



## Elm Leisure Eco Panel

Why Use the Eco Panel system when building your swimming pool

- 1) **Eco Panel** designed by Ben Monks building pools for 37years, why as no other panel can compete, similar systems either don't have the thermal properties or they are not compatible with all pool products limiting in strength and you may not be able to integrate other pool products onto them like you can with the Eco Panel e.g., covers lights, depths, heat retention covers, underwater steps.
- 2) Cheaper to heat your swimming pool with higher temperatures
- 3) Longer summer with higher water temperatures
- 4) Saving of thousands over the years with higher water temperatures
- 5) Adds to the sale of your pool when moving showing lower running costs.
- 6) Keeping your hand in the green lane
- 7) Strength stronger than other designs or conventional pools.
- 8) Versatile for virtually any shape

### A GRP Panel for above ground and in ground swimming pool

Analysis.

INTRODUCTION This Basic summarises the structural analysis of The **Eco Panel** system is a GRP panel to form the wall of a swimming pool. The **Eco panels** are to be supported by an external steel frame and or Concrete beam subject to installation. And final design. This analysis is limited to the GRP panel.

and does not include the steel frame nor concrete Beam.



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The Institute of Swimming Pool Engineers



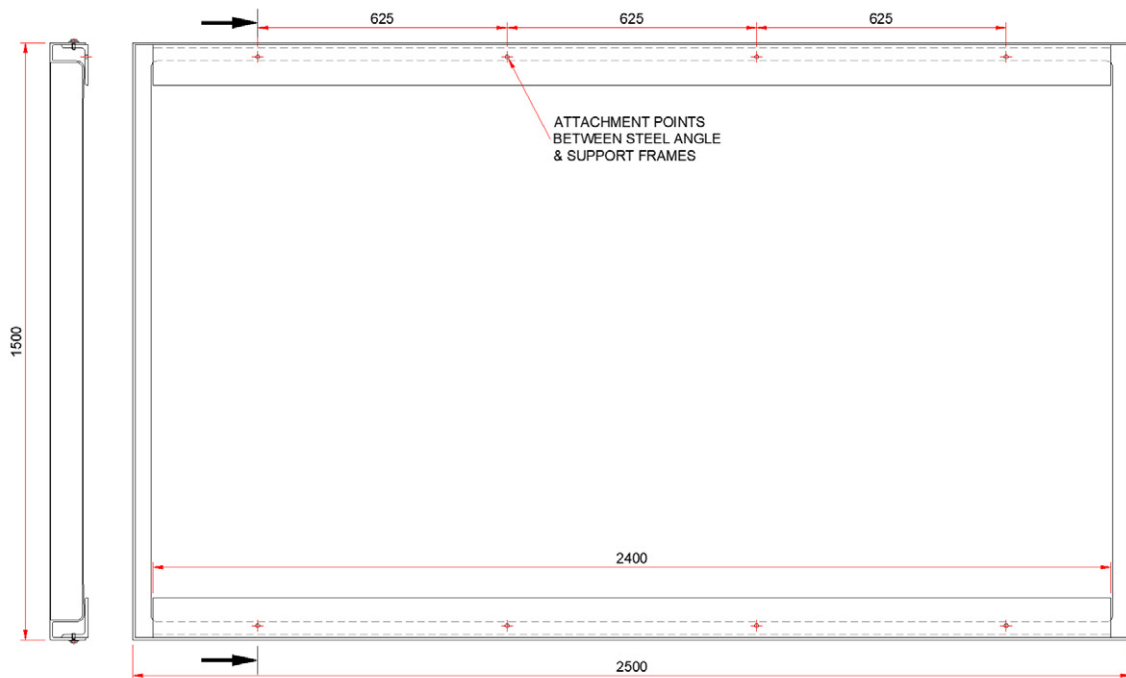
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### GEOMETRY & SUPPORT DETAILS

The GRP **Eco panel** is to be 2.5m wide x 1.5m high. The vertical face of the panel is flat and is reinforced with a foam core to form a structural sandwich. Also has a Unique mail female locater when connecting panels together.



**Each panel** is supported by external steel frames and or concrete beam supporting the top and bottom edges of the panel as shown in the sketches below.

Details of the panel construction and edge flange details are shown in the sketch below.

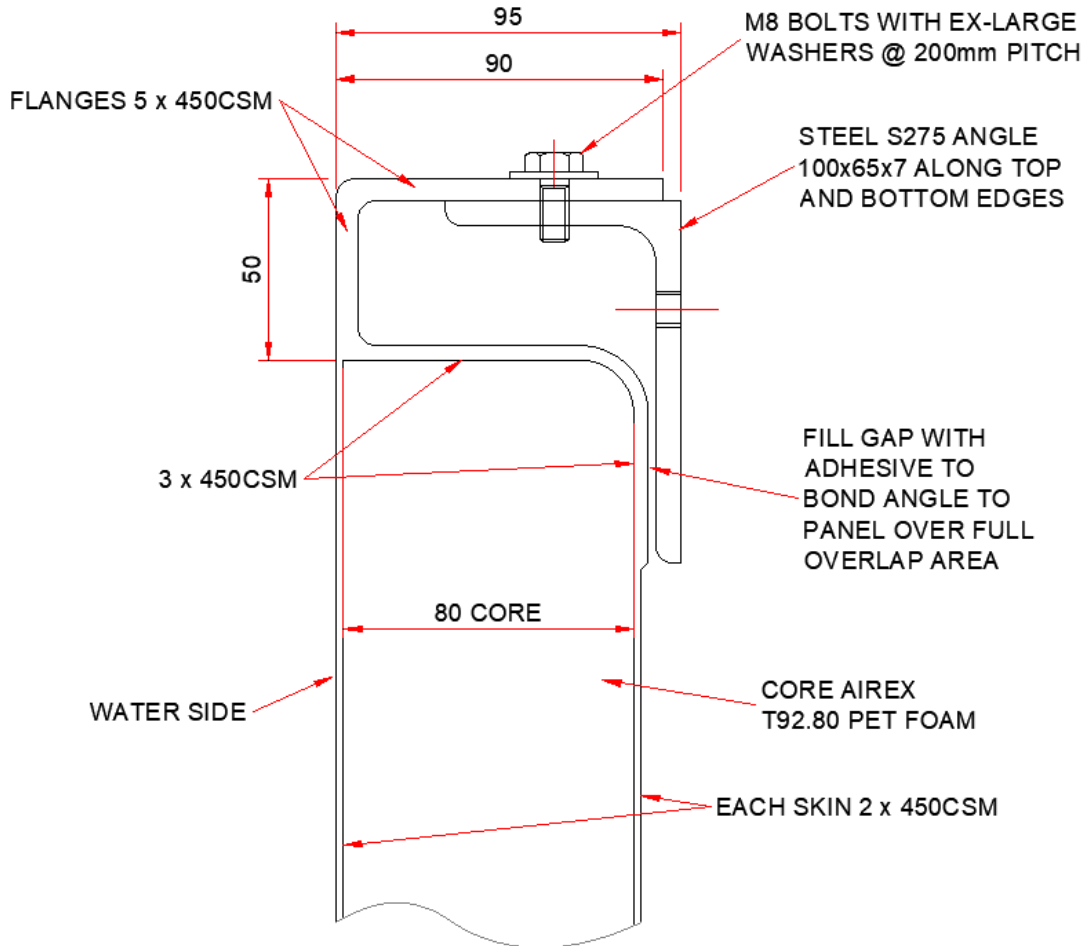


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**Eco Panel Only uses High-Quality MATERIALS & LAMINATE**



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The **Eco panel** is moulded inside a female mould to give a good external finish. The surfaces of the panel are finished with a good quality UV, water and weather resistant gelcoat.

the laminating resins are High Quality to ensure good water and blister resistance and good resins and gelcoats comply with the requirements of BS EN 13121 for both mechanical properties and chemical resistance.

The laminate is made to from layers as shown in the sketch above.

The joints are reinforcements that are required are over lapped and staggered layers.

The **Eco Panel** laminate is cured while in the mould to avoid distortion. the laminate is then postcured to achieve optimum properties and chemical resistance in accordance with resin suppliers' recommendations.

laminates have special resin: glass ratio by mass, giving the following layer thicknesses;

Reinforcement Cured layer thickness

300 CSM 0.74 mm

450 CSM 1.1 mm

600 CSM 1.48 mm

Moulding Process Hand layup, Resin: Glass Ratio by weight.

Laminate Density,

Modulus E 7,000 N/mm<sup>2</sup>, Tensile Strength 80 N/mm<sup>2</sup>

Compression Strength 120 N/mm<sup>2</sup>, Flexural Strength 100 N/mm<sup>2</sup>

FACTORS OF SAFETY AND ULTIMATE LIMIT STATES The following factors are applied in the design.

- General Load Factor, Material factors on FRP strength, From EUROCOMP Design Code (ref 1), For long-term loads such as permanent hydrostatic pressure



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**ALLOWABLE STRESSES**

The **Eco Panel** laminate properties and the overall factor shown above, the following allowable laminate stresses are calculated; Allowable Tensile Stress 9.5 N/mm<sup>2</sup>

Allowable Compression Stress 14.3 N/mm<sup>2</sup>,

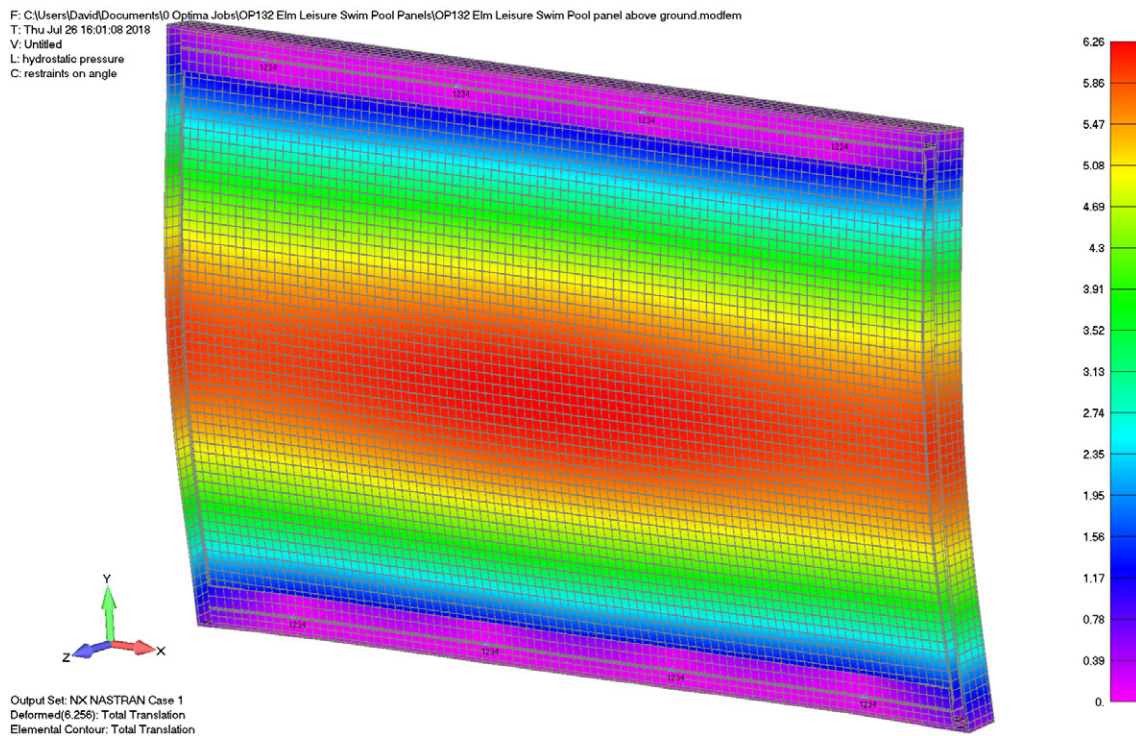
**LOADING**

The **Eco panel** has been designed to resist the hydrostatic pressure of water with the water level at the top edge of the panel. The pressure on the panel therefore varies from zero at the top to maximum at the panel base.

Pressure at base of panel = 1000 x 9.81 x 1.5 = 14,715 N/m<sup>2</sup>

The **Eco panel** has been analysed using a 3D FEA model as shown below.

**Eco Panel** model includes the GRP



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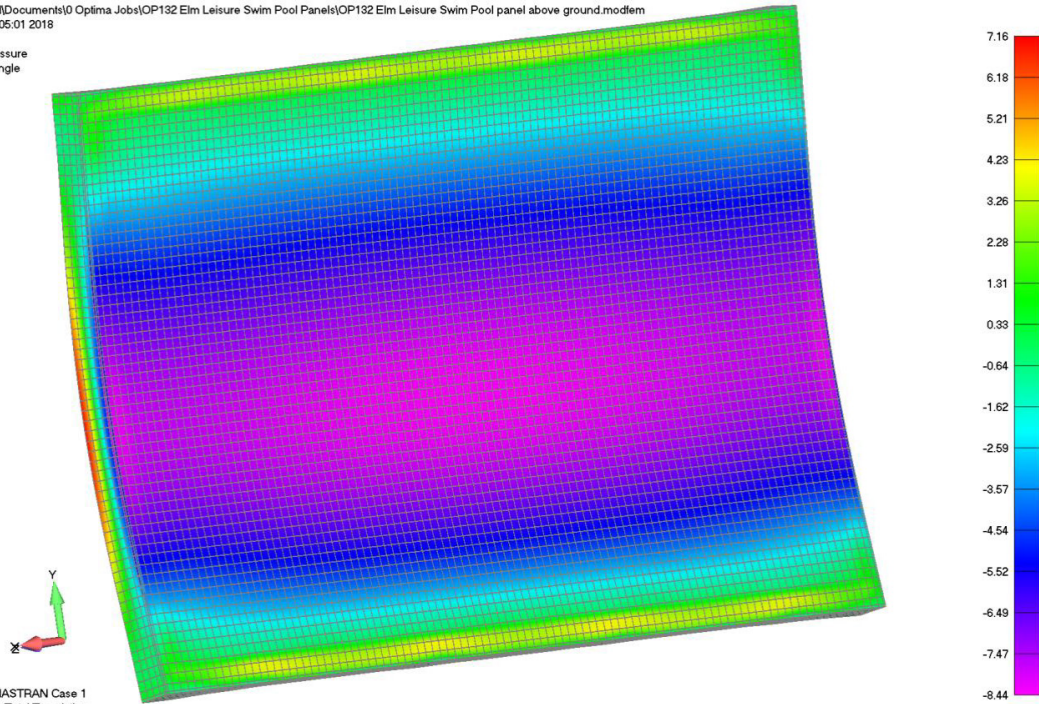


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### Eco Panel pressure. Maximum deflection

F: C:\Users\David\Documents\0 Optima Jobs\OP132 Elm Leisure Swim Pool Panels\OP132 Elm Leisure Swim Pool panel above ground.modfem  
 T: Thu Jul 26 16:05:01 2018  
 V: Unfilled  
 L: hydrostatic pressure  
 C: restraints on angle



Output Set: NX NASTRAN Case 1  
 Deformed(8.256): Total Translation  
 Elemental Contour: Lam Ply1 Y Normal Stress



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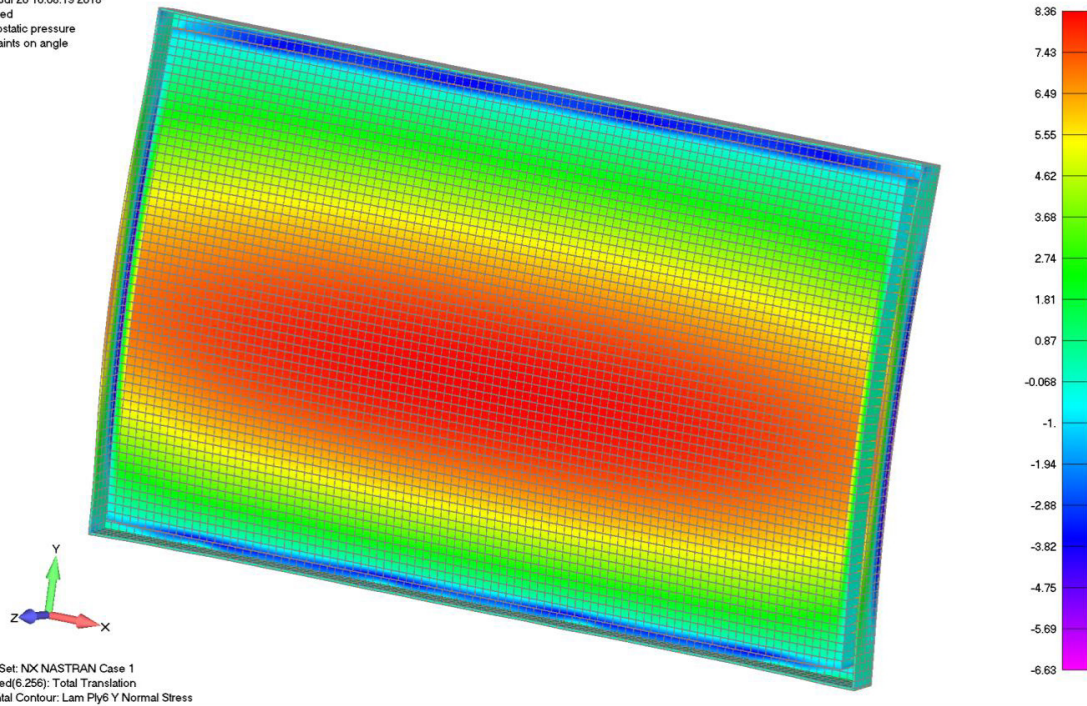
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### Eco Panel Vertical laminate stresses on front face

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 T: Thu Jul 26 16:08:19 2018  
 V: Unfilled  
 L: hydrostatic pressure  
 C: restraints on angle



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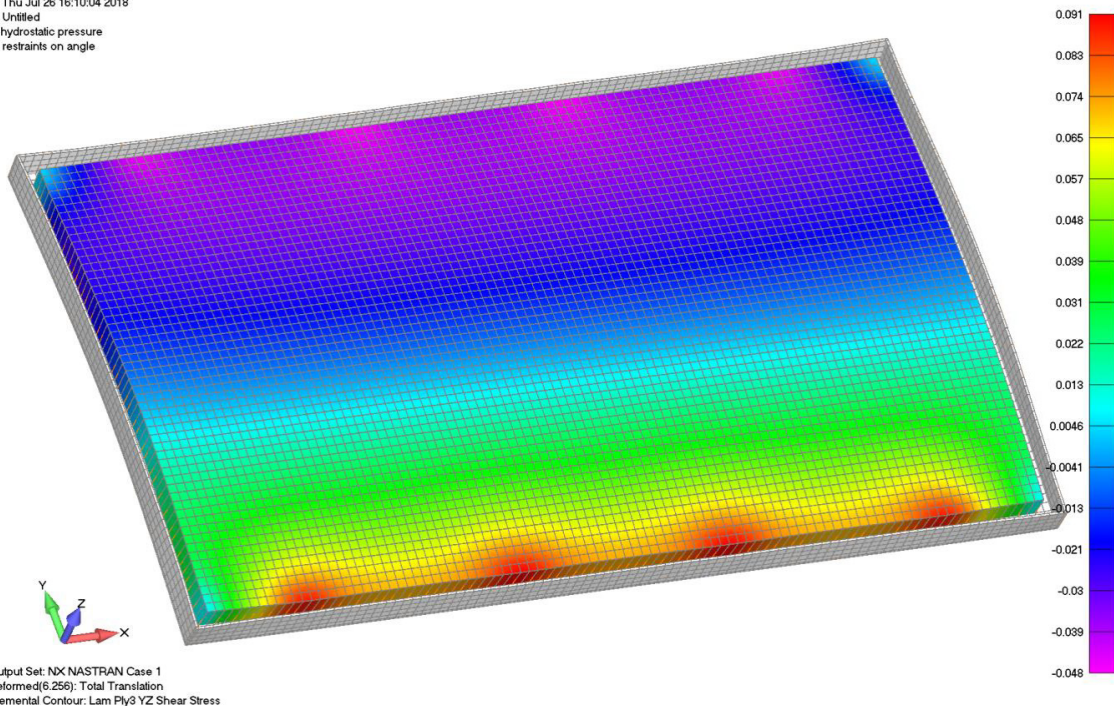
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**Eco Panel Vertical laminate stresses on rear face**

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Issue: A GRP Panel for above ground swimming pool and in Ground

F: C:\Users\David\Documents\0 Optima Jobs\OP132 Elm Leisure Swim Pool Panels\OP132 Elm Leisure Swim Pool panel above ground.modfem  
 T: Thu Jul 26 16:10:04 2018  
 V: Untitled  
 L: hydrostatic pressure  
 C: restraints on angle



Elm Leisure Eco Panel Above Ground Swim Pool Panel and in Ground

Core shear stress



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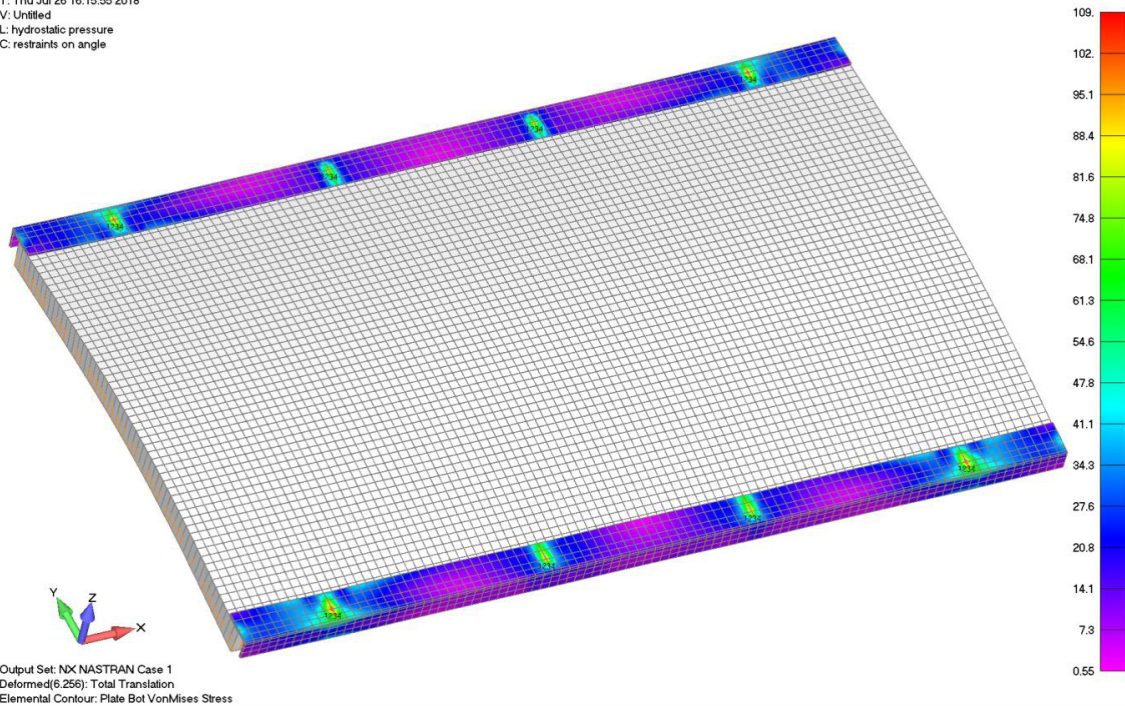
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### Eco Panel Von-Mises stress in steel angle

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 T: Thu Jul 26 16:15:55 2016  
 V: Unlifted  
 L: hydrostatic pressure  
 C: restraints on angle



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### The Elm Leisure **Eco Panel**

Laminate stresses are shown to be low and within acceptable limits.

The proposed panel design is considered high quality.

the **Eco Panel** is manufactured using high quality materials and moulded using good practices, in particular noting the following points;

a) **Eco Panel** Materials are suitable for the application with good water, chemical, UV and weather

resistance and used in accordance with manufacturers recommendations.

b) **Eco Panel** has a continuous and complete bond between the skins and foam core, which is equal to the strength of the core.

c) **Eco Panel** joints in the core are fully bonded to achieve shear continuity of the core.

d) **Eco Panel** joints in laminate reinforcement layers are overlapped by min 50mm.

1. EUROCOMP Design Code and Handbook 1996 – Structural Design of Polymer Composites.

2. BS EN 13121-3:2008+A1:2010 – GRP tanks and vessels for use above ground – Part 3 Design and



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