



ANTHONY WARD  
PARTNERSHIP LTD

## 11/ DSH / 01 Structural Calculations for DS 80 Trailer Mounted Stage for Daytona Stage Hire

### Summary

#### Introduction

This document is a summary of the key points from the structural engineering calculations prepared by Anthony Ward Partnership Limited dated April 2005.

#### General

The superstructure is supported by the trailer chassis and travels in a different configuration than when it is deployed. When the stage is deployed, the sides of the trailer fold out on hydraulic rams in an upward direction to form the roof of the stage. Next, the inner side panels fold out on hydraulic rams in a downward direction to form the stage deck area. The roof as a whole is then raised further, with dual cranked towers placed under the central towers and bolted to the chassis, also four corner towers support the roof and connect it to the deck.

When the stage is in travelling mode, all panels fold back to their original positions to form a standard articulated trailer shape. The panels are locked into position before setting off.

The roof panels are constructed from commercial vehicle industry standard GRP coated plywood. The rear and side walls are fashioned from a system of interlocking UPVC panels.

The front and rear roof panels are hinged on the central cross stage trusses. No load shall be applied to these hinged panels until the corner props are positioned and adjusted to take load from the panels.

It is assumed in the preparation of these calculations that the roof structure will be supplied to organisations that have relevant experience of structures of this type and used by competent and suitably experienced people.

#### Documentation

The structures have been designed using the latest editions of all appropriate British Standards and British Standard Codes of Practice. The principal codes were:-

BS 6399	Design Loadings for Buildings
BS 8118	The Structural Use of Aluminium
BS 7905	Lifting Equipment for Performance, Broadcast and Similar Applications Part 2 Specification for the Design and Manufacture of Aluminium and Steel Trusses and Towers
BS EN 755	Aluminium and aluminium alloys - extruded rod/bar; tube and profiles Part 2 Mechanical Properties

The User shall refer to the following documents:-

BS 7906	Lifting Equipment for Performance, Broadcast and Similar Applications Part 2 Code of Practice for the Use of Aluminium and Steel Trusses and Towers
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FS-45009

The Event Safety Guide - Guidance to Health, Safety and Welfare at Music and Similar Events - HSG195 Health and Safety Commission

Temporary Demountable Structures Institution of Structural Engineers, UK

#### **Payload**

The roof comprises six cross stage trusses which each have a payload capacity of 1000 kg. This gives a total payload for the roof of 6000 kg (6 tonnes) depending upon operational circumstances.

#### **Seismic loads**

The structure has not been designed to resist any seismic forces to which it may be subjected. The structure is considered to be temporary and hence the probability of a seismic occurrence during operation is assumed to be negligible. If the User considers that the probability is greater than that assumed then he shall undertake the necessary calculations.

#### **Rain loads**

The roof structure is essentially flat with two central gutters for drainage. The trusses will deflect under load and therefore there is significant risk of ponding. It is proposed set the roof at a slight angle to allow for run-off around the rear and sides and the hinge lines of the roof panels. For the purposes of these calculations, an average of 10 mm of water across the whole roof area has been assumed. The roof shall be set up in a period of significant rain fall to check this assumption. If the assumption proves inadequate, then the angle of the roof shall be increased.

#### **Wind loads**

The structure is to be used for short periods and therefore the design wind speeds are limited to 25m/s in accordance with Temporary Demountable Structures published by the Institution of Structural Engineers.

It should be noted that the wind loading on the roof structure will change significantly if side and rear wall are included. The top flaps in the walls adjacent to the roof trusses are always open and set at 45 degrees.

The design wind speeds for the structure are as follows:

Basic design mean wind speed 25 m/s = 55 mph  
Roof panels to be folded down at wind speed of 55 mph  
Lighting equipment to be removed at wind speed of 20 m/s = 45 mph  
Sound cabinets to be lowered to stage level at wind speed 20 m/s = 45 mph  
Additional vent flaps are opened in the side and rear walls at wind speed of 15 m/s = 34 mph  
Wind speeds are measured at 10 metres above ground level.

The user shall advise his client of the operating limits of the structure.

When the wind speeds reach the speeds shown above, it will be necessary and instigate the derigging procedures set out in the Operations Management Plan.

The wind speed shall be monitored in accordance with the requirements set out in the structural calculations.

#### **Stage Loading**

The design loadings for the stage areas are taken from BS 6399 Design Loadings for Buildings, Part 1, Table 1.

Category C4	Uniformly distributed load 7.5 kN/m <sup>2</sup> Point or concentrated load 4.5 kN
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These are approximately equivalent to	Uniformly distributed load 750 kg/m <sup>2</sup> Point or concentrated load 450 kg
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