

Tents, marquees and grandstand seating

Guidance for the design and construction of temporary demountable structures

Temporary Demountable Structures must comply with Temporary Demountable Structures Guidance (Second edition March 1999). Available from: The Institution of Structural Engineers, 11 Upper Belgrave Street, London SW1X 8BH

1. Introduction and scope of the guide

- a. The Guide is concerned with the structural safety and adequacy of demountable structures, also the overall planning and management of events.
- b. Demountable structures are used for a variety of functions; some may carry substantial numbers of persons.
- c. Demountable structures are often required at short notice making it necessary for decisions to be made relatively quickly.
- d. The client is the person or organisation who procures a demountable structure for use at an event; this may be the owner of the venue, site or building where an event takes place but is not necessarily the event organiser who promotes and manages an event.
- e. The achievement of safety requires judgment based on experience. It is not merely a matter of the rigid application of standards.
- f. The approach to risk management should always be one of flexibility and judgment.
- g. An objective assessment by a competent person is required.
- h. A person shall be regarded as competent where they have sufficient training and experience to take responsibility for an identified task. It is important that they have a detailed knowledge of the type of structure, and particularly of those matters that are essential for its structural reliability. A competent person will have an awareness of the limitations of their own experience and knowledge.

2. Principal responsibilities

- a. Responsibility for the safety of persons attending an event lies with the client. The client cannot pass on the responsibility for safety to any third party.
- b. The client must make sure that competent persons are employed to design, supply and erect the temporary demountable structures.
- c. Evidence of the design process being carried out should be available. Where structures are intended for repetitive use, a standard design is acceptable provided that evidence of the original design is available.
- d. An independent design check of a standard system must be carried out by a chartered engineer. A check of the design of any special or non-standard arrangement of elements must be carried out by a chartered engineer.
- e. It is the responsibility of all those concerned with temporary demountable structures to exercise care in their work and in all matters relating to the safety of the people who may be using them.
- f. A competent person is required to confirm that a structure has been erected in accordance with the original design.
- g. A completion certificate is required to confirm that the appropriate independent erection checks have been carried out and that a temporary structure has been erected in accordance with the design.
- h. A competent person representing the event organiser must be responsible for implementing a safety plan.
- i. A documented safety plan must be prepared identifying the hazards and associated risks relating to the temporary demountable structure for the proposed event, setting out responsibilities for managing the risks.

3. Hazards and risks relating to demountable structures

- a. All employers are required under the Management of Health and Safety at Work Regulations 1992 to carry out an assessment to identify hazards and risks that could cause injury to the employees or the public.
- b. A structural means of providing a safe route from any part of a demountable structure to either a place of safety or a final exit (means of escape) is essential.

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- c. Crowds may impose significant vertical and horizontal loads on temporary structures; crowd behavior in emergencies is also an important consideration.
- d. A plan for managing all risks should be prepared. The most important aspects of a safety plan are its actions and the management of these actions.
- e. It is particularly important that proper consideration is given at the design stage to providing good sightlines.

4. Statutory control

Venue owners and event organisers are principally responsible, in law, for complying with public safety legislation while the structure is in use.

5. Procurement and use

- a. The client should provide the contractor for the demountable structure with a written technical specification of requirements.
- b. Last minute changes cause the majority of problems and must be avoided.
- c. It is the client's responsibility to provide temporary structures (and exits) that are safe for their users.
- d. The client should make sure that competent persons are employed to design, erect, inspect and dismantle the structure.
- e. Design documentation must be provided by the designer of a temporary structure that enables the basis of design to be clearly understood and the design criteria to be verified. May include drawings, calculations, certificates, statements of loading, etc.

6. Ground and site conditions

- a. Designers should be aware that the performance of the ground under short-term loading can be significantly different from that when the loading is applied for a considerable period.
- b. Clients should give basic information on ground conditions but it is likely that a competent person will be required to determine the allowable bearing capacity. Local knowledge is invaluable.

7. Erection, inspection and dismantling

- a. The critical erection stages for temporary demountable structures should be identified during the design process. An erection method statement, together with drawings, is necessary for this purpose.
- b. A risk assessment must be carried out by a competent person to identify the hazards associated with the design, construction or operation of a temporary demountable structure, determining the level of risk for people constructing or using the structure, and assessing the likelihood and consequences of an incident.
- c. The structure should be erected safely in accordance with the erection method statement and drawings provided.
- d. Bracing should be arranged to provide stability at all stages of erection.
- e. Inspection is essential to maintain the safety and integrity of a demountable structure.
- f. An inspection of a temporary structure must be made by a competent person after every erection of the structure. Where the erection check is carried out by a member of the erection team, evidence of that person's competence should be made available. The results of this inspection should be recorded on the completion certificate.
- g. Damaged or defective components should be clearly marked and removed from the site as soon as possible.
- h. The repeated use of demountable structures will inevitably lead to general wear and tear in addition to damage or distortion that may occur during handling, transportation, assembly and dismantling.

8. Wind loading

- a. The design wind speed must accommodate the maximum wind speed that a temporary structure is designed to withstand.
- b. Contractors and suppliers of temporary demountable structures should have access to a reliable local weather forecasting service if wind speed monitoring is to be carried out during an event.

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9. Grandstands

- a. Design of temporary grandstands and seating must be the responsibility of a competent person. Before assembly, the design should be independently checked by a chartered engineer.
- b. Demountable framed structures must be designed to form a robust and stable three-dimensional structural arrangement that will support the design loadings for the required period with an adequate margin of safety.
- c. Demountable structures must possess sufficient transverse and longitudinal stiffness and strength to resist wind loads, notional horizontal loads and other dynamic loads induced by spectator movements.
- d. Dynamic loads will only be significant when any crowd movement is synchronised and periodic. If the synchronised movement excites a natural frequency of the structure, resonance will occur which can greatly amplify its response.

NOTE: - The design must include provision for emergency lighting of escape routes.

Combustible materials must not be stored underneath raised areas.

10. Stages and barriers

- a. Temporary stages and barriers must be assembled in accordance with plans and specifications drawn up by a competent person. The calculations involved in drawing up the plans and specifications should be independently checked by a chartered engineer.
- b. Design of any temporary staging system is essentially a consideration of the balance between weight, strength, fabrication cost and deployment cost of the individual components. In such a consideration, safety must not be compromised. All such structures must be certified as fit for purpose by a competent person.
- c. Lack of handrails and poor stairs are the biggest causes of stage-related accidents indoors.
- d. The area immediately in front of a stage presents particular hazards for a standing audience.

11. Ancillary special structures

- a. Some of these structures differ in that during an event they are located in the middle of a venue and are surrounded by the audience.
- b. As with other temporary structures, an independent design check by a chartered engineer should be carried out.
- c. It is paramount that the design of the structure is appropriate for the situation and that the structure is built strictly in accordance with the design.
- d. All activities relating to the structure must conform to the requirements of The Work At Heights Regulations 2005. In particular with respect to guard rails, toe boards, barriers and similar collective means of protection.

12. Tents and marquees

- a. Tents and marquees should be capable of withstanding all forces that they may reasonably be expected to encounter. Of these, wind is the most important from a design point of view.
- b. The design of new large marquees should be carried out by a competent person and subject to an independent check by a chartered engineer.
- c. Particular attention should be given to the strength and soundness of guy ropes and anchors, including the anchorage in the ground.
- d. Anchors are a critical aspect of marquee structures.
- e. After erection and before use, a tent or marquee should be thoroughly inspected by the supplier.

Phone: 07974 768553 or Email: info@consultmartin.co.uk

Further information: www.consultmartin.co.uk