

A GRID STRUCTURE

The invention relates to a grid structure, and in particular, a grid structure for stabilising and/or supporting grass and/or soil.

Grid structures have previously been used for supporting or stabilising soil or grass by being imbedded in the soil or grass. Typically the grid structure has an array of open cell structures which are interconnected. The grid supports soil and/or grass located within the cells and around the cells.

Grid structures are normally formed into modules which may be coupled to each other to form an extended grid structure which can cover an infinitely large area. However, conventional grid structures have the disadvantage that during transportation there is a substantial amount of wasted space which is normally the space within each cell and the space surrounding the cell between one cell and adjacent cells.

In addition, conventional coupling mechanisms to couple adjacent modules together tend to fail after periods of use, for example, due to fatigue from forces exerted on the grid structure, for example, due to soil movement or where the grids are used for supporting grass, for example, in car park areas, fatigue due to vehicles moving over the grids.

In accordance with a first aspect of the present invention, a grid structure comprises a number of cells, each cell being spaced apart from and connected to a number of nearest adjacent cells, and the centres of the cells defining a first array of points; the cells defining a number of openings, the size of the openings being greater than the cell size, and the centres of the openings defining a second array of points; and, the spacing of the points of the second array being substantially identical to the spacing of the points of the first array.

In accordance with a second aspect of the present invention, a grid structure comprises a number of cells, each cell being spaced apart from and connected to a number of nearest adjacent cells; the cells define a number of openings, the size and distribution of the openings being such that cells of a like grid structure may be inserted into the openings.

These aspects have the advantage that it permits two grid structures to be nested together, the cells of one grid structure being located in the openings between the cells of the other grid structure.

Preferably, the cells may be arranged in a rectangular grid structure with the centers of the nearest adjacent cells defining a square with a side length greater than twice the width of a cell.

Preferably, the nearest adjacent cells are diagonally adjacent cells and the spacing between the centre of one cell and the centre of each of the next nearest adjacent cells is greater than the width of one cell.

In accordance with a third aspect of the invention, a grid structure comprises an array of cells, peripheral cells in the array comprising coupling means to permit the grid structure to be coupled to a like grid structure, the coupling means comprising a first coupling member on a peripheral cell of the grid structure and a second coupling member on a peripheral cell of the like grid structure, the first and second coupling members being adapted to engage with each other, at least partially within one of the peripheral cells, to couple the grid structure to the like grid structure.

Preferably, the first coupling member comprises a male section and the second coupling member comprises an aperture within and adjacent to the cell wall of the peripheral cell, the male section engaging with the aperture.

Typically, the third aspect may be combined with the first and/or second aspects in the grid structure.

Preferably the cells have a substantially square cross-section. However, cells having other cross-sections could

be used, such as circular, hexagonal or other polygonal shapes.

Preferably, each cell is diagonally connected to four adjacent cells.

Typically, each cell comprises internal cross-members. These have the advantage of enhancing the structural strength of the cells. Preferably, the cross-members extend across the cell. Typically, the cross-members extend across the cell in two mutually transverse planes which butt transversely to the side walls of the cells.

An example of a grid structure in accordance with the invention will now be described with reference to the accompanying drawings, in which:-

Figure 1 is a perspective view of a first example of a grid structure;

Figure 2 is a top view of the grid structure shown in Figure 1;

Figure 3 is a bottom view of the grid structure shown in Figure 1;

Figure 4 shows the grid structure of Figure 1 nested together with an identical grid structure;

Figure 5 is a perspective view from above of a non-peripheral cell in the grid structure shown in Figures 1 to 3;

Figure 6 is a perspective view from above of a female peripheral corner cell in the grid structure shown in Figures 1 to 3;

Figure 7 is a perspective view from below of the female peripheral corner cell shown in Figure 6;

Figure 8 is a perspective view from above of a male peripheral corner cell in the grid structure shown in Figures 1 to 3;

Figure 9 is a perspective view from below of the male peripheral corner cell shown in Figure 8;

Figure 10 is a perspective view of a second example of a grid structure;

Figure 11 is a perspective view from above of a non-peripheral cell in the grid structure shown in Figure 10;

Figure 12 is a perspective view from above of a male peripheral corner cell in the grid structure shown in Figure 10;

Figure 13 is a perspective view from above a female peripheral corner cell in the grid structure shown in Figure 10.

Figures 1 to 3 show a first example of a grid structure 1 which comprises an array of cells 2, 3, 4 diagonally interconnected by cross struts 5. The grid structure 1 has three types of cell structure, non-peripheral cells 4 which are each connected by cross struts 5 to four adjacent cells and two types of peripheral cells 2, 3. The two types of

peripheral cells 2, 3 are a male peripheral cell 3 which includes male coupling members 6 and a female peripheral cell 2 which includes female coupling members 7.

The grid structure 1 also includes a male peripheral corner cell 3a and a female peripheral corner cell 2a. The peripheral corner cells 2a, 3a have three female and three male coupling members 7, 6 respectively. The other peripheral cells 2, 3 each have two female and male coupling members 7, 6 respectively. In addition, the peripheral corner cells 2a, 3a are each connected to two peripheral cells 2, 3 by connecting members 8 which increase the rigidity of the connection of the corner members 2a, 3a to the grid structure 1.

Each of the cells 2a, 3a, 4 are shown in more detail in Figs. 5 to 8. Each of the cells 2a, 3a, 4 and the peripheral non-corner cells 2, 3 have a generally square cross-sectional area and are defined by upstanding side walls 9 with curved corner walls 11. The upper edges of the side walls 9 are castellated so that a central section 10 of each side wall 9 is lower than the height of the corner walls 11.

The lower central section 10 has the advantage that when the grid structure 1 is used to support grass, for example, in a car park area or an area where traffic passes over the grid structure 1, the grass may enter into the lower region

10. If the lower region 10 is not present, the grass would tend to be severed by the edges of the cell walls 9 when vehicles pass over the cells 2, 2a, 3, 3a, 4.

The non-peripheral cell 4 (see Fig. 5) has a cross strut 5 extending from each corner wall 5. The struts 5 also extend into the cell itself and meet at a central point 14.

The male peripheral corner cell 3a is shown in more detail in Figures 8 and 9, and is similar to the non-peripheral cell 4, except that three of the cross-struts 5 are replaced by male coupling members 6. Each male coupling member 6 comprises an elongate section 17 extending from a corner wall 11 and terminates in a pin section 15. The male peripheral cells 3 are similar to the male peripheral corner cell 3a, except that there are only two male coupling members 6 on adjacent corner walls 11 (see Figure 2).

The female peripheral corner cell 2a is shown in more detail in Figures 6 and 7, and is similar to the non-peripheral cells 4, except that three of the cross-struts 5 are replaced by female coupling members 6. Each female coupling member 6 comprises an elongate recessed section 19, which has a recess 18, and an aperture 16 located within and adjacent to a respective corner wall 11. The female peripheral cells 2 are similar to the female peripheral corner cell 2a, except that there are only two female

coupling members 6 on adjacent corner walls 11 (see Figure 2).

As shown in Figures 2 and 3, the cells 2, 3, 4 are interconnected diagonally with each other, such that the cross struts 5 run through the diagonal of each cell. In addition, each non-peripheral cell 4 is at a center of a square, the sides of which are defined by the centers of the four nearest adjacent cells. In addition, the diagonal dimension of each cell is less than half the length of the diagonal of the square defined by the center points of the four nearest adjacent cells. Hence, the opening defined by four immediately adjacent cells is bigger than the cross-sectional area of one cell. This permits a like grid structure 1a to be nested within the grid structure 1 with the cells of one grid located within the openings of the other grid, as shown in Figure 4. In order to nest the structures 1, 1a within each other, the like grid structure 1a is turned upside down and placed on top of the grid structure 1 such that the cells of one grid structure locate between the cells of the other grid structure.

This has the advantage of reducing the space occupied by the grid structures 1, 1a during storage or transportation by approximately half the volume that would otherwise be required to store or transport the grid structures 1, 1a.

In use, a number of grid structures 1 can be interconnected

to each other to form an extended grid structure by coupling male peripheral cells 3, 6 on one grid structure 1 to female peripheral cells 2 on another grid structure 1.

A male coupling member 6 engages with a female coupling member 7 by the pin section 15 engaging with the aperture 16 in the female coupling member 7 and the elongate section 17 engaging with the recess 18 in the elongate recessed section 19.

As the pin sections 15 engage with the apertures 16 within the cell walls 9, 11 and the recess 18 extends over the edge of the member 17, this aids the rigidity of the coupling together of the male and female cells 2, 3 and of adjacent grid structures 1.

Figures 10 to 13 show a second example of a grid structure 20 which comprises an array of cells 22, 22a, 23, 23a, 24 diagonally interconnected by a cross struts 25. The grid structure 20 is similar to the grid structure 1 and the cells 22, 22a, 23, 23a, 24 are similar to the cells 2, 2a, 3, 3a, 4 which form part of the grid structure 1.

The main difference between the grid structure 20 and the grid structure 1 is that in the grid structure 20, the cross struts 25 (which are equivalent to the cross struts 5) include a wall portion 35 which extends externally from the corner walls 11 of the cells 22, 22a, 23, 23a, 24. In

addition, the internal portions of the struts 25 on the non-peripheral cells 24 and the male peripheral cells 23, 23a also include a wall portion 36 extending up the inside of the corner walls 11. The female peripheral cells 22 differ from the female cells 2 in that they do not include the elongate recessed section 19 but have on the cross struts 25, adjacent to corner walls 11 which do not include apertures 16, internal walls 36 extending up the inside of the corner walls 11. Hence, on the female corner peripheral cell 22a there is one internal wall 36 and on the other female peripheral cells (i.e. non-corner cells) 22 two internal walls 36 are provided.

The advantages of the wall portions 35, 36 on the cross struts 25 is that they enhance the structural strength of the cells 22, 23, and due to the shape of the wall portions 35, 36 it is also possible to nest one grid structure 20 within another grid structure 20, in a similar manner to the way in which the grid structure 1 may be nested.

The invention also has the advantage that it permits a more rigid connection of the grid structures 1, 20 to each other, compared with conventional grid structures. In addition, the nesting ability of the grid structures 1, 20 also reduces the volume required for storage and transportation of the grid structures 1, 20.

CLAIMS

1. A grid structure comprising a number of cells, each cell being spaced apart from and connected to a number of nearest adjacent cells, and the centres of the cells defining a first array of points; the cells defining a number of openings, the size of the openings being greater than the cell size, and the centres of the openings defining a second array of points; and, the spacing of the points of the second array being substantially identical to the spacing of the points of the first array.

2. A grid structure according to claim 1, wherein the cells are arranged in a rectangular array with the centers of the nearest adjacent cells to one cell defining a square having a side length greater than twice the width of a cell.

3. A grid structure according to claim 2, wherein the nearest adjacent cells are diagonally adjacent to the one cell and the spacing between the center of the one cell and the center of each of the next nearest adjacent cell is greater than the width of the one cell.

4. A grid structure according to any of the preceding claims, wherein the cells have a substantially square cross-section.



5. A grid structure according to any of the preceding claims, wherein the openings have a substantially square cross-section.
6. A grid structure comprising a number of cells, each cell being spaced apart from and connected to a number of nearest adjacent cells; the cells define a number of openings, the size and distribution of the openings being such that cells of a like grid structure may be inserted into the openings.
7. A grid structure comprising an array of cells, peripheral cells in the array comprising coupling means to permit the grid structure to be coupled to a like grid structure, the coupling means comprising a first coupling member on a peripheral cell of the grid structure and a second coupling member on a peripheral cell of the like grid structure, the first and second coupling members being adapted to engage with each other, at least partially within one of the peripheral cells, to couple the grid structure to the like grid structure.
8. A grid structure according to claim 7, wherein the first coupling member comprises a male section and the second coupling member comprises an aperture within and adjacent to the cell wall of the peripheral cell, the male section engaging with the aperture.



9. A grid structure according to any of the preceding claims, wherein each cell is diagonally connected to four adjacent cells.
10. A grid structure according to any of claims 1 to 6, comprising the features of any of claims 7 to 9.
11. A grid structure according to any of the preceding claims, wherein each cell comprises internal cross-members.
12. A grid structure according to claim 11, wherein the cross-members extend across the cell.
13. A grid structure according to claim 11 or claim 12, wherein the cross-members extend across the cell in two mutually transverse planes and butt transversely to the side walls of the cells.