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Shade Australia
Commercial Umbrella Engineering Detail – Commercial In Confidence

SUMMARY OF ANALYSES

At your request we have undertaken a design review of standard square and octagonal *UltraShade* CE Series umbrella fra to 6.0m product range. Attached is our detailed report, however the following summary is provided.

From geometric and materials data provided of the dimensions, sections and profiles used in manufacture, a design ch completed of the following standard *UltraShade* CE umbrellas:

Square: 3.6m, 4.0m, 4.5m, 4.8m, 5.0m.

Octagonal: 3.5m, 4.0m, 4.5m, 5.0m, 5.5m, 6.0m.

This has involved wind tunnel model testing and engineering analyses of the output, based on umbrella frames as present and the assumptions noted below.

1. DESIGN ASSUMPTIONS

These umbrellas are considered to be less permanent than a building structure and cannot be considered to provide meanir an extreme wind event.

Further, umbrellas can be expected to be in the general proximity of building structures larger than the umbrellas.

Because of the materials used, overstressing and failure of the umbrella frame is expected to be by ductile yielding in the This would result in bending of radial arms, bending of the main post, or bending of the base spigot, so that the frame will break. This may be preceded by ripping of the fabric cover, depending on its age and condition, which would also rela though the fabric pieces remain attached to the frame.

These might be considered to be "safe" modes of failure, in that it is unlikely that a failing umbrella would become a proj damage downwind *(the major cause of damage in Cyclone Tracy, for example)* except by uprooting the entire frame and footing.

Footing options have not been evaluated in this design check due to the variability of footing and soil types possible.

The following table shows wind speed ratings (maximum safe wind speed) for square and octagonal umbrella frames in closed condition, as manufactured. This does not account for degradation of synthetic materials over time, nor for modificati maintenance that may result in reduced strength over time.

TABLE 1 - FRAME WIND RATING (km/hr)

OCTAGONAL Size		WIND RATINGS Open Km/h	Closed Km/h	SQUARE Size		WIND RATINGS Open Km/h	Closed Km/h
3.5m	(8.73 sq m)	>200	>200	3.6m	(12.96 sq m)	>200	>200
4.0m	(11.55 sq m)	>200	>200	4.0m	(16.0 sq m)	192	>200
4.5m	(14.4 sq m)	>200	>200	4.5m	(20.25 sq m)	172	>200
5.0m	(17.5 sq m)	>200	>200	4.8m	(23.04 sq m)	143	>200
5.5m	(21.45 sq m)	183	>200				
6.0m	(25.7 sq m)	155	>200				

To put these wind ratings in perspective, Australian Standard AS 1170.2-1989 (SAA Loading Code, Part 2, Wind Loads) nominates basic wind speeds as follows:

WIND REGION TO AS1170.2-1989	BASIC WIND SPEED (km/hr)
A (Normal)	148
B (Intermediate)	176
C (Tropical Cyclones)	205

Thus, whilst wind speeds the umbrellas should sustain might seem to be high, the expected maximum wind speed is also high, based on analysis of historical data as encapsulated in the Australian Standard. Refer to attached map of Australia which indicates location of wind regions as described above.

The basic wind speeds nominated in the Australian Standard are directly comparable with wind ratings given for the umbrellas, based on the design assumptions noted herein. These assumptions will not cover all potential installations of *UltraShade* umbrellas, but should relate to the majority.

Installations which do not comply with the nominated assumptions herein can be evaluated on a job by job basis, as required.

The wind ratings given above are not directly comparable with the W33, W41 etc wind loading classification system adopted for timber framed residential design manuals by TRADAC. These are based on a particular interpretation of the wind loading code, different in some ways to that adopted for these umbrellas structures as noted above.

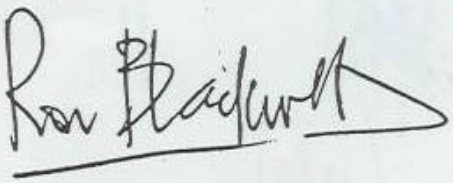
As an approximation, however, the following table shows wind ratings generally in terms of this classification system, which may be useful as a rough guide.

TABLE 2 – FRAME WIND RATING

OCTAGONAL				SQUARE			
Size		Open	Closed	Size		Open	Closed
3.5m	(8.73 sq m)	W60	W60	3.6m	(12.96 sq m)	W50	W50
4.0m	(11.55 sq m)	W50	W60	4.0m	(16.0 sq m)	W41	W50
4.5m	(14.4 sq m)	W50	W50	4.5m	(20.25 sq m)	W33	W50
5.0m	(17.5 sq m)	W41	W50	4.8m	(23.04 sq m)	<W33	W50
5.5m	(21.45 sq m)	W33	W50				
6.0m	(25.7 sq m)	<W33	W50				

We trust that this provides the information you require at this time. Please contact us if you have further questions or comments.

Yours faithfully



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