MOVABLE SECURITY BARRIER STRUCTURE

TECHNICAL FIELD

The present disclosure relates to a movable security barrier structure. Aspects of the invention relate to a movable security barrier structure and a movable security barrier.

BACKGROUND

It is known to provide security barriers for preventing vehicular access to particular areas. Some of these barriers have sufficient strength to prevent intentional vehicular penetration. Such barriers are referred to in the art as hostile vehicle mitigation (HVM) barriers. In order to prevent vehicular penetration these HVM barriers typically form permanent rigid structures which often have footings that penetrate deep into the ground. Where at times vehicular access is needed and at other times vehicular attack needs to be prevented then some current solutions exist. These include large heavy gates having large structures at either end and some posts which can rise from the ground. Gates are often problematic in areas where frequent pedestrian through flow is needed as they force pedestrians to all converge on single points to pass the barrier. Rising bollards often need deep footings from which to rise.

It is an aim of the present invention to provide a barrier that address one or more of the disadvantages associated with the prior art.

SUMMARY OF THE INVENTION

Aspects and embodiments of the invention provide a structure for a movable security barrier, and a movable security barrier, as claimed in the appended claims.

According to an aspect of the present invention there is provided structure for a movable security barrier, the structure having an impact facing side and a protection facing side, the structure comprising: a first bollard support for supporting a first bollard, a carrier structure supporting the first bollard support, the first bollard support being movable along a track within the carrier structure, and a movable retention means for preventing movement of the first bollard support along the track.

The invention enables the bollard structure to be moved to one side to allow vehicular passage when desired, and to obstruct vehicular passage at other times.

The structure may also comprise a second bollard support for receiving a second bollard the carrier structure supporting the second bollard support. The second bollard support may be movable along the track within the carrier structure, and the movable retention means may also prevent movement of the second bollard support along the track.

By providing two bollard supports a wider section of passage can be protected. Either only the first bollard may move to allow vehicular passage, or both the first and the second bollard may move.

In an arrangement the track runs substantially parallel to and in between the impact facing side and the protection facing side.

At least the first bollard support may comprises a base plate for moving along the track, a security bollard retention portion comprising a substantially vertically extending tubular portion and a substantially horizontally extending tubular section between the vertically extending tubular portion and the impact facing side and opening into the vertically extending tubular portion adjacent to the base plate, a first load spreader bar oriented parallel to the track and adjacent the vertically extending tubular portion at a position above the substantially horizontally extending tubular section, and a second load spreader bar oriented parallel to the track and located adjacent the vertically extending tubular portion on a side thereof opposite to the first load spreader bar. Optionally the second bollard support may also comprises a base plate for moving along the track, a security bollard retention portion comprising a substantially vertically extending tubular portion and a substantially horizontally extending tubular section between the vertically extending tubular portion and the impact facing side and opening into the vertically extending tubular portion adjacent to the base plate, a first load spreader bar oriented parallel to the track and adjacent the vertically extending tubular portion at a position above the substantially horizontally extending tubular section, and a second load spreader bar oriented parallel to the track and located adjacent the vertically extending tubular portion on a side thereof opposite to the first load spreader bar.

By providing a boot shaped security bollard retention portion a L-shaped bollard can be inserted which has a foot that extends into the substantially horizontally extending tubular section. The load spreader bar above the substantially horizontally extending tubular section helps spread any impact load on the L-shaped bollard into a larger area of the carrier structure.

The movable retention means may comprise a lid of the carrier structure, the lid being movable between a closed position in which the first bollard support is in one of a first location and a

second location, and is prevented from movement along the track, and an open position in which at least the first bollard support can be moved along the track between the first position and the second position. When in the closed position the second bollard support may be in one of the second location and a third location and be prevented from movement along the track, and when the lid is in the open position the second bollard carrier may be moved along the track between the second position and the third position.

The lid may comprise a substantially planar steel structure forming a first opening at the first location and a second opening at the second location, and wherein the lid comprises reinforcement adjacent the first opening and adjacent the second opening. The lid may form a third opening therein at the third location.

In an embodiment the lid may further form a fourth opening at a fourth location, and wherein with the lid in an open position the first and second bollard carriers can be moved between a first configuration in which they are in the first and second positions respectively, a second configuration in which they are in the second and third positions respectively, and a third configuration in which they are in the first and fourth positions respectively, and wherein with the lid in the closed position the first and second bollard carriers are each respectively retained in one of the first, second, and third configurations. The third and fourth positions may be outboard of the second and first positions respectively.

As such the invention can provide the structure comprising a first bollard carrier and a second bollard carrier and the lid may define a first position, a second position, a third position and a fourth position. In this arrangement, when in use to impede vehicular passage, when the lid is closed the first and second bollard carriers are in the first and second positions respectively and when the lid is opened the first and second bollard carriers can be moved in one direction into the second and third positions respectively, or alternatively may be moved in the opposite direction into the fourth and first positions respectively. In this manner the structure can provide a barrier that can open in either direction. This is advantageous as it allows two identical structures to be installed adjacent and aligned with each other such that the first and second bollard carriers of one structure can be moved in a first direction and the first and second bollard carriers of the other structure can be moved in a second, opposite, direction to enable a wider opening to be achieved. The use of two identical structures is beneficial as splitting the structure enables easier handling and installation than a single massive structure, and by having the same design for both parts, not only are manufacturing efficiencies achieved but install is also simplified as the structures are bi-directional so do not need to be installed in a particular “left hand” and “right hand” pair.

When the first bollard carrier is in the first position, a bollard therein may impede vehicular passage and when the first bollard carrier is in the second position a bollard therein may allow vehicular passage.

In this manner the ability to move the bollards is simply affected by opening the lid of the carrier structure and the bollards are retained in place simply by closing the lid. This enables quick and simple unskilled operation to move the bollard carriers between the positions in which a bollard therein enable and prevent vehicular passage.

It will be understood that the first and/or second bollard support may be provided with one or more additional retainers to retain them in a respective position on the track that is aligned with a position in which the lid can be moved from the first position to the second position. The one or more additional retainers may include a detent mechanism that locates the first and/or second bollard support in a said aligned position or may comprises any known retention mechanism, for example a sprung or un-sprung bolt mechanism. The use of an additional retainer assists in the operation of the structure as it allows the bollard and bollard support to be positively located prior to the lid being lowered to prevent their movement. Where an additional retainer is used, this may require a second action to release the additional retainer after lifting the lid, prior to moving the bollard.

It will be appreciated that in one embodiment, while the retainers may assist in preventing movement of the bollards along the track, the lid is structured to significantly prevent movement of the bollards along the track under a large impact, for example when struck by a vehicle. i.e. the significant retaining structure of for preventing movement of the bollards under impact is provided by the lid.

The carrier structure may comprise a substantially U-shaped channel having the track running along the interior of a base thereof. The U-shaped channel may have an outer support on an outer side of its protection facing side, and the outer support may comprise an elongate bar, located adjacent the first position, the elongate bar extending parallel to the track.

The carrier structure may have a first lip section extending from the impact facing side towards the protection facing side such that when the first bollard support is in the first location the first lip section extends over the first load spreader. The carrier structure may also comprise an elongate first load spreader bar oriented parallel to the track and attached to the first lip section

such that when the first bollard support is in the first location the first load spreader bar extends over, and to either side of, the substantially horizontally extending tubular section thereof.

The carrier may additionally have a second lip section extending from the impact facing side towards the protection facing side such that when ethe of the first bollard support and the second bollard support is in the second location the second lip section extends over the first load spreader thereof. The carrier structure may comprise a further elongate first load spreader bar oriented parallel to the track and attached to the second lip section such that when either of the first bollard support and the second bollard support is in the second location the further elongate first load spreader bar extends over, and to either side of, the substantially horizontally extending tubular section thereof. The first load spreader bar may be manufactured from spring steel.

Optionally, the structure can include at least one first brace extending from the carrier structure towards the impact facing side and/or at least one second brace extending from the carrier structure towards the protection facing side. The at least one first and/or at least one second brace may each comprise a substantially horizontal planar base plate and one or more substantially vertical planar web sections, the one or more substantially vertical planar web sections extending between the substantially horizontal planar base plate and the carrier structure.

A first and a second brace may be at each of the first location and the second location.
Optionally the lid may comprise a substantially planar steel structure forming a first opening at the first location and a second opening at the second location, the lid comprising reinforcement adjacent the first opening and/or adjacent the second opening. The structure may have a cover portion adjacent the first location, the cover portion configured such that when the lid is in the closed position the cover portion and the lid form a substantially continuous co-planar upper surface of the structure. The first opening may be formed between the lid and the cover portion the lid.

According to another aspect of the invention there is provided a security barrier comprising a structure as defined above and a first bollard located in the first bollard support. The security barrier may also have a second bollard located in the second bollard support.

According to a further aspect of the invention there is provided a security barrier system comprising two security barriers of the invention.

Optionally, the security barrier comprises rebar reinforcement attached to the at least one first brace and/or at least one second brace, and wherein the rebar and the first brace and/or the second brace are substantially encased in concrete.

Within the scope of this application it is expressly intended that the various aspects, embodiments, examples and alternatives set out in the preceding paragraphs, in the claims and/or in the following description and drawings, and in particular the individual features thereof, may be taken independently or in any combination. That is, all embodiments and/or features of any embodiment can be combined in any way and/or combination, unless such features are incompatible. The applicant reserves the right to change any originally filed claim or file any new claim accordingly, including the right to amend any originally filed claim to depend from and/or incorporate any feature of any other claim although not originally claimed in that manner.

BRIEF DESCRIPTION OF THE DRAWINGS

One or more embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 shows a front perspective image of a first embodiment of a security barrier of the invention having the structure of the invention in a first configuration;

Figure 2 shows a front perspective image of the security barrier of Figure 1 having the structure of the invention in a second configuration;

Figure 3 shows a rear perspective image of the security barrier of Figure 1 having the structure of the invention with the lid raised to allow movement of the bollards;

Figure 4 shows a top view of a structure of the security barrier of Figure 1 with the lid omitted;

Figure 5 shows a side view of the structure of Figure 4;

Figure 6 shows a lid and cover of the structure of Figure 4;

Figure 7 shows a front view of a portion of a security barrier of the invention containing a bollard at a first position;

Figure 8 shows section “A” – “A” of figure 7;

Figure 9 shows a top view of a bollard support of a security barrier invention containing bollard impact bars;

Figure 10 shows a top view of a second first embodiment of a security barrier of the invention, the security barrier having a single bollard;

Figure 11 shows a top view of a structure of the security barrier of Figure 10 with the lid and bollard omitted;

Figure 12 shows a top view of a third first embodiment of a security barrier of the invention, the security barrier having a single bollard;

Figure 13 shows a track plate for use in the invention;

Figure 14 shows a perspective view of the structure of the first embodiment of the invention with the bollards removed;

Figure 15 shows a top view of the structure of the invention adapted for a surface mount application;

Figure 16 shows a front view of the structure of the invention adapted for a surface mount application, with bolts inserted;

Figure 17 shows a side view if a surface mounted structure of the invention;

Figure 18 shows a top view further embodiment of a security barrier of the invention in a first configuration;

Figure 19 shows a top view of the embodiment of Figure 18 in a second configuration;

Figure 20 shows a top view of a security barrier structure formed of two security barriers of the embodiment of Figure 18; and

Figure 21 shows a front view of the security barrier structure of Figure 20 in three different configurations.

DETAILED DESCRIPTION

A movable security barrier 10 in accordance with an embodiment of the present invention is described herein with reference to the accompanying Figures. The security barrier 10 has a structure 12 in accordance with an embodiment of the present invention.

With reference to Figure 1, a movable security barrier 10 is shown. The security barrier 10 has a structure 12 for a movable security barrier and a movable first bollard 14 and a movable second bollard 16. While the example embodiment is described herein in relation to a security barrier with first and second movable bollards, it will be appreciated that the barrier could only have one movable bollard, or may have one movable bollard and one fixed bollard. The barrier 10 (and the structure 12) have an impact facing side A and a protection facing side B. The barrier is designed such that it is effective against stopping vehicular penetration, for example from a hostile vehicle, from the impact facing side A such that the space adjacent the protection facing side B is protected from vehicles that may collide with the impact facing side A, either intentionally or accidentally.

By virtue of the first and second bollards 14, 16 being movable, in the event that it is required to allow a vehicle to pass the security barrier 10, the bollards can be moved to one side to allow the vehicle to pass.

Turning now to the structure 12 of the barrier, it has three main parts, a carrier structure in the form of a base box 18, a lid 20 pivotally movable relative to the base box 18, and support braces 22.

The base box 18 is elongate in shape and is manufactured in the form of a substantially U-shaped channel 24 having an end plate 26 at either end. At least one of the end plates 26 has one or more drainage ports 28 therein. In use, of water ingresses into the base box 18, for example as a result of inclement weather, it can drain therefrom via the drainage ports 28. In use the drainage ports 28 would be connected by conduits to a suitable rainwater drain. The base box 18 contains the components that permit the bollards 14, 16 to move, as described below.

The lid 20 is pivotally connected to the base box 18 at or along a longitudinal edge thereof. The lid 20 extends substantially along the length of the base box 18. In the example embodiment the lid 20 does not extend along the full length of the base box 18, however it will be appreciated by the skilled person that this is merely a design choice. The lid 20 has a number of cut outs 30, 32, 34 that when in the closed position form respective first, second and third openings in the lid 20, said openings opening into the base box 18. The lid 20 is manufactured from a planar material and in the example embodiment is made of steel plate having a thickness between 5mm and 25mm, optionally in the region of 10mm. The lid 20 is connected to the base box 18 by two or more hinges.

The lid 20 provides a movable retention means for preventing movement of the first and second bollard 14, 16 in a direction along a longitudinal axis thereof. The lid 20 is pivotally movable between a closed position in which the first bollard 14 is in one of a first location X and a second location Y, and is prevented from movement along the longitudinal axis, and an open position in which at least the first bollard 14 can be moved along the longitudinal axis between the first position X and the second position Y.

When the lid 20 is in the closed position the second bollard 16 is in one of the second location Y and a third location X and is prevented from movement along the longitudinal axis by the lid 20. When the lid 20 is in the open position the second bollard 16 can be moved along the track between the second position Y and the third position Z. The cutouts 30, 32, 34 in the lid correspond to the first, second and third position X, Y, Z respectively. The first and second positions X, Y are the positions in which when the respective bollards 14, 16 are located, the security barrier is effective at mitigating vehicular penetration, and is the position depicted in Figure 1. In order for vehicles to be allowed to pass the security barrier the second bollard 16 is moved into position Z and the first bollard 14 is moved into vacated position Y, as depicted in Figure 2.

The base box 18 includes a cover portion 36 located adjacent the adjacent the third location Z. The cover portion 36 is shaped and attached such that when the lid 20 is in the closed position the cover portion 36 and the lid 20 form a substantially continuous co-planar upper surface of the structure and the first opening is formed at location X between the lid 20 and the cover portion 36. A removable cover plate 88 is provided which can be selectively positioned to close one of the openings at the respective one of the positions X, Y and X that is not occupied by a bollard 14, 16. The removable cover plate 88 is attached to the base box 18 by one or more bolts.

The lid 20 is provided with reinforcement adjacent the cutouts 30, 32, 34. The reinforcement adjacent the first and second cutouts 30, 32 opening comprise an L plate 38 made of 12mm steel, and a brace 40, also made of 12mm steel plate. The L plate 38 is located adjacent and aligned with the edge of the cutout 30, 32 and extends downwards therefrom when the lid 20 is in the closed position. The brace 40 extends downward from the lid 20 substantially perpendicular to and abutting the surface of the L plate 38 so that it supports it. The cutout 32 has an L plate 38 and associated brace 40 at opposing sides thereof. The cutout 34 has an L plate 38 and associated brace 40 on one side thereof, away from the cover portion 36. The reinforcement in the example embodiment is attached to the lid 20 by means of bolts passing through the lid 20 and the L plates 38. The heads of the bolts are countersunk into the upper surface of the lid 20 so that the upper surface of the lid is substantially flush when closed. In addition, or as an alternative to attachment by bolts, the reinforcement could be welded to the lid 20. Corner reinforcement plates 42, made of 10mm steel plate, are provided at the internal corners of the cutouts 30, 32 34, These reinforce the lid 20 in this region and assist in preventing or minimising damage.

The lid 20 is provided with hinge attachments 90 on one longitudinal edge by which the lid 20 is pivotally attached to the base box 18, and a plurality of countersunk holes 92. The plurality of holes are positioned to align with a plurality or tapped holes in the base box 18 when the lid 20 is closed. When closed, the lid 20 is secured in place in the closed position by bolts passing through the holes 92 and secured in the threaded holes in the base box 18. Due to the weight of the lid 20, one or more gas struts 92 may be provided to assist its opening.

A rim 96 is welded round the edge of the U-shaped channel 24 to provide a water trap in the form on a channel around the edge of the base box 18. The lid 20 closes over the water trap such that water running of the lid enters the channel and can therefore be drained therefrom without entering the base box 18.

A pair of rails 44 is attached to the lower inner face of the base box 18 and runs along its longitudinal length to form a track. As such it will be understood that the tracks runs substantially parallel to and in between the impact facing side and the protection facing side of the barrier. The tracks 44 may be directly attached to the base box 18 or may be attached to a plate 102 (Figure 13) having a plurality of tapped holes 104 therein for attaching it thereto. The plate is in turn bolted to the lower inner face of the base box 18 through holes 106 therein. Attaching the tracks 44 to a plate 102 prior to location in the base box 18 has the advantage that in the event of any damage to the tracks 44, for example as a result of an impact on the barrier, the damage can be substantially limited to the joint between the track 44 and the plate

102. This simplifies repair by removal and replacement of the damaged plate 102 and tracks 44. In addition it facilitates manufacture by avoiding the necessity to operate accurate machining operations on the large bae box 18 by enabling the drilling and tapping of the plurality of holes 104 to be done on the plate 102 which is simple to handle.

In an alternative arrangement, instead of the plate 102 having holes 106 therein it may be a piece of tapped plate that is welded to the bottom of the base box 18 to locally reinforce the base box at the point of attachment of the tracks 44. The weld maybe continuous in order to create a strong join or alternatively could be tack welded in a number of places such that under impact the tack welds shear, thereby preventing significant damage to the tracks 44 or the bottom of the base box 18 and therefore allowing for a simple repair.

Mounted on the tracks are a first and second bollard support 46, 48. It will be appreciated that in the example embodiment that the barrier 10 has two bollards, and hence two bollard supports. In other embodiments only one bollard, and associated bollard support may be used, or alternatively 3 or more bollards and associated bollard supports may be used. It will be appreciated that where more than two bollards are used the lid 20 will have additional cut outs to align with the bollards.

The first 46 and second 48 bollard supports support a respective first and second bollard 14, 16, and are each being movable along a track within the base box 18 when the lid 20 is open such that the first and second bollard 14, 16 extend therefrom at the locations X, Y and Z when the lid 20 is closed. The lid 20 forms a movable retention means which prevents movement of the first bollard 14 and the second bollard 16 along the track.

In the embodiment described herein both the first and second bollard supports 46, 48 are movable along the track formed by the rails 44, however it will be appreciated that one of the bollards could be fixed in location, for example attached directly to the base box 18 and not movable along the track. This would result in a barrier of the invention which has one fixed bollard and one slidable bollard. The embodiment shown in the figures which has two movable bollards offers a wider opening when the bollards are moved to allow access as the second bollard 16 can be moved to one side and the first bollard 14 replace its place, whereas with one fixed bollard and one movable bollard, the movable bollard will remain towards the opening from the fixed bollard resulting in a narrower opening. Either embodiment will have its advantage dependant on the location of the bollard and the maximum desired size of the opening when it is desired to allow vehicular passage past the barrier.

In the example embodiment the each of the first and second bollard support 46, 48 comprises a base plate 54 for moving along the rails 44. The base plate 54 is attached to the rails 44 by linear slides, which may comprise recirculating ball carriages 56 as are known in the art. Attached to each base plate 54 is a security bollard retention portion 58 comprising a substantially vertically extending tubular portion 60 and a substantially horizontally extending tubular section 62 between the vertically extending tubular portion and the impact facing side A. The tubular section 62 opens into the vertically extending tubular portion 60 adjacent to the base plate 54. The tubular section 62 may be enclosed on its distil end. In this manner the security bollard retention portion 58 forms a boot shaped structure. In the example embodiment the substantially vertically extending tubular portion 60 and the substantially horizontally extending tubular section 62 each comprise rectangular steel box section.

The first and second bollard 14, 16 each comprise a number of substantially vertical impact bars 64, 66 extending upwardly from the security bollard retention portion 58 to a height of between 60cm and 150cm from the top of the base box 18. The vertical impact bars 64, 66 maybe covered with a cosmetic shroud 68, for example a steel or polymer covering. In the example embodiment the first and second bollard each rise to a height of approximately 1 meter from the top of the base box 18, the impact bars 64, 66 being slightly shorter, for example in the region of 90cm to 98cm. Othe heights may be used. The vertical impact bar 64 furthermost towards the impact facing side A comprises an L shaped piece of spring steel, the foot of the L extending into the horizontally extending tubular section 62. The remainder of the vertical impact bars 66 comprise substantially straight pieces of spring steel arranged in the vertically extending tubular portion 60 adjacent the vertical impact bar 64 to substantially fill the vertically extending tubular portion 60. One or more steel packing shims, sized to fill any remaining space between the rearmost vertically extending impact bar 66 and the protection facing side B of the vertically extending tubular portion 60 are inserted to secure the vertical impact bars 64, 66. Under impact from the impact facing side A the vertical impact bar 64 will bear on the vertical impact bars 66 and will bear upwards on the inner surface of the horizontally extending tubular section 62. The vertically extending tubular portion 60 and the horizontally extending tubular section 62 maybe fabricated from steel box section having a wall thickness in the region of 15 to 25mm. The vertical impact bars 64, 66 are preferably manufactured from spring steel and may have a first cross sectional dimension the region of 90mm to 120mm and a second cross sectional dimension in the region of 35mm to 55mm. Other dimensions may be used. The vertical impact bars 64, 66 can easily be inserted and removed from the vertically extending tubular section.

Although not shown in the images, it will be understood that the first and/or second bollard support 46, 48 may be provided with one or more additional retainers to retain them in a respective position on the tracks 44 that is aligned with a position in which the lid 20 can be moved from the first position to the second position. The one or more additional retainers may include a detent mechanism that locates the first and/or second bollard support 46, 48 in a said aligned position or may comprises any known retention mechanism, for example a sprung or un-sprung bolt mechanism. The use of an additional retainer assists in the operation of the structure as it allows the bollard 14, 16 and bollard support 46, 48 to be positively located prior to the lid 20 being lowered to prevent their movement. Where an additional retainer is used, this may require a second action to release the additional retainer after lifting the lid, prior to moving the bollard. Alternatively, if it is for example a sprung detent mechanism a simple sideways movement of the bollard 14, 16 of sufficient force will move the detent and allow the bollards 14, 16 to move on the rails 44.

A lipped section 52 extends from adjacent an upper edge of the impact facing side of the base box 18 at locations X and Y. The lip section is formed by attaching, for example by bolting and/or welding, a L shaped lip bracket 100 to the base box 18. The L shaped bracket is preferably formed from mild steel and is arranged such that one side of it abuts the U-shaped channel 24 and the other side extends therefrom towards the protection facing side B. A first load spreader bar 50 is attached beneath each L shaped lip bracket 100 such that it abuts the lower projecting face thereof. The first load spreader bar 50 is oriented substantially parallel to the rails 44 and is dimensioned such that a lower face of the first load spreader bar is immediately adjacent to and above the substantially horizontally extending tubular section 62 when it is in the first and/or second position. The first load spreader bar 50 extends either side of the substantially horizontally extending tubular section 62 and is manufactured from spring steel. In order to further support the first load spreader bar 50 one end of it locates in a size matched opening in one or more support plates 94 and is welded thereto. The support plates 94 are welded to the sidewall of the U-shaped channel 24. In one embodiment the support plates 94 extend downwards and are also welded to the bottom of the U-shaped channel. In this embodiment the support plates can also act as an end stop limiting the extent of movement of the bollard supports 46, 48 in that direction. In other embodiments the support plates 94 extend from the sidewall of the U-shaped channel 24 and have a space therebeneath such that one of the bollard supports 46, 48 can slide thereunder at an extent of their movement. The support plates 94 may be located adjacent one another as shown at one end of Figure 4 or may be separated from one another as shown at the other end of Figure 4.

When a bollard is in the first position A or the second position B, the substantially horizontally extending tubular section 62 locates under the first load spreader bar 50 and the lipped section 52, i.e. the first lipped section 52 and the first load spreader bar 50 extend over the substantially horizontally extending tubular section 62. The length of the lipped section 52 is dimensioned such that the whole of the first load spreader bar 50. Under impact from the impact facing side A, upward force of the foot of the vertically extending impact bar 64 spreads into the horizontally extending tubular section 62, into the first load spreader bar 50, which is immediately adjacent to it, and into the lipped section 52. In this manner the force is distributed into the structure 12. This enables the load imparted onto the vertically extending impact bars 64, 66 to be absorbed and transferred into the structure 12 without the impact bars 64, 66 being ripped from their bollard support.

At each of the first and second positions X, Y the sidewall of the U-shaped channel 24 on the protection facing side B is reinforced. The reinforcement includes a rear inner support 70 and a rear outer support 72.

The rear inner support 70, comprises a second load spreader bar in the form of at least one elongate spring steel plate attached to the inner surface of the U-Shaped channel 24, for example by welding or bolting, such that when a bollard support 46, 48 is in the first or second position the rear inner support 70 extends axially along the U shaped channel 24, parallel to the track, to either side thereof. Each bollard support 46, 48 is dimensioned such that when located in the first or second position X, Y the rear surface of the vertically extending tubular portion 60, i.e. the surface on the side opposite to the first load spreader bar, is located adjacent to and in close proximity to the rear inner support 70. For example, the rear surface of the vertically extending tubular portion 60 may be located within 1 to 10mm of the rear inner support. A clearance is required in order to enable the bollard supports 46, 48 to move along the rails 44. In the example embodiment the rear inner support comprises a first elongate spring steel plate that extends to either side of the bollard support 46, 48 when they are in the first or second position, and a second elongate spring steel support, adjacent and above the first elongate spring steel plate. The second elongate spring steel support is dimensioned to have a width in the region of 0.8 to 2 times the width of the vertically extending tubular portion 60, its width may be substantially equal to the width of the of the vertically extending tubular portion 60. The second elongate spring steel support is positioned such that its upper edge is substantially aligned with the upper edge of the U-shaped channel 24.

The rear outer support 72, also referred to as the outer support, comprises at least one elongate spring steel bar retained adjacent to the outer surface of the U-Shaped channel 24

on the protection facing side B of the barrier. A rear support is provided at each of the first and second locations X, Y such that the sidewall of the U-shaped channel 24 is sandwiched between the rear inner support 70 and the rear outer support 72. The rear outer support 72 is dimensioned such that it extends along the axis of the base box 18 beyond the ends of the rear inner support in both directions. The rear outer support may be attached to the U-shaped channel 24 by means of bolting or welding, or alternatively may be retained adjacent to it but not attached fixed thereto. Under impact from the impact facing side, the vertically extending impact bars 64, 66 bear on the rear of the vertically extending tubular portion 60, which will cause it to close the gap to the rear inner support 70 transferring load thereto, and subsequently the load will be transferred to the rear outer support, from where it will be transferred into the surrounding material as described below.

At each of the first and second locations X, Y The structure 12 of the security barrier has a first support brace 22 extending from the base box 18 towards the impact facing side A and a second support brace 74 extending from the base box 18 towards the protection facing side B. Each of the first and second braces are made up of a substantially horizontal planar base plate 76a, 76b and a plurality, in the example embodiment three, substantially vertical planar web sections 78a, 78b. In some embodiments the substantially horizontal base plates 76a, 76b, may comprise two ends of a common base plate. The substantially vertical planar web sections 78a, 78b extend between the substantially horizontal planar base plate 76a, 76b and outer impact facing side walls and the outer protection facing side walls of the base box 18, respectively.

The first and second support braces 22, 74 are attached to the base box 18, for example by welding. The substantially vertical planar web sections 78b of the second brace 74 each have a notch provided in their upper edge at a location immediately adjacent to the U-shaped channel. The notch is dimensioned to substantially match the cross-sectional dimension of the rear outer supports 72 such that the rear outer supports 72 may be located in the notches so as to retain it adjacent to the protection facing side of the U-shaped channel 24.

The vertical planar web sections 78a, 78b may be provided with reinforcement attachment tabs 80 welded to their upper edge at a location between their two ends. The reinforcement attachment tabs 80 extend from the vertical planar web sections 78a, 78b such that a lower edge of the reinforcement attachment tabs 80 is substantially coplanar with the upper edge of the vertical planar web sections 78a, 78b to which they are attached. Rebar reinforcement grids 82, each comprising two or more longitudinal bars 84 extending substantially parallel to the longitudinal axis of the base box 18 and a plurality of cross members 86 extending

substantially perpendicularly across the longitudinal bars 84 and attached thereto on one side thereof, are attached to the first support braces 22 and the second support braces 74. To attach the rebar reinforcement grids 82, they are placed with the cross members 86 below the longitudinal bars 84 at a position with a cross member adjacent to a reinforcement attachment tab 80, and moved in a direction parallel to the longitudinal axis of the base box 18 such that one or more cross member passes under a reinforcement attachment tab. In this manner, prefabricated rebar grids 82 can quickly and easily be assembled onsite without the need for them to be wired or tack welded in place.

In order to install the security barrier of the invention, a shallow excavation is made such that the top of the lid is flush with the finished surface level. The barrier structure is located in the excavated area and the rebar attached as described above and the drainage ports 28 are attached to drainage conduit. The excavated area is then infilled with concrete around the base box 18 to at least a level that substantially encapsulates the first and second braces 22, 74 and the rebar grids 82.

In use, when providing protection, the security barrier 10 will be arranged as shown in Figure 1. The posts 13, 16 are in locations X and Y respectively and vehicular passage is prevented. It will be appreciated that the separation between the post centres may be dependent on the location and size of vehicle that the barrier is intended to mitigate against. In in the example embodiments the gap is in the region of 1m to 2m, preferably in the region of 1.3 to 1.5m. The separation may depend on the width of the bollards 14, 16 and preferably the gap between adjacent bollards 14,1 6 in the protecting configuration does not exceed 120cm.

In order for a vehicle to be allowed to pass the security barrier the bolts securing the lid 20 in the closed position and the bolt securing the removable cover 88 are removed and the removable cover lifted. The lid 20 is then pivoted open as depicted in Figure 3. Once the lid 20 is open the second bollard support 48 and the second bollard 16 are manually slid along the rails 44 from position Y to position Z. Subsequently the first bollard support 46 and the first bollard 14 are manually slid along the rails 44 from position X to position Y. The lid 20 is then lowered back into place such that the cutouts 32, 42 lower around the bollards 14, 16. The removable cover 80 is then placed over the opening 30 that has been vacated by the first bollard 14, and the lid 20 and removable cover 80 are resecured by preplacing the bolts that hold them in place. The security barrier is then configured as shown in Figure 2, leaving space for a vehicle to pass at location X. Once the need for vehicular passage is over the barrier is returned to the position depicted in Figure 1 by reversing the process.

Where a larger gap is needed two of the security barriers described herein, configured as mirror images on one another, may be arranged adjacent to one another such that their respective first bollards 14 are adjacent one another and separated from one another by a gap substantially equal to the gap between the first and second bollards of each security barrier when in the position depicted in Figure 1. In this manner when the respective first bollards are moved a larger gap, roughly equivalent to three times the separation gap between the bollards can be created. Such an arrangement can mitigate against narrower vehicles whilst still enabling larger vehicles to pass. The two security barriers may me embedded in a common concrete bed. In once arrangement the base box 18 of the two security barriers may be combined in a single unitary base box.

Referring to Figures 10 and 11 an embodiment comprising just a first bollard 14 is shown. Figure 10 depicts a top view of the security barrier with the bollard in the position in which it protects against vehicular passage. Figure 11 depicts the structure of the same embodiment with the lid omitted. As can be seem, when only a single bollard is used the parts of the structure associated with the second position have been removed, leaving a similar to that depicted in figures 1 to 9, however having only the first position X and the third position Z. As can be seen only a single bollard support 46 is mounted on the rails 44, and all the structure associated with the second position Y is omitted, i.e. the first load spreader bar 50, the L shaped lip bracket 100, the first brace 22, the rear inner support 70 and the rear outer support 72 hidden from view, are only provided in the base box 18 at the first position X. In Figure 11 the rim 96, which is omitted in corresponding Figure 4 of the first embodiment, is shown which provides a water trap in the form on a channel around the edge of the base box 18. Any water accumulating in the channel and be drained therefrom via drain holes 98 which are connected to the drainage ports 28 (figure3) by a conduit. This embodiment is useful where it is necessary only to prevent vehicular access to a narrow passage the second bollard and bollard support and the second opening are omitted such that the security barrier comprises only a first bollard, and bollard support, that is movable between two positions.

Referring to figure 12 a top view of a further embodiment of a security barrier of the invention having a just a first bollard 14 is shown. In the embodiment the location of the first position X is substantially central and two third positions Z are provided, one at either end of the structure 10.

It will be appreciated that in the above embodiments, at the third position Z, the structure 12 is not provided with the reinforcement necessary for a bollard located at that third position Z to be fully effective at preventing vehicular penetration. Notwithstanding above, if it was

desirable to provide protection at the third location, a corresponding structure including: the first load spreader bar 50, the L shaped lip bracket 100, the first and second support braces 22, 74, the rear inner support 70 and the rear outer support 72, may be provided at the third position.

Referring to Figure 14, the structure 12 of the invention with the impact bars 64, 66 removed is shown. With the impact bars removed, the structure forms a relatively compact unit which can be stacked for storage and/or transport in a relatively tight arrangement. This assists in facilitating their installation as they can be easily and economically transported to their install location prior to the impact bars being installed the removal of the impact bars significantly reducing their 3D space envelope. The removable nature of the impact bars enables the structures to be stacked in a stable manner, which would not be possible with the impact bars in place. Additional removable covers 88 may be applied during transit or storage to assist in preventing dirt ingress into the base box. These additional removable covers 88 may be steel or may be made of a cheaper packaging material. Optionally a storage area may be provided in the base box, for example under the cover portion 36, such that if the impact posts are required to be removed for a period of time after the structure 12 has been installed, they can be replaced to provide a substantially continuous upper surface of the structure that is safe for pedestrians and vehicles to transit.

Referring to Figures 15 to 17, a further embodiment of the invention is shown. This embodiment is substantially identical to the embodiment of Figure 1, except in that the embodiment of Figure 1 is intended to be installed so that the lid is substantially flush with the surface in which it is installed, and the embodiment of Figures 15 to 17 is intended to be surface mounted. To enable surface mounting a plurality of surface mount flanges 108 are attached to the base box 18, for example by welding. The flanges 108 each comprise a piece of steel L plate having thickness of 20mm. Each flange 108 has a plurality of holes 112 therein for receiving bolts. The horizontal base plates 76a, 76b are also provided with a plurality of holes 110 therein, also for receiving bolts 114. To install the surface mount security barrier 10, the barrier is placed in its desired location on a hard solid ground surface. The ground is then drilled through the holes 110, 112 so as to provide holes in the ground surface aligned therewith. Ground anchors or the like can then be applied into the holes, and retained in place with grout if needed. Bolts 114 are then introduced through the holes 110, 112 to attach the security barrier 10 to the ground. Once attached to the ground shuttering is provided around the barrier and filled with concrete to create a ramped concrete embedment which covers the first support brace 22 and the second support brace 74 and ramps from the ground surface

up to the edge of the lip 96 (see Figure 3). In this manner the security bollard is secured in place and a speed bump, having the bollards extending therefrom is created.

Referring to Figures 18 and 19 another embodiment of the invention is shown which has two posts movable between four positions. This embodiment is, in essence the right-hand portion of Figure 1 and Figure 2 mirrored at its mid-point such that the lid 20a has four openings defining four respective locations X, Y, Z and Z' in which the posts 14, 16 can be located. In this arrangement the security bollards 14, 16 can be in a first configuration (Figure 18) which is a protecting position and in which they are located in the two innermost positions X, Y, or in one of three open positions: a second configuration in which they are located at Y and Z, a third configuration in which they are located at X and Z' (Figure 19), or a fourth configuration in which they are locate at Z and Z'. When located in the fourth configuration the opening will be slightly widened, and when located in the second or third configuration the opening will be wider and allow passage either to one side of the first and second bollards 14, 16 or to the other side.

In this embodiment, the interior arrangement is also substantially at position X is substantially the same as at position Y as described herein above with reference to Figures 1 to 4.

Referring to Figures 20 and 21 a security barrier system 200 of the invention is shown. The security barrier system comprises two security barriers 10A, 10B, each as shown in Figures 18 and 19, located adjacent to one another. As shown in Figure 21, the security bollards 14, 16 are located at 1300mm centres which, taking into consideration the width of the impact bars 64, 66 creates a barrier system with gaps of 1160mm between adjacent security bollards, which is as suitable width to prevent the majority of medium to large vehicles passing, but is wide enough to allow for the passage of foot passengers, baby buggies, and smaller vehicles such as bicycles. If access is required for a medium sized vehicle, then as show in Figure 21, the security bollards 14 and 16 of security barrier 10B can be moved from their first and second locations X, Y to their second and third Y, Z. As shown, this creates a gap having a clearance width of 2460mm between the protective security bollards which is sufficient for vehicles up to the size of a large SUV to pass. In the event that even larger vehicles need to pass then in addition to the security bollards 14 and 16 of security barrier 10B being moved to locations Y and Z, the security bollards 14 and 16 of security barrier 10A can be moved to locations X and Z' to create a gap of 3760 in the line of protection. This gap will allow for even larger vehicles, for example a large lorry which in Europe has a maximum width of 2.6 meters, to pass. In this way a versatile security barrier system 200 can be created that is adaptable to selectively allow or prevent passage of different sized vehicles.

It will be appreciated that various changes and modifications can be made to the present invention without departing from the scope of the present application.

CLAIMS

1. A structure for a movable security barrier, the structure having an impact facing side and a protection facing side, the structure comprising:

a first bollard support for supporting a first bollard, a carrier structure supporting the first bollard support, the first bollard support being movable along a track within the carrier structure, and a movable retention means for preventing movement of the first bollard support along the track, and wherein

the movable retention means comprises a lid of the carrier structure, the lid being movable between a closed position in which the first bollard support is in one of a first location and a second location and is prevented from movement along the track, and an open position in which at least the first bollard support can be moved along the track between the first position and the second position.

2. The structure according to claim 1 further comprising a second bollard support for supporting a second bollard, the carrier structure supporting the second bollard support.

3. The structure according to claim 2 wherein the second bollard support is movable along the track within the carrier structure, and the movable retention means further prevents movement of the second bollard support along the track, and wherein the track runs substantially parallel to and in between the impact facing side and the protection facing side.

4. The structure according to any one of the preceding claims wherein at least the first bollard support comprises a base plate for moving along the track, a security bollard retention portion comprising a substantially vertically extending tubular portion and a substantially horizontally extending tubular section between the vertically extending tubular portion and the impact facing side and opening into the vertically extending tubular portion adjacent to the base plate.

5. The structure according to claim 4 wherein the second bollard support comprises a base plate for moving along the track, a security bollard retention portion comprising a substantially vertically extending tubular portion and a substantially horizontally extending tubular section between the vertically extending tubular portion and the impact facing side and opening into the vertically extending tubular portion adjacent to the base plate.

6. The structure according to claim 3 or any claim dependent thereon, wherein when in the closed position the second bollard support is in one of the second location and a third

location and is prevented from movement along the track, and when the lid is in the open position the second bollard carrier can be moved along the track between the second position and the third position.

7. The structure according to any one of the preceding claims, wherein the lid comprises a substantially planar steel structure forming a first opening at the first location and a second opening at the second location, and wherein the lid comprises reinforcement adjacent the first opening and adjacent the second opening.

8. The structure according to claim 6 and claim 7, wherein the lid forms a third opening therein at the third location.

9. The structure according to claim 8 wherein the lid further forms a fourth opening at a fourth location, and wherein with the lid in an open position the first and second bollard carriers can be moved between a first configuration in which they are in the first and second positions respectively, a second configuration in which they are in the second and third positions respectively, and a third configuration in which they are in the first and fourth positions respectively, and wherein with the lid in the closed position the first and second bollard carriers are each respectively retained in one of the first, second, and third configurations.

10. The structure of claim 9 wherein the third and fourth positions are outboard of the second and first positions respectively.

11. The structure according to any one of the preceding claims wherein the carrier structure comprises a substantially U-shaped channel having the track running along the interior of a base thereof.

12. The structure according to claim 5, or any claim dependent thereon, wherein the carrier structure comprises a first lip section extending from the impact facing side towards the protection facing side such that when the first bollard support is in the first location the first lip section extends over the substantially horizontally extending tubular section.

13. The structure according to claim 12 wherein the carrier structure comprises an elongate first load spreader bar oriented parallel to the track and attached to the first lip section such that when the first bollard support is in the first location the first load spreader bar extends over, and to either side of, the substantially horizontally extending tubular section thereof.

14. The structure according to claim 12 and claim 6, wherein the carrier structure comprises a second lip section extending from the impact facing side towards the protection facing side such that when either of the first bollard support and the second bollard support is in the second location the second lip section extends over the substantially horizontally extending tubular section.

15. The structure according to claim 14 wherein the carrier structure comprises a further elongate first load spreader bar oriented parallel to the track and attached to the second lip section such that when either of the first bollard support and the second bollard support is in the second location the further elongate first load spreader bar extends over, and to either side of, the substantially horizontally extending tubular section thereof.

16. The structure according to claim 11, or any claim dependant thereon, wherein the U-shaped channel comprises a second load spreader bar oriented parallel to the track and attached thereto on an inner side of its protection facing side and an outer support on an outer side of its protection facing side, the outer support comprising an elongate bar, the second load spreader bar and the outer support located adjacent the first position, and optionally the second position, and extending parallel to the track.

17. The structure according to any one of the preceding claims, wherein the structure further comprises at least one first brace extending from the carrier structure towards the impact facing side and/or at least one second brace extending from the carrier structure towards the protection facing side; said at least one first and/or at least one second brace each comprising a substantially horizontal planar base plate and one or more substantially vertical planar web sections, the one or more substantially vertical planar web sections extending between the substantially horizontal planar base plate and the carrier structure.

18. The structure according to claim 15 comprising a first and a second brace at each of the first location and the second location.

19. The structure according claim any one of the preceding claims, wherein the structure comprises a cover portion adjacent the first location, the cover portion configured such that when the lid is in the closed position the cover portion and the lid form a substantially continuous co-planar upper surface of the structure and wherein the first opening is formed between the lid and the cover portion the lid.

20. A security barrier comprising a structure according to any one of the preceding claims and a first bollard located in the first bollard support.

21. The security barrier according to claim 20, when dependent upon claim 5, wherein the first bollard comprises at least a first L-shaped portion that extends into both the substantially vertically extending tubular portion and the substantially horizontally extending tubular section.

22. The security barrier according to claim 20 or claim 21, depending through claim 2, wherein the security barrier comprises a second bollard located in the second bollard support.

23. The security barrier according to claim 22 when dependent upon claim 5, wherein the second bollard comprises at least a first L-shaped portion that extends into both the substantially vertically extending tubular portion and the substantially horizontally extending tubular section.

24. A security barrier system comprising a first security barrier according to any one of claims 20 to 23, and a second security barrier according to any one of claims 20 to 23, the first security barrier and the second security barrier arranged adjacent to and aligned with one another along their longitudinal axes.

25. The security barrier according to any one of claims 20 to 23 or the security barrier system of claim 24, depending through claim 17, wherein the or each security barrier comprises rebar reinforcement attached to the at least one first brace and/or at least one second brace, and wherein the rebar and the first brace and/or the second brace are substantially encased in concrete.