

IMPROVEMENTS IN AND RELATING TO ROAD BARRIERS AND PARTS AND FITTINGS THEREFOR

TECHNICAL FIELD

5 The present invention relates to improvements in and relating to road barriers and parts and fittings therefor.

BACKGROUND ART

The present invention relates to an improved energy absorbing system for road barriers and parts and fittings therefor.

10 In particular, the present invention in one aspect relates to an impact extension frame assembly for use as part of an impact attenuator system which is both light weight and robust.

In another aspect the present invention relates to an impact attenuator system.

There being a need in the art for a light weight transportable impact attenuator system which can protect drivers for head on impacts with the end of a solid road barrier for example a concrete barrier.

15 All references, including any patents or patent applications cited in this specification are hereby incorporated by reference. No admission is made that any reference constitutes prior art. The discussion of the references states what their authors assert, and the applicants reserve the right to challenge the accuracy and pertinency of the cited documents. It will be clearly understood that, although a number of prior art publications are referred to herein, this
20 reference does not constitute an admission that any of these documents form part of the common general knowledge in the art, in New Zealand or in any other country.

Throughout this specification, the word "comprises", or variations thereof such as "comprise" or "comprising", will be understood to imply the inclusion of a stated element, integer or step, or group of elements integers or steps, but not the exclusion of any other element, integer or step,
25 or group of elements, integers or steps.

Further aspects and advantages of the present invention will become apparent from the ensuing description which is given by way of example only.

DISCLOSURE OF THE INVENTION

30 According to a first aspect there is provided an **impact extension** frame assembly for an impact attenuator system wherein the carriage frame assembly includes left and right side frames connected at an upstream end via:

- i. a top plate adapted to receive a connection component; and
- ii. a cross member;

wherein the left and right side frames are also connected at a downstream end thereof via at least one shearing member.

- 5 An objective of the first aspect of the present invention is to provide an impact extension frame assembly which can receive a head-on impact force or near head on force and redirect the force of the impact to the barrier sections in a manner which enables more force to be absorbed in a more controlled manner than if barrier sections alone where to receive the head-on impact force.

- 10 According to a further aspect of the present invention there is provided an impact attenuator system which can redirect an impact force from a near head-on impact which is at substantially 5 degrees to the longitudinal axis of the upstream terminal end barrier section.

- In particular it would be useful to have an impact extension frame assembly which can receive a near head-on impact force which is substantially 5 degrees to the longitudinal axis of the upstream end barrier section to help prevent vehicles entering upstream area of the work zone protected by the barrier.
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Preferably, the impact extension frame assembly projects a distance X ahead of the end face of an upstream terminal barrier section to which the impact extension frame assembly is attached.

Preferably, the shearing member, in use, passes through an aperture in an upstream terminal barrier section to further connect the energy absorbing element thereto.

- 20 Preferably, the left and right side frame members present a symmetrical contact zone for receiving the force of a head on collision.

Preferably, the contact zone may be positioned to be at a height which is at, or near, the mid region to upper region of the barrier section.

Preferably, the left and right side frames are identical.

- 25 Preferably, the left and right side frames have horizontal and vertical members which in use are configured to fit within channel portions on the outer surface of the barrier section.

Preferably, the energy absorbing element is used in combination with a cover.

Preferably, the top plate is adapted to have two apertures therein which in use can receive a nose pin.

- 30 Preferably, the left and right side frame members do not contact the ground or other support surface

Preferably, the top plate, cross member and shearing member all have dimensions which can hold the left and right side frame members in close contact to the outer walls of a upstream terminal barrier section of an impact attenuator system.

Preferably, the left and right side frame members only longitudinally extend around 33% the
5 length of the terminal barrier section to which they are attached.

According to a second aspect there is provided an impact attenuator system which includes:

- at least two adjacent plastic hollow barrier sections (barrier sections) which are filled with water and are connected to one another at respective ends thereof wherein one barrier section has an upstream position relative to the other barrier section(s); and
- 10 - an energy absorbing element which includes:
 - i. a carriage frame assembly comprising left and right side frames connected at an upstream end thereof via:
 - ii. a top plate adapted to receive a connection component;
 - iii. a cross member;

15 wherein the left and right side frames are also connected at a downstream end thereof via at least one shearing member, the shearing member further securing the carriage frame assembly to the forward end of the barrier section having the upstream position.

Preferably, in the impact attenuator system of the present invention all the barrier sections may be filled with water.

20 According to a third aspect there is provided a kit of parts for a carriage assembly for an impact attenuator system which includes:

- left and right side frames;
- a top plate;
- a cross member; and
- 25 - a shearing member.

According to a fourth aspect there is provided a kit of parts for an impact attenuator system which includes:

- a kit of parts for a carriage assembly, to be fitted in use, to an upstream hollow barrier section;

- a plurality of hollow barrier sections adapted to be filled with water;
 - an asymmetric twin pin connector for connecting the carriage assembly to the upstream hollow barrier section;
 - a symmetric twin pin connector for connecting the plurality of hollow barrier sections.
- 5 According to a fifth aspect there is provided an asymmetric dual pin for connecting two adjacent plastic road barrier sections (barrier sections), wherein the assembly includes:
- a first pin;
 - a second pin;
 - a bridge member connected to the top end of both the first and second pins;
- 10 wherein the length of the first pin is sufficient to pass through all the connecting portions on both adjacent barrier sections to effect a connection therebetween; and
- wherein the length of the second pin is only sufficient to pass through the top-most connecting portion on both adjacent barrier sections.

- According to a sixth aspect there is provided an asymmetric dual pin substantially as described
- 15 above wherein the length of the second pin is substantially 20% of the length of the first pin.

BRIEF DESCRIPTION OF THE DRAWINGS

Further aspects of the present invention will become apparent from the ensuing description which is given by way of example only and with reference to the accompanying drawings in which:

- 20 Figure 1 shows a perspective view of a preferred embodiment of a carriage frame assembly in accordance with one aspect of the present invention.
- Figure 2 shows a side view of the carriage frame assembly of Figure 1.
- Figure 3 shows a side view of a preferred embodiment of an impact attenuator system which includes the carriage frame assembly of Figures 1 and 2 in accordance with a
- 25 Figure 4 shows a plan view of the impact attenuator system Figure 3.
- Figure 5 shows a side view of an upstream terminal (UT) plastic barrier section used in the impact attenuator system of Figures 3 and 4.
- Figure 6 shows a perspective view of the terminal plastic barrier section of Figure 5.

- Figure 7 shows a cross-sectional view of the UT barrier section of Figures 5 and 6.
- Figure 8 shows a nose pin used in the impact attenuator system of Figure 3 in more detail;
- Figure 9 shows an asymmetric dual pin used in the impact attenuator system of Figure 3 in more detail;
- 5 Figure 10 shows a standard twin pin used in the impact attenuator system of Figure 3 in more detail;
- Figure 11 shows a plan view showing a near head-on impact which can be redirected by the impact attenuator system shown in Figures 3 and 4.

10 **BEST MODES FOR CARRYING OUT THE INVENTION**

With respect to Figures 1 -4 there is shown a carriage frame assembly 1 having a left side frame 2L and a right side frame 2R which form an open sided (non-walled) structure.

The left and right side frames 2L,2R are connected via a top plate 3 which is bolted thereto with structural bolts 3A. the top plate 3 has a bent profile when viewed side on.

- 15 The top plate 3 has two apertures 3B therein into which a connection component in the form of a nose pin 6 is located. The twin pin 6 locates, in use, into apertures in a top connecting projection 3005ucp on the upstream end 3005U of a plastic upstream terminal (UT) barrier section 3005 – see Figure 5.

- 20 The left and right side frames 2L,2R are further connected via a cross member in the form of a length of SHS 4. Bolts (not shown) pass through apertures 4A to connect the cross member 4 to the left and right side frames 2L,2R.

The left and right side frames 2L,2R are further connected via a shearing member in the form of a M36 solid circular bar 5 at the downstream end of the left and right side frames 2L,2R.

- 25 The solid circular bar 5 - in use - passes through apertures 3005AA in barrier section 3005 – see Figure 5.

The ends of the solid circular bar 5 are threaded and receive washers and nuts 9 thereon.

In Figure 2 it can be seen that side frame 2L (which is identical to side frame 2R) has:

- an upstream vertical member 2uv and a downstream vertical member 2dv;
 - an upper upstream horizontal member 2uuh and an upper downstream horizontal member 2duh welded to upstream vertical member 2uv;
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- a lower upstream horizontal member 2luh and a lower downstream horizontal member 2ldh.

The upstream end of the side frame 2L also has an upper inclined reinforcing sections 2uir and a lower inclined reinforcing section 2lir both of which span from the respective distal ends of the upstream vertical section 2uv to the upstream distal end of the two horizontal members 2uuh and 2luh.

With respect to Figures 3 and 4 there is shown an impact attenuator system 3000 which is located upstream of a concrete road barrier not shown but extending in direction Y. The length of the impact attenuator system 3000 as shown by double headed arrow X is around 9.3m.

The impact attenuator system 3000 has a transition shroud 3010 attached via bolts 3015 to end section cover 3014 at a downstream end thereof and is connected via a standard twin pin 3011 to the connection portions (not shown) of downstream plastic barrier section 3002. The end section cover fits over the upstream terminal end of a concrete barrier (not shown) but extending in direction Y.

The impact attenuator system 3000 has a carriage frame assembly 1 which is connected - via a nose pin 6 and solid bar 5 - to a water filled road barrier section 3005, which is an upstream terminal barrier section, having an upstream position relative road barrier sections 3007, 3009 and 3002.

The carriage assembly 1 has a nose section 1N which extends out from the upstream terminal end of barrier section 3005. The carriage assembly 1 also has a tail section 1T which is horizontal member 2ldh which extends downstream of body section 1B of the carriage frame assembly 1. The distal end of horizontal member 2ldh receives the circular solid bar 5.

The side frames 2L,2R have a body and tail sections 1B, 1T dimensioned to fit within vertical and horizontal grooves in the outer surface of plastic barrier section 3005 – discussed in relation to Figure 5 below.

The nose section 1N of the carriage assembly 1 is surrounded by a plastic nose cover 3006.

The upstream terminal barrier section 3005 is connected to a downstream adjacent plastic water filled barrier section 3007 via asymmetric pin 3008. The asymmetric pin 3008 has a first pin 3008l which is longer than a second pin 3008s both pins 3008l, 3008s are connected via a bridge member 3008b – see Figure 9.

It can be seen that the length of the second pin 3008s is around 20% of the length of the first pin 3008l.

The asymmetric pin 3008 is always oriented when joining adjacent barrier sections so that the shorter pin 3008s is upstream of the longer pin 3008l.

The plastic barrier section 3007 is itself connected to a further downstream water filled plastic barrier section 3009 via a standard twin pin 3011.

- 5 The plastic barrier section 3009 is connected to downstream water filled plastic barrier section 3002 via standard twin pin 3011.

In Figures 5 and 6 the upstream terminal (UT) barrier section 3005 is shown in more detail. The UT barrier section 3005 has an upstream end 3005U and a downstream end 3005D.

- 10 The upstream end 3005U has three connection portions 3005ucp. The nose pin 6 (see Figure 8) passes through apertures 3B in top plate 3 of the carriage frame assembly 1 and into apertures 3005A in the top upstream connection portion 3005ucp.

As mentioned above side frames 2L,2R fit within vertical and horizontal grooves 3005v and 3005h respectively. The shearing member in form of solid bar 5 of the carriage frame assembly passes through aperture 3005AA.

- 15 After an impact in direction Z (see Figure 1) the carriage assembly 1 moves downstream along UT barrier section 3005, and the shearing member is forced against and shears the side walls 3005WL and 3005WR of the barrier section 3005 – refer Figures 3, 5 and 7.

- 20 This downstream movement of the carriage frame assembly 1 following impact causes an upper section (not shown) of the barrier section 3007 to buckle upwards, as the barrier section 3005 becomes effectively unzipped, as a result of the shearing of the side walls, via travel of the carriage assembly 1 there along.

Upward motion of the unzipped upper section during this travel of the carriage assembly creates a further braking force. As the length of the buckling upper portion of the barrier section increases in length/weight with further downstream travel of the carriage assembly.

- 25 Figure 11 shows a plan view of impact attenuator system 3000 in which the same reference numerals as used for Figures 3 and 4 have been used to indicate like elements. As can be seen there is a plastic nose cover 3006 located adjacent the upstream terminal barrier section 3005 which is connected to downstream adjacent plastic water filled barrier section 3007.

- 30 Figure 11 in particular shows a vehicle 1100 travelling in direction Y about to have a near head-on impact at an angle of 5 degrees as shown by double headed arrow Z to the longitudinal axis A of upstream terminal end of the impact attenuator 3000.

**DISCUSSION OF THE INVENTION INCLUDING A NUMBER OF NON-LIMITING EXAMPLES
OF ENVISAGED ALTERNATE WAYS TO IMPLEMENT THE INVENTION**

The carriage frame assembly may have left and right side frames which are made from lengths of rectangular hollow section (RHS) or square hollow section (SHS) steel.

- 5 The carriage frame assembly also have a configuration which may vary.

Preferably, the carriage frame assembly may have side frames which are configured to:

- receive the impact force of a vehicle; and
- remain attached to an upstream end of a terminal barrier section - following an impact - and which travels with the carriage frame assembly following an impact.

- 10 In one embodiment each side frame may have a framework comprising two spaced apart vertical sections and two spaced apart horizontal sections. The framework also including inclined reinforcing sections which span from the respective distal ends of the upstream vertical sections to the upstream distal ends of the two horizontal sections.

- 15 In a preferred embodiment the lowermost horizontal section of the side frame may have a downstream distal end which projects further downstream than the upper horizontal section. Preferably, the shearing member may be connected at or near the downstream distal end of the lowermost horizontal section.

The vertical sections may be formed from a single length of material.

Preferably, the vertical sections may be made from a length of square hollow section (SHS) steel.

- 20 The upper and lower horizontal sections may each be made from two lengths of square hollow section (SHS) steel which are horizontally aligned with one another.

The plate may have a number of different forms.

In one embodiment it may be a flat plate.

- 25 In a preferred embodiment it may be a bent plate with a flat section and an angled section – when viewed side on.

The plate may include two apertures which – in use -can receive a connection component.

The cross member may be a length of hollow section steel. Preferably, the cross member is a length of SHS steel.

- 30 The shearing member may have a number of different forms without departing from the scope of the present invention.

In one preferred embodiment the shearing member may be in the form of a solid bar.

Preferably, the bar may have a circular in cross-sectional profile.

In an alternate embodiment the bar may have a triangular, rectangular or square cross-sectional profile and be oriented with respect to the horizontal so as to have one edge projecting ahead off
5 the intersecting surfaces forming the edge.

In a further alternate embodiment, the bar may have a flat cross-section profile. The bar having a thickness which is substantially 5% to 10% of the width of the bar so as to create a blade-like profile.

The invention may also be said broadly to consist in the parts, elements and features referred to
10 or indicated in the specification of the application, individually or collectively, in any or all combinations of two or more of said parts, elements or features.

Aspects of the present invention have been described by way of example only and it should be appreciated that modifications and additions may be made thereto without departing from the scope thereof as defined in the appended claims.

WHAT WE CLAIM IS:

1. An impact extension frame assembly for an impact attenuator system wherein the carriage frame assembly includes left and right side frames connected at an upstream end via:

- i. a top plate adapted to receive a connection component; and
- ii. a cross member;

wherein the left and right side frames are also connected at a downstream end thereof via at least one shearing member.

2. An impact extension frame assembly for an impact attenuator as claimed in claim 1 wherein the impact extension frame assembly projects a distance X ahead of the end face of an upstream terminal barrier section to which the impact extension frame assembly is attached.

3. An impact extension frame assembly for an impact attenuator as claimed in claim 1 wherein the shearing member, in use, passes through an aperture in an upstream terminal barrier section to further connect the energy absorbing element thereto.

4. An impact extension frame assembly for an impact attenuator as claimed in claim 1 wherein the left and right side frames have horizontal and vertical members which in use are configured to fit within channel portions on the outer surface of the barrier section.

5. An impact extension frame assembly for an impact attenuator as claimed in claim 1 wherein the left and right side frame members do not contact the ground or other support surface.

6. An impact extension frame assembly for an impact attenuator as claimed in claim 1 wherein the left and right side frame members only longitudinally extend around 33% the length of the terminal barrier section to which they are attached.

7. An impact attenuator system which includes:

- at least two adjacent plastic hollow barrier sections (barrier sections) which are filled with water and are connected to one another at respective ends thereof wherein one barrier section has an upstream position relative to the other barrier section(s); and
- an energy absorbing element which includes:
 - i. a carriage frame assembly comprising left and right side frames connected at an upstream end thereof via:
 - ii. a top plate adapted to receive a connection component;
 - iii. a cross member;

wherein the left and right side frames are also connected at a downstream end thereof via at least one shearing member, the shearing member further securing the carriage frame assembly to the forward end of the barrier section having the upstream position.

8. An impact attenuator system as claimed in claim 7 wherein all the barrier sections are filled with water.

9. A kit of parts for a carriage assembly for an impact attenuator system which includes:

- left and right side frames;
- a top plate;
- a cross member; and
- a shearing member.

10. A kit of parts for an impact attenuator system which includes:

- a kit of parts for a carriage assembly, to be fitted in use, to an upstream hollow barrier section;
- a plurality of hollow barrier sections adapted to be filled with water;
- an asymmetric twin pin connector for connecting the carriage assembly to the upstream hollow barrier section;
- a symmetric twin pin connector for connecting the plurality of hollow barrier sections.

11. An impact attenuator system which can redirect an impact force from a near head-on impact which is at substantially 5 degrees to the longitudinal axis of the upstream terminal end barrier section.