

Vehicle Barrier

[0001] This invention relates to a vehicle barrier for allowing or preventing passage of vehicles.

5

[0002] Conventional vehicle barriers or barricades are used to control access of vehicles to or from a property. These are often fixed installations; one type may range from a bar that can be lowered into an operating position or raised to an inoperative position for controlling vehicle passage; another type may involve elaborate mechanisms embedded in a roadway in which a barrier member may be extended to obstruct vehicles or retracted for vehicle passage.

10

[0003] International patent application WO 01/92642, in the name of Mudhar, et al., describes to a barrier having a clapper pivotably attached to a base member. The clapper is moveable between an operative position and an inoperative position. In the operative position, the clapper is backward inclined with respect to the oncoming traffic, and is held in position by a linkage. The linkage attached to the clapper has a shear pin. The maximum height of the fully raised clapper is typically limited to about 6 inches.

20

[0004] US patent no. 4,627,763 issued to Roemer, et al., describes to a vehicle barrier pivoted on a housing, which is located in a pit. The barrier is forward inclined with respect to the oncoming traffic. The barrier is moveable between an inoperative position and an operative position. In the operative position, a shear member permits the barrier to pivot beyond its operative position when impacted above a predetermined value, thereby lifting the vehicle off the ground and throwing it upwardly.

25

[0005] US patent no. 5,228,237 issued to Nasatka describes to a vehicle barrier attached pivotably to a base. The barrier is forward inclined with respect to the oncoming traffic, and is moveable between an inoperative position and an operative position. In the operative position, the barrier is held in its forward inclined position by a spring acting against a brace. The brace is designed to absorb an impact.

30

[0006] International patent application WO 92/01116 in the name of Ovington describes a road blocker consisting of a cover member consisting of two hinged plates. The cover member in an operative position is folded into an inverted-V to create a step
5 to prevent vehicle passage. In an inoperative position, the cover member is retracted to its flat position for vehicle passage.

[0007] International patent application WO 94/12731 in the name of George Fischer describes a vehicle barrier having a structure defining a recess; an arm pivoted
10 at one end of the structure; a second arm pivoted at another end of the structure; and link bar for linking the first arm to the second arm. In the operative position, the link bar and the second arm form a leg of an inverted-V whilst the first bar forms the other leg. In the inoperative position, the arms and link bar are folded into the recess of the structure. The vertical height of the V-shaped barrier is typically limited to about 700
15 mm from the ground.

[0008] Despite the development of known vehicle barriers, there is still a need to provide a vehicle barrier that is resilient enough to stop an errant vehicle. In view of recent increase in security concerns, there is also a need to provide a vehicle barrier that
20 can be moved to any location quickly, easily and frequently.

[0009] The present invention thus provides a vehicle barrier, wherein the vehicle barrier comprises: a base element; a barrier element; and a guiding element. The guiding element connects the barrier element to the base element such that the
25 guiding element permits the barrier element to move downwards relative to the base element upon impact by a vehicle.

[0010] In an embodiment of the guiding element, the guiding element comprises a clamping element associated with a slot. The clamping element passes
30 through the associated slot to clamp the barrier element to the base element. The slot can be either on the barrier element or on the base element. In one such embodiment, the clamping element is a bolt and a nut. The bolt passes through its associated slot in

the barrier element on one side of the barrier element and engages with the nut on the other side of the barrier element. In another embodiment, the bolt passes through a slot in the base element instead of the barrier element. Typically, a plurality of bolt, nut and slot arrangement is provided, depending on the magnitude of the downward force and weight that each bolt, nut and slot arrangement is designed to withstand.

[0011] In another embodiment of the clamping element, the clamping element comprises a screw and a screw engaging thread. The screw passes through the slot and engages with the screw thread on the barrier element. The clamping element also works if the slot is on the barrier element and the screw thread is on the base element.

[0012] In other embodiments of the clamping element, any fastener can be used so long as the fastener is firm and strong enough to hold the barrier element to the base element and allows the barrier element to move relative to the base element upon an impact on the barrier element. For example, a pin associated with a wedge is a form of such a fastener.

[0013] In another embodiment of the guiding element, the guiding element may comprise a bar associated with a groove and a locking screw. The locking screw provides a normal (perpendicular) force between the bar and groove for generating friction between the bar and the groove, but allows relative movement between the bar and the groove when there is an impact. The bar can be on the barrier element and the groove on the base element. It also works if the bar is on the base element while the groove is on the barrier element. The locking screw engages with a cooperating screw thread either on the bar or on a part forming the groove. If through holes are provided, each screw is replaced by a bolt and nut, and a slot is provided on either the bar or groove to permit relative movement of the bar in the groove. In other embodiments in which the bar and groove are tight fit, no locking screw is required. In yet other embodiments, the bar and groove can be made in different cooperating shapes, including for example but not limited to, a T-shaped bar associated with a T-slot; a dovetail-shaped bar associated with a dovetail-groove; or a round bar associated with a longitudinally open cylindrical bore.

[0014] In another embodiment of the vehicle barrier, the guiding element is mounted on a pivot. In one such embodiment, a line of action of the guiding element is offset from the pivot. The pivot can be on either the front or rear side of the barrier element with respect to the direction of an impact.

[0015] In an embodiment in which the pivot is at the front of the barrier element, upon an impact on the barrier element, the barrier element is rotated about the pivot and at the same time is moved down towards the base element. If effect, the pivot at the front of the barrier element acts as a further guiding element, for example, as shown in Figs. 8g-8i.

[0016] In another embodiment of the vehicle barrier, in addition to the pivot, a stopper, connected to the base element, is provided at the rear of the barrier element. The pivot allows the barrier element to rotate upon an impact on the barrier element, whilst the stopper prevents the barrier element from rotating beyond a position, as predetermined by the position of the stopper.

[0017] The stopper can be of any dimension and shape as long as it is able to withstand an impact on the stopper. For example, the stopper can have a surface that cooperates with the rear of the barrier element during an impact on the barrier element. Alternatively, an anti-friction bearing, such as a roller, ball or sliding bearing may be provided on the stopper, and the barrier element acts directly on the anti-friction bearing rather than on the stopper. In such an embodiment in which the stopper and barrier element surfaces cooperate, an additional guiding element is thus provided. The stopper can be in front or at the rear of the barrier element. Typically, the pivot is spaced as far apart from the stopper as the dimensions of the barrier element, the base element and the guiding element allow. The greater this spacing is, the greater a perpendicular distance of a reaction force at the stopper is from the pivot. For a given impact, the greater the perpendicular distance, the lower are the reaction forces at the stopper and pivot. The spacing apart of the stopper from the pivot provides an effective counter torque to withstand an impact.

[0018] In a further embodiment of the vehicle barrier, a cam is provided on the rear of the barrier element. The cam is in contact with the stopper at the rear of the barrier element. On the cam, a cam surface is in contact with the stopper, at least after
5 an impact. In practice, there is a small angular gap α , for example, of about 3° or about 4° between the barrier element and stopper prior to an impact. Prior to an impact, the cam surface may not be in contact with the stopper. Upon impact, the barrier element is rotated about the pivot through the angular gap α , and the cam surface comes into contact with the stopper and acts on the stopper to generate a downward force and
10 movement to the barrier element.

[0019] The cam surface can be a flat surface or a profile surface. Any surface profile works as long as the cam surface bears against the stopper at an angle other than that perpendicular to the impact of direction. An impact causes the cam surface to bear
15 on the stopper at such an angle so as to generate a downward force and movement to the barrier element.

[0020] The stopper can be of any dimension and shape as long as it is able to withstand an impact on the stopper. At least along the line of contact of the stopper
20 with the cam surface, the stopper has a surface that is continuous.

[0021] An additional surface is also provided on the cam. The additional cam surface is disposed substantially on an opposite face as the other cam surface. An additional stopper, also connected to the base element, is disposed on the rear of the
25 barrier element on the same side as the additional cam surface. The additional cam surface has a curved surface that is suitable for hooking onto the additional stopper. When the barrier element has been moved down a predetermined distance as generated by the other stopper and engaging cam surface, the additional cam surface comes into contact and hooks onto the additional stopper. Once this hooking operation is done, the
30 barrier element is located in its operative position and is then rigidly connected to the base element. In this position, the barrier element is able to transmit any impact on it to the base element through the stopper, additional stopper, guiding element and pivot.

[0022] Like the (first) stopper, the additional stopper can be of any dimension and shape to withstand an impact on the additional stopper. Also, at least along the line of contact of the additional stopper with the additional cam surface, the additional stopper has a surface that is continuous.

[0023] In accordance with the above disclosure, the (first) stopper is alternatively located at the front of the barrier element. In one such embodiment, the (first) stopper is connected to the barrier element. In another embodiment, the (first) stopper is connected to the base element. In a further embodiment, for example as shown in Figs. 8a-8e and 8f, a stopper is connected to each of the barrier element and the base element. Such connection can be achieved by, for example, but not limited to, welding. In addition, the cam as described above, may then be provided with the additional cam surface and the additional stopper.

[0024] In one embodiment of the base element, the base element may comprise a recess to accommodate the barrier element after the barrier element has been moved downward towards the base element. In another embodiment, the recess may comprise an aperture or opening in the base element. In a further embodiment, an edge of the aperture or opening may act as a further stopper to the barrier element extending into the aperture or opening.

[0025] The barrier element can be a flat piece of metal, such as steel. It may be a solid piece or it may be formed from an expanded metal mesh or fabricated by welding metal bars, pipes, struts or any other structural beams and sections together. The barrier element can also be partially planar and ribs may be formed or attached to strengthen the barrier element. Depending on the length of the barrier element and the expected vehicle size and speed (i.e. the predetermined designed impact), the barrier element can be made from other materials that can absorb the kinetic energy of an impact, such as for example, fibre reinforced resin or plastics, wood, aluminium, or other resilient materials.

[0026] In an embodiment of the barrier element, the barrier element is quadrilateral and has a long dimension extending across the flow of traffic. The barrier element has a lower edge adjacent to the base element and an upper free edge.

5 [0027] Depending on the ground on which the base element rests, the barrier element may be allowed to contact the ground if the barrier element moves through the aperture or opening in the base element. If the ground is soft, the barrier element may penetrate a predetermined distance into the ground. To assist the ground penetration, the lower edge of the barrier element may have a straight, a notched or a serrated
10 profile, or any combination of a straight, notched and serrated profile. Ground penetration of the barrier plate allows the kinetic energy of an impact to transmit from the vehicle barrier to the ground. Ground penetration also enhances the stability of the base element on the ground. Further, ground penetration also minimises the buckling of the lower edge of the barrier element during an impact. In the embodiment where a
15 recess instead of an opening is provided on the base element, the recess prevents the barrier plate from contacting the ground and this prevents damage to either the barrier element or the ground.

[0028] The upper free edge of the barrier element may also have any
20 combination of straight, notched and serrated profile. In addition or alternatively, the upper edge profile may be sharp or have spear-like projections. These notches, serrations or projections help to engage with the body of a vehicle during impact, thereby transforming the kinetic energy of the vehicle to others forms of energy. It is also found that these notches, serrations or projections also minimise buckling of the
25 free upper edge of the barrier element.

[0029] In another embodiment of the vehicle barrier, the vehicle barrier has a barrier element actuator to move the barrier element between its operative position and an inoperative position. In the inoperative position, the barrier element is lowered down
30 and rests on part of the base element, and a vehicle can then move on the barrier element and over the vehicle barrier. In one such embodiment, the barrier element actuator is a piston actuator.

[0030] If the piston actuator is mounted on the rear of the barrier element, the piston actuator extends to move the barrier element from the operative position to its inoperative position. If the piston actuator is mounted at the front of the barrier element, the piston actuator retracts to move the barrier element from the operative position to its inoperative position.

[0031] In other embodiments, the barrier element actuator can be a screw actuator driven by a motor, including for example, an electric motor or a fluid motor. The barrier element actuator can also be a rope and pulley system; a chain and sprocket system; or any other mechanical system to move the barrier element from its inoperative position to its operative position, whilst allowing gravity force to move the barrier element from its operative position to its inoperative position.

[0032] In the operative position the barrier element is typically inclined to the base element at an angular inclination of between about 10° and about 80 to 90°. The inclination is forward in the direction of vehicle flow. At an instant impact, the barrier element is allowed to move further to an inclination of up to about 120° after impact. In some embodiments, the barrier element inclination is between about 40° and about 50° prior to an impact. During impact, the forward inclination and subsequent rotation of the barrier element may uplift a vehicle, and in so doing lifting the drive wheels of the vehicle off the ground and thereby slowing down the vehicle. In the inclined position, it is sufficient if the barrier element has a vertical height component above the ground and the height component is noticeable by a vehicle driver approaching this vehicle barrier. A typical height component may range from about 1 m to about 2 m depending on the type of vehicle the vehicle barrier is to control. For example, the vehicle may be, but is not limited to, an automobile, such as a car; a motorbike, a tripod, a lorry; a prime mover; an armoured vehicle; or a tank.

[0033] In the forward inclination range, the barrier element tends to be more rigid or stiff considering the direction of an impact. However, this forward inclination

is not a limitation to the present invention; a backward inclination is equally suitable for the barrier element.

[0034] In another embodiment of the vehicle barrier, a ramp is provided at the front edge of the base element to enable a vehicle to mount when the barrier element is in the inoperative position. Likewise, a ramp can be provided at the rear edge of the base element for a vehicle to dismount, in addition to or regardless of any ramp at the front edge of the base element. The weight of the or each respective ramp bearing on part of the base element stabilizes the base element and enhance the safe use of this vehicle barrier, for example, by minimising the possibility of the vehicle barrier from tipping over during operation or inadvertently. If further stability of the vehicle barrier is required, the or each ramp or base element can be mounted to the ground, for example by means of anchor bolts, such as an expansion or a chemical resin type.

[0035] In another embodiment of the vehicle barrier, the stopper, the additional stopper, the pivot and an end attachment of a barrier element actuator are connected to the base element by an inner support member and an outer support member. The inner and outer support members are typically spaced apart and are connected perpendicularly to the base element. The stopper, the additional stopper, the pivot and the actuator end attachment are connected between the inner and outer support elements. In one such embodiment, the inner and outer support members may be each formed from a plate whose plane is in the direction of impact. In addition, the inner support member is designed to have an edge adjacent the rear of the barrier element such that the edge acts as an additional guiding element. The edge of the barrier element may also act as a further stopper to the barrier element during an impact.

[0036] In another embodiment of the vehicle barrier, the barrier actuator is located at the front of the barrier element, instead of being located between the inner and outer support elements. In addition, the guiding element is mounted on a pivot. The guiding element and pivot are similar to those described above. A linkage arm, including for example a linkage arm comprising a plurality of segments, is provided at the front of the barrier element to hold the barrier element in its operative position once

the barrier element actuator has moved the barrier element to its position. In such an embodiment, a stopper is provided at the front of the barrier element. The pivot and stopper are located in the base element so that they do not extend out of the base element when the barrier element is retracted to its inoperative position.

5

[0037] In a further embodiment of the vehicle barrier, the base element of the vehicle barrier is mounted with at least one ground spiking element. The ground spiking element has a pivot, an eccentric lobe and a stopping face. The ground spiking element is connected to the base element by a pin passing through the pivot, typically with the pin in a direction transverse to the flow of traffic. In one such embodiment, the pin is moveable in slots enlongate perpendicular to the pin's centre line. The eccentric lobe is designed to project beyond a bottom of the base element once the ground spiking element has rotated about the pivot to an operative position. Typically, the rotation is about a quarter-turn. Typically, the ground spiking element rotates under gravity to its operative position about the pivot and slides along the pivot pin's enlongate slots until the stopping face comes into contact with an engaging face on the base element. In a non-operative position, the ground spiking element is held in its position by a locking means, for example, but not limited to, a screw mounted on the base element. In use, the locking means may be put to its ineffective position or it may be physically removed.

[0038] In some embodiments, instead of relying on gravity to turn the ground spiking element to its operative position, a resilient means, such as a spring may be used. In other embodiments, the ground spiking element may be a singular elongate member. In other further embodiments, the singular elongate ground spiking element may be supported at two or more intermediate points to the base elements. In yet further embodiments, the ground spiking element is discrete and a plurality of ground spiking elements are according provided.

[0039] The ground spiking element helps the base element to contact and engage with the ground during an impact. In so doing, the ground spiking element also helps to transfer the kinetic energy of a vehicle to the ground, and allows the vehicle

barrier to bring a vehicle to a halt within a stopping distance shorter than that of known devices.

5 [0040] In yet another embodiment of the vehicle barrier, the vehicle barrier is mounted on a trailer integrally or separately. This embodiment allows this vehicle barrier to be deployed to any location for controlling vehicle traffic. The other advantage is that it can be deployed quickly, easily and frequently as the need arises. When mounted separately on a trailer, the entire vehicle barrier may need to be hoist up to and down from the trailer during deployment.

10

[0041] In one embodiment, a long dimension of the barrier element is parallel to the chassis of the trailer. In this orientation, an impact on the vehicle barrier is transmitted transversely onto the wheels of the trailer to the ground. Transmitting an impact in the rolling direction of the wheels, requires the wheel braking mechanisms to
15 absorb the impact. An advantage of using the vehicle barrier according to this embodiment is that the wheel braking mechanism is not relied on for absorbing an impact energy.

[0042] The portion of the chassis adjacent the barrier element and between the
20 front and rear wheels of the trailer is lower or closer to the ground than the rest of the chassis. As described earlier, ramps are provided at the front and rear edges of the base element (chassis) allow a vehicle to mount and dismount.

[0043] This invention will be further illustrated by way of non-limiting
25 examples, with reference to the accompanying drawings, in which:

[0044] Figs. 1a-1b show a schematic of a vehicle barrier according to a first embodiment of the present invention.

30 [0045] Fig. 2a is a schematic of a vehicle barrier according to a second embodiment.

[0046] Fig. 2b is a schematic of a vehicle barrier according to a third embodiment.

5 [0047] Figs. 3a-3b show a schematic of a vehicle barrier according to a fourth embodiment.

[0048] Fig. 4 shows a front view of the vehicle barrier according to a fifth embodiment of the present invention.

10 [0049] Figs. 5a-5c illustrate the base element having a piston actuator for use with the present invention according to a sixth embodiment.

[0050] Fig. 6 illustrates an alternative arrangement of the piston actuator shown in Fig. 5.

15

[0051] Fig. 7 shows an exploded view of a vehicle barrier according to a seventh embodiment.

20 [0052] Figs. 8a-8i show a vehicle barrier according to an eighth embodiment of the vehicle barrier.

[0053] Figs. 9a-9c show a vehicle barrier according to a ninth embodiment of the vehicle barrier.

25 [0054] Fig. 10 shows a vehicle barrier mounted on a trailer according to a tenth embodiment of the present invention.

[0055] Fig. 11 is a cross-sectional view of the vehicle barrier shown in Fig. 10.

30

[0056] Figs. 1a-1b illustrate the principle of operation of a vehicle barrier 10 according to the present invention. The vehicle barrier 10 has a base element 20, a

barrier element 24 and a guiding element 28. The barrier element 24 is connected to the base element 20 by the guiding element 28. The guiding element 28 permits the barrier element to move downwards relative to the base element upon a vehicle impacting on the barrier element 24 in the direction of arrow A. In Fig. 1a, a recess 48 in the base element 20 is provided to accommodate the barrier element 24 after it has been moved down towards the base element 20. In contrast, Fig. 1b shows an opening or aperture 48a in the base element 20 instead of a blind recess. In the embodiment shown in Fig. 1b, the barrier element 24 can move through the opening 48a and contact the ground on which the base element 20 rests.

10

[0057] Fig. 2a illustrates another embodiment of the vehicle barrier in which the guiding element 28 is mounted on a pivot 32. In this embodiment, the guiding element 28 is formed by a plurality of bolts 30 passing through their associated slots in the barrier element 24 and a bracket 31 connected to the pivot 32. The bolts 30 engage with the respective nuts to clamp the barrier element to the bracket 31. As shown, the barrier element 24 is at a small angular gap α of, say, about 3° or 4° away from a stopper 36 prior to an impact. On an impact to the barrier element 24, the barrier element 24 rotates through the angular gap α , hits and is limited by the stopper 36 and moves downward to the base element 20 as permitted by the guiding element 28.

20

[0058] Fig. 2b illustrates an embodiment of the vehicle barrier in which the guiding element 28 is mounted on a pivot 32, as described above. In contrast to the stopper 36 in Fig. 2a, a stopper 36a is alternatively mounted at the front of the barrier element 24 such that the reaction forces at the stopper 36a and the pivot 32 provide a counter-torque to an impact on the barrier element. In addition, the base element 20 is shown with an opening 48a.

25

[0059] Figs. 3a and 3b show another embodiment of a vehicle barrier in which a cam 40 is disposed on the rear of the barrier element 24. The cam 40 has a surface 40a in contact with the stopper 36 prior to an impact on the barrier element 24. Upon impact, the barrier element 24 is rotated about pivot 32 through the angular gap α in a clockwise direction, as seen in Fig. 3a. The cam surface 40a acts on the stopper 36 and

30

generates a downward force and movement to the barrier element 24 with respect to the base element 20. In Fig. 3a, the base element 20 is shown with a recess 48 whilst in Fig. 3b, the base element 20 has an opening 48a.

5 [0060] As shown in Figs. 3a and 3b, the cam 40 also has an additional surface 40b disposed substantially on an opposite face as the surface 40a. An additional stopper 44 is disposed at the rear of the barrier element on the same side as the additional cam surface 40b. The additional surface 40b has a curved surface that is suitable for hooking onto the additional stopper 44. When the barrier element 24 has been moved
10 down a predetermined distance, the additional cam surface 40b hooks onto the additional stopper 44. Once the additional surface 40b is hooked onto the additional stopper 44, the barrier element 24 is located in its position, and the barrier element 24 is then able to transmit any impact from the barrier element 24 to the base element 20 through the stopper 36, additional stopper 44, guiding element 28 and pivot 32.

15

[0061] Fig. 4 shows a front view of a vehicle barrier 10 according to one embodiment. The barrier element 24 is quadrilateral and has a lower edge 24a adjacent the base element 20 and an upper free edge 24b. The lower edge and upper edge 24a, 24b may comprise a straight, a notched 25 or a serrated 26 profile. It may also comprise
20 any combination of these profiles.

[0062] Figs. 5a-5c show an embodiment of the vehicle barrier 10 having a piston actuator 52 supported between an inner support element 22a and outer support element 22b. The inner and outer support elements each extends typically
25 perpendicularly to the base element 20. The inner and outer support elements 22a, 22b are more clearly illustrated in Fig. 7. The piston actuator 52 moves the barrier element 24 between its operative position and an inoperative position. Fig. 5a shows the actuator 52 holding the barrier element in an operative position prior to an impact. As can be seen in Fig. 5a, there is an angular gap α between the rear of the barrier element
30 24. Upon impact, the barrier element 24 is rotated through the angular gap α in a counterclockwise direction as seen in Fig. 5b, is limited by a stopper 36 and is moved down towards the base element 20 as permitted by the guiding element 28 and the

interaction of the cam 40 on the (first) stopper 36. In one embodiment of the inner support element 22a, an edge 23 of the inner support element 22a adjacent the rear of the barrier element 24 is formed to engage with the rear of the barrier element 24. The edge 23 acts as a further guiding element to the barrier element 24. In addition or
5 alternatively, the edge 23 also acts a further stopper to the barrier element 24. In the inoperative position, the barrier element 24 is lowered down and rests on part of the base element 20, as can be seen in Fig. 5c. In the inoperative position, a vehicle is then allowed to move on the barrier element 24 and over the vehicle barrier 10. In Figs. 5a-5c, the piston actuator 52 is mounted on the rear of the barrier element 24. The piston
10 actuator 52 extends to move the barrier element 24 from the operative position to its inoperative position.

[0063] Fig. 6 shows another embodiment of the vehicle barrier 10 in which a piston actuator 52a is mounted on the front side of the barrier element 24. The piston
15 actuator 52a retracts to move the barrier element 24 from the operative position to its inoperative position.

[0064] Fig. 7 shows an exploded view of the vehicle barrier 10 in which the stopper 36, the additional stopper 44, a pin 32a accompanying the pivot 32, and an pin
20 53 accompanying the actuator 52 are mounted between a pair of inner support element 22a and the outer support element 22b. The pair of inner and outer support elements 22a, 22b are typically spaced apart and is connected typically perpendicularly to the base element 20. As shown in Fig. 7, the inner and outer support elements 22a, 22b are in the form of parallel plates with their planes in the direction of impact, as indicated by
25 arrow A. Also shown in Fig. 7, the cam 40 and pivot 32 are detached from the barrier element 24 along their respective detachment lines indicated in Fig. 7. As can also be seen in Fig. 7, another pair of inner and outer support elements 22a, 22b is also provided to support the barrier element 24 at a far end of the quadrilateral barrier element 24. Ramps 64, 64a are provided at each of the front and rear edge of the base
30 element 20 for a vehicle to respectively mount on and dismount from the vehicle barrier 10.

[0065] Figs. 8a-8f show another embodiment of the vehicle barrier 10 in which a barrier element actuator 52b is located in front of the barrier element 24. When the barrier element is moved by the barrier element actuator 52b to its operative position, the barrier element 24 is held in position by a linkage arm 54, such as shown in Figs. 8b and 8d. As shown in Figs. 8d-8f, the linkage arm 54 is shown to comprise of two segments. Also as shown in Figs. 8a-8f, the guiding element 28 is mounted on a pivot 32 with a stopper 36a mounted at the front of the barrier element 24. The stopper 36a and pivot 32 are located in the base element 20, so that the entire barrier element 24 is retracted within the base element 20 when the barrier element 24 is in its inoperative position, such as shown in Fig. 8a. Upon an impact on the barrier element 24 in the direction of arrow A, the barrier element 24 is rotated clockwise (as seen in the figures) about the pivot 32 until the barrier element 24 is substantially perpendicular to the base element 20. The barrier element 24 in the substantially perpendicular position is then limited by the stopper 36a. To allow the barrier element 24 to rotate to the substantially perpendicular position, the two segments of the linkage arm 54 slide relative to each other and extend the overall length of the linkage arm 54. In one embodiment as shown in Fig. 8f, a stopper 68 is provided on the base element 20. The stopper 68 alone may be provided. In another embodiment, the stopper 68 may be provided in addition to the stopper 36a. The stopper 68 may be a singular piece or it may be discrete pieces arranged in a row adjacent a long edge of the barrier element 24. Further, ramps 64, 64a are also shown at each of the respective front and rear end of the base element 20.

[0066] As shown in Figs. 8a-8i, the pivot 32 is offset from the guiding element 28. With reference to Figs. 8g, the barrier element 24 is retracted to its inoperative position. As shown in Fig. 8g, the barrier element 24 is parallel to the base element 20, the pivot 32 is at a height h from the base element 20, the barrier element 24 is at a perpendicular distance y from the pivot 32, and barrier element 24 is extended beyond the pivot 32 by a distance x . As can be seen in Figs. 8c, 8e-8f and 8i, when the barrier extension distance x is greater than the pivot height h and the barrier element 24 is moved to a position substantially perpendicular to the base element 20, the barrier element 24 extends through an aperture or opening 48a in the base element 20 to contact a ground on which the base element 20 rests. When the barrier element 24 is

limited to an inclined position during an impact and the barrier element 24 is to extend through the aperture or opening 48a, the barrier element extension distance x should accordingly be greater than distance h .

5 [0067] Figs. 9a-9c show an embodiment of the vehicle barrier 10 in which the base element 20 has at least one ground spiking element 72. Fig. 9b shows the ground spiking element 72 in its non-operative position. In the non-operative position, the ground spiking element 72 is held in position by a locking means (not shown). Fig. 9c shows the base element 20 lifted up from a ground on which it rests and the locking means (not shown) is put into its ineffective position, the ground spiking element 72 is rotated by gravity to its operative position. In the operative position of the ground spiking element 72, the ground spiking element 72 is rotated about a quarter-turn about its pivot 72a and an eccentric lobe 72b of the ground spiking element 72 is designed to project below a bottom of the base element 20 whilst the stopping face 72c contacts a part of the base element 20. The ground spiking element 72 helps the base element 20 to engage with the ground, and in so doing also helps to dissipate the kinetic energy of a vehicle, thereby allowing the vehicle barrier 10 to bring a vehicle to a halt within a stopping distance shorter than that of known devices.

20 [0068] Fig. 10 shows an embodiment of the vehicle barrier 10 mounted on a chassis 56 of a trailer. In this embodiment, the base element 20 forms the chassis 56 of a trailer and a long edge the barrier element 24 is parallel with the long side of the chassis 56. A portion of the chassis 56a adjacent the barrier element 24 and between the front and rear wheels 60 of the trailer is lower or closer to the ground.

25

[0069] Fig. 11 shows a cross section of the vehicle barrier 10 shown in Fig. 10. In Fig. 11, ramps 64, 64a are provided for vehicles to respectively mount on and dismount from the lowered portion 56a of the chassis 56.

30 [0070] While only a few embodiments of a vehicle barrier 10 have been described and illustrated, it is understood that many changes, modifications and

variations could be made to the present invention without departing from the principle and scope of the present invention.

CLAIMS:

1. Vehicle barrier comprising:
 - a base element;
 - a barrier element; and
 - a guiding element;wherein the guiding element connects the barrier element to the base element such that upon impact by a vehicle, the guiding element permits the barrier element to rotate and move downwards relative to the base element.
2. A vehicle barrier according to claim 1, wherein the guiding element comprises a clamping element associated with a slot, with the clamping element passing through the associated slot to clamp the barrier element to the base element.
3. A vehicle barrier according to claim 2, wherein the clamping element is at least one of the following: a bolt and a nut; a screw and a screw thread; or a fastener.
4. A vehicle barrier according to claim 3, wherein the fastener is a pin associated with a wedge.
5. A vehicle barrier according to any one of the preceding claims, wherein the guiding element comprises a bar associated with a groove.
6. A vehicle barrier according to claim 5, wherein the bar and associated groove is at least one of the following pairs: a T-bar and a T-slot; a dovetail bar and a dovetail slot; and a round bar and a longitudinal open cylindrical bore.
7. A vehicle barrier according to any one of the preceding claims, wherein the guiding element is mounted on a pivot.

8. A vehicle barrier according to claim 7, wherein a line of action of the guiding element is offset from the pivot.
9. A vehicle barrier according to claim 7 or 8, further comprising a stopper.
- 5 10. A vehicle barrier according to claim 9, wherein the stopper is mounted at the front of the barrier element.
11. A vehicle barrier according to claim 9, wherein the stopper is mounted at the rear of the barrier element.
- 10 12. A vehicle barrier according to claim 11, further comprising a cam disposed on the rear of the barrier element, with the cam being in contact with the stopper.
- 15 13. A vehicle barrier according to claim 12, wherein said cam comprises a surface that is in contact with the stopper.
14. A vehicle barrier according to claim 12 or 13, further comprising an additional stopper disposed near the rear of the barrier element, the additional stopper being on a side of the cam opposite that as the stopper.
- 20 15. A vehicle barrier according to claim 14, wherein the cam further comprises an additional surface, the additional surface engages with the additional stopper to locate the barrier element after the barrier element has moved as a result of an impact.
- 25 16. A vehicle barrier according to any one of the preceding claims, wherein the base element comprises a recess for accommodating the barrier element after the barrier element has moved.
- 30 17. A vehicle barrier according to claim 16, wherein the recess comprises an aperture.

18. A vehicle barrier according to any one of the preceding claims, wherein the barrier element is quadrilateral and has a lower edge adjacent the base element and an upper free edge.

5 19. A vehicle barrier according to claim 18, wherein the lower edge contacts a ground on which the barrier element rests.

20. A vehicle barrier according to claim 18 or 19, wherein the lower edge comprises a straight, a notched or a serrated profile, or any combination thereof.

10

21. A vehicle barrier according to any one of claims 18-20, wherein the upper free edge comprises a straight, a notched or a serrated profile, or any combination thereof.

22. A vehicle barrier according to any one of the preceding claims, wherein the base
15 element further comprising a barrier element actuator, the barrier element actuator is arranged to move the barrier element to and from an operative position.

23. A vehicle barrier according to claim 22, wherein the barrier element actuator is arranged to retract the barrier element.

20

24. A vehicle barrier according to claim 23, wherein the barrier element actuator is arranged to extend the barrier element.

25. A vehicle barrier according to any one of claims 22-24, wherein in the operative
25 position the barrier element is inclined to the base element at an angular range of about 10° to about 90°.

26. A vehicle barrier according to claim 25, wherein in the operative position the
barrier element is inclined to the base element at an angular range of about 40° to about
30 50°.

27. A vehicle barrier according to claim 25 or 26, wherein the barrier inclination is forward with respect to an impending impact.
28. A vehicle barrier according to any one of the preceding claims, further
5 comprising a ramp at a front edge of the base element for a vehicle to mount.
29. A vehicle barrier according to any one of the preceding claims, further comprising a ramp at a rear edge of the base element for a vehicle to dismount.
- 10 30. A vehicle barrier according to any one of the preceding claims, comprising a stopper disposed on the base element.
31. A vehicle barrier according to any one of the preceding claims, further comprising at least one ground spiking element.
15
32. A vehicle barrier according to claim 31, wherein the ground spiking element has an eccentric lobe designed to project below a bottom of the base element when the ground spiking element is in use.
- 20 33. A vehicle barrier according to any one of the preceding claims, wherein the base element comprises part of a chassis of a trailer.
34. A vehicle barrier according to claim 33, wherein the long side of the barrier element is parallel with the long side of the chassis.
25
35. A vehicle barrier according to claim 33 or 34, wherein a portion of the chassis cooperating with the barrier element is closer to the ground than the rest of the chassis.