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	<h1>Loading for Temporary Installation Structures</h1>			

## 1. Introduction

This Practice Note sets out a suggested design approach to assist structural engineers preparing and certifying designs for Temporary Structures, that is internal and external structures in the public domain at events attended by the public of a temporary nature that are in place typically between 1 day and 1 month. Such structures are likely to include:

- Concert staging, temporary seating stands and associated temporary structures.
- Marquee structures and Tents.
- Inflatable structures.
- Temporary art works or sculptures.
- Temporary entertainment installations.
- Temporary exhibition and advertising installations.

The nature of Temporary Structures is such that:

- They may be used by substantial numbers of people during major events or involve interaction with the public.
- They may be required at very short notice where the time from concept to use at an event may be limited.

It is essential to design temporary structures to suit the specific intended purpose and to recognise that the key to the safety of temporary structures lies largely in proper planning and control of work practices. The fact that a structure is designed for temporary use does not change the overall expectation for safety.

The ACSE is not attempting to set out all the various types of installation structures and designs possible but set out guiding principles which can form a design approach for such structures.

This practice note is not intended to relate to: Any structures which are in place beyond 1 month; Temporary structures (such as formwork and falsework, scaffolding etc) used in the construction industry and are covered elsewhere.

## 2. Definitions

*Temporary Structure:* A temporary structure installed at a public event which is in place between 1 day and 1 month.

*Design Engineer:* The engineer responsible for the design and certification of the Temporary Structure.

*Alternative Method approach:* A first principles engineering approach, as detailed in Australian Building Codes Board (ABCB) 'Temporary Structures-Standard' published in 2015.

*Review Engineer:* The engineer responsible for reviewing and assessing the design and design approach adopted by the design engineer, where required by local authorities.

*Design Wind Speed:* The wind speed, based on the duration of the installation, for which the framing of the Temporary Structure and the ballast restraining the structure has been designed.

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*Wind Management Plan:* A plan outlining the steps to be undertaken during the event should the wind loading approach the Design Wind Speed for the Temporary Structure.

## 3. Design Wind Load

AS1170.2 table 3.1 provides regional wind speeds ( $V_R$ ) for return periods above 1 year.

For external structures in service for a short period, an appropriate Design Wind Speed for the Temporary Structure(s) shall be adopted by the design engineer. In determining a suitable design wind the design engineer should consider:

- 1) The duration of the installation or event. This should include the 'bump in' and 'bump out' periods.
- 2) Minimum wind speeds dictated by local authorities for the site of the installation.
- 3) The suitability of the structure to be partially unclad in the lead up to use and minimise the exposure time to the Design Wind Speed.
- 4) The suitability of the structure to be de-clad or modified to reduce the effects of wind load on the structure should wind approach the *Design Wind Speed*.
- 5) Interaction with the Public. I.e. Is it possible to implement an exclusion zone around the structure when the wind approaches the design wind speed.
- 6) Methods and accuracy of the 'on-site' wind speed measurement available.

### Recommendations on determining an appropriate Design Wind Speed may be found in:

- 1) Australian Building Codes Board (ABCB) 'Temporary Structures-Standard' published in 2015. (Attached)
- 2) Technical Note: 'Design wind speeds for temporary structures' prepared by C-H Wang† and L Pham; Ecosystem Sciences, CSIRO, Melbourne; © Institution of Engineers, Australia 2012 Australian Journal of Structural Engineering, Vol 12 No 2
- 3) Design Guide: 'Temporary Demountable Structures' prepared by IStructE UK, Fourth Edition, 2017

SampleTable: Regional wind speeds for Reference periods not exceeding one year from the Institution of Engineers, Australia 2012 Australian Journal of Structural Engineering, Vol 12 No 2

Region	Probability of exceedance	Regional wind speed (in m/s) for a reference period of			
		1 year	6 mth	1 mth	1 wk
A	1:100	41	39	34	30
	1:500	45	43	39	34

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	1:1000	46	45	41	37
B	1:100	48	44	32	22
	1:500	57	53	43	33
	1:1000	60	57	47	38

## 4. Other Loading

Other potential applied live loads should be considered in your design and listed on design sketches or drawings. This could include crowd loading, any attached cladding or equipment.

The level of security and /or supervision around the installation should also be considered to understand the level of robustness of the structure that is required. Any special requirements or limitations of the structure should be notified to the supervisor if applicable.

If an installation is to be left unattended in a public space then the accessibility and susceptibility to breakages that could cause bodily harm should be considered..

## 5. Design Review

A design review, by a Review Engineer, is required by some local authorities when the design engineer adopts 'An Alternative Method' approach involving the application of engineering practice from first principles or undertaking a risk based assessment which confirms that a lower Design Wind Speed than that nominated by the local authorities can be adopted.

## 6. Responsibilities – Design Engineer, Review Engineer and Client.

The following responsibilities apply to the Design Engineer:

- 1) To prepare a design that includes an assessment of the wind speed determination and any assumptions, or conditions to make the design valid.
- 2) To complete a safety in design risk assessment specific to the design.
- 3) To prepare a design certificate which clearly identifies the Temporary Structure and defines:
  - The materials and construction - including what needs to be frangible (as required)
  - Confirms the Design Wind Speed
  - Documents a Wind Management plan where appropriate
  - Identifies any special design conditions or assumptions.
- 4) To engage a Review Engineer where 'An alternative Method' approach is adopted.
- 5) To review the constructed structure and ensure that it has been constructed in accordance with the design and any frangible elements are installed correctly.

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- 6) The design responsibility remains with the Design Engineer

The following responsibilities apply to the Review Engineer:

- 1) Be independent of the design
- 2) To assess that the design approach adopted by the Design Engineer is appropriate, considered and reasonable.
- 3) To review and assess the safety in design risk assessment and make comment as required.
- 4) The design responsibility remains with the Design Engineer

The following responsibilities apply to the Client:

- 1) To provide the Design Engineer with a clear understanding of the use, duration and location of the temporary structures.
- 2) To read and understand the instructions prepared by the design engineer and to implement the requirements of any Wind Management Plan.

## **7. Documents to be Provided with Design Certification**

The following documents are to be provided by the Design Engineer as part of the certification of the Temporary Structure:

- 1) Design drawings/sketches showing the Temporary Structure location, structural framing, detailing and any conditions such as ballast/attachment of ballast.
- 2) Design Certificate detailing: Design wind Load; duration of installation;
- 3) Wind Management Plan;
- 4) Letter of Review by Review Engineer (if appropriate).

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