CG6:20

Scaffolding Design

NASC
NATIONAL ACCESS & SCAFFOLDING CONFEDERATION

To be read in conjunction with TG21 A Guide to Commissioning Scaffold Design

1. Introduction

The supply, hire, erection and dismantling of scaffolding equipment can be described as the supply of goods and services as defined by the Supply of Goods and Services Act 1982 (the Act). For the hire of scaffolding equipment, the hirer must provide appropriate information and guidance for the customer to use the equipment safely.

In the absence of any specific terms in the contract, Section 13 of Part II of the Act implies a term that the supplier will carry out the service with reasonable skill and care. Given that the service, in most cases, includes for the design of the scaffold, the implied term of reasonable skill and care applies to both the design and the construction of the scaffold. Some contracts may require the scaffolding contractor to construct a scaffold to a design supplied by the client or a third party, which would relieve the contractor of any design responsibility, but not the construction responsibility.

BSEN 12811 Part 1 (Scaffolds – performance requirements and general design) was introduced to the scaffolding industry. NASC guidance TG (Technical Guidance) 20:05 was developed in January 2005 and a revised version TG20:08 was published in November 2008, subsequently TG20 has been further developed with the addition of an eGuide and the current version is TG20:13. For the rest of this document we will refer to this as TG20.

The Work at Height Regulations 2005 (Schedule 3 Part 2) require that strength and stability calculations for the scaffolding shall be carried out unless a note of the calculations, covering the structural arrangements, is available or it is assembled in conformity with a recognised standard configuration. TG20 gives a range of basic scaffolds for which no further design is required. For the design of system scaffolds, any scaffold not within the manufacturer's user manual/handbook will need a specific design supported by calculations.

2. Design Criteria

The bespoke design of a scaffold will involve calculations and may include the preparation of a drawing by a competent engineer. To establish the arrangement, the designer may be able to use generic information that is already available. Decisions concerning the arrangement of component parts are made by members of the scaffolding contractor's staff and operatives. Instructions for the construction of large or complicated structures are often provided in the form of drawings, which are prepared by persons with the relevant competence and skills. Design drawings give details of the arrangement of the significant components to be incorporated into the finished structure. The preparation of such drawings, and hence the design, is generally the responsibility of the scaffolding designer. Instructions for the erection of many basic scaffolds are given in the form of written instructions or a scaffolding plan to previously agreed parameters, which

form a standard design. In these circumstances the scaffolding contractor is relying on the skill and expertise of his operatives to determine the arrangement and position of the component parts. However, this reliance by the scaffolding contractor, on the skill and expertise of his operatives, will not relieve them of their responsibility for the adequacy of the design used by his operatives.

In the Construction (Design and Management) Regulations 2015 scaffolding companies who use external design sources must assess the competency of their designers. The guidance offered in PAS 91:2013+A1:2017 should be followed where relevant.

A guide to determining a competent designer is as follows:

- Designer or principal designer has as a minimum an HNC in Civil, Structural or Mechanical Engineering, preferably registered with one of the recognised engineering institutions I.e. ICE, IStructE, IET etc
- And/or has a minimum 5 years proven experience in a scaffolding design office
- And/or has a minimum 5 years proven experience in a principal contractors temporary works design department

In contracts where there are no express terms as to the design requirement, the implied terms will apply. The need to test whether reasonable skill and care has been used most often occurs following an accident. There are two methods of making the test. The first is through detailed calculations prepared on sound engineering principles. The second is to compare the design with a known and accepted standard.

3. Training Needs

Following changes to TG20, scaffolding contractors need to ensure that adequate training is given to all relevant members of staff in order to update their knowledge. Depending on the procedures of individual contractors it is unlikely to be sufficient to only train scaffolding design engineers. It is also necessary to include additional training for operatives, supervisors, contract managers, estimators and anybody involved in the erection, dismantling and management of scaffolding operations. Contractors should review their procedures in detail to determine the extent of the training required to bring their staff up to date. Emphasis should be placed on the use and/or the non use of the TG20 eGuide as a design tool.

4. Insurance

The failure of a contractor to exercise reasonable skill and care in the construction of a scaffold may render the contractor liable to his client for damages. Such damages could be considerable and therefore the contractor should consider taking out insurance against this eventuality, even if there is no contractual requirement for such insurance.

Contractors' all risks (CAR) insurance provides coverage for property damage and third-party injury or damage claims, the two primary types of risks on construction projects. Damage to property can include improper construction of structures, damage that happens during a renovation, and damage to temporary work erected on-site.

Where the design is undertaken by the scaffolding contractor themselves, they will need to ensure they have the suitable level of Professional Indemnity or equivalent Insurance to cover such work.

Contractors are **strongly** advised to check the cover provided by their insurance policies in respect of their liability for design.

Contractors who use third party designers, as opposed to in-house staff, should ensure that the third party designer also has adequate professional indemnity insurance in place. Failure to do so may render them liable for any claim and could compromise the terms of their insurance.

5. Ownership of the design and copyright

The ownership of a design may ultimately pass to the client. Where ownership has passed to the client, the client will be entitled to pass the design on to another third party contractor to carry out the work who must ensure that the requirements specified on the design (e.g. configuration, material standards etc.) are strictly complied with. The subsequent liability for the design will then be subject to the conditions of contract between the client, the third party contractor and the designer.

In circumstances where a contractor is invited to tender for work where the design is provided by the client / others, the contractor should carry out their own checks and satisfy themselves as to the adequacy of the design.

Copyright in any drawing remains with the originator of the drawing, restricting the use and reproduction of it, unless the contract specifies otherwise. Contracts for the design only of scaffolds may require the designer to relinquish the copyright and enable the procurer of design to use the drawings to obtain tenders for the construction of the scaffold by third party contractors.

6. Common problems and misconceptions associated with design of scaffolds

a) The direct costs associated with the design of simple scaffolds may be insignificant, because the design involves no more than reliance on the expertise of the supervisor or operative using their knowledge and experience of an appropriate standard solution, such as a basic scaffold as defined in an appropriate TG20 compliance sheet. However, the design cost implications of complex scaffolds, involving the time of engineers, can be significant, and unless specifically identified within the quotation, may be deemed to be included within the price.

b) The design cost of complex variations should be included within the price of the quotation. Justification of these costs may be difficult if the original contract work was for simple scaffolds requiring little specialist design and the value of the variation is required to be pro-rata to the original works.

c) The ongoing cost of design may be significant on large contracts particularly where the design of the scaffold is incomplete at tender stage. Scaffold contractors should ensure that provision is made for such costs within their tenders.

d) A contractor should ensure that sufficient allowance is made in the programme for any design time required prior to commencement on site. A client may often forget that design time is also required for any variations and could result in accusations of delay by the main or scaffolding contractor. For companies who use external design there could be a minimum of two weeks turnaround period. Note the CDM Regs 2015 regulations 4 & 5 make specific reference to time & resource.

Independent scaffold with transom units

A tied independent scaffold with 2.0 m maximum lift heights, clad with brick guards, assembled from tubes, fittings and TG20 compliant prefabricated structural transom units.

Design height

- ✓ Maximum height: 6.0 m to the top lift.

Maximum loading

- ✓ One lift loaded, plus one lift 50% loaded, per façade to a maximum of: 2.0 kN/m²;
- ✓ Inside boards loaded to a maximum of 0.75 kN/m² at the working lift;
- ✓ Foundation design leg load (for the client): 8.79 kN.

Ties

- ✓ 1 x 3.7 kN (standard duty) tie per 16.0 m²;
- ✓ Max. 4.0 m between tie lines (tied at alternate lifts);
- ✓ Max. 4.0 m horizontal distance between vertical tie lines;
- ✓ Tied at the top lift at alternate standards.

Location

Suitable for sites with a wind factor of 20.0 (low wind exposure), during spring or summer.

Add-on features

- ✓ A gin wheel may be used to lift a maximum of 50 kg.

Design advice may be required if any add-on features not stated on this compliance sheet are attached to the scaffold.

Criteria

To be erected as a TG20 compliant tied independent scaffold as described in TG20:13 chapter 06:

- ✓ May be formed from high-tensile galvanised steel tubes of 3.2 mm wall thickness and minimum 355 N/mm² design strength to BS EN 10219-1;
- ✓ TG20 compliant prefabricated structural transom units will be provided at every standard-to-ledger intersection;
- ✓ 3 – 5 main boards and up to 2 inside boards wide;
- ✓ Maximum lift height: 2.0 m;
- ✓ Maximum bay length: 2.0 m;
- ✓ Maximum transom spacing: 1.2 m;
- ✓ Wire or plastic brick guards may be provided;
- ✓ Boarded at any number of lifts;
- ✓ Tied to a permeable façade (with significant openings);
- ✓ Façade braced in every elevation, one set per six bays;
- ✓ Ledger bracing may be omitted from this scaffold erected with prefabricated structural transom units to the maximum safe height specified;
- ✓ Double guard rails and toe boards at boarded lifts (triple permitted at top);
- ✓ Single guard rails at unboarded lifts;
- ✓ Internal edge protection provided where required;
- ✓ Tied in accordance with TG20:13 chapter 07. Tie tubes may be connected only to the inner face of the scaffold.

Sign-off

Contract no:		Client:	
Company:		Scaffold reference:	
NASC membership no (1):		Site reference:	
Name:		Signature:	
Position:		Date:	
Notes:			

(1) Use of this NASC document does not infer NASC membership. Go to www.nasc.org.uk to confirm membership. Illustrations are indicative.

Fig. 1: A sample Basic scaffold provided by the TG20 eguide.

e) Considerable non-recoverable costs can be incurred in design time when clients provide inadequate details of their requirements. This may also lead to a failure to secure work because of the inability to compare tenders on a like for like basis. Scaffolding contractors should refer to TG20 and TG21 (Appendix B) for guidance. Any information discussed in the brief should be minuted as part of the meeting.

f) It is a common misconception within the industry that scaffolds designed to the requirements of a published standard such as BS EN 12811-1 or TG20 relieve the main or scaffolding contractor of any design liability.

g) It is also a common misconception, particularly among operatives, that a designed scaffold is one built to an engineers drawing and calculations. Furthermore, if they build it to a recognised standard, they do not consider it to be a designed scaffold. On that basis operatives rarely consider themselves as having any design responsibility. However, if scaffolders modify a design or standard configuration they may be considered to have responsibilities under the CDM regulations.

h) All designs must be checked. It is also becoming increasingly common for clients to request third party design checks. For example Network Rail have forms F001/F002/F003 for external design companies to check over designs. This is in line with BS5975 and a guide to the categories may be found in TG21 (Appendix A).

7. A Guide to Scaffolds requiring input from a competent scaffold design engineer

The design of some scaffolds, particularly large, complex structures or those where the public may have access, require specific input from a competent scaffold design engineer. The following list includes but is not limited to such scaffolds: -

- Independent tied scaffolds other than those covered by TG20
- Sheeted and netted scaffolds other than those covered by TG20
- Access scaffolds with more than two working lifts
- Scaffolds for the attachment of lifting tackle
- Buttressed free-standing scaffolds other than rakered independents convered by TG20
- Suspended scaffolds
- Slung scaffolds
- Truss-out scaffolds
- Cantilever scaffolds other than cantilevers on independent scaffolds as covered by TG20
- Protection fans, nets and pavement frames
- Bridging in access scaffolds other than those convered by TG20
- Scaffolds using prefabricated beams i.e. unit beams, ladder beams and aluminum beams beyond the scope of TG20
- Birdcage scaffolds other than those covered by TG20
- Tower scaffolds other than those covered by TG20
- Scaffolds on a sloping base
- Temporary buildings and temporary roofs and their supporting structures

- Load bearing platforms other than TG20 loading bays
- Shoring
- Storage racking
- Radial scaffolds i.e. spheres and tanks (internal and external)
- Temporary ramps and roadways
- Pedestrian bridges and walkways
- Spectator terraces and seating stands
- Offshore scaffolds outside OCA handbook
- System scaffolds not within the range of standard designs provided in the manufacturers handbook.

This list is not exhaustive but should be used as a guide.

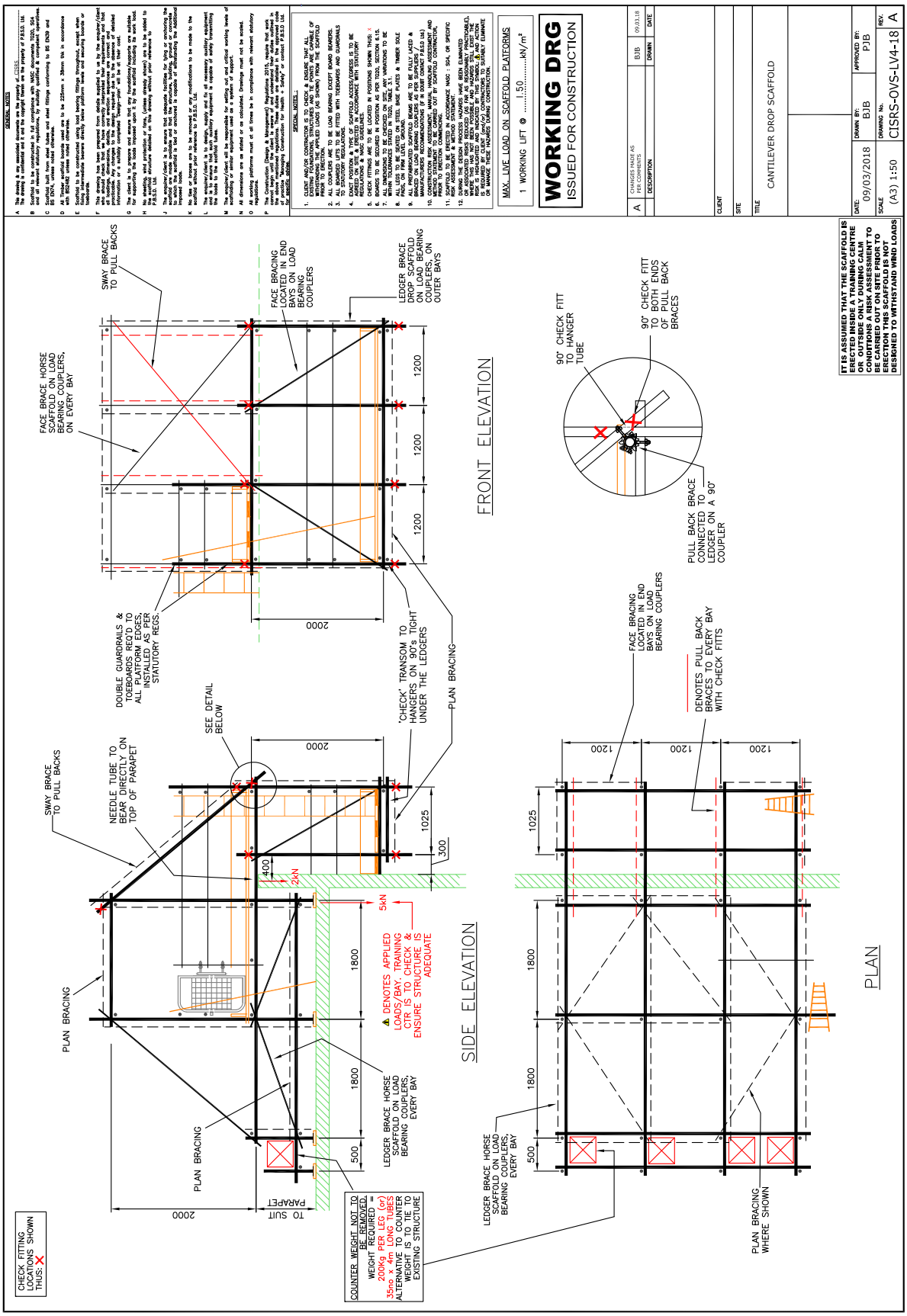

Fig 2: A sample Complex scaffold provided by a scaffold designer

For details of current NASC Design members please go to the NASC website www.nasc.org.uk

Reference Documents

BS EN 12811-1: 2003
Temporary Works Equipment Part 1: Scaffolds – Performance Requirements and General Design

BS EN 12811-2: 2004
Temporary Works Equipment Part 2: Information on Material

BS EN 12811-3: 2004
Temporary Works Equipment Part 3: Load Testing

TG20 Current Edition
A comprehensive guide to good practice for tube and fitting scaffolding

SG4 Current Edition
Preventing Falls in Scaffolding operations

BS EN 1991-1-1:2002 and accompanying NA
Eurocode 1: Actions on structures Part 1-1: General Actions _ Densities, Self-weight, imposed loads of buildings

BS EN 1991-1-4:2005 + A1:2010 and accompanying NA
Eurocode 1: Actions on structures Part1-4: General actions – Wind Actions

BS EN 1991-1-3:2003+A1:2015 and accompanying NA
Eurocode 1: Actions on structures Part1-3: General actions – snow loads

BS5975: 2019 + A1:2011
Code of Practice for Temporary Works Procedures and the permissible stress design of falsework

TG21 Current Edition
A guide to Commissioning Scaffold Design