

A ROOF BALLAST BLOCK

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This invention relates to a ballast block for roof construction having an improved configuration and characteristics which provide enhanced durability and resistance to weathering.

It has long been the practice to provide roof construction comprising a deck covered by a water impermeable membrane, the membrane being held in place and protected by loose ballast blocks as described, for example, in Klein U.S. Patent 3,892,899, with or without additional layers of thermal insulation and/or wear-resistant outer protective layers.

Conventional ballast blocks having vertical edges and flat bottom faces have exhibited a number of shortcomings. The blocks impede drainage of rain and moisture from the surface of the membrane and from the spaces between blocks; in cold weather, freezing of the water between adjacent blocks causes cracking or disruption of the blocks, and removal of replacement

of the blocks is difficult because of the narrow spacing between them. Moreover, such blocks are subject to disruption or breakage when the roof is exposed to high winds unless the blocks are
5 excessively heavy. Heavy blocks are difficult to handle and to install manually and require stronger supports for the roof deck.

10 It has now been found that these and other problems can be solved by means of a ballast block having generally rectangular top and bottom faces and two parallel edges bevelled at substantially identical angles of between
15 12° to 23° from the vertical, the remaining two edges being substantially vertical, and having a plurality of parallel spaced channels in its bottom face, wherein the block has a density in the range of 1360 to 2480 kg/m^3 (85
20 to 155 lbs/ft^3), 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 a capability of undergoing at least 100 freeze-thaw cycles without cracking.

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

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Figure 1 is an isometric view showing one embodiment of a ballast block in accordance with the present invention;

5 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;

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

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

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

15 Figure 5 is a view in cross-section partly broken away showing a roof construction embodying blocks of the present invention;

Figure 6 is a view in cross-section partly broken away showing a second roof construction embodying blocks of the present invention;

20 Figure 7 is a view in cross-section partly broken away showing a third roof construction;

Figure 8 is a view in cross-section partly broken away showing a preferred pattern of alignment of blocks of the present invention in a corner portion of a roof;

Figure 9 is a view in section taken along line 9-9 of Figure 8; and

Figure 10 is a view in section taken along line 10-10 of Figure 9.

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As appears from Figures 1 to 4 of the drawings, a preferred embodiment of the invention comprises a ballast block 10 having rectangular, e.g. square top and bottom faces 12, 14 and having two parallel edges 16, 18 bevelled at 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 a plurality of parallel spaced channels 24 parallel to 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, they can in an alternative embodiment be arranged parallel to the vertical edges 20, 22.

The block of the preferred embodiment 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 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.

The block of the present invention can be made in a conventional concrete block making machine by an extrusion procedure from a zero slump mixture of expanded Normanskill shale, 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 edge 22, as shown in Figure 1 to 4 of the drawing.

5 When the ballast blocks are used in a loose laid roof construction, they are preferably laid with channels 24 parallel to the direction of slope of the roof deck to provide for maximum drainage, particularly in the case of blocks from which the optional transverse channel 26 is omitted. However, 10 in using the preferred embodiment which includes the transverse channel 26, the direction of channels 24 after laying is of no consequence.

As shown in Figure 5, in the simplest roof 15 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, 20 or the like. If desired, a parapet 34 along the edge of deck 32 is provided with a sloping inner wall 36 which overlies the bevelled edge of the outer row of blocks 10 and serves to clamp the edges of the blocks to the deck. As shown in Figure 6, a layer of any

conventional thermal-insulating material 38 such as expanded polystyrene, fiberglass, fiberboard, foamed polyurethane or the like, may be

5 interposed between deck 32 and membrane 30, and a double layer of blocks 10 can be used. If desired, each block of the upper layer can be secured to the underlying layer by an adhesive 40. In this construction, parapet 42 has a
10 vertical inner wall 44 against which is anchored a tapered blocking strip 46 having a sloping wall 47 serving to clamp the outer row of blocks 10 to the deck. Blocks 10, because of the inclusion of expanded Normanskill shale and
15 because of the channels in the bottom face of the blocks possess an unusually low coefficient of thermal conductivity, of the order of $0.3 \text{ Wm/m}^{20} \text{ K}$ to $0.6 \text{ Wm/m}^{20} \text{ K}$ (as determined by ASTM C 177), thus making it possible to use less
20 conventional insulation in the roof construction than is usually required, or even to dispense with it entirely.

25 In the roof construction shown in Figure 7, the layer of thermal insulation 38 is placed above the membrane 30, being interposed between membrane 30 a layer of blocks 10. In
30 this embodiment a second layer of conventional heavyweight blocks 49 having

all four edges vertical can be laid on top of the first layer if desired.

It has been found that high winds encountered during stormy weather present a particular problem in the case of roof constructions in which the deck has one or more square corners. In the case of such corners, maximum resistance to damage from wind forces can be achieved by laying the blocks of the present invention in a special pattern. The pattern is shown in Figures 8 to 10 of the drawings in which 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. 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 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,

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preferably for fifteen successive rows, and that it be maintained for at least fifteen successive blocks from the corner along the outer row.

- 5 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 to disruption by wind forces, so that the blocks may be laid indiscriminately,
- 10 without regard to alignment. In order to provide for maximum drainage of water from the surface of the membrane, however, as pointed out above, it is desirable to have channels 24 of each block arranged parallel to the direction of
- 15 slope of the roof deck even in the central portion of the roof.

- 20 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 over each other in the case of thermal expansion or contraction and also facilitate removal
- 25 and/or replacement of individual blocks by the insertion of a lifting tool or pry member between the bevelled faces of adjacent blocks.

- 30 Attention is directed to co-pending Application No. 8418453 (Serial No. 2144462).

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CLAIMS

1. A roof ballast block having
5 generally rectangular top and bottom faces, and
two parallel edges bevelled at substantially
identical angles of between 12° to 23° from
the vertical, the remaining two edges being
substantially vertical, and having a plurality
10 of parallel spaced channels in its bottom face,
wherein the block has a density in the range of
 1360 to 2480 kg/m^3 (85 to 155 lbs/ft^3), a
compressive strength of at least 172×10^3
 kN/m^2 (2500 psi), a flexure tensile strength
15 of at least $2.1 \times 10^3 \text{ kN/m}^2$ (300 psi), and a
capability of undergoing at least 100
freeze-thaw cycles without cracking.

2. A ballast block as claimed in
20 Claim 1, in which the block has square top and
bottom faces and the channels are parallel to
the bevelled edges.

25 3. A ballast block as claimed in
Claim 1, and having at least one additional
channel in its bottom face transverse to the
parallel channels.

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4. A ballast block as claimed in Claim 2
and having at least one additional channel in its
bottom face adjacent and parallel to one of the
vertical edges, the block having a weight 49 to 83
5 kg/m² (10 to 19 lbs/ft²) of upper face.

5. A roof ballast block substantially
as herein described with reference to and as shown
in the accompanying drawings.

