applicable. No permanent works load yet.
- Combination 2 — during loading. The permanent works is being placed (concrete pour, precast erection, steel landing). Dominant actions: self-weight, the permanent works load (typically 100 per cent of dead load during pour), a localised concreting allowance over a 3 m × 3 m area, lateral loads from traffic, plant and pumping, and erection-tolerance sway. Wind is 'working wind' — a reduced value reflecting the fact that severe wind stops pouring. This combination is the one that governs many members during the most dynamic period.
- Combination 3 — after loading. The permanent works is in place but has not yet reached full self-supporting strength. Dominant actions: self-weight, full permanent works load (now including imposed live loads from storage, traffic and plant), maximum wind (the pour is finished, full wind is realistic), and temperature effects where the permanent works is long enough (over 60 m for bridges).

Several points recur in examinations of falsework incidents:

- The most dynamic period is Combination 2, but the most heavily loaded period is often Combination 3. Both must be checked.

- Maximum wind does not apply to Combination 2 because pouring stops in severe wind; this is explicit in BS 5975-2:2024.
- Seismic actions are not included in UK combinations. For overseas projects, a seismic combination must be added using the relevant national annex to BS EN 1998.

6.5 Lateral stability and the minimum horizontal disturbing force

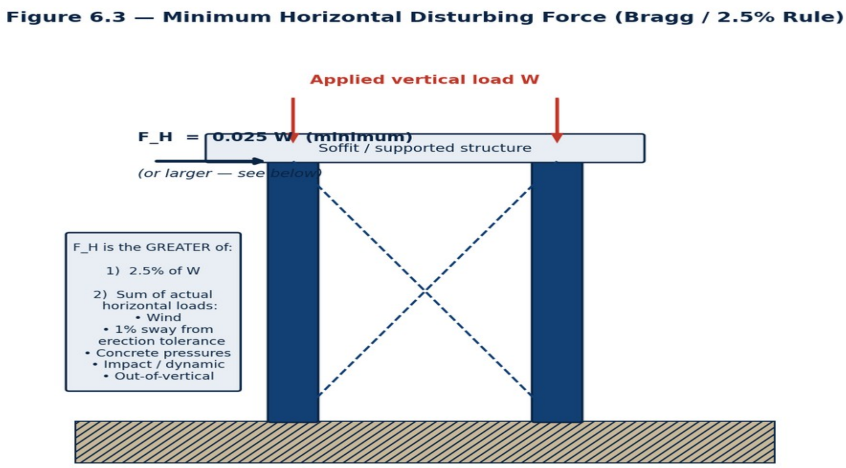

Figure 6.3 — The minimum horizontal disturbing force (the 'Bragg 2.5 per cent rule').

Introduced in the Bragg Report of 1975 and retained through every subsequent revision of BS 5975, the minimum horizontal disturbing force remains one of the most important single concepts in temporary works design. At each stage of construction, the falsework (or other TW) is designed to resist, simultaneously with the applied vertical loads, a horizontal force FH taken as the greater of:

- 2.5 per cent of the applied vertical loads, applied at the points of contact between the vertical loads and the supporting falsework, or
- the sum of actual horizontal actions, including wind, out-of-vertical effects from erection tolerance (notionally 1 per cent of vertical load), concrete pressures, dynamic and impact forces, and environmental actions.

The 2.5 per cent rule is a lower bound. Real lateral loads frequently exceed it. The rule prevents the most common failure mode — falsework designed only for vertical loads, with no explicit lateral resistance, failing under a small accidental sway.

In limit state design, BS EN 12812 introduces a sway imperfection value of 1 per cent of the vertical load for Class B2 falsework less than 10 m tall, increasing for taller structures, applied as a persistent variable horizontal action. The philosophy is the same — a minimum notional lateral action must always be present. The magnitude differs between methods, which is another reason the two cannot be mixed.

6.6 Wind loading on falsework and other temporary works

Wind is the single most consistent cause of temporary works instability when it is under-estimated. BS 5975-2:2024 permits a simplified wind method derived from BS EN 1991-1-4 and applicable to the majority of falsework. The simplified method uses a peak velocity pressure qp derived from site-specific basic wind velocity, a topography factor, and a height factor; the resulting force on the falsework is calculated using a net pressure coefficient that depends on whether the falsework is clad, sheeted or open.

Three pitfalls recur in wind calculations:

- Debris netting and sheeting transform the wind profile. Clad falsework sees a net pressure coefficient of 1.30 (in line with TG20:21 and the national annex to BS EN 1991-1-4). Netting added after the design is finalised is a frequent cause of instability — the wind load can double.
- Height factors matter. A falsework scheme extending from ground level to a 12 m tall deck is in a different wind regime at its top from at its base. The simplified method accommodates this.
- Topography is often under-appreciated. Hillside sites, exposed coastal sites and estuarine sites generate wind speeds significantly above the basic regional value. In extreme cases (long laminar wind regimes on estuaries or large plains) vortex shedding and aeroelastic instability must be considered.

For temporary works other than falsework — hoardings, edge protection, tied scaffolds, cladding supports — the same wind principles apply, with the net pressure coefficient tailored to the geometry. Hoardings in urban environments are particularly sensitive: TG20:21 and the BS 5975 Part 2 simplified method both give suitable starting points, but detailed checks per BS EN 1991-1-4 are warranted for tall or exposed hoardings.

6.7 Worked Example 1 — Proprietary Push-Pull Prop

Illustrative example — inputs are hypothetical

All values in this example are illustrative and for teaching only. They are NOT a design. Real designs must use actual loads, actual prop supplier data, and independent checking to the appropriate category.

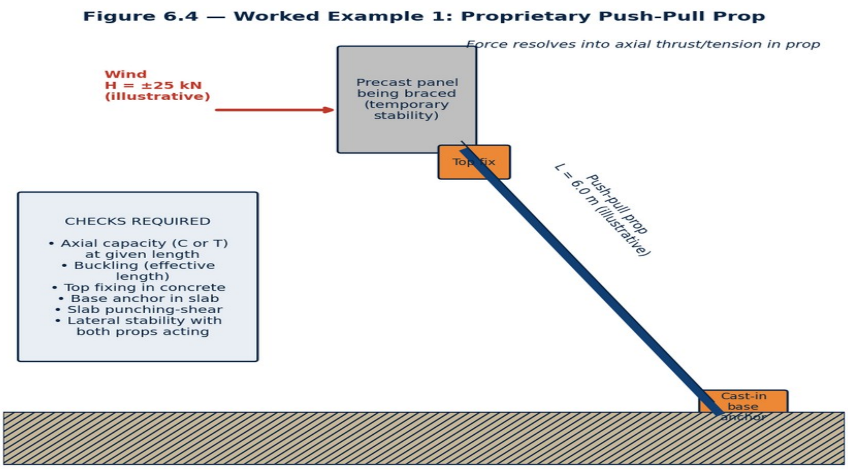

Figure 6.4 — Worked Example 1: Proprietary push-pull prop bracing a precast panel.

6.7.1 Scenario and assumptions

A single precast concrete wall panel, 3.5 m wide × 4.5 m tall × 200 mm thick, has been lifted into position and is being held plumb by two proprietary push-pull props on one face while the cast-in permanent connections are completed. Wind is the dominant action during this temporary period.

- Panel mass and self-weight: 3.5 × 4.5 × 0.20 × 24 kN/m³ = 7.56 m³ × 24 = approximately 75 kN (panel self-weight, acts vertically, taken by the lifting equipment until released).
- Wind design: characteristic wind pressure on the face taken as qp = 0.9 kN/m² (illustrative — would be derived from BS EN 1991-1-4 for the specific site, exposure, height and topography).
- Prop geometry: two props at ~45° to the panel, connected to cast-in top fix 4.0 m above the slab and to a cast-in base anchor 4.0 m from the panel base.
- Prop length L = √(4.0² + 4.0²) = 5.66 m ≈ 6.0 m allowing for fixings.

6.7.2 Lateral force

Wind force on the panel, assuming it acts on the full projected area:

```
Face area     A = 3.5 × 4.5 = 15.75 m²
Wind force    Fw = qp × A × Cf
Taking Cf = 1.3 (exposed panel, net)
Fw = 0.9 × 15.75 × 1.3 = 18.4 kN  (illustrative)
```

Minimum 2.5% rule: the 'vertical' load here is the panel self-weight 75 kN, so 2.5% = 1.9 kN — not governing. Wind governs.

Apply also a 1% of vertical load for erection tolerance and an allowance for accidental impact. For simplicity, adopt a design horizontal force H_des = 25 kN at the top of the panel, giving margin over pure wind.

6.7.3 Prop force

Each prop shares the horizontal force. Assume half each (two props in the same plane):

```
Horizontal per prop   Hp = 25 / 2 = 12.5 kN
Prop inclination      θ = 45°
Axial force in prop   Pax = Hp / cos(45°) = 12.5 / 0.707 = 17.7 kN
```

Prop acts in compression (wind pushing panel outwards) or tension (wind from opposite direction). Check both.

6.7.4 Prop capacity check (permissible stress)

Supplier data for a typical push-pull prop rated at this length (~6 m) gives an illustrative safe working load of 40 kN in compression and 35 kN in tension for this length (these figures are illustrative; actual values must come from the specific supplier's technical data):

```
Applied axial force       Pax = 17.7 kN
Supplier SWL compression  = 40 kN     >  17.7 kN  ✓
Supplier SWL tension      = 35 kN     >  17.7 kN  ✓
```

Prop section is adequate. Now check the connections.

6.7.5 Top-fix check

The top fix is typically a cast-in anchor in the permanent slab or beam. Supplier anchor data and a check of the concrete breakout cone per BS EN 1992-4 (fastenings for use in concrete) are required. Illustrative values:

```
Anchor tensile capacity (supplier)  = 25 kN
Concrete breakout check (EN 1992-4)  — to be verified by detailed
check
Applied force at anchor             = 17.7 kN  <  25 kN  ✓ (subject
to breakout check)
```

6.7.6 Base anchor check

The base cast-in anchor sees similar force magnitudes. The check must include shear as well as tension, and any combined interaction. Slab punching shear at each anchor location is a further check, especially in thin slabs.

6.7.7 Lateral stability of the pair

With both props operating, the two-prop system must be stable in the perpendicular direction too. For a one-sided prop arrangement, the panel relies on its own base connection and self-weight for out-of-plane stability. If base connection capacity is in doubt, a third prop perpendicular or a bracing strut is warranted.

6.7.8 Residual risks and site controls

- Wind cut-off: prop system designed for 0.9 kN/m². Working procedure must suspend operations if wind exceeds the design value.
- No removal of props until permanent connections are complete and verified — formal permit to unload required.
- Inspection of props, top and base fixings at least daily during the temporary condition.
- No loads to be placed on the panel (e.g. plant, scaffold ties) during the temporary period.

6.8 Worked Example 2 — Falsework Leg with Sole Plate on Ground

Illustrative example — inputs are hypothetical

All inputs illustrative. Not a design. Actual ground-bearing capacity must come from a site-specific geotechnical report; actual prop capacities from the supplier.

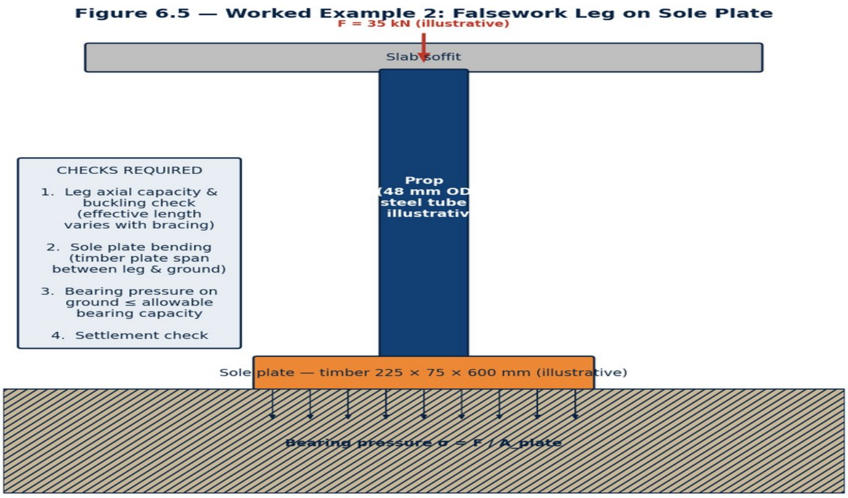

Figure 6.5 — Worked Example 2: single falsework leg bearing through a sole plate onto ground.

6.8.1 Scenario and assumptions

- A proprietary 48.3 mm OD steel tube falsework leg (illustrative) supports a soffit 3.0 m above ground.
- Leg axial load F = 35 kN (illustrative, derived from slab self-weight + construction loads tributary to this leg).
- Sole plate: Grade C24 timber, 225 mm × 75 mm × 600 mm long (illustrative).
- Ground: firm to stiff sandy clay with allowable bearing pressure q_allow = 100 kPa (illustrative — to be verified from GI report).
- Effective length of leg = 3.0 m with bracing providing node points at 1.5 m spacing (illustrative).

6.8.2 Leg axial capacity (permissible stress)

Supplier data for the 48.3 mm tube at effective length 1.5 m gives an illustrative safe working axial load of approximately 45 kN. At 3.0 m effective length (unbraced), the same tube would be nearer 20 kN. This example assumes the bracing is correctly installed:

```
Applied axial      F    = 35 kN
SWL (braced 1.5m)  = 45 kN     >  35 kN   ✓
```

Critical dependency: the design assumes bracing is installed at 1.5 m spacing. If bracing is missing, SWL drops to ~20 kN and the leg is overloaded by 75%.

6.8.3 Sole plate bending check

The sole plate sits under the leg and spans outward to distribute load onto the ground. Taking the timber as simply spanning on a central line load from the leg base, with uniform reaction from the ground:

```
Timber section    b × d = 225 × 75 mm
Section modulus   Z = b × d² / 6 = 225 × 75² / 6 = 210,938 mm³
Length             L = 600 mm

Idealise as a simply supported beam with central point load F = 35
kN
```

```
Max bending moment M_max = F × L / 4 = 35,000 × 600 / 4 = 5,250,000
N.mm

Applied bending stress  σ = M / Z = 5,250,000 / 210,938 = 24.9 N/mm²
Permissible bending for C24 (short-term) ≈ 14 N/mm² × k-factor
With load-duration factor k_mod = 1.25 (short-term), permissible ≈
17.5 N/mm²

RESULT:  24.9 > 17.5   FAIL
```

The 225 × 75 section is inadequate in bending. Options: use a thicker sole plate (e.g. 225 × 150), shorten the effective span by using a closer-packed arrangement, or use a steel plate.

Re-try with a 225 × 150 mm C24 sole plate:

```
New Z = 225 × 150² / 6 = 843,750 mm³
New σ = 5,250,000 / 843,750 = 6.2 N/mm²  <  17.5 N/mm²   ✓
```

6.8.4 Ground bearing check

Assume the revised 225 × 150 × 600 mm sole plate. Bearing pressure on ground:

```
Contact area        A = 225 × 600 = 135,000 mm² = 0.135 m²
Bearing pressure    σ = F / A = 35,000 N / 0.135 m² × 10⁻³ = 259 kPa

RESULT:  259 kPa  >  q_allow = 100 kPa   FAIL
```

Ground bearing governs. Need a larger bearing footprint.

Adopt a larger sole plate or grillage to spread the load. For this example, use a 600 × 600 mm plywood + timber grillage:

```
New contact area    A = 600 × 600 = 360,000 mm² = 0.36 m²
New pressure        σ = 35,000 / 0.36 × 10⁻³ = 97 kPa  <  100 kPa   ✓
```

6.8.5 Settlement check

Bearing pressure is within allowable, but settlement must also be acceptable. Differential settlement between adjacent legs could redistribute load; BS 5975-2:2024 identifies settlement as an action in Combination 3. For the illustrative stiff sandy clay, total settlement of a few millimetres is expected — acceptable for a nominally rigid steel falsework arrangement but not negligible. For a scheme over softer ground, settlement checks become critical and may drive the design to a piled or grillage solution.

6.8.6 Lessons from this example

- Sole plate bending often governs before ground bearing — check both, do not assume.
- The effective length assumed in the leg capacity depends on bracing being correctly installed. This is a site discipline issue, not just a design one.
- Spreading load is usually cheaper than finding a different ground condition. A grillage or larger pad is almost always available as an option.

6.9 Worked Example 3 — Trench Support in Cohesive Soil

Illustrative example — inputs are hypothetical

Illustrative. Real trench support designs require a site-specific geotechnical report, explicit consideration of groundwater, surcharge, base stability and any adjacent structures or services, and a competent designer checked to Category 2 or 3.

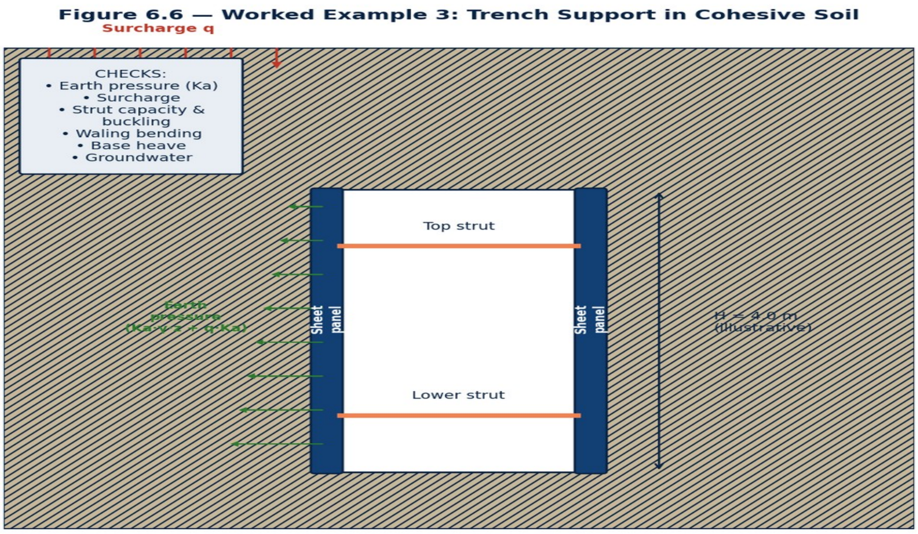

Figure 6.6 — Worked Example 3: braced trench support in cohesive soil.

6.9.1 Scenario and assumptions

- 4.0 m deep trench in firm clay (illustrative).
- Soil properties (illustrative): unit weight γ = 19 kN/m^3; undrained shear strength cu = 40 kPa; drained φ' = 22°; effective cohesion c' ≈ 0.
- Groundwater: below trench base (illustrative).
- Surcharge: plant and stored material adjacent, taken as q = 15 kPa.
- Trench box with sheet-pile type panels and two levels of hydraulic struts at 1.0 m and 3.0 m below ground level.

6.9.2 Active earth pressure

Working in drained (effective) terms, which governs long-term conditions, and using a simplified Rankine approach (vertical wall, horizontal ground surface):

```
Ka = (1 - sin φ') / (1 + sin φ') = (1 - sin 22°) / (1 + sin 22°)
Ka = (1 - 0.375) / (1 + 0.375) = 0.625 / 1.375 = 0.45

At depth z, active pressure  σa = Ka × γ × z + Ka × q

At base (z = 4.0 m):
σa = 0.45 × 19 × 4.0 + 0.45 × 15
   = 34.2 + 6.75 = 41.0 kPa
```

```
Total horizontal force per metre run:
Pa = 0.5 × Ka × γ × H² + Ka × q × H
   = 0.5 × 0.45 × 19 × 4² + 0.45 × 15 × 4
   = 68.4 + 27.0 = 95.4 kN/m run
```

6.9.3 Strut forces

For a two-strut braced wall, an approximate approach is the 'apparent earth pressure diagram' method (Peck / Terzaghi) which redistributes pressure. For this illustrative case we apply the simplified tributary-area method for teaching:

```
Upper strut at 1.0 m: tributary depth ≈ 0 to 2.0 m
Lower strut at 3.0 m: tributary depth ≈ 2.0 to 4.0 m

Upper strut force/m = 0.5 × (σ_top + σ_mid) × 2.0
    σ_top = 0.45 × 15 = 6.75 kPa (surcharge only at ground)
    σ_mid at z = 2.0 m = 0.45 × 19 × 2 + 6.75 = 17.1 + 6.75 = 23.9
kPa
    Upper = 0.5 × (6.75 + 23.9) × 2.0 = 30.6 kN/m

Lower strut force/m = 0.5 × (σ_mid + σ_base) × 2.0
    σ_base = 41.0 kPa (from above)
    Lower = 0.5 × (23.9 + 41.0) × 2.0 = 64.9 kN/m
```

NOTE: Peck's apparent pressure method typically gives rectangular or trapezoidal distributions that redistribute load more onto upper struts. A real design should use Peck / Terzaghi / EN 1997 methods appropriate to the soil type, not tributary area.

At 1.5 m strut spacing along the trench, typical hydraulic struts see:

```
Upper strut force = 30.6 × 1.5 = 46 kN
Lower strut force = 64.9 × 1.5 = 97 kN
```

6.9.4 Strut capacity

Proprietary hydraulic struts typically have SWLs well in excess of these values at the spans required. Select strut type from supplier tables using the clear span and the calculated force, including any bending (for eccentric load or impact from machinery).

6.9.5 Other checks

- Base heave check: for cohesive soils with $c_u < \gamma H/5$ approximately, base heave can be critical. Here $\gamma H = 19 \times 4 = 76$; $c_u = 40$. Ratio 76/40 = 1.9 — not critical. However for shallower cu or deeper trenches this can be the governing check.
- Passive resistance at toe: for cantilever sections and for the embedded portion of panels, verify passive resistance per BS EN 1997.
- Groundwater: present example assumes water table below base. Where water is present, effective stress calculations change significantly and hydrostatic pressure dominates.
- Surcharge limits: site enforcement of the assumed 15 kPa surcharge — barriers, signage, designated zones — is essential.

- Adjacent services and structures: any within the active zone (typically 1H back from the top of the cut for cohesive soils) must be specifically considered.

6.9.6 Residual risks and controls

- Trench inspection before entry each shift, after heavy rain, and after any impact.
- No excavator movements closer than 1 m to the trench edge unless specifically designed for.
- Ladder access at maximum 7.5 m intervals within the trench.
- Controlled removal of struts on backfilling — bottom-up installation, top-down removal.

6.10 Worked Example 4 — Mobile Crane Outrigger Spreader Pad

Illustrative example — inputs are hypothetical

Illustrative. Real outrigger designs require specific manufacturer outrigger loads for each crane configuration and lift, actual site ground data, and compliance with LOLER and the Construction Plant-hire Association good-practice guide 'Ground conditions for construction plant'.

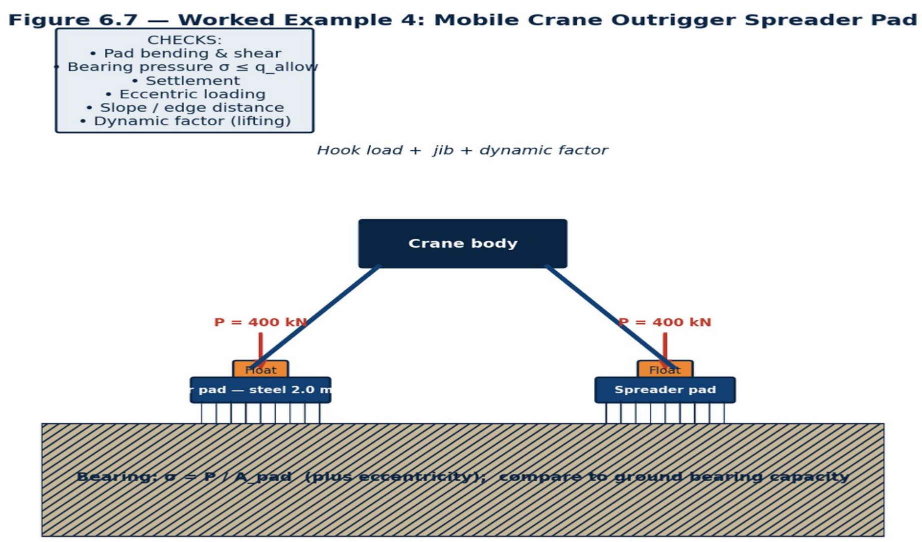

Figure 6.7 — Worked Example 4: spreader pad under mobile crane outrigger.

6.10.1 Scenario and assumptions

- 80-tonne all-terrain mobile crane (illustrative).
- Manufacturer outrigger load at worst lift configuration: P = 400 kN (illustrative — actual value from crane chart).
- Crane float dimensions: 500 × 500 mm steel foot (illustrative).
- Spreader pad: timber mat, 2.0 m × 2.0 m × 200 mm thick (illustrative).
- Ground: compacted granular hardstanding with allowable bearing q_{allow} = 150 kPa (illustrative — from GI or site verification).

6.10.2 Bearing pressure under float alone

Float area $A_{float} = 0.5 \times 0.5 = 0.25\ \text{m}^2$

Pressure $\sigma = P / A = 400 / 0.25 = 1{,}600\ \text{kPa}$

This is 10× the allowable. A spreader is essential.

6.10.3 Bearing pressure under spreader pad

```
Pad area       A_pad = 2.0 × 2.0 = 4.0 m²
Pressure       σ = 400 / 4.0 = 100 kPa
Allowable      q_allow = 150 kPa       ✓
```

6.10.4 Pad structural check

The pad must distribute the 400 kN float load across its 2.0 m × 2.0 m area. A punching-shear / bending check is required. For a typical timber mat (laminated timber, several layers), manufacturer SWL data usually covers this directly. For a purpose-built steel plate, bending and shear checks under BS EN 1993 or the BS 5975-2:2024 permissible stress approach apply.

6.10.5 Eccentric loading and dynamic effects

Outrigger loads change with jib angle, slew direction and hook load. The design must use the worst case from the crane chart. A dynamic factor (typically 1.1 to 1.25 depending on lifting operation type) should be applied unless the manufacturer's load already includes one. Sudden release of load (emergency stop, line slippage) produces impact loads that can exceed static design values.

6.10.6 Edge and slope effects

The crane position relative to any excavation, slope, retaining wall or uncompacted fill is critical. Rule of thumb: the outrigger pad must stand back at least 1.5 × pad width from any excavation edge, and the ground beyond the pad must be able to carry the bearing pressure for at least that distance, unless specifically designed otherwise.

6.10.7 Site verification

Before lifting:

- Verify ground bearing on site — plate load test, DCP test, or visual confirmation of specified material.
- Inspect the pads for damage, warping or deterioration. Timber mats degrade with repeated wetting and loading.
- Check slope of the setup — cranes have strict tilt tolerances, typically less than 1 per cent.
- Confirm clearance from all overhead lines and buried services before any slewing.

6.11 Working platforms for tracked plant (BR470)

Figure 6.8 — Working Platform for Tracked Plant (BR470 concept)

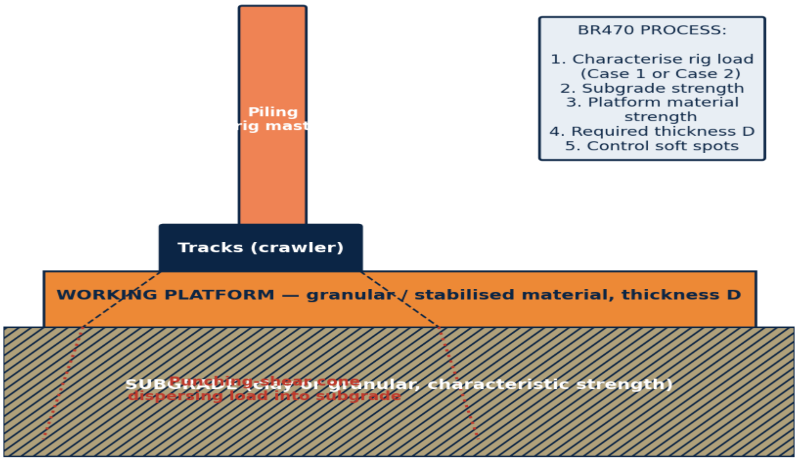

Figure 6.8 — Working platform concept — load path from tracked plant through platform to subgrade.

BR470, 'Working platforms for tracked plant — good practice guide to the design, installation, maintenance and repair of ground-supported working platforms' (Building Research Establishment), is the de-facto UK design standard for working platforms used by crawler-mounted piling rigs, drilling rigs and service cranes. BR470 works on two loading cases:

- Case 1 — the rig operator is unlikely to be able to aid recovery from an imminent platform failure. Examples: standing, travelling and handling. Factored loading: $q_{1d} = 2.0 \times q_{1k}$.
- Case 2 — the operator can control the load to aid recovery. Examples: drilling, casing installation, rig slewing with fixed jib. Factored loading: $q_{2d} = 1.5 \times q_{2k}$.

The design process verifies four things in turn. First, that the subgrade alone cannot support the plant (otherwise no platform is needed). Second, that the platform material is stronger than the subgrade. Third, that the platform material can provide the required bearing resistance if placed sufficiently thick. Fourth, the required thickness D of platform, accounting for load spread through the platform into the subgrade by a punching-shear mechanism.

Two practical experience points matter more than the numerical design:

- Soft spots and weak zones kill platforms. BR470 is emphatic that most platform failures are caused by localised weaknesses — old foundations, poorly backfilled excavations, old drainage runs, differential moisture. Site walkover, trial pits and DCP testing are essential before the design is validated on site.
- Maintenance is the other killer. A platform designed and installed correctly may degrade rapidly under wet weather, heavy concrete delivery traffic, or plant spragging. The platform owner must maintain it to the design standard — thickness, drainage, slope and integrity — throughout its life.

BR470 also offers the option to enhance bearing resistance using structural geosynthetic reinforcement at the base of the platform, with prescribed factors on tensile strength. This can substantially reduce required thickness on weak subgrades and is increasingly common.

6.12 Residual risk, deflection limits and constructability

6.12.1 Residual risks in the design output

A BS 5975-compliant design output does not stop at the calculations. It must also communicate to the site team the residual risks and assumptions under which the design holds. Typical residual risks to flag:

- Specific loading limits — maximum imposed load, maximum wind speed for working, prohibited activities.
- Critical details — joints, connections, restraints that must be installed correctly for the design to be valid.
- Sequence dependencies — elements that must be installed in a specific order; removal sequences.
- Inspection requirements — what must be checked before loading, during use, and before dismantling.
- Environmental limits — rain, wind, temperature, groundwater thresholds that trigger stop work.

6.12.2 Deflection limits

BS 5975-2:2024 and BS EN 12812 both acknowledge that deflection limits for falsework are usually less onerous than for permanent works, but they still matter. For soffit falsework supporting concrete, the deflection between supports affects the finished soffit level — commonly limited to span/500 or 25 mm, whichever is less, during pour. For lateral deflection under wind, sway limits of height/200 are common. The design brief should state the deflection limits; where it is silent, the designer should propose and seek acceptance.

6.12.3 Constructability

A design that is calculatively correct but physically unbuildable is a failed design. Practical constructability checks include:

- Erection sequence — can the scheme be built from bottom up, can it be stable in partial-erection states, is there physical access for the components?
- Clearance — are there enough tolerances for site deviation in adjacent permanent works, for slipform movement, for formwork stripping?
- Handling — can the components be lifted and placed by the crane or plant available on site?
- Inspection access — can the critical joints and members be inspected after installation?
- Dismantling — is the scheme designed to come apart safely, or does removal require destructive cutting?

A common TWC practice is to require a 'construction sequence' sheet from the designer as part of the design output, not left to the site team to invent. This is particularly important for complex or temporary-then-permanent schemes such as façade retention.

6.13 Key takeaways and actions

- Permissible stress and limit state are both valid under BS 5975-2:2024. Choose at design brief stage and stick to one.

- Eurocode interfaces matter — align load factoring and material factoring with the permanent works code where interaction is significant.
- Design for three combinations — before, during and after loading — not a single load case.
- Always apply the minimum 2.5 per cent (permissible) or 1 per cent sway (limit state) horizontal disturbing force.
- Wind is the single most under-estimated load — debris netting or cladding doubles it; topography and height matter.
- Worked examples show recurring traps: sole-plate bending before ground bearing; active earth pressure plus surcharge; effective length of falsework legs depends on bracing being installed.
- Residual risks and constructability are design outputs, not site afterthoughts.

Checklist 6.1 — Design readiness

1. Design method stated in brief (permissible or limit state). 2. Load combinations 1, 2 and 3 all checked. 3. Minimum horizontal disturbing force included. 4. Wind loading derived for site-specific exposure and topography. 5. Check for cladding/netting effects. 6. Every interface, restraint and connection checked. 7. Ground bearing verified from GI report, not assumed. 8. Residual risks and limits communicated in the output. 9. Construction sequence provided. 10. Deflection limits stated.

Chapter 8 — Common Temporary Works Types — Management and Design in Practice

Chapter summary

Every site sees a characteristic set of temporary works types: excavation support, falsework and formwork, propping and shoring, façade retention, scaffolding, hoardings and edge protection, crane bases and outriggers, working platforms, temporary access structures, and — on energy projects — substation-specific items. Each has its own management and design disciplines. This chapter covers what good looks like for each type.

8.1 Excavation support — trenches, cofferdams and retaining schemes

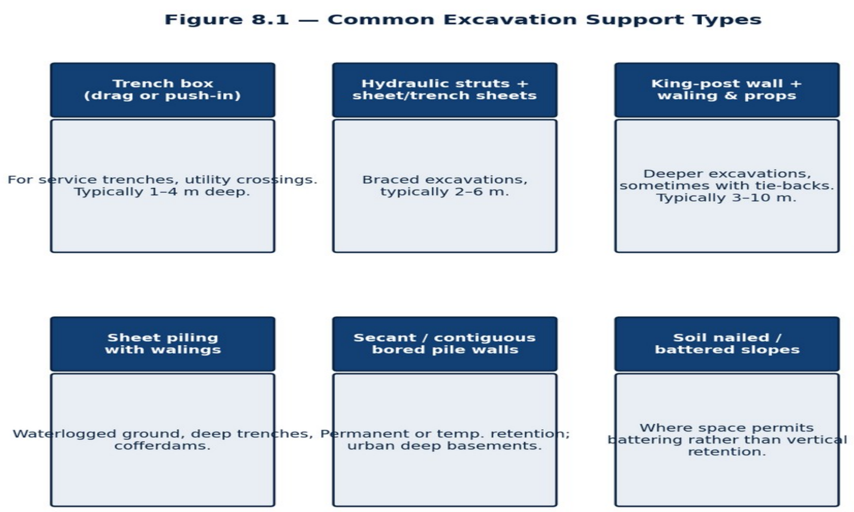

Figure 8.1 — Common excavation support types.

Excavation support is the largest single category of temporary works by incident frequency. UK HSE data over the last twenty years consistently shows trench and excavation collapses as a leading cause of construction fatalities. Proper management is non-negotiable.

8.1.1 Key design considerations

- Ground conditions — never assume. A site-specific geotechnical investigation is required, interpreted by a competent geotechnical engineer. BS EN 1997-1 and its UK national annex govern.
- Groundwater — often the decisive factor. Dewatering may be needed; or the design may need to resist full hydrostatic pressure. Dewatering discharges require environmental consent.
- Surcharge — plant, stored material, traffic. Enforceable on site by physical barriers, signage and competent supervision.
- Adjacent structures and services — within the 'active zone' (typically 1H for cohesive soils, wider for granular). Movement monitoring often required.
- Base stability — heave in cohesive soils, piping in granular under water.

- Sequence — upper levels excavated first, support installed as excavation proceeds. Reverse for removal.

8.1.2 Key management considerations

- Temporary works designer must be competent in excavation support. Category 2 minimum for most schemes; Category 3 for complex, deep or high-consequence schemes.
- Permit to excavate alongside permit to load — sometimes the right order is 'permit to install support' first.
- Daily inspections by a competent person before first entry each shift, after heavy rain, and after any impact (PUWER and the L101 ACOP apply).
- Emergency rescue procedures for persons trapped — notify emergency services of the depth and access arrangements during mobilisation.

8.2 Falsework and formwork for in-situ concrete

Figure 8.2 — Typical Falsework Arrangement (In-Situ Concrete Soffit)

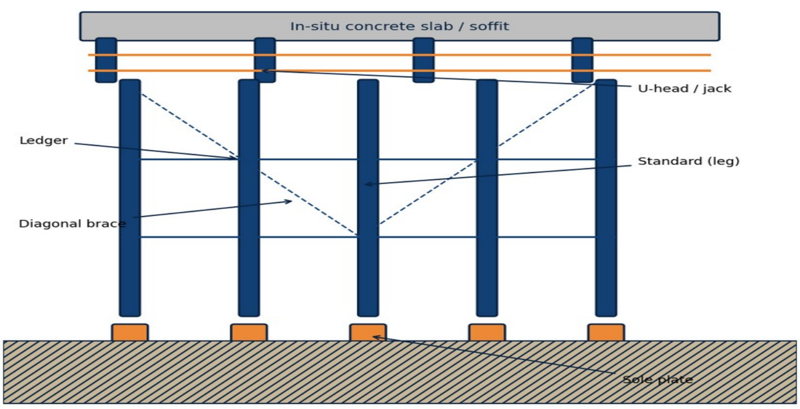

Figure 8.2 — Typical falsework arrangement for an in-situ concrete soffit.

Falsework — the engineered structure that supports concrete formwork until the concrete has gained sufficient strength — is the subject of BS 5975-2:2024 directly. Formwork is the contact face against which the concrete is poured. Both must be designed together.

8.2.1 Key design considerations

- Concrete pressure on vertical formwork — CIRIA C766 is the standard reference; BS EN 12812 and BS EN 13670 apply. Pour rate, temperature, mix design, slump, and form geometry all matter. Pressures of 50 kPa+ are common for tall pours.
- Falsework vertical load path — self-weight, concrete, construction load, wind. Load combinations 1, 2, and 3 as in Chapter 6.4.
- Lateral stability — 2.5 per cent rule or actual, whichever greater.
- Top restraint — if assumed, must be physically present and connected. A frequent incident cause.
- Deflection limits — typically span/500 or 25 mm.

- Striking times — concrete cube strengths or maturity, not clock time alone. Permit to unload is mandatory.

8.2.2 Key management considerations

- Design check Category depends on complexity. Standard proprietary falsework can be Category 0 if used strictly within supplier limits; bespoke soffit falsework typically Category 1 or 2; launch falsework, complex propping and falsework for major bridges Category 3.
- Erection inspection per ITP, with independent check before first pour.
- Concrete pour method statement includes pour rate, concrete temperature, cube break points, strike time gates.
- Back-propping regime for multi-storey construction — designed as part of the scheme, not added on site.

8.3 Propping, back-propping and shoring

Propping and shoring covers the family of temporary works used to support part of a structure while other parts are altered, removed or constructed. It overlaps with falsework but is usually applied to existing or partially-completed structures rather than to forms for new concrete.

8.3.1 Key design considerations

- What is the existing structure being supported actually doing? For alteration and refurbishment, a structural survey is needed to determine how load flows through the existing fabric.
- Load transfer — props must be taken down to a competent load path. Existing slabs may require back-propping below to carry the added load.
- Stability during partial demolition — floors removed above a propping scheme alter its restraint and stability. Sequence is critical.
- Needling through brickwork — the needle carries wall load during creation of new openings. Needle spacing, bearing on the wall, and bearing at the support ends all must be checked.
- Pre-tensioning of props — some proprietary systems benefit from being jacked against the supported element to pre-tension them and reduce slack under load. Strictly per supplier.

8.3.2 Key management considerations

- Often the propping scheme interacts with demolition works. The interface between propping TWC and demolition contractor must be explicitly managed.
- Alteration work in occupied buildings adds CFR significantly — risk class typically at least Medium, often High.
- Monitoring during use — visual inspection, and instrumented movement monitoring for critical schemes.
- Permit to unload only after permanent work is fully stiffness- and strength-capable.

8.4 Façade retention and needling

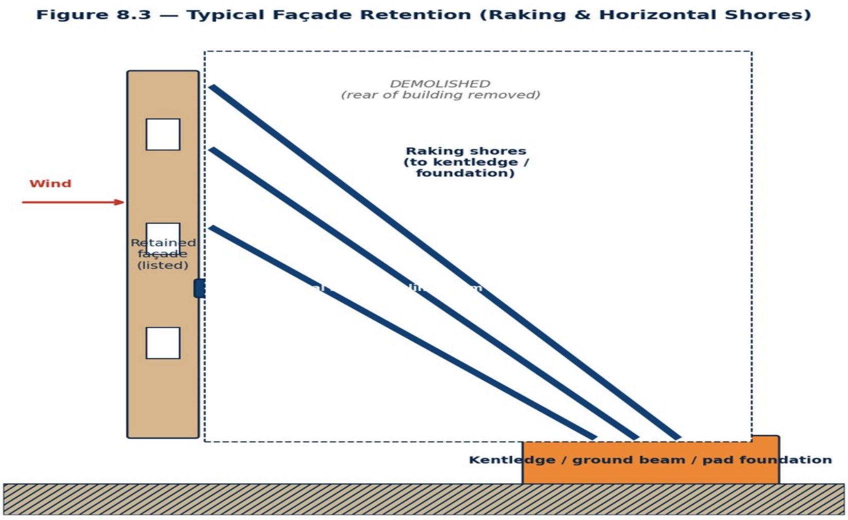

Figure 8.3 — Typical façade retention with raking and horizontal shores.

Façade retention is used where a façade must be preserved — typically for heritage or planning reasons — while the structure behind is demolished and rebuilt. It is one of the most demanding classes of temporary works, routinely Category 3 with peer review.

8.4.1 Key design considerations

- Stability of the façade in its naked state. The façade has been designed to work with its rear structure; once that is removed it becomes an unstable standalone element exposed to wind.
- Raking shores — take wind load and provide stability. Must be taken back to competent ground or kentledge. Weight of kentledge is substantial.
- Horizontal shores and walings — tie floor levels of the façade together and transfer load to raking shores.
- Flying shores — between façades across a void.
- Wind load governs — the façade is usually tall and broad. BS EN 1991-1-4 calculation warranted; simplified methods may under-read.
- Thermal movement of the retained façade — particularly for long elevations or facades with large glazing.

8.4.2 Key management considerations

- Interface with demolition — sequence critical. Typically demolition must stop while retention is installed, then proceed carefully.
- Party wall and heritage consents — party wall awards and listed-building consents must be obtained in advance and reflected in the design.
- Monitoring — façade movement, raking shore loads (if load cells installed), local settlement. Often daily during demolition, weekly thereafter.
- Long-duration schemes may see the retention in place for many months. Weather, vandalism and gradual creep all need managing.

8.5 Scaffolding and tied-access systems

Figure 8.4 — Tied Scaffold — Principal Forces and Tie Requirements

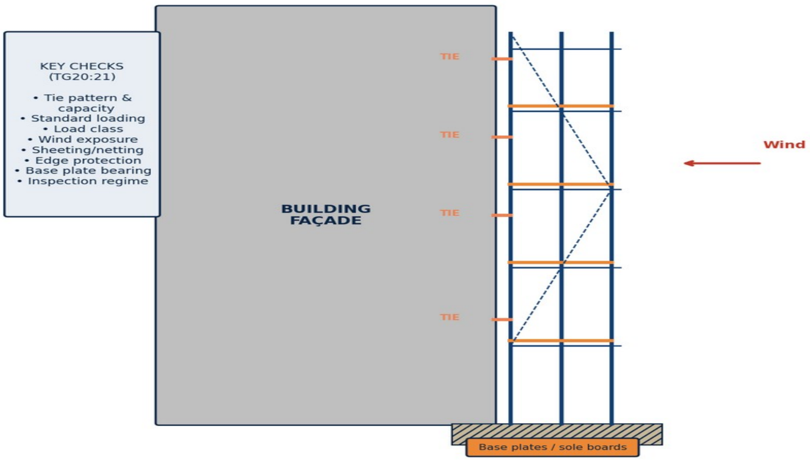

Figure 8.4 — Tied scaffold — principal forces and tie requirements.

Scaffolding is the most common temporary works on most sites, and its management is generally handled under a combination of TG20:21 (tube-and-fitting scaffold), supplier technical manuals (system scaffold), and the scaffold contractor's own procedures. BS 5975 management procedures still apply.

8.5.1 Key design considerations

- Load class (Classes 1 to 6 per BS EN 12811) — light, general, heavy duty, special. Must match intended use.
- Tied or independent — tied into a building for stability is the norm for tall or exposed scaffolds.
- Tie pattern and capacity — TG20 compliant designs have standardised tie patterns; departures need specific design.
- Sheeting, netting and cladding — hugely increase wind load. Scaffolds designed as 'open' that are later sheeted are a classic failure mode.
- Loading bays, hoists, rubbish chutes — specific add-on loads.
- Working platforms on the scaffold — fall protection per WAHR.

8.5.2 Key management considerations

- TG20 compliance sheet or bespoke design — required for every scaffold.
- Handover certificate from scaffold contractor at completion, at each alteration, and at periodic intervals (every 7 days for WAHR inspection).
- Scaffold inspection register — entries by a competent person after erection, after alteration, after events that could affect integrity, and at least weekly in normal use.
- No unauthorised alterations. Site discipline on this is essential — removing a single brace for access that is not replaced has caused fatalities.

8.6 Hoardings, edge protection and fans

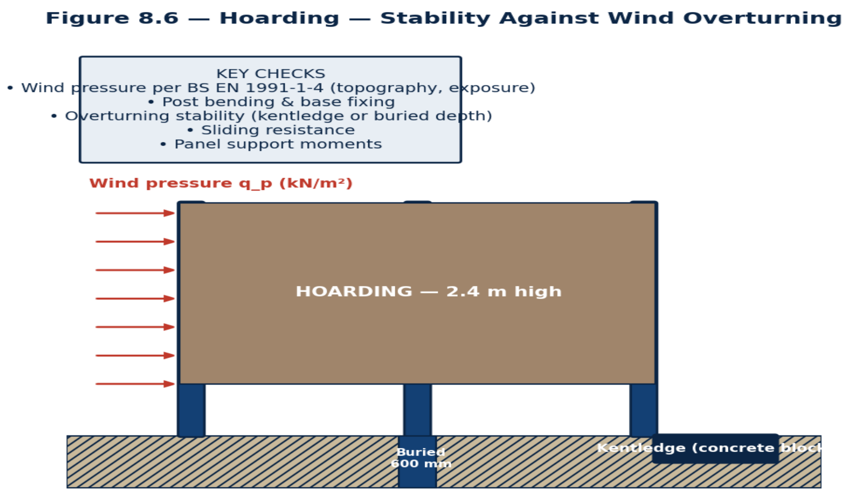

Figure 8.6 — Hoarding stability against wind.

Hoardings are often treated as joinery. They are structures. In exposed locations, wind load on a 2.4 m tall hoarding run can generate substantial overturning moments and require designed foundations or kentledge.

8.6.1 Key design considerations

- Wind pressure per BS EN 1991-1-4 — include topography, exposure, and specific reduction for partial permeability if applicable.
- Post bending and base fixing — typically the limiting element.
- Stability — kentledge (concrete blocks), buried depth, anchorage to ground beam. For timber hoardings on asphalt or paving, anchorage is limited.
- Sliding resistance — especially for kentledge solutions.
- Hoardings supporting advertisement or signage — significant additional wind load and eccentric effects.
- Edge protection — BS EN 13374 applies; Classes A, B, C depending on slope and use.
- Protection fans — need wind load and drop-load design.

8.6.2 Key management considerations

- For perimeter hoardings on public pavements — interface with highway authority and public liability considerations.
- Inspection after severe weather.
- Graffiti, vandalism, weather damage — all reduce structural integrity over time.

8.7 Crane bases and outrigger spreader arrangements

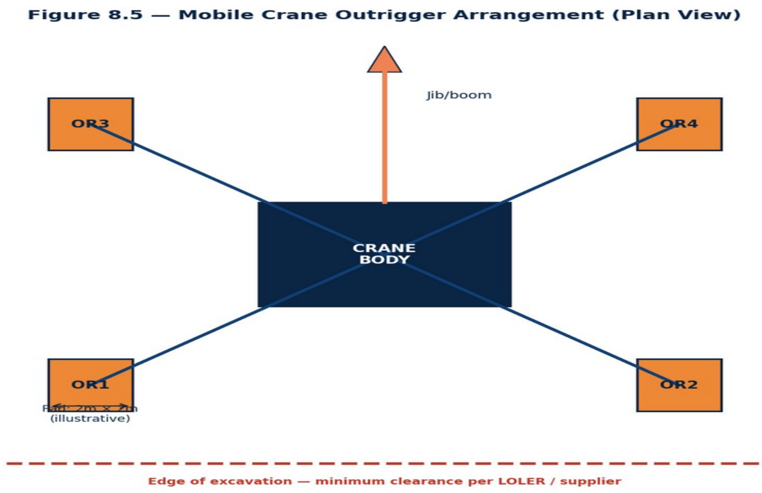

Figure 8.5 — Mobile crane outrigger arrangement in plan.

Crane stability is a safety-critical temporary works topic that interacts with LOLER (lifting operations) as well as BS 5975. The mobile crane outrigger example in Chapter 6.10 covered the pad design. For tower cranes and larger mobile cranes, a dedicated crane base design is often required.

8.7.1 Tower crane bases

- Tower crane manufacturer provides base loads — dead weight, operating moment, out-of-service wind moment, imbalance. The temporary works designer sizes the base (piled pad, ballasted pad, or fixing anchors) to resist these.
- Operating condition, out-of-service condition, and climbing / erection conditions all must be checked.
- Interfaces with permanent works common — tower crane bases are often incorporated into permanent foundations.

8.7.2 Mobile crane outrigger arrangements

- Outrigger loads vary dramatically with jib configuration, radius, hook load and slew angle. Use the worst case across the planned lift range.
- Spreader pads must be sized for the worst outrigger load.
- Ground investigation to confirm bearing — do not assume.
- Minimum clearance from excavations, slopes, retaining walls, buried services.
- The Construction Plant-hire Association good-practice guide 'Ground conditions for construction plant' is the standard UK reference.

8.7.3 Crawler cranes

- Crawler cranes track pressures are lower than outrigger pressures but cover larger areas. A working platform to BR470 principles is typical.
- Travelling and slewing generate dynamic effects. Check Case 1 and Case 2 loading per BR470.

8.8 Working platforms for tracked plant

Working platforms for crawler-mounted piling rigs, drilling rigs and service cranes are designed to BR470 (see Chapter 6.11). Management considerations to add:

- The FPS (Federation of Piling Specialists) / Federation of Piling Contractors have issued detailed guidance including the 'Working platform certificate' that the ground supporting contractor should issue to the piling contractor. This is the industry-standard handover.
- Site discipline on platform loading, traffic, and maintenance is critical. A platform that was fit for purpose at handover may not be fit for purpose after two weeks of rain and heavy traffic.
- Access ramps onto the platform are a common weak point — 50 per cent thicker is a typical BR470 rule of thumb, and slopes of less than 1:10 are safer.

8.9 Temporary access structures — stair towers, bridges and gantries

Temporary access structures cover stair towers for vertical circulation on scaffold, temporary pedestrian bridges across live traffic or rail, and gantries for protection of public spaces below active work. Each has specific design considerations.

- Stair towers — CDM and WAHR-compliant stair geometries, dynamic loads from running (design for pedestrian dynamic load per BS EN 1991-1-1), fall protection on both sides, intermediate landings, tie-in to the adjacent scaffold or structure.
- Pedestrian bridges over live operations — impact loads, fall protection, closure-failure modes (debris, people, plant), cleaning and maintenance access.
- Gantries — drop loads and impact loads per BS 5975-2:2024; integration with scaffolding.
- All temporary access must meet WAHR hierarchy — fall prevention preferred over mitigation.

8.10 Temporary works in high-voltage substation environments

High-voltage substations — operational or under construction — present a class of risk that the general BS 5975 framework must be supplemented to address. In a UK context, the Electricity at Work Regulations 1989, ENA Technical Specifications, BS EN 50110, BS EN 61936 and individual utility rules (National Grid, DNO-specific) all apply in parallel with BS 5975. TWC consulting practice in this area has the following recurring disciplines:

8.10.1 Electrical clearance and segregation

- Minimum safe working distances to live apparatus — drawn from the utility safety rules, not from BS 5975. These distances depend on voltage, work activity, and competence of personnel.
- Physical segregation of working areas from live apparatus — barriers, screens, scaffold fans — designed for both physical protection and maintenance of electrical clearance.
- Scaffolding near live conductors — induced voltage is significant. Scaffolds must be earthed and bonded, using specific competent practice.

8.10.2 Temporary earthing and bonding

- Temporary working earths applied after isolation and proving dead are a statutory requirement in the UK. Their location, capacity and integrity is part of the permit to work system.
- Equipotential zones for personnel — the bonding arrangement that ensures a worker contacting the structure is at the same potential as their feet, eliminating touch and step potential.
- Temporary works that form an earth path (scaffolding, temporary steelwork, reinforcement cages during construction) must be designed for fault currents during energisation testing and, if working adjacent to live apparatus, for fault currents in normal operation.

8.10.3 Integration with Permit to Work

- The temporary works permit to load and the electrical permit to work must be aligned. It is common for the electrical PTW to be the master document — no work starts until PTW is issued, and PTW cannot be released while temporary works remain loaded in certain configurations.
- Switching schedules — the sequence of isolations, earthing and proving — drive the temporary works sequence. Temporary works programming must respect and integrate with the switching programme.
- Induced voltage mitigation — long parallel conductors (cables, scaffolding tube runs) adjacent to live HV circuits can develop induced voltages. Specific mitigation (additional earthing, segmentation) is required.

8.10.4 Crane and lifting operations near live apparatus

- Boom, cable and load clearance from live conductors must be maintained at all configurations. This drives crane position, jib length, and sometimes requires temporary de-energisation of adjacent circuits.
- Outrigger stability on substation surfaces (often paved or gravelled) — bearing capacity and differential pressures must be verified. Standard crane outrigger pads may not be appropriate for the available ground.
- Earthing of the crane — required throughout lifting operations near live apparatus.

8.10.5 Arc flash and worker protection

- Arc flash boundaries — zones around live apparatus where an arc-flash event could cause burns. Work within these zones requires arc-rated PPE and specific permits.
- Temporary works must not create new arc-flash hazards — for example, by providing a conductive path between phases, or by failing under fault and contacting live apparatus.

8.10.6 Integration with civil works

- Excavation in substations often intersects buried HV cables — cable-avoidance plans, cable-location surveys and hand-dig protocols are standard.
- Concrete cast around live HV apparatus — specific temporary works to protect both the concrete pour and the apparatus. This includes scaffolding, protection sheets, and often dedicated dewatering to prevent grout-slurry ingress to oil-filled or gas-insulated equipment.

- Interface with cable tunnels, trefoil cable formations, and joint bays — each has specific TW requirements for access, ventilation, and lifting.

8.10.7 Key management considerations in HV environments

- Competence in both civil TW and HV safety is rare in single individuals — expect to appoint separate TWCs / engineers working in integrated teams.
- CFR is routinely CFR3 because a temporary works failure could propagate to a fault on live apparatus — loss of life, secondary fire/explosion, network failure, customer outage.
- Peer review on all complex substation temporary works is appropriate.
- Utility standards (ENA TS, National Grid TP, utility-specific) may impose requirements stricter than BS 5975. Always the stricter applies.

Key takeaways — Chapter 8

Each TW type has its own management and design disciplines. Do not try to manage a façade retention the same way as a trench box. HV environments require layered control combining civil TW management with electrical safety rules. Scaffolding, crane bases and working platforms are routinely under-designed because they look familiar — resist this complacency.

End of Chapter 8

Volume 2 has covered the design principles, Eurocode interface, worked examples and common temporary works types that every project engages with. Volume 3 will move to company procedures — the flagship ten-step guide to writing and implementing a BS 5975:2024-compliant procedure for any size of company — together with case studies, future-trend discussion and a full library of appendices, glossary, references and index.

End of Volume 2

This concludes Volume 2 — Design Principles and Common Temporary Works Types. Volume 3 will cover:

- Chapter 7 — The flagship ten-step guide to writing and implementing a company Temporary Works Procedure aligned with BS 5975:2024.
- Chapter 9 — Anonymised case studies and lessons learned (falsework, façade retention, excavation, propping and scaffolding).
- Chapter 10 — Future trends: BIM, digital twins, sustainability, AI-assisted compliance and design optimisation.
- Full appendix library — including every template referenced across Volumes 1 to 3.
- Glossary, references and index.

— End of Volume 2 —