

(10)

1.

A ROOF CONSTRUCTION

This invention relates to a roof construction having a layer of ballast blocks disposed on the top of a water-impermeable membrane and pertains more specifically to a pattern of alignment of blocks adjacent rectangular corners of the roof to achieve maximum resistance to disruption of the blocks by storm winds.

It has previously been proposed to provide roof constructions comprising a deck covered by a water-impermeable membrane, the membrane being held in place and protected by loose ballast blocks each of which has a rectangular configuration as described for example in Kline U.S. Patent 3,892,899, with or without additional layers of thermal insulation and/or wear resistant outer protective layers. However, when such blocks are light in weight, i.e. weigh less than about 98 kg/m^2 (20 lbs/ft^2) of top face, they are subject

to disruption and breakage by the forces generated by high winds such as normally occur in storms, the disruptive forces being particularly troublesome in areas adjacent the rectangular corners of roofs and when the wind direction is toward the corner at an angle of approximately 45° to each edge.

Enhanced wind resistance can be achieved by a roof construction according to the inventions comprising a deck having at least one rectangular corner, a membrane, and a layer of abutting rows of ballast blocks laid above the membrane, each of the blocks having two parallel edges bevelled at substantially identical angles of between 12° to 23° from the vertical, the remaining two edges being substantially vertical, wherein the blocks in the corner are arranged in a pattern in which the outer rows of the blocks except for the corner blocks are arranged with outwardly and downwardly bevelled edges adjacent to the edge of the deck; means clamp the block edges to the deck; each successive row of blocks inwardly from the outer row has the same alignment as the outer row except for the corner block at the intersection of the rows; each corner block in each row is in alignment with either of the two rows of

which it forms a corner; and the pattern extends inwardly from each edge of the roof corner for at least ten rows.

5 An embodiment of the invention will now be described by way of example and with reference to the accompanying drawings, of which:

Figure 1 is an isometric view showing one embodiment of the ballast block useful in practicing
10 the present invention;

Figure 1a is a top plan view of the block of Figure 1;

Figure 2 is a view similar to that of Figure 1 showing the bottom face of the block;

15 Figure 2a is a bottom plan view of the block of Figure 1;

Figure 3 is a view in section taken along line 3-3 of Figure 1;

20 Figure 4 is a view in section taken along line 4-4 of Figure 1;

Figure 5 is a view in cross-section taken along line 5-5 of Figure 6 showing a roof having a corner constructed in accordance with the present invention;

Figure 6 is a view in section taken along

(13)

4.

line 6-6 of Figure 5; and

Figure 7 is a view in section taken along
line 7-7 of Figure 6.

5 As appears from Figures 1 to 4 of the drawings
a preferred ballast block for use in practicing the
present invention comprises a block 10 having
rectangular, e.g. square top and bottom faces 12, 14
and having two parallel edges 16, 18 bevelled at
10 substantially identical angles from the vertical. The
angles A shown in Figure 4 can vary from 12° to 23° .
The remaining two edges 20, 22 are substantially
vertical. In the bottom face 14 are preferably a
plurality of parallel spaced channels 24 parallel to
15 bevelled edges 16, 18, and an additional optional
channel 26 which is transverse to the parallel channels
24 and which extends adjacent and parallel to vertical
edge 22. While the channels 24 are parallel to
bevelled edges 16, 18 in the preferred embodiment,
20 they can in an alternative embodiment be arranged
parallel to the vertical edges 20, 22.

The block is composed of lightweight concrete
containing expanded shale or similar aggregate made
from clay, shale or slate having substantially the

same physical properties, a minor proportion of sand, and Portland cement, as described in Phalen, Advances in Materials, Technology in the Americas, Vol. 1, pages 87-92 (New York 1980), the proportions being selected as described therein to provide a block having a density or specific gravity in the range from 1360 to 2480 kg/m³ (85 to 155 lbs/ft³) (determined according to ASTM C 331), a compressive strength of at least 172 x 10³ kN/m² (2500 psi) (determined according to ASTM C 192 and C 495 using 15 x 30 cm. cylinders), a flexure tensile strength of at least 2.1 x 10³ kN/m² (300 psi) (determined according to ASTM C 293), and a capability of undergoing at least 100 freeze-thaw cycles without cracking (determined according to ASTM C 666). The weight of a block having the configuration shown in Figures 1 to 4 which is 0.3 m (1 foot) on a side and 51 mm (2 inches) thick is from 49 to 83 kg/m² (10 to 17 lbs/ft²) of upper face.

20 The preferred block used in the present invention can be made in a conventional concrete block making machine by an extrusion procedure from a zero slump mixture of expanded shale or similar aggregate made from clay, shale or slate having substantially

(15)

the same physical properties, Portland cement, sand and water in the desired proportions. Blocks made in this manner normally have channels 24 parallel to bevelled sides 16, 18, and have the transverse channel 26, when present, adjacent to vertical edges 22, as shown in Figures 1 to 4 of the drawings.

As shown in Figures 5 to 7, in the simplest roof construction the blocks 10 are merely laid in loosely-abutting relation directly on top of water-impermeable membrane 30 which in turn is supported by roof deck 32. Membrane 30 may be of any conventional composition such as butyl rubber, plastics, asphalt-impregnated felt, or the like. Parapet 34 extends along the edge of deck 32 and is provided with a sloping inner wall 36. The blocks are laid in such a pattern that all of each outer row of blocks 10 have their outwardly and downwardly bevelled edges arranged adjacent to the outer edge of deck 32 except for corner block 48 which is not in alignment with one of the two outer rows of which it forms a corner, but instead is turned 90° so as to be in alignment with the other outer row. Consequently, the sloping wall 36 of parapet 34, which overlies the bevelled edges 16 of the blocks serves to clamp this row of blocks to

the deck. Similarly, each successive row of blocks inwardly from each outer row has the same alignment as the outer row with the exception that each corner block 50, 52 of each successive row may be in

5. alignment with either of the two rows of which it forms a corner. For maximum resistance to disruption it is essential that the specified pattern be maintained for at least ten rows inwardly from each edge of the deck at the corner, preferably for fifteen successive
- 10 rows, and that it be maintained for at least fifteen successive blocks from the corner along the outer row. Further inwardly toward the center of the roof and away from the corner the alignment of the blocks in each row has no appreciable effect upon resistance
- 15 to disruption by wind forces, so that the blocks may be laid indiscriminately, without regard to alignment. In order to provide for maximum drainage of water from the surface of the membrane, however, it is desirable to have channels 24 of each block arranged parallel to
- 20 the direction of slope of the roof deck even in the central portion of the roof. If desired, there can be used in place of parapet 34 a tapered blocking strip having a sloping inner face which is anchored to the parapet or on the deck adjacent its edge and

(17)

- 8 -

which serves to clamp the outer row of blocks to the deck in the same manner as the parapet.

5 It will be noted that in the case of
blocks 10 laid in the patterns shown in Figures
5 to 7 of the drawing, the bevelled edges of the
blocks facilitate sliding movement of the blocks
10 or contraction and also facilitate removal
and/or replacement of individual blocks by the
insertion of a lifting tool or pry member
between the bevelled faces of adjacent blocks.

15 Adhesive may be present between the
bevelled edges of adjacent blocks bonding the
edges together.

20 At least one additional layer of blocks
in the same pattern may be on top of the first
layer.

25 Attention is directed to co-pending
Application No. 8418452 (Serial No. 2144461).

30

35

18

CLAIMS

1. A roof construction comprising a
5 deck having at least one rectangular corner, a
membrane, and a layer of abutting rows of
ballast blocks laid above the membrane, each of
the blocks having two parallel edges bevelled at
10 substantially identical angles of between 12°
to 23° from the vertical, the remaining two
edges being substantially vertical, wherein the
blocks in the corner are arranged in a pattern
in which the outer rows of the blocks except for
15 the corner blocks are arranged with outwardly
and downwardly bevelled edges adjacent to the
edge of the deck; means clamp the block edges
to the deck; each successive row of blocks
inwardly from the outer row has the same
alignment as the outer row except for the corner
20 block at the intersection of the rows; each
corner block in each row is in alignment with
either of the two rows of which it forms a
corner; and the pattern extends inwardly from
each edge of the roof corner for at least ten
25 rows.

2. A roof construction as claimed in
Claim 1, in which an adhesive is present between
30 the bevelled edges of adjacent blocks bonding
the edges together.

35



19

3. A roof construction as claimed in Claim 1 or 2, in which at least one additional layer of blocks in the same pattern is on top of the first layer.

5

4. A roof construction as claimed in Claim 1 or 2, in which each block has a plurality of parallel spaced channels in its bottom face parallel to the bevelled edges.

10

5. A roof construction as claimed in Claim 1 or 2, in which each block has a plurality of parallel spaced channels in its bottom face parallel to the bevelled edges and an additional channel in its bottom face adjacent to and parallel with one of the vertical edges.

20

6. A roof construction as claimed in Claim 1 or 2, in which each block has a weight of $49 \text{ to } 83 \text{ kg/m}^2$ ($10 \text{ to } 17 \text{ lbs/ft}^2$) of top face, a compressive strength of at least $172 \times 10^3 \text{ kN/m}^2$ (2500 psi), a flexure tensile strength of at least $2.1 \times 10^3 \text{ kN/m}^2$ (300 psi), and is capable of undergoing at least 100 freeze

25

30

35



thaw cycles without cracking.

7. A roof construction substantially as
herein described with reference to and as shown in
5 the accompanying drawings.
-

