



**Temporary Works
forum**

Promoting best practice in
the construction industry.

TW18.033, v2, 5.11.19

Research and guidance

The following topics have been identified as either ideas for research, third-year project dissertations and/or further industry guidance. Those undertaking such work involving 'temporary works' are invited to contact the TWf Secretary (secretary@twforum.org.uk).

Overall

A. International management practice

- How the requirements for good communication, co-operation, co-ordination and competency are achieved; training and qualification.
- International practice and management systems.
- Managing methods to avoid catastrophic collapse.
- Research synergies that exist in the design and construction of temporary works within Europe and worldwide with a view to explore future improvements in health in design.
- Review of design materials, detailing of temporary works, BIM in TWs and work practices.
- What is the global practise in temporary works? (Are the French, Germans, Japanese, Americans doing anything different?)

B. Contractual documents, standards and specifications – best practice

- The client role and 'clienting': How can projects be established for success; pitfalls to avoid?
- What proportion of the UK construction industry actually works to the requirements of BS5975 and what are the barriers to uptake?
- Designing temporary works to European standards.
- Temporary works issues at SME level: What can the industry do to make a difference?
- Behaviours and system effects in temporary works.



C. Training courses; university and technical teaching; research centres of excellence; availability of expert knowledge

- The education of engineers, their role in the 'eco-system' of complex project delivery, with a special focus on part-built states, temporary (in)stability, temporary works, catastrophic risks; cover also how to deal with situations that call for experience and judgement, and be able to calibrate the assurance gained (or not) from the application of science and codes.
- Research what really needs researching (What do we need to research to improve the state of the art?).

D. Forensic studies

- Collect 20-30 written up case studies of failure (and successes?)
- Forensic engineering - Learning from our/other industries trends.

Design, specifically to underpin safe use of the limit state approach

E. Horizontal stability, including stability forces on formwork

- Structural stability in the temporary condition.

F. Partial safety factors

- Partial safety factors for loads and strength of materials; load variability; material variability, second hand materials, incorporation of suppliers' components.

G. Errors in construction; workmanship and tolerance

H. Load paths and load sharing

- Measurement of real loads under piling, demolition and excavation plant.
- Development of sensors to establish real behaviour of temporary works performance.
- Research actual loads in in-situ reinforced concrete slabs and backpropping, including impact of preloading and stiffness to advise permanent works designers how to make allowance for these construction loads.
- Imposed loads on structures from construction method/equipment.



- I. **Stiffness of joints**
- J. **Validity of p-delta approach**
- K. **Effects of time**
- L. **Plant loads**
- M. **Wind loads**
 - Short duration work, e.g. scaffolding
 - Statistical factor(s)
 - Basic wind speeds
- N. **Pressures on inclined formwork**
- O. **Shear in wood-based sheet materials**

Other specific areas of research

- P. **Design of grillages**
 - Fabricated steel structures in temporary works – general rules and examples
- Q. **Testing, test-reporting and characterisation of proprietary components**
- R. **Plant platform design (geotechnical)ⁱ**
 - Plant platforms and trends in the inherent (in)stability of plant.
 - What is the influence of splitting the responsibility for the inherent stability and ground load of plant vs. the provision of the platform?
 - Why do failures occur and what can we do about it (design of plant platforms)?
 - Geotechnical: Granular working platform design and issues.
- S. **Thrust blocks**
 - Thrust blocks – real performance and properties



- T. Rebar stability**
- U. Temporary works for water retaining concrete**
- V. Striking criteria, especially for 'quick strip' soffits**
 - Use of concrete in temporary works – general rules and examples
- W. Obtaining good finishes; use of formwork liners**
- X. Ability of formwork to act as head restraint to falsework**
 - Technical investigation and analysis of commercial position
 - Interaction of aluminium falsework towers where not head restrained.
- Y. Backpropping and load distribution in multi-storey construction**
 - Use of prestressed backprops, special considerations for prestressed construction.
 - Back propping load distribution.
 - Review of actual loads in slabs and props in backpropping situations. What is the impact of preloading props and prop stiffness? How do drop-head systems work in a backpropping environment? If the top slab takes 65% of the load why are concrete superstructures rarely design to support these loads?
- Z. Wind uplift on table forms**
- AA. Geotechnical**
 - Soil-structure interaction using pre-loaded and/or hydraulic struts (applying to FEA models, etc.).
 - Deep embedded anchors above current guidelines.
 - Geotechnical design and specialist processes in temporary works – jet grouting, ground improvement, ground freezing, NATM, observational method, slope stability, battered excavation, retaining walls, reinforced soil, soil nails, barrettes, ground water control, bearing piles, pad foundations, rock, settlement, testing and site investigation.
 - Services excavations and trenching.
 - Major excavations including cofferdams, shafts and caissons.



BB. Plunge columns

- Investigation into design issues around plunge columns (e.g. effective length, restraint from temporary backfill, embedment in pile, interaction with pile and fixity of pile within subgrade).
- Strength, etc. of H-beams cast into concrete subject to lateral load (also, cast into piles; transfer of shear and bending).

CC. Prefabrication

- Use of Design for Manufacture and Assembly (DfMA) to improve constructability of tunnels and reduction of on-site temporary works.
- Prefabrication, modularisation and robotics - all to reduce safety risk on site.

DD. Props

- Prop stiffness and pre-stress: The current vogue is to design based on stiffness (leading to large props) as opposed to smaller props within built pre-stress facility.

EE. Material

- Use of alternative materials within temporary works (e.g. bridges, retaining wall systems, crane mats); weight efficiency benefits
- Use of timber and timber products in temporary works – general rules and examples, with a detailed treatment of formwork

FF. Modelling

- Use of physics-enabled modelling to simulate structural behaviour and deflections, test for robustness and so forth.

GG. Stability and erection

- Temporary conditions of the permanent works, including bridge construction, multi-storey backpropping, core construction, striking calculations
- Fixing points and connections for structural erection and temporary works; moving joints



HH. Access

- Access engineering.
- Access platforms.
- Temporary demountable structures.
- Access and other uses or "scaffolding" type materials for "other" uses.

II. BIM

- SME use of BIM/digital tools – low cost entry

JJ. Geotechnical

- Behaviour of clays in the very short term for trench lining systems
- Driveability of trench sheets/ Use of EMVs – as opposed to piles
- Soil arching theory for UK soils
- Prop stiffness and thermal loads

KK. Material

- Use of composites for temporary works equipment (TWE)

LL. Sustainability

- Sustainability calculation for TWE

Topic guides and interpretative documents

- Services excavations and trenching.
- Major excavations including cofferdams, shafts and caissons.
- Falsework, scaffolding and support structures built from scaffolding and falsework materials; support systems to single sided and climbing formwork.
- Plant platforms and fabricated cabin gantries.
- Demolition, partial demolition, structural alteration and facade retention.
- Marine works – stability of floating plant, maritime structures, issues with the interaction between floating and static structures, fendering, underwater excavation, and underwater ground preparation.
- Temporary bridging.
- Heavy moves.
- Pressure testing.
- Site roads.
- Vehicle barriers.