

ROOM TO MOVE

TRUSSES



CLIENT

Smith Bros Terminals Pty Ltd

DESIGN

Bigspace Structures Pty Ltd

ENGINEERING DETAIL

SW Healey & Associates Pty Ltd

STEEL FABRICATOR

Edcon Steel Pty Ltd

The Bigspace Structures design concept is now available in Australia. The design concept is able to achieve uninterrupted column free space in buildings spanning up to 150 metres and offers Architects and Developers the benefit of constructing buildings with increased operational efficiency.

“These efficiencies are modelled for different market applications and are typically around 3%.

This is significant when pallet movements or other operational activities are occurring many thousands of times a day and result in increased rental returns. The increased rental returns increase the asset value by around 12 to 15%”. Murray Ellen, Bigspace Engineer.



DuraGal sections were specified by Bigspace Structures for the top and bottom chords, vertical web members and angle bracing.

They contributed significantly in reducing the material and surface coating costs in the design for an unloading canopy for Smith Bros warehousing at Port Botany, NSW.

MAJOR BENEFITS OF USING DURAGAL INCLUDED:

- High strength corrosion resistant structure.
- Cost reductions.
- Lightweight construction.
- Faster fabrication, by eliminating the need for third party protective coatings.
- Ideal form for post-tensioning and grouting.

INTRODUCTION:

The Bigspace design concept is well established overseas, being used for industrial, commercial, rural and sporting facilities.

The benefits promoted include increased operational efficiency, lightweight and faster construction times, and lower cost compared to more traditional designs.

The shop fabricated truss members were supplied to site in modules and assembled on site at ground level. The purlins are attached and roof sheeting secured prior to erecting the whole assembly onto the supporting columns.

The extension to the Smith Bros, Port Botany facility involved a tensioned open web truss design to provide the client with a 60 metre column free area for easier loading/unloading of shipping containers.

DESIGN BRIEF:

The client required a basic awning to protect customer goods from the weather during loading/unloading operations. The approximate area involved covered 1500m².

An original design provided for 8 universal beams supporting columns along the 60 metre elevation. This would have forced the unloading container trucks and forklift operations to manoeuvre between the columns.

The Bigspace Structures design provided a column free area allowing trucks to unload, end-on, under cover without the restrictions of columns.

“Our experience with welding the DuraGal Sections with the black steel plate was very similar to welding black hollow sections to black steel plate with, minimal spatter, and easy cleaning. Sound welds were easily achieved”

**JOHN CLARKE,
PRODUCTION MANAGER,
EDCON STEEL PTY LTD**



STRUCTURAL DESIGN:

The detailed structural design and modelling for this project was completed by SW Healey & Associates, under license from Bigspace Structures.

DuraGal Hollow Sections C450L0 ranging from 50 x 50 to 100 x 100 SHS were used for the twin top and single bottom chord members, and the vertical web members.



Fly Bracing: 65 x 65 CA DuraGal Angle C450L0.



Columns: OneSteel 200UC & 250UC Universal Columns in a buttress open web form.

The bottom chord of the open web trusses contained the steel cables that were subsequently tensioned to store energy for resisting uplift forces and allows considerable spans to be achieved with sections of a much lighter mass. This not only contributes to a reduction in the mass of the rafter overall, but also contributes to savings in columns and footings.

The use of the higher tensile DuraGal sections led to a reduction in the mass of the truss assembly and also contributed to lower crane costs on site.

1.0 Notes on Structural Design used on this project

1.1 All DuraGal SHS/RHS Hollow Sections are DualGrade®. DuraGal DualGrade exceeds the tensile requirements of AS 1163:1991^[1] grades C450L0 while still meeting the higher elongation figures of grade C350L0.

1.2 DuraGal Open Sections are manufactured to OneSteel Specification TS100^[2].

FABRICATION:

Fabrication of the truss modules involved shop welding using simple jig work. The lightweight modular design lent itself to being easily transported and assembled on site at ground level using bolted connections.



The DuraGal sections were shop welded using the Gas Metal Arc Welding process. (GMAW)

The following parameters were used for welding the DuraGal and black steel plate sections.

Welding wire: Solid 1.2mm

Welding gas: Blueshield 23^[3]

The welding equipment was set for a standard 6mm continuous fillet weld.

Amps: 290

Volts: 27

Wire Speed: 10m/min

2.0 Notes on Welding.

2.1 DuraGal is supported by all of the major suppliers of welding consumables.

2.2 DuraGal with a Carbon Equivalent (CE)=0.39^[4] does not require specialised pre-treatment.

2.3 Refer also to the DuraGal Easy Welding Guide.

COATINGS:

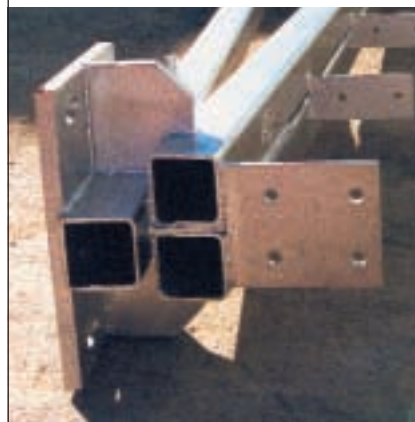
Except for repair of the heat affected zones around the welds and cut edges, the DuraGal Sections did not require additional protective coatings to be applied.

DuraGal Hollow Sections are Hot-dip galvanized to AS/NZS 4792:1999 ILG 100^[5], and DuraGal Open Sections to AS/NZS 4791:1999 ILG 100^[6].

Weld & Cut end repair

Following fabrication, the fresh weld areas and any exposed cut ends of the DuraGal sections and the black steel plate were prepared for painting. Using a combination of wire brushing and power tool cleaning, this operation was followed by cleaning with detergent and water to the relevant codes.

After drying, two coats of zinc rich primer were applied. When dry, an application of a colour matching aluminium paint was used to restore these areas and provide a close match to the DuraGal (refer to note 3.2). The result was very pleasing overall finish to the steelwork.



The OneSteel hot rolled Universal Columns used for the support columns were batch Hot-dip galvanized after fabrication to AS/NZS 4680:1999^[7].

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3.0 Notes on painting and corrosion topics.

3.1 Specifiers should make reference to a coatings manufacturer of their choice to determine the most suitable paint coating for the application and site environment.

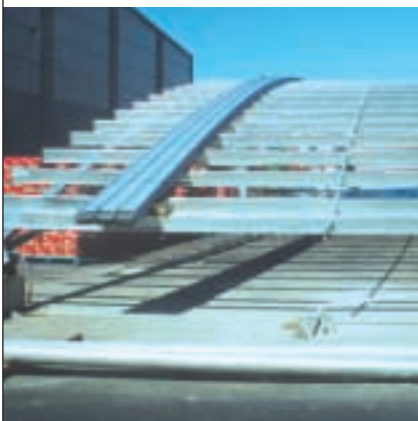
3.2 Aluminium colour match paints should be used in addition to, and over a suitable weld repair coating recommended by the coating manufacturer.

3.3 Refer also to the DuraGal Easy Painting and Corrosion Protection Guide.

ROOF SHEETING:

A specially equipped mobile roll-forming machine allowed coils of steel strip to be transformed into 60 metre long profiled roof sheet quickly and accurately on site. Using a computer controlled process, the sheets were rolled and placed onto the roof structure while at ground level. Normally the sheets are fixed at ground level prior to lifting. In this instance, the sheets were stacked over the frame at ground level, and fixed into place after erection.

Another OneSteel product, Roofsafe® Safety Mesh was used over the roof purlins prior to the initial placement of the roof sheets, with complete installation occurring prior to lifting the roof structure into place.



REFERENCES:

- [1] AS 1163:1991 Structural steel hollow sections.
- [2] TS 100 Technical Specification for DuraGal Profiles (April 1998)
- [3] Blueshield 23 is a registered trademark of Air Liquide.

[4] Carbon Equivalent calculated in accordance with AS/NZS 1554.1.2000 Welding of steel structures.

[5] AS/NZS 4792:1999 Hot-dip galvanized (zinc) coatings on ferrous hollow sections, applied by a continuous or a specialised process.

[6] AS/NZS 4791:1999 Hot-dip galvanized (zinc) coatings on ferrous open sections, applied by an in-line process.

[7] AS/NZS 4680:1999 Hot-dip galvanized (zinc) coatings on fabricated ferrous articles.

ACKNOWLEDGEMENTS:

- Smith Bros Terminals Pty Ltd
- Bigspace Structures Pty Ltd: (02) 9660 9800
- SW Healey & Associates: (02) 9894 8500
- Edcon Steel Pty Ltd: (02) 9905 6622

FURTHER INFORMATION:

For further information on any of the OneSteel Products or OneSteel publications mentioned in this application contact:

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