

## Description

The object of the invention is a construction element used for building supporting walls designed to accommodate plants, having cells that serve as a hidden housing.

5 Ever larger cuttings are being built to create or widen roads and these require the construction of supporting walls. These walls are costly and unsightly. Complying with environmental conservation efforts, vegetation could be incorporated in such supporting walls.

These supporting walls may be used by individuals, professionals (highway and  
10 bridges departments, rural engineers, landscapers, public works contractors, growers, etc.).

Construction elements are already known. These elements may be used as containers and are cases providing a large open space on which shrubs and ground cover plants are grown. They are assembled dry and fit one with another.

Other elements are of the type with a cavity which stops the water from draining  
15 away too rapidly. The external shape is also designed as a barrier to noise. The elements or containers are filled with earth as they are assembled. Because of their case-like shape, these elements form a chain when assembled as a supporting wall.

The building elements described above are plant containers which are assembled dry and fitted with each other to form a supporting wall. This type of supporting wall may be  
20 fragile to a certain extent depending on the slope of the bank or cutting, climate, etc.. The plants are used for decorative purposes to hide the wall but the fact that they are used does not have an affect on the construction elements or improve the stability of the wall.

The invention is intended to resolve these problems. The plants serve a purpose on the supporting wall which is anchored by the roots of the plants in the earth, the roots of

the plants crossing from one construction element to another, thereby improving assembly of the elements with each other.

The invention is an improved version of the construction element described in patent FR-A-2.561.684. The construction element used for dry building supporting walls, 5 designed to be stocked with plants, is a bottomless container and is characterised in that the vertical partitions are arranged so that they define a large space on the downhill side which serves as a flower pot and at least two smaller spaces on the uphill side that serve as cells for the roots.

The construction element for dry building supporting walls designed for stocking 10 with plants of the bottomless container type having vertical partitions that define spaces is characterised in that the front part of the container is of a trapezoidal shape so as to reduce the weight of the front of the element and increase the weight of the rear rectangular part. The vertical partitions are arranged so that they define a space on the downhill side which may be used as a plant container and at least two smaller spaces on the uphill side which 15 serve as cells for the roots. The size of the smaller spaces on the uphill side is such that when the containers are positioned on top of the other, the roots emerging from the upper container can grow towards the ground only and not into the lower container, i.e. the vertical partition of the upper container reaches the level of wall on the uphill side of the lower container, the vertical partition being parallel to the wall of the container on the 20 uphill side.

These technical features allow the vegetation to grow quickly and the roots to anchor themselves in the bank to the rear of the wall. A network of roots is created, considerably increasing the resistance of the elements to the thrust.

The prior art may be defined by the following patents: FR-A-2.422.774; EP-A-

0047717; DE-A-3.003.434. All these patents describe construction elements but not construction elements with a large space on the downhill side and at least two smaller spaces on the uphill side.

Only document CH-A-612.238 describes a construction element divided into two chambers, a downhill chamber and an uphill chamber.

The construction element in accordance with the invention complements the construction element described in patent FR-A-2.561.684. This construction element, known as a heavy element as opposed to the base element, which is light, allows very high supporting walls (for example 8 to 10 metres) to be built by a single workman and requires no special tools or machinery. The centre of balance is modified since the width and length ratios are different.

The heavy element or the light element in accordance with the invention has been designed to compensate one thrust force with another thrust force due to its technical features. The light element, for example, weighing less than 25 kg, may be considered as a weight.

The heavy element has supplementary spaces or cells which allow additional plant growth forcing the roots to penetrate three or four lower elements.

Because the cells are arranged in this way, a recess is formed that may be used as a hidden housing for building reinforced supporting walls if necessary as a result of strong thrust force.

The heavy element in accordance with the invention is made up of the light element on the front part, one of whose features is its trapezoidal shape, on the one hand, and of a complementary element in the rear part, on the other. The light element is a bottomless container in which a first partition defines a large space on the downhill side and a small

space on the uphill side. This vertical partition is parallel to the partition of the container. The uphill space is itself sub-divided into two small spaces by a second vertical partition perpendicular to the first. This element extends into a bottomless container which has a slot at the level of its lateral edges thus forming a horizontal recess. A median vertical wall in the extension of the second vertical wall forming the two spaces divides the container into two spaces. This second vertical wall continues beyond the slot to divide the end part of the construction element on the uphill side into two further small spaces or cells.

The light element assembled with the complementary element make up the heavy element.

Made in a much bigger size and therefore with a greater weight, the heavy element may be used to strengthen river banks or lakes.

In accordance with another embodiment, the end part on the uphill side or rear part of the complementary element may simply be filled in rather than divided into two other small spaces or cells. This embodiment lightens still further the weight of the element on the downhill or front (trapezoidal) side and adds weight to the rear or uphill side.

In accordance with another embodiment, the construction element allows for curved construction. To this end, the lateral walls may be curved. The construction element used for curved construction is of a lower height than the value of the slots located in the lower part.

The supporting wall designed for containing plants is built from dry-mounted construction elements by fitting them into each other and by placing one on top of the other. Each light element is of the bottomless container type with two vertical, exterior side walls and vertical partitions. A first vertical partition, parallel to the wall on the uphill

side of the container defines a large space on the downhill side which serves as a plant container and at least one space on the uphill side used as a rooting cell for the upper container, which is mounted on the lower container slightly set back towards the uphill side, this latter space being divided into at least two smaller spaces by a second vertical partition 5 perpendicular to the uphill wall and the first partition. The size of the spaces on the uphill side is such that when the containers are mounted on top of each other the roots emerging from the upper container may grow only in the direction of the ground and not into the lower container, i.e. the vertical partition of the upper container reaches the level of the uphill wall of the lower container. The construction element is made up of a light element 10 with a complementary element that forms the uphill part of the construction element and which forms, beyond a slot located on each edge of the container, two small spaces or cells providing for additional growth.

The complementary element forming the uphill part of the construction element extends to a slot on each edge of the container forming a horizontal recess. A median 15 vertical wall defines two cells or spaces which may be used as a hidden housing. Beyond the slots, a vertical wall extending the vertical walls forms two small spaces or cells.

At the level of the lower edges there is a slot at the front and another wide slot in the median part of the bottomless block.

The special cells may be used as a hidden housing for reinforced or non-reinforced 20 pillars.

The horizontal recess formed by the slot allows a reinforced or non-reinforced beam to be inserted.

The longitudinal walls form two parallel curves.

The construction element is made from two adjacent containers known as light

elements, manufactured as a single block. The two exterior vertical side walls of the element are concave.

The construction element may be used in conjunction with a special piece to form a curve, the special piece having convex exterior vertical side walls.

5 A construction element may be made up from a heavy element and an adjacent light element manufactured as a single block, wherein the exterior vertical wall of the light element is concave.

The attached drawings are given by way of example and do not limit the scope of the invention. They show a preferred embodiment in accordance with the invention. They  
10 provide a clearer understanding of the invention.

Figure 1 is a view in perspective of a heavy element in accordance with the invention.

Figure 2 is a sectional view along the axis A-A shown in figure 1.

Figure 3 is a side view highlighting the way in which two heavy elements are used  
15 in conjunction with each other.

Figure 4 is a view showing an assembly of light elements positioned on top of heavy elements.

Figure 5 is a view showing an assembly of heavy elements assembled on top of each other in which the special cells are used as hidden housing for insertion of a reinforced or  
20 non-reinforced horizontal beam or pillar.

Figure 6 is a view in perspective of several heavy elements assembled with each other for strengthening a bank, for example. This figure 6 shows another embodiment in which all the technical features except the general parallelepiped shape but in which longitudinal walls form two parallel curves and in which the uphill part of the

complementary element is filled.

Figure 7 is a planar view of a heavy element, not claimed, without a slot section between the light element and the complementary element.

Figure 8 is a sectional view of the construction element shown in figure 7.

5 Figure 9 is a view in perspective of the heavy element shown in figure 7.

Figure 10 is a view in perspective of a supporting wall constructed with the elements shown in figure 7.

Figure 11 is a view showing a supporting wall in which the elements have been weighted to the rear either because of the upper thrust forces and loads or because of the  
10 natural slope of the terrain.

Figure 12 is a planar view of a supporting wall in which the elements form an angle each around the other; to this end, the elements are not slotted into to each other from the bottom but from the top where there is a fixing means such as an upper slot in the truncated part at the front.

15 Figure 13 is a side view of the construction element, not claimed, being used for the supporting wall shown in figure 12.

Figures 14, 15, 16 show:

- a side view (figure 14) of a light element with its slotting means at the top,
- a view from above (figure 15) showing the elements set back from each other and  
20 no longer adjacent,
- a side view (figure 16) of some assembled elements.

Figure 17 is a view of the construction element (light or heavy) with concave vertical exterior side walls being used in conjunction with the special part with convex vertical exterior side walls. This combination may be used to form a plant container.

Figure 18 is a dividing wall decorated with plant containers alternated on two faces.

Figure 19 is a view of the combination of elements such as that shown in figure 17 but where the angle is open.

Figure 20 is a view of the combination of elements such as that shown in figure 17 5 but where the angle is closed.

Figure 21 shows a vertical dividing wall that may be planted forming a vertical sound barrier.

The heavy element 1 is an element generally prefabricated in a concrete that has undergone vibration.

10 It is a single bottomless container whose downhill part has all the features of a light element, i.e. a parallelepiped rectangle with truncated corners 2, 3 in the downhill part; a vertical partition 4 separates the container into two parts, a large space 5 and a small space or cell 6 separated itself into two small spaces 7 and 8 by another vertical partition 9 perpendicular to the first vertical partition 4.

15 The part on the uphill side extends to a slot 10 on each upper edge of the container serving as a horizontal recess for a reinforced or non-reinforced beam 23, whilst the interior of the container has two cells 11, 12, separated by a vertical wall 16 which extends the vertical wall 13. These two cells 11, 12 serve as a hidden housing for reinforced or non-reinforced pillars 24.

20 At the level of the lower edges, there is a slot at the front 17 and another large slot 18 in the median part of the bottomless block. These slots 17, 18 allow the elements to be slotted into each other.

Figure 3 shows how the heavy blocks 19, 20 may be slotted into each other.

In figure 4, a series of heavy blocks 21 forms the base of the supporting wall whilst

the lighter blocks or elements 22 are slotted into the heavy elements 21 in the crest of the wall in order to lighten the assembly and thus contribute to better stability.

Finally, figure 5 shows fixtures that may be reinforced beams 23 or reinforced or non-reinforced pillars 24.

5        These fixtures, whether reinforced or non-reinforced pillars or beams 23, 24 may be used in instances where extreme thrust forces so require. These beams 23 or pillars 24 are positioned in the special cells 11, 12 which serve as a hidden housing. The beam 23 uses the recess formed by the slot 10.

Figure 6 shows a view in perspective of several elements 25, which may be used  
10 for forming curves. The longitudinal walls 26, 27 form two parallel curves. The rear part 28 may be filled. Unlike the parallelepiped element, the curved element 25 allows curves to be formed and will be at a greater height than the value of the slots located in the lower part.

Figures 7, 8 and 9 show a heavy element 30 not claimed. This heavy element is  
15 made up of a light element 31 and a complementary element 32. The essential difference in the heavy element, shown in figures 1, 2, 3 is that this element does not have the slot 10.

This element has a fixing means such as the front slot 17 and the slot 18. The point  
of this embodiment is that the empty heavy element may weigh about twenty kilos but may  
20 weigh fifty kilos when filled.

This element allows supporting walls of at least ten metres to be built.

The advantages of this heavy element are as follows:

- continuity on the ground, distribution of load, reduced stresses on the ground,
- overhang system, one thrust force compensating another thrust force,

- the heavy elements may be slotted together: the rigidity of the assembly is guaranteed: it is impossible for there to be any sliding forwards or backwards,
  - positioning of the cells on top of each other guaranteeing rapid and durable growth,
  - fully dry assembly avoiding the creation of water pockets that may be detrimental
- 5 to the stability of the construction.

Depending on the potential thrust forces and loads uphill, it is sometimes necessary to balance the heavy elements 30 at the rear as shown in figure 11. This assembly may also be used to follow the natural slope of the terrain.

Figures 12 and 13 show another embodiment in which the heavy element 33 does  
10 not have the front slot section 17 or the central slot 18. The only fixing means is a slot 34, this slot being at the top front truncated part. This form of heavy element has not been claimed either.

This modification to the fixing means allows heavy elements to be used without having to use them adjacent to each other so that it is possible to give a certain angle  
15 between the different elements, as shown in figure 12. This arrangement makes it possible to curve the supporting wall.

Figures 14, 15 and 16 show a light element 35. This light element, like the heavy element previously described, has a modification at the level of its fixing means. Fixing is by means of a top slot 36 in the front part, this slot 36 allowing the supporting wall to  
20 be built with elements that are not necessarily adjacent to each other; as shown in the bottom diagram of 15, it allows a gap to be left between the different elements 35.

Figures 17, 18, 19, 20, 21 show construction elements 29 that are not claimed in themselves and formed of two adjacent containers 37, 38, being light elements manufactured as a single block, whose vertical side walls 39 and 40 are concave so that

these elements may be assembled with each other. As shown in figure 21, it is necessary to pour in concrete 45, possibly with reinforcing rods 41, if the wall to be built is a quite high dividing wall (see figure 18 in particular).

Figure 17 shows a plant container in which two elements 29 have been assembled using a special piece 42 with convex vertical exterior side walls 43 and 44.

Figure 19 also shows an assembly that allows an open angle to be obtained whilst figure 20 shows an assembly with a closed angle.

Figure 21 shows a dividing wall that may be planted, which has hollow cavities and cavities filled with concrete as well as plantable cavities, forming together a vertical sound barrier.

### LIST OF REFERENCES

- |         |                                  |
|---------|----------------------------------|
| 1.      | Heavy element                    |
| 15 2.3. | Corners                          |
| 4.      | Vertical partition               |
| 5.      | Large space                      |
| 6.      | Space on the uphill side         |
| 7.8.    | Small space on the downhill side |
| 20 9.   | Vertical partition               |
| 10.     | Slot                             |
| 11.12.  | Cells                            |
| 13.     | Vertical wall                    |
| 14.15.  | Cells                            |

- 16. Vertical wall
- 17. Front slot
- 18. Slot
- 19.20. Heavy blocks
- 5 21. Heavy blocks
- 22. Lighter elements
- 23. Beams
- 24. Pillars
- 25. Perspective of several elements
- 10 26.27. Longitudinal walls
- 28. Rear part
- 29. Construction element
- 30. Heavy element
- 31. Light element
- 15 32. Complementary element
- 33. Heavy element
- 34. Upper slot
- 35. Light element
- 36. Upper slot
- 20 37. Adjacent container
- 38. Adjacent container
- 39. Concave vertical wall
- 40. Concave vertical wall
- 41. Reinforcing rods

- 42. Special piece
- 43. Convex vertical side wall
- 44. Convex vertical side wall
- 45. Concrete.

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## CLAIMS

1. A supporting wall designed to accommodate plants and made up of dry-mounted construction elements (1, 19, 20, 21) by slotting the elements into each other and by  
5 positioning them on top of each other, each light element being of the type made from a bottomless container having two exterior vertical side walls (26, 27; 39, 40) and vertical partitions, a first vertical partition (4), parallel to the wall of the container on the uphill side, defining a large space (5) on the downhill side which serves as a plant container and at least one space (6) on the uphill side serving as a rooting cell for the upper container  
10 mounted on the lower container set back towards the uphill side, this latter space (6) being divided into at least two smaller spaces (7,8) by a second vertical partition (9) perpendicular to the uphill wall and the first partition; the size of the uphill spaces (7, 8) is such that the containers are positioned on top of each other, the roots emerging from the upper container being able to grow in the direction of the ground only and not into the lower container, i.e.  
15 the vertical partition of the upper container reaches the level of the uphill wall of the lower container, characterised in that

the construction element is made up of a light element (31) and has a complementary element (32) which forms the uphill part of the construction element and which forms, beyond a slot (10) located on each edge of the container, two small spaces or cells (14, 15)  
20 which provide for additional growth; the light element and the complementary element forming a heavy element (1, 19, 20, 21).

2. A supporting wall in accordance with claim 1, characterised in that

the complementary element forming the uphill side of the construction element



extends to a slot (10) on each side of the container forming a horizontal recess; a median vertical wall (13) in the extension of the second vertical wall (9) defines two cells or special spaces (11, 12) which may be used as a hidden housing; beyond the slot (10) a vertical wall (16) extends the vertical walls (9 and 13) forming the two small spaces or cells (14, 15).

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3. A supporting wall in accordance with claim 2, characterised in that

at the level of the lower edges, there is a front slot (17) and another wide slot (18) in the median part of the bottomless block.

10 4. A supporting wall in accordance with claim 2, characterised in that

the special cells (11, 12) serve as a hidden housing for reinforced or non-reinforced pillars (24).

5. A supporting wall in accordance with claim 2, characterised in that

15 the horizontal recess formed by the slot (10) allows a reinforced or non-reinforced beam (23) to be inserted.

6. A supporting wall for forming curves in accordance with claim 1 or 2, characterised in that

20 the longitudinal walls (26, 27) form two parallel curves.

7. A supporting wall in accordance with claim 1, characterised in that the two vertical exterior side walls (39, 40) of the element are concave.



8. A supporting wall in accordance with claim 1, characterised in that the construction element may be used in conjunction with a special piece (42) to create a curve, the special piece having convex vertical exterior side walls (43, 44).

5 9. A supporting wall in accordance with claim 1, characterised in that

a construction element may be formed of a heavy element and an adjacent light element manufactured as a single block, wherein the vertical exterior wall of the light element is concave.