

"BUILDING PANEL"

Field of the Invention

The present invention relates to a building panel and a building system and
5 relates particularly, though not exclusively, to a polycarbonate roofing or wall
panel.

Background to the Invention

Polycarbonate roofing panels are well known in the building and construction
arts. They are relatively lightweight, strong and translucent, providing a
10 passive form of solar heating and lighting. They are used in domestic,
industrial and commercial building applications. Prior art polycarbonate
roofing panels are supplied in varying thicknesses up to 30mm, and up to 6m
in length. For some specialised applications they can be purchased up to 12m
in length. However all prior art polycarbonate sheeting requires additional
15 steelwork for support, and this introduces undesirable aesthetic constraints
from an architectural and design perspective.

The present invention was developed with a view to providing a building panel
and system which fills a gap in the building and construction industry, namely,
a cost-effective polycarbonate system with long span capability. However it
20 will be apparent that the building panels can also be manufactured from
suitable materials other than polycarbonate.

References to prior art in this specification are provided for illustrative
purposes only and are not to be taken as an admission that such prior art is
part of the common general knowledge in Australia or elsewhere.

25 Summary of the Invention

According to one aspect of the present invention there is provided a
polycarbonate building panel for the construction industry, the panel
comprising:

a hollow elongate structure having a generally rectangular cross-sectional profile, the elongate structure comprising first and second outer skins joined by first and second side walls; and

connecting means provided on each side wall respectively wherein, in use, adjacent panels can be connected to each other side by side with the connecting means to form a segment of a wall or roof.

Preferably the outer skins of the elongate structure have a degree of outward curvature in profile so as to form convex outer surfaces. The convex outer surfaces advantageously give the panel a self-cleaning ability wherein dust and other contaminants simply run-off the outer convex surfaces when wetted. Preferably the first and second side walls are substantially parallel. Typically the first and second side walls are substantially planar.

Preferably the elongate structure comprises a third inner skin in the form of a web extending between the first and second side walls so as to divide the interior of the elongate structure into two chambers. The dual chamber profile of the elongate structure provides structural strength and rigidity, as well as improved thermal and sound insulation properties.

Preferably the connecting means each comprise a first rib and a second rib, the first rib being adapted to engage with a matching rib on an adjacent panel and the second rib also being adapted to engage with a matching rib on the adjacent panel. Preferably the first and second ribs each have a curved profile and are arranged with concave surfaces facing each other wherein in use, the ribs together with the side wall form a cavity. Preferably the matching ribs on an adjacent panel have a matching curvature and are received in a nested engagement with the respective first and second ribs when adjacent panels are connected to each other side by side with the connecting means. Advantageously the nested engagement of the ribs together with the respective side walls of the adjacent panels form an enclosed chamber between the adjacent panels. Typically the ribs have a semicircular profile.

Preferably an elongate locking member is received in the enclosed chamber to lock the ribs into nested engagement with each other wherein, in use, adjacent panels are locked together to form a segment of a wall or roof.

Advantageously the hollow elongate structure is manufactured from extruded polycarbonate. Preferably the outer skins and side walls of the elongate structure are between 1mm to 2.5mm thick. Typically the upper outer skin is between 1.2mm to 2.0mm thick. Typically the lower outer skin is between 1.4mm to 1.8mm thick. Preferably the upper outer skin has a UV resistant layer applied to it. Typically the UV resistant layer has a minimum thickness of 0.050mm.

Preferably the total thickness of the polycarbonate panel is between 65mm to 90mm. More typically the total thickness of the polycarbonate panel is between 73mm to 76mm. A preferred embodiment of the polycarbonate panel is about 74mm thick. Preferably the total width of the polycarbonate panel is between 80mm to 120mm. More typically the total width of the polycarbonate panel is between 95mm to 110mm. A preferred embodiment of the polycarbonate panel is about 100mm wide.

In one form of the panel the elongate structure is substantially planar. In another form of the panel the elongate structure is formed with a degree of longitudinal curvature to give the panel increased load-bearing capacity.

According to another aspect of the present invention there is provided a polycarbonate building system for the construction industry, the system comprising:

a plurality of polycarbonate building panels, each panel comprising:

a hollow elongate structure having a generally rectangular cross-sectional profile, the elongate structure comprising first and second outer skins joined by substantially parallel first and second side walls; and

connecting means provided on each side wall respectively;

wherein, in use, the plurality of panels can be joined to each other side by side with the connecting means to form a segment of a wall or roof.

Preferably the polycarbonate building system further comprises an elongate locking member adapted to engage with the connecting means to join adjacent panels to each other side by side. In one embodiment the locking member is in the form of an extruded aluminium bar. In another embodiment

5 the locking member is in the form of an extruded polycarbonate bar.

Preferably the polycarbonate building system further comprises an end cap adapted to be received in the hollow end of the elongate structure. Advantageously the end cap has first and second spigot pieces adapted to be received in the two chambers of the hollow elongate structure.

10 According to a further aspect of the present invention there is provided a building panel for the construction industry, the panel comprising:

a hollow elongate structure having a generally rectangular cross-sectional profile, the elongate structure comprising first and second outer skins joined by first and second side walls; and

15 connecting means provided on each side wall respectively wherein, in use, adjacent panels can be connected to each other side by side with the connecting means to form a segment of a wall or roof.

According to a still further aspect of the present invention there is provided a building system for the construction industry, the system comprising:

20 a plurality of building panels, each panel comprising:

a hollow elongate structure having a generally rectangular cross-sectional profile, the elongate structure comprising first and second outer skins joined by substantially parallel first and second side walls; and

connecting means provided on each side wall respectively;

25 wherein, in use, the plurality of panels can be joined to each other.

Throughout the specification, unless the context requires otherwise, the word "comprise" or variations such as "comprises" or "comprising", will be understood to imply the inclusion of a stated integer or group of integers but not the exclusion of any other integer or group of integers. Likewise the word

"preferably" or variations such as "preferred", will be understood to imply that a stated integer or group of integers is desirable but not essential to the working of the invention.

Brief Description of the Drawings

- 5 The nature of the invention will be better understood from the following detailed description of a preferred embodiment of the building panel, given by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a section view through a preferred embodiment of the building panel according to the present invention;

- 10 Figure 2(a) is a section view showing a first embodiment of the manner of joining adjacent panels together side by side;

Figure 2(b) is a section view showing a second embodiment of the manner of joining adjacent panels together side by side;

Figure 3 is a top perspective view of the panel of Figure 1;

- 15 Figure 4 is a top perspective view showing a plurality of the panels of Figures 1 and 3 joined together side by side;

Figure 5 is an exploded top perspective view of the panels in Figure 4; and,

- 20 Figure 6 is side elevation of a preferred embodiment of an end cap for the building panel of Figure 1.

Detailed Description of Preferred Embodiments

- A first preferred embodiment of the building panel 10 as shown in Figures 1 to 4 comprises a hollow elongate structure 12 having a generally rectangular cross-sectional profile as can be seen most clearly in Figure 1. The elongate structure 12 comprises first and second outer skins 14a and 14b joined by substantially parallel first and second side walls 16a and 16b. The outer skins 14 of the elongate structure 12 preferably have a degree of outward curvature in profile so as to form convex outer surfaces. The convex outer surfaces advantageously give the panel 10 a self-cleaning capability wherein dust and
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other contaminants simply run-off the outer convex surfaces when wetted. The building panel is preferably made of polycarbonate.

The panel 10 further comprises a connecting means 18 provided on each side wall 16 respectively wherein, in use, adjacent panels 10 can be
5 connected to each other side by side with the connecting means 18 to form a segment of a wall or roof, as shown in Figure 4. The panels 10 are primarily designed for use as roofing panels, however in view of their structural strength and rigidity it will be understood that they can also be used in a variety of other ways for constructing a building, including wall panels.

10 Preferably the elongate structure 12 comprises a third inner skin in the form of a web 20 extending between the first and second side walls 16 so as to divide the interior of the elongate structure into two chambers. The dual chamber profile of the elongate structure 12 provides the panel 10 with additional structural strength and rigidity, as well as improved thermal and sound
15 insulation properties.

Preferably the connecting means 18 each comprise a first rib 22a and a second rib 22b. The first rib 22a is adapted to engage with a matching rib 22a on an adjacent panel, and the second rib 22b is also adapted to engage with a matching rib 22b on the adjacent panel (see Figure 2). In this embodiment
20 the first and second ribs 22 each have a curved profile and are arranged with concave surfaces facing each other. In the present case the ribs 22 have a semicircular profile, however it will be understood that a variety of profiles would work.

As can be seen most clearly in Figure 1, the ribs 22 together with the side
25 wall 16 form a cavity. Preferably the matching ribs 22a and 22b on an adjacent panel have a matching curvature and are received in a nested engagement with the respective first and second ribs 22a and 22b when adjacent panels are connected to each other side by side with the connecting means (see Figure 2). The inside diameter of the first rib 22a is approximately
30 equal to the outer diameter of the matching rib 22a, and the outside diameter of the rib 22b is approximately equal to the inside diameter of the matching rib 22b, in order to facilitate their nested engagement. Advantageously the

nested engagement of the ribs 22 together with the respective side walls 16 of the adjacent panels 10 form an enclosed cavity 24 between the adjacent panels.

Preferably an elongate locking member 26 is received in the enclosed cavity 5 24 to lock the ribs 22 into nested engagement with each other. In this manner adjacent panels 10 are locked together to form a segment of a wall or roof. One of the purposes of the locking bars 26 is to absorb upwardly directed wind pressure. Figure 4 illustrates a roof segment of a wall segment 30 formed from a plurality of the panels 10 connected to each other side by side 10 with the connecting means 18. Two types of locking member 26 are provided (see also Figure 5). A first locking member 26a is made from extruded aluminium and gives the roof segment increased strength and rigidity. A second locking member 26b is made from extruded polycarbonate. Both locking members 26 are typically inserted manually during the assembly 15 process. Preferably the ribs 22 are sealed in their nested engagement using a butyl rubber mastic sealant.

In one form of the panel 10 the elongate structure 12 is substantially planar. In another form of the panel 10 (not illustrated) the elongate structure 12 is formed with a degree of longitudinal curvature to give the panel increased 20 load-bearing capacity. The locking members 26 may likewise be curved so as to be received in the enclosed cavities 24 between the panels. The panels 10 can be pre-curved during the manufacturing process. When the panels 10 have been assembled they are placed on a bending table which slides directly into the oven for a specified time period. The angle of curvature of the 25 bending table is preset to correspond to the desired shape of the roof. After this process the panels are left to cool and on larger spans curved aluminium locking bars 26 are inserted. This then forms the specified curvature of the panels. The completed panels can then be delivered to site. Installation of the panels is identical to flat applications; polycarbonate locking bars 26 are 30 inserted, which simply lock the panels together.

A typical roof bay comprises six of the panels 10 connected side by side (two of the roof segments 30 of Figure 4 connected side by side). Various

combinations of locking members 26a and 26b may be employed to attain different structural strength capabilities for the roof bay. The loading combinations are as follows:

Flat panels

Lock Specification (LS)	Max free span
1	2.61 metre
2.1	3.18 metre
2.2	3.62 metre
2.5	4.38 metre

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Curved panels

Lock Specification (LS)	Free span	Free span	Free span	Free span
	20 degrees	25 degrees	30 degrees	35 degrees
1	6.05 metre	6.43 metre	6.72 metre	6.93 metre
2.1	8.00 metre	8.50 metre	8.88 metre	9.16 metre
2.2	9.49 metre	10.08metre	10.53metre	10.86metre
2.5	11.36metre	12.07metre	12.24metre	12.00metre

LS1 = 6 polycarbonate locking bars in a six panel bay

LS2.1 = 1 aluminium locking bar + 5 polycarbonate bars in a six panel bay

10 LS2.2 = 2 aluminium locking bars + 4 polycarbonate bars in a six panel bay

LS2.5 = 5 aluminium locking bars and 1 polycarbonate bar in a six panel bay

The Locking System weight and dead load specifications are as follows:

LS1 weight = 7kg/sqm. Dead load 0.078kN/sqm.

LS2.1 weight = 9kg/sqm. Dead load 0.091kN/sqm.

15 LS2.2 weight = 10kg/sqm. Dead load 0.101kN/sqm.

LS2.5 weight = 14kg/sqm. Dead load 0.142kN/sqm.

Advantageously the hollow elongate structure 12 is manufactured from extruded polycarbonate. Preferably the outer skins 14 and side walls 16 of the

elongate structure 12 are between 1mm to 2.5mm thick. Preferably the upper outer skin 14a is slightly thicker than the lower outer skin 14b. Typically the upper outer skin 14a is between 1.2mm to 2.0mm thick. Typically the lower outer skin 14b is between 1.4mm to 1.8mm thick. Preferably the upper outer skin 14a has a UV resistant layer applied to it. Typically the UV resistant layer has a minimum thickness of 0.050mm.

Preferably the total thickness of the polycarbonate panel 10 is between 65mm to 90mm. More typically the total thickness of the polycarbonate panel 10 is between 73mm to 76mm. A preferred embodiment of the polycarbonate panel 10 is about 74mm thick. Preferably the total width of the polycarbonate panel 10 is between 80mm to 120mm. More typically the total width of the polycarbonate panel 10 is between 95mm to 110mm. A preferred embodiment of the polycarbonate panel 10 is about 100mm wide.

Preferably the building panel 10 further comprises an end cap 40 adapted to be received in the hollow end of the elongate structure 12. Advantageously the end cap 40 has first and second spigot pieces 42a and 42b adapted to be received in the two chambers of the hollow elongate structure 12. As can be seen most clearly in Figure 6, the end cap 40 has a planar front face 44, on the back of which the spigot pieces 42 are formed. The first spigot piece 42a opens onto the front face 44, and forms a handhold which can be grasped to insert the end cap 40 into the end of the hollow elongate structure 12 (see Figure 5).

Now that a preferred embodiment of the building panel and building system has been described in detail, it will be apparent that the embodiment provides a number of advantages over the prior art, including the following:

- (1) It has superior span capabilities of up to 12m curved and 4.38m flat.
- (2) It is fully trafficable; workman can walk on it during installation.
- (3) It can be supplied flat or curved in one complete span up to 15m long.
- (4) It facilitates rapid installation. 600mm bay six panel configurations are supplied prefabricated and need only be joined every 600mm on site.

- (5) It is a lightweight, high impact strength product. Each bay can be easily lifted and locked into place manually on site.
- (6) Each segment is identical to the next to give total conformability.
- (7) It provides superior thermal performance and sound reduction.
- 5 (8) It is silicone free. No possible leakage where product is sealed. The unique connecting system as well as sealed joint allows for thermal moment without compromising thermal performance.
- (9) Being translucent it maximises natural light without excessive glare.
- (10) It has a self-cleaning dome shape.
- 10 (11) Curved roof segments can be pre-curved in the oven during the manufacturing process.
- (12) Being a tailor-made product means less wastage on site.

It will be readily apparent to persons skilled in the relevant arts that various modifications and improvements may be made to the foregoing embodiments, 15 in addition to those already described, without departing from the basic inventive concepts of the present invention. For example, the connecting means may take the form of suitable fasteners for connecting the panels side by side. Therefore, it will be appreciated that the scope of the invention is not limited to the specific embodiments described.

The Claims defining the Invention are as follows:

1. A polycarbonate building panel for the construction industry, the panel comprising:
 - 5 a hollow elongate structure having a generally rectangular cross-sectional profile, the elongate structure comprising first and second outer skins joined by first and second side walls; andconnecting means provided on each side wall respectively wherein, in use, adjacent panels can be connected to each other side by side with the
10 connecting means to form a segment of a wall or roof.
2. A polycarbonate building panel as defined in claim 1, wherein the outer skins of the elongate structure have a degree of outward curvature in profile so as to form convex outer surfaces.
3. A polycarbonate building panel as defined in claim 1, wherein the first and
15 second side walls are substantially parallel.
4. A polycarbonate building panel as defined in claim 3, wherein the first and second side walls are substantially planar.
5. A polycarbonate building panel as defined in any one of claims 1 to 4, wherein the elongate structure comprises a third inner skin in the form of a
20 web extending between the first and second side walls so as to divide the interior of the elongate structure into two chambers.
6. A polycarbonate building panel as defined in any one of claims 1 to 5, wherein the connecting means each comprise a first rib and a second rib, the first rib being adapted to engage with a matching rib on an adjacent panel and
25 the second rib also being adapted to engage with a matching rib on the adjacent panel.
7. A polycarbonate building panel as defined in claim 6, wherein the first and second ribs each have a curved profile and are arranged with concave surfaces facing each other wherein in use, the ribs together with the side wall
30 form a cavity.

8. A polycarbonate building panel as defined in claim 7, wherein the matching ribs on an adjacent panel have a matching curvature and are received in a nested engagement with the respective first and second ribs when adjacent panels are connected to each other side by side with the connecting means.
- 5 9. A polycarbonate building panel as defined in claim 8, wherein the nested engagement of the ribs together with the respective side walls of the adjacent panels form an enclosed chamber between the adjacent panels.
10. A polycarbonate building panel as defined in any one of claims 7 to 9, wherein the ribs have a semicircular profile.
- 10 11. A polycarbonate building panel as defined in claim 9, wherein an elongate locking member is received in the enclosed chamber to lock the ribs into nested engagement with each other wherein, in use, adjacent panels are locked together to form a segment of a wall or roof.
12. A polycarbonate building panel as defined in claim 1, wherein the outer
15 skins and side walls of the elongate structure are between 1mm to 2.5mm thick.
13. A polycarbonate building panel as defined in claim 12, wherein the upper outer skin is between 1.2mm to 2.0mm thick.
14. A polycarbonate building panel as defined in claim 13, wherein the lower
20 outer skin is between 1.4mm to 1.8mm thick.
15. A polycarbonate building panel as defined in claim 12, wherein the upper outer skin has a UV resistant layer applied to it.
16. A polycarbonate building panel as defined in claim 15, wherein the UV resistant layer has a minimum thickness of 0.050mm.
- 25 17. A polycarbonate building panel as defined in claim 1, wherein the total thickness of the polycarbonate panel is between 50mm to 80mm.
18. A polycarbonate building panel as defined in claim 1, wherein the total thickness of the polycarbonate panel is between 73mm to 76mm.

19. A polycarbonate building panel as defined in claim 18, wherein the polycarbonate panel is about 74mm thick.
20. A polycarbonate building panel as defined in claim 1, wherein the total width of the polycarbonate panel is between 80mm to 120mm.
- 5 21. A polycarbonate building panel as defined in claim 20, wherein the total width of the polycarbonate panel is between 95mm to 110mm.
22. A polycarbonate building panel as defined in claim 21, wherein the polycarbonate panel is about 100mm wide.
23. A polycarbonate building panel as defined in any one of claims 1 to 22,
10 wherein the elongate structure is substantially planar.
24. A polycarbonate building panel as defined in any one of claims 1 to 22, wherein the elongate structure is formed with a degree of longitudinal curvature to give the panel increased load-bearing capacity.
25. A polycarbonate building system for the construction industry, the system
15 comprising:
- a plurality of polycarbonate building panels, each panel comprising:
- a hollow elongate structure having a generally rectangular cross-sectional profile, the elongate structure comprising first and second outer skins joined by substantially parallel first and second side walls; and
- 20 connecting means provided on each side wall respectively;
- wherein, in use, the plurality of panels can be joined to each other side by side with the connecting means to form a segment of a wall or roof.
26. A polycarbonate building system as defined in claim 25, further comprising an elongate locking member adapted to engage with the
25 connecting means to join adjacent panels to each other side by side.
27. A polycarbonate building system as defined in claim 26, wherein the locking member is in the form of an extruded aluminium bar.

28. A polycarbonate building system as defined in claim 26, wherein the locking member is in the form of an extruded polycarbonate bar.

29. A polycarbonate building system as defined in claim 25, further comprising an end cap adapted to be received in the hollow end of the
5 elongate structure.

30. A polycarbonate building system as defined in claim 29, wherein the end cap has first and second spigot pieces adapted to be received in two chambers of the hollow elongate structure.

31. A building panel for the construction industry, the panel comprising:
10 a hollow elongate structure having a generally rectangular cross-sectional profile, the elongate structure comprising first and second outer skins joined by first and second side walls; and

connecting means provided on each side wall respectively wherein, in use, adjacent panels can be connected to each other side by side with the
15 connecting means to form a segment of a wall or roof.

32. A polycarbonate building panel as defined in claim 31, wherein the hollow elongate structure is manufactured from extruded polycarbonate.

33. A building system for the construction industry, the system comprising:

a plurality of building panels, each panel comprising:

20 a hollow elongate structure having a generally rectangular cross-sectional profile, the elongate structure comprising first and second outer skins joined by substantially parallel first and second side walls; and

connecting means provided on each side wall respectively;

wherein, in use, the plurality of panels can be joined to each other side by
25 side with the connecting means to form a segment of a wall or roof

34. A building panel substantially as herein described with reference to and as illustrated in any one or more of the accompanying drawings.

35. A building system substantially as herein described with reference to and as illustrated in any one or more of the accompanying drawings.