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(54) Road safety barrier

(57) A road safety barrier (1) comprises a series of beam sections (2a to 2d) together forming a length of barrier and supported above the ground by way of posts (3a to 3g). The positions of successive posts along at least part of the length of the barrier shift relative to the centres of the beam sections (C). The shift may be progressive but uniform along a section thereof so that the flexibility of the barrier is substantially constant. Shifting the locations of the posts along the length of the barrier by an increasing or decreasing amount has the effect of increasing or decreasing the strength of the barrier so that different road conditions can be accommodated even though beam sections of constant length are used to construct the barrier.

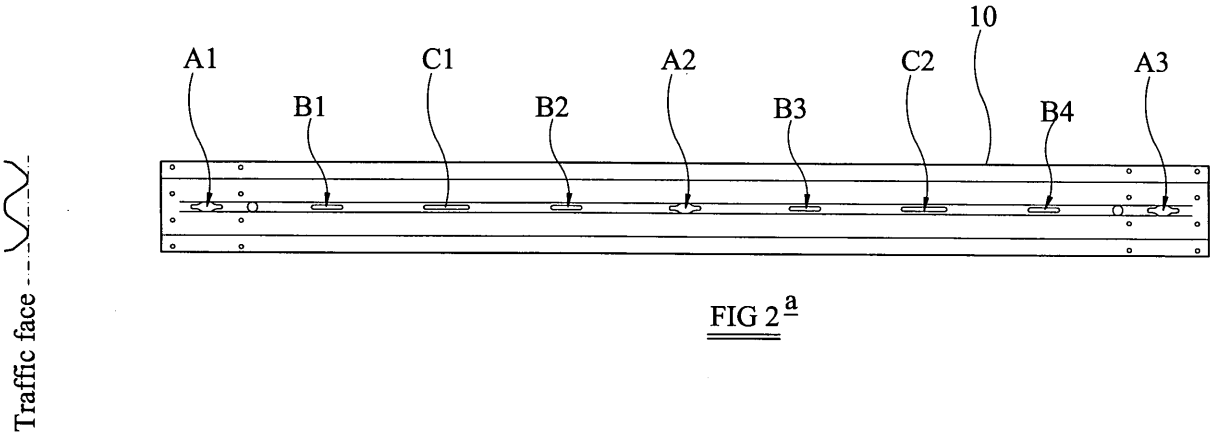

FIG 2[a]

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Description

[0001] The invention relates to road safety barriers and in particular but not exclusively to road safety barriers of the 'W' profile 'post and beam' type.

[0002] One known road safety barrier comprises a series of 'W' profile beam sections that are joined together at overlapping ends. The beams are supported above the ground by posts positioned along the length of the barrier. The design criteria for a given length of safety barrier with respect to impact resistance and flexibility on impact are determined according to the road conditions. For example, the safety barrier of a central reservation between roads carrying vehicles travelling in opposite directions may be designed to offer a relatively high resistance with lower flexing on impact in order to ensure errant vehicles are deflected back into their direction of travel. On the other hand, a more flexible barrier may be desirable in other circumstances, not least because it may be simpler and less expensive to install.

[0003] The impact response, particularly with respect to flexibility, of a safety barrier of this type is governed to a significant extent by the length of beam sections and number of posts per section. Essentially, since the beam sections are manufactured in standard lengths, the more posts supporting each section, the more resistant the barrier is to flexing on impact. In these 'post and beam' prior art road safety barriers, the posts are invariably positioned at the same locations relative to each beam section. That is to say, for any given length of barrier, the posts are positioned at points which are the same distance from the position where beam sections overlap. In another configuration, representing a barrier more resistant to flexing on impact, two posts per section may be adopted, positioned at the same location relative to the section supported by them from one beam section to the next.

[0004] Installation of these 'post and beam' road safety barriers requires careful planning in order that the lengths of beam sections and number of posts carried to the site are appropriate to meet the impact design criteria for the section of safety fence under construction. This is limiting in cases where the crash characteristics of the barrier may be redesigned or varied during the installation programme. The fixed post-beam relationship for the length of the barrier also makes it difficult to construct a barrier that has an impact flexibility that varies along its length to provide for changing road conditions. For example, it may be necessary to construct a stretch of barrier alongside a bridge buttress having a different flexing characteristic from the sections of barrier farther away. In this case, different post positions will be required. A further limitation arises if the design criteria require a gradual or even a stepped change in barrier flexibility over a given stretch of road.

[0005] For example, a known barrier comprises a series of beam standard length sections of 3.2m, with posts spaced either at intervals of 1.6m or 3.2m. In the first case, each post is positioned 0.8m from the central point of overlap of sections or, for a less flexible barrier in the second case, an additional post is provided midway between the posts of the first case so that there are two posts supporting each section. The beam is provided with means for facilitating attachment of posts at each of these positions. The posts may be fixed to the beam section by means of bolts passing through slots or holes in the section. However, the problem is that as the slots or holes are formed during the manufacture of the beam section, the ability to add additional ones to a given beam section on site in order to provide a stiffer section of barrier is limited. It is therefore not possible to construct a barrier with flexibility characteristics that differ from either the 1.6m-spacing barrier, or the 3.2m spacing barrier.

[0006] It is an aim of the present invention to provide a road safety barrier that alleviates the aforementioned problems and limitations.

[0007] According to the present invention, there is provided a road safety barrier comprising a series of beam sections together forming a length of barrier and supported above the ground by way of posts, wherein the positions of successive posts along at least part of the length of the barrier shift relative to the centres of the beam sections.

[0008] In a preferred embodiment, the shift may be progressive but uniform along a section thereof so that the flexibility of the barrier is substantially constant. A change in the degree of shift from one post to the next can provide for a change in the flexibility of the barrier from one section thereof to another. The ability to shift the post positions along the length of the barrier allows the designer to tailor or vary the flexibility of the barrier along a predetermined length thereof using beam sections of substantially equal length. This allows greater flexibility in the use of standard length beam sections by simplifying installation time and costs. Furthermore, since the design criteria are determined by the performance classes of the relevant national or international standards (e.g. European Standard EN1317 Part 2), it is advantageous to have a system in which the flexibility/stiffness of the barrier can be altered according to the constraints of those official standards, whilst keeping the installation time and costs to a minimum. For example, a crash test scenario could involve use of a barrier having a post spacing that progressively changes along its length and so has a crash characteristic (i.e. stiffness) which progressively changes. This makes it easier to determine whether a given post spacing/barrier stiffness meets a performance class.

[0009] Fixing means are provided on the beam sections to facilitate fixing of the posts to the beam. In accordance with a preferred embodiment, these are provided at more than two but preferably more than five locations advantageously equi-spaced along the longitudinal axis of the beam. The provision of a greater number of fixing means permits shifting of posts from one to the next by smaller increments. This makes it easier to install a barrier which meets a given performance class using

beam sections of the same length.

[0010] The advantage arising from the present invention is that by increasing the number of fixing means along the length of a beam section, the options for varying the positional relationship between adjacent posts increases. It is no longer necessary to position posts symmetrically with respect to the beam sections. Shifting the locations of the posts along the length of the barrier by an increasing or decreasing amount has the effect of increasing or decreasing the strength of the barrier so that different road conditions can be accommodated even though beam sections of constant length are used to construct the barrier. A stretch of barrier of constant strength along its length is established by locating the posts at an even spacing relative to one another, but the design options in terms of the absolute strength of the barrier for a given beam section length are increased.

[0011] According to the present invention, there is further provided a method of constructing a road safety barrier which at least in part comprises a series of beam sections of substantially equal length supported above the ground by posts, the method comprising shifting the locations of the posts relative to the centres of the beam sections from one beam section to the next.

[0012] This method is particularly advantageous as it allows the strength/flexibility of the barrier to be varied in accordance with the obstacles or features such as bridge buttresses that are situated along the length of the barrier as the barrier is constructed using a standard uniform length than necessary in the prior art method of construction.

[0013] Advantageously, the number of posts required that will allow the barrier to conform to the necessary safety criteria can be kept to a minimum, thereby minimising the cost of the barrier itself, and the associated installation and maintenance costs.

[0014] In some embodiments of the invention, the separation between adjacent posts may be such that some beam sections are not directly supported by posts, but are instead supported by the beams (and their supporting posts) to which they are joined at either end.

[0015] According to the present invention, there is further provided a method of testing a crash barrier system, the system comprising a series of beam sections together forming a length of barrier and supported above the ground by way of posts, wherein the positions of successive posts along at least part of the length of the barrier shift relative to the centres of the beam sections such that the stiffness of the barrier varies along the length, the method comprising conducting road crash tests at differing points along the length and determining whether the results of said crash tests satisfy predetermined criteria.

[0016] An embodiment of the invention will now be described by way of example with reference to the following drawings, in which:

Figure 1 depicts a length of road safety barrier constructed in accordance with the prior art;

Figure 2a shows a beam section which may be used to form part of the barrier according to the invention;

Figure 2b is a cross-sectional view of the beam section of Figure 2;

Figure 3 is a cross-sectional view of a 'Z' section post which may be used to support the barrier according to the invention; and

Figures 4-7 are simplified representations of barriers according to exemplary embodiments of the invention.

[0017] Figure 1 illustrates a prior art 'post and beam' type road safety barrier 1 constructed from beam sections 2a to 2d of length 'L' supported above the ground by a series of posts 3a to 3g. The beam sections 2a to 2d are joined and secured together by bolts (not shown) passing through apertures 4a to 4c and/or 7a to 7d provided at overlapping ends of adjacent beam sections such that the distance between the centres of adjacent beam sections is 'C'. Apertures 5a to 5c and 6a to 6c are provided along the longitudinal axis of each beam section to provide a fixing location for a supporting post. In this example, the posts 3a and 3b are fixed to apertures 5a and 5b respectively by bolts (not shown) and the same corresponding positions for the other beams along the length of the barrier 1. The posts are spaced by a distance 'd' inwardly with respect to the centre of respective overlapping ends. It is apparent from Figure 1 that the prior art barrier is supported by posts that are in a fixed positional relationship with reference to the centres of the beam sections.

[0018] Figure 2a shows a beam section 10 which may be used in accordance with one embodiment of the present invention. As illustrated in Figure 2b, the beam section 10 has a 'W' profile. The section 10 is provided with a series of fixing means in the form of slots indicated in Figure 2a by 'Slots A1, A2, A3; Slots B1, B2, B3, B4; and Slots C1 and C2'. Slots A1, A2 and A3 correspond to apertures 4a, 4b and 5b of Figure 1, slots A1 and A3 providing for bolts to secure adjacent beam sections with an optional post. Slots C1 and C2 correspond to apertures 3a and 3b of Figure 1 and provide fixing locations for posts. However, in contrast to figure 1, the beam section 10 is provided with additional fixing means Slot B1, B2, B3 and B4 as shown substantially equi-spaced in relation to the others. These additional slots, although is would be apparent to the skilled man in the art that an alternative form of post fixing means may be adopted, provide fixing locations which allows the post locations to be shift along the length of the barrier. Still further slots or fixing means may be provided in the beam section thereby allowing the posts to shift in relation to the beam sections by smaller increments along the length thereof.

[0019] Figure 3 is an example of a 'Z' section post 3a which may be used in embodiments of the invention, showing additionally the orientation thereof in relation to the direction of traffic flow when installed.

[0020] Figure 4 shows elevational and plan views of a longer section of road safety barrier 20 in order to illustrate the shift of posts relative to the centres of the beam sections as the barrier advances from one direction to the other. In this example, the barrier is constructed from beam sections 22a, 22b, 22c etc. which are of substantially equal length (3.2m) and supported by posts 24a, 24b, 24c etc which, although they are equally spaced apart (2m), are staggered relative to the centres or ends of the beam sections. In other words, in this example, the spacing of the posts is such that although post 24g is fixed at the overlapping portions of adjacent beam sections 22d and 22e respectively, the next recurrence of coincidence between a post and beam section overlap occurs five beam section lengths away in either direction. The frequency of coincidence is therefore a function of the average number of posts supporting each beam section, i.e. 1.6 (8 posts divided by 5 beam sections) and so a function of the strength or flexibility of the barrier. Clearly, the closer the post spacing for a given beam section length, the stronger the barrier because, on average, each beam section is supported by more posts. However, from the constructional standpoint, it is clear that the flexibility or strength of the barrier can be simply varied by varying the post spacing in a progressive manner along the length thereof. Should it be desired to install a stronger section of barrier to shield a bridge buttress for example, the contractor simply has to bring the spacing of the posts closer together for that section. The advantage with the barrier embodying the present invention is that he may do so using standard beam sections. It is also possible for a designer/contractor to change the strength of a barrier after initial installation by shifting the posts without need to change the beam sections as well.

[0021] Figures 5-7 show three alternative embodiments. In figure 5, there are 4 posts supporting 3 beam sections - a ratio of 1.33 posts per section. In figure 6, the barrier is more flexible because there are fewer posts per beam section on average, namely 8 posts supporting 9 beam lengths. In figure 7, 4 posts support 5 beam sections so that every 5 beam lengths (or 'repeat'), one beam is supported only by its adjacent beams.

[0022] Examples of the ratio, for a given length of barrier, of the distance between adjacent posts to the beam section length may include any one of: 0.5; 0.625; 0.75; 0.875; 1.0; 1.125; and 1.25 although the more flexibility there is for locating posts along a beam section, the more finely graded the shifting of the posts may be.

[0023] Although the aforementioned examples show equal post spacing, the degree of shift may increase or decrease along the length of the barrier to facilitate a graded change in flexibility.

Claims

1. A road safety barrier comprising a series of beam sections together forming a length of barrier and supported above the ground by way of posts, wherein the positions of successive posts along at least part of the length of the barrier shift relative to the centres of the beam sections.

2. A road safety barrier according to claim 1, wherein the shift in respect of the posts along part of the length of the barrier is progressive but uniform.

3. A road safety barrier according to claim 2, wherein the uniform shift is such as to provide a substantially constant flexibility along that length of the barrier.

4. A road safety barrier according to claim 1, wherein the shift in respect of the posts along part of the length of the barrier varies.

5. A road safety barrier according to claim 4, wherein the flexibility of the barrier varies in accordance with the varying shift along that length of the barrier.

6. A road safety barrier according to claim 1, wherein the spacing between adjacent posts along a first section of the barrier differs from that of a second section, such that the first section has a different flexibility characteristic from the second section, and that the lengths of the beam sections forming said first and second sections are substantially equal to one another.

7. A road safety barrier according to any one of claims 1 to 3, wherein the post spacing is substantially equal along said at least part of the length of the barrier.

8. A road safety barrier according to any one of the preceding claims, wherein over a given length of the barrier, the ratio of the post spacing to the beam section length or distance between adjacent centres lies within the range 0.5 to 1.25.

9. A road safety barrier according to any one of the preceding claims, wherein the beam sections along said at least part of the length of the barrier are each provided with fixing means positioned at more than five locations along their length, the fixing means providing for location and fixing of the posts to the beam section.

10. A road safety barrier according to claim 9, wherein said fixing means of at least some of said beam sections are substantially equally spaced apart with respect to one another.

11. A road safety barrier according to any one of the

preceding claims, wherein the beam sections are corrugated.

12. A road safety barrier according to claim 11, wherein the corrugated beam sections have a 'W' profile.

13. A road safety barrier according to any one of the preceding claims, wherein at least some of the posts are 'Z'-shaped in cross-section.

14. A method of constructing a road safety barrier which at least in part comprises a series of beam sections of substantially equal length supported above the ground by posts, the method comprising shifting the locations of the posts relative to the centres of the beam sections from one beam section to the next.

15. A method according to claim 14, wherein the spacing between the posts is substantially equal such that said part has a substantially uniform flexibility characteristic.

16. A method according to claim 14, wherein the spacing between the posts progressively varies from one beam section to the next such that the flexibility of the part of the barrier varies along its length.

17. A method of testing a crash barrier system, the system comprising a series of beam sections together forming a length of barrier and supported above the ground by way of posts, wherein the positions of successive posts along at least part of the length of the barrier shift relative to the centres of the beam sections such that the stiffness of the barrier varies along the length, the method comprising conducting road crash tests at differing points along the length and determining whether the results of said crash tests satisfy predetermined criteria.

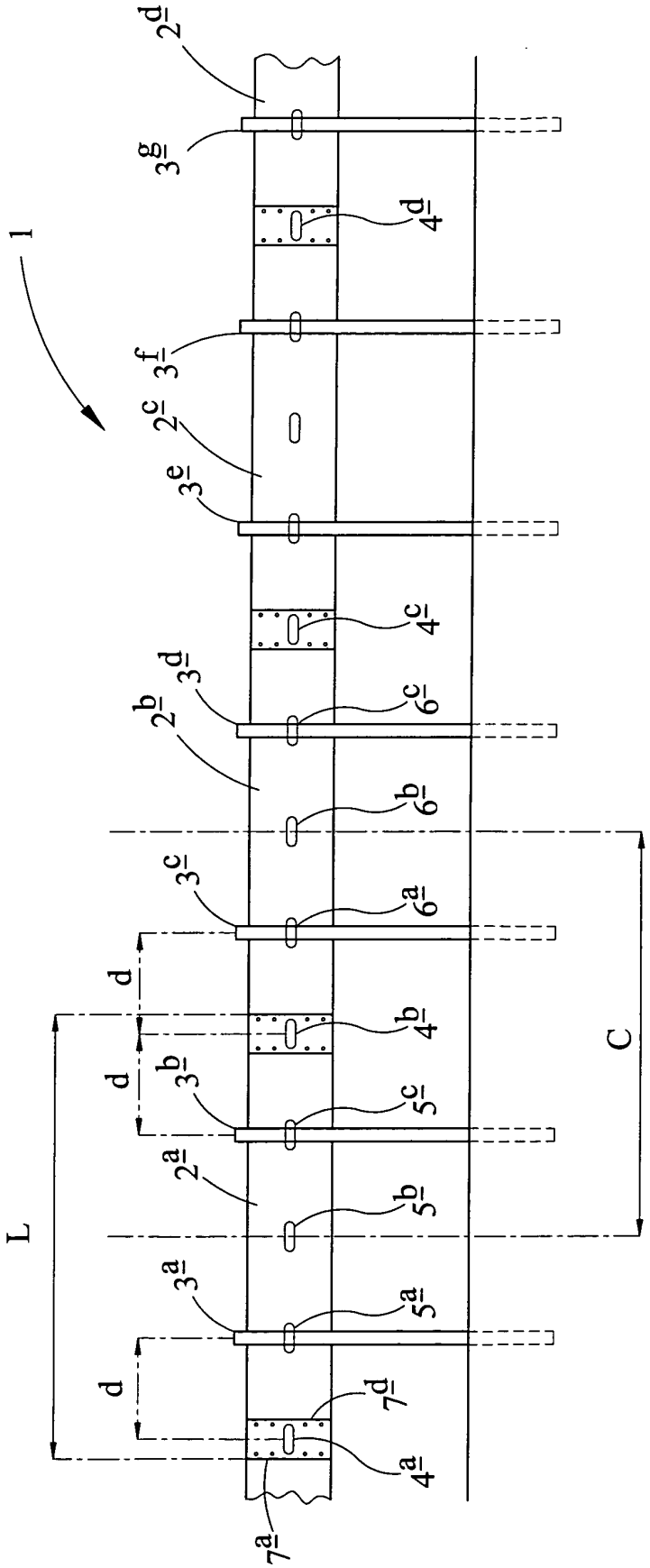

1
2d
3g
4d
3f
2c
3e
4c
3d
2b
6c
6b
3c
6a
d
4b
3b
5c
2a
5b
3a
5a
7d
4a
7a
L
C

FIG 1

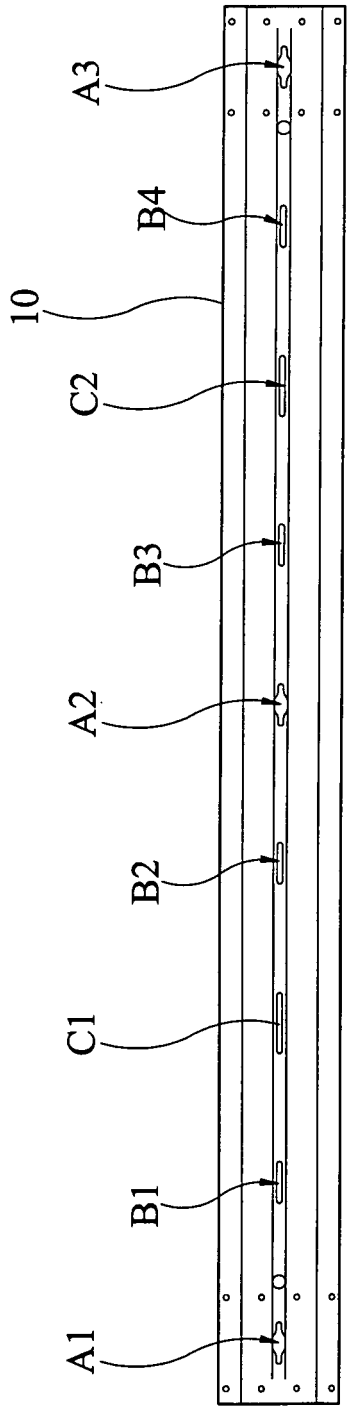


FIG 2a

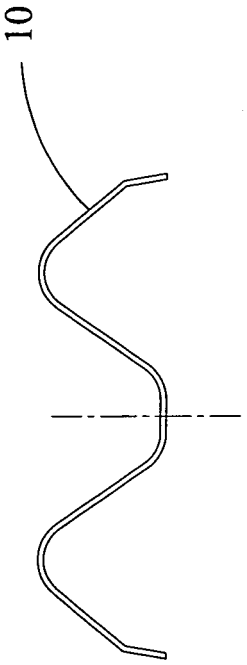
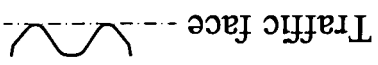


FIG 2b



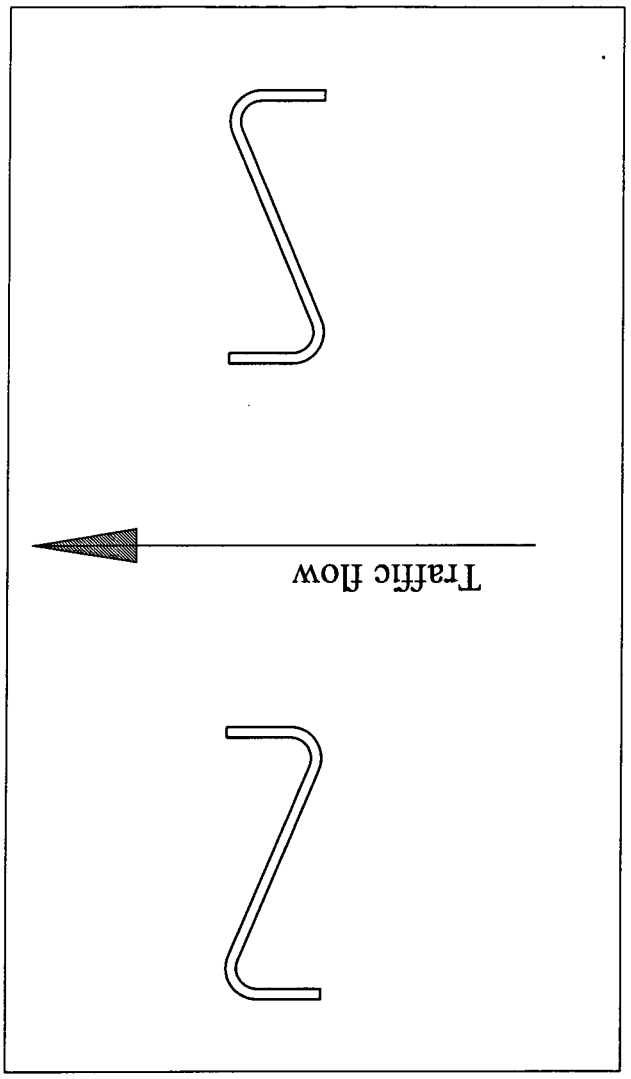
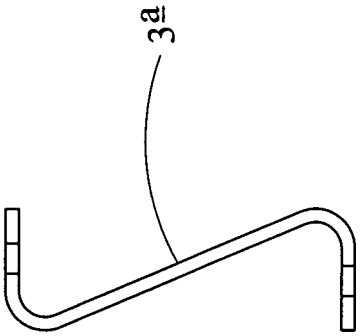


FIG 3



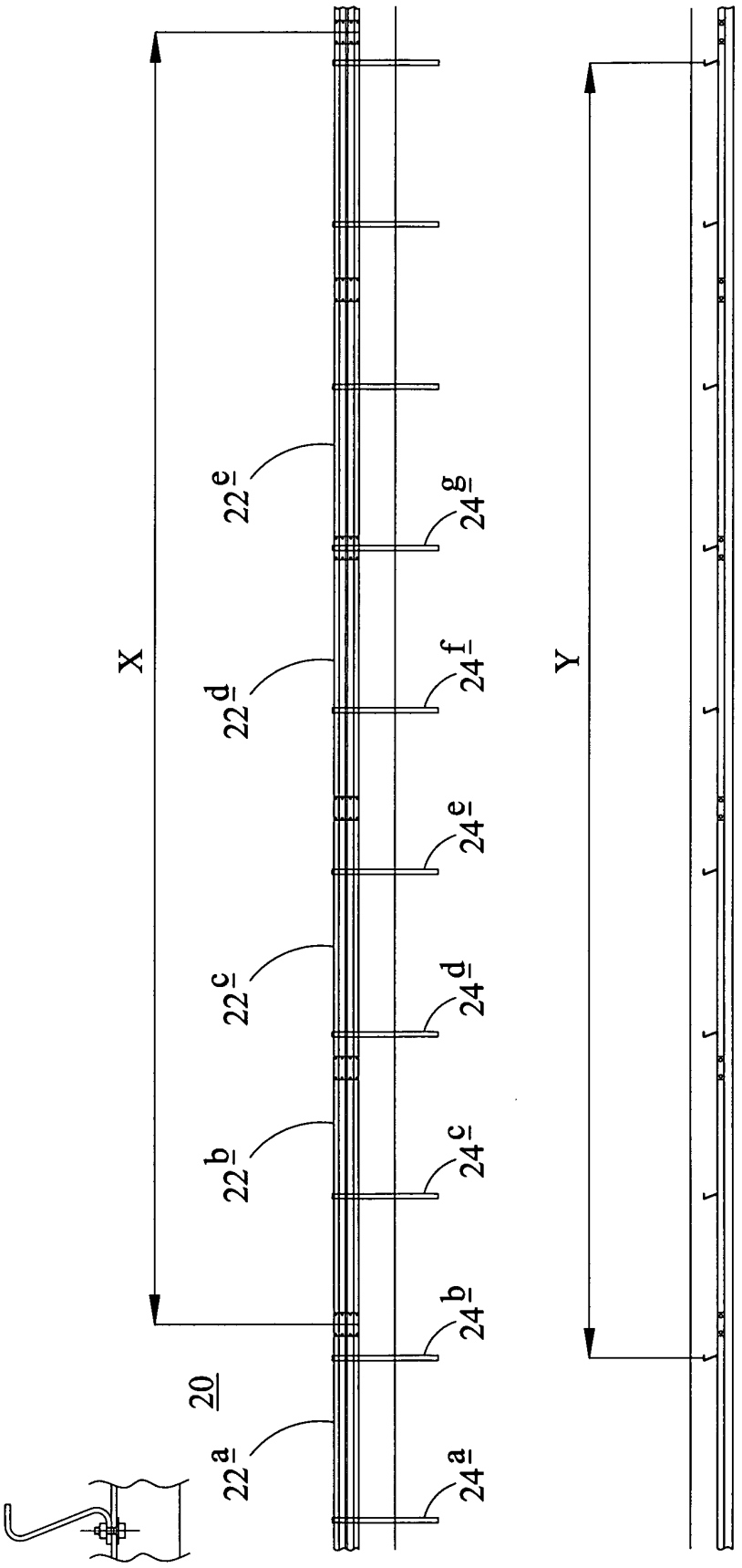

X
Y
20
22a
22b
22c
22d
22e
24a
24b
24c
24d
24e
24f
24g
Traffic flow

FIG 4

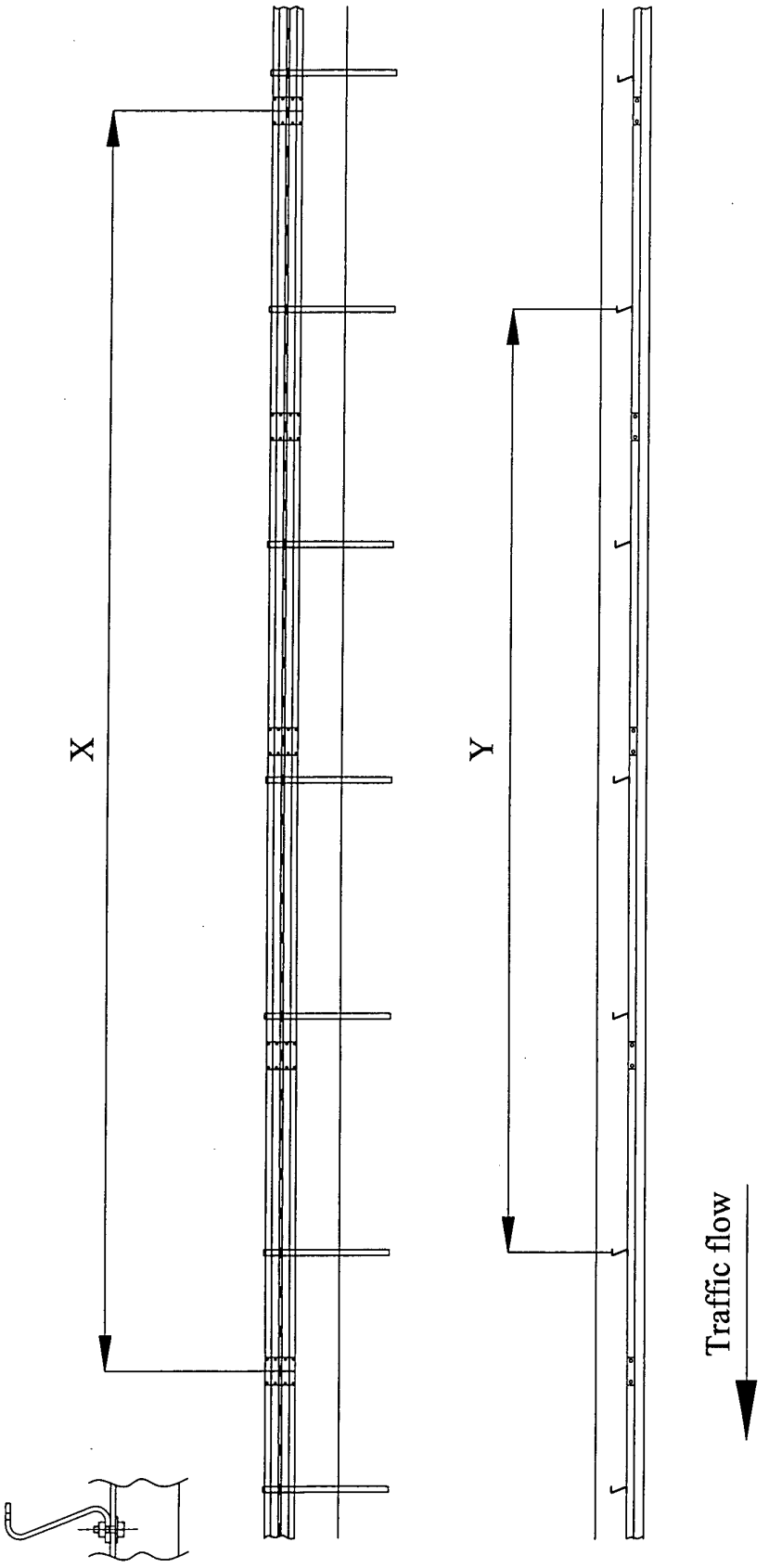


FIG 5

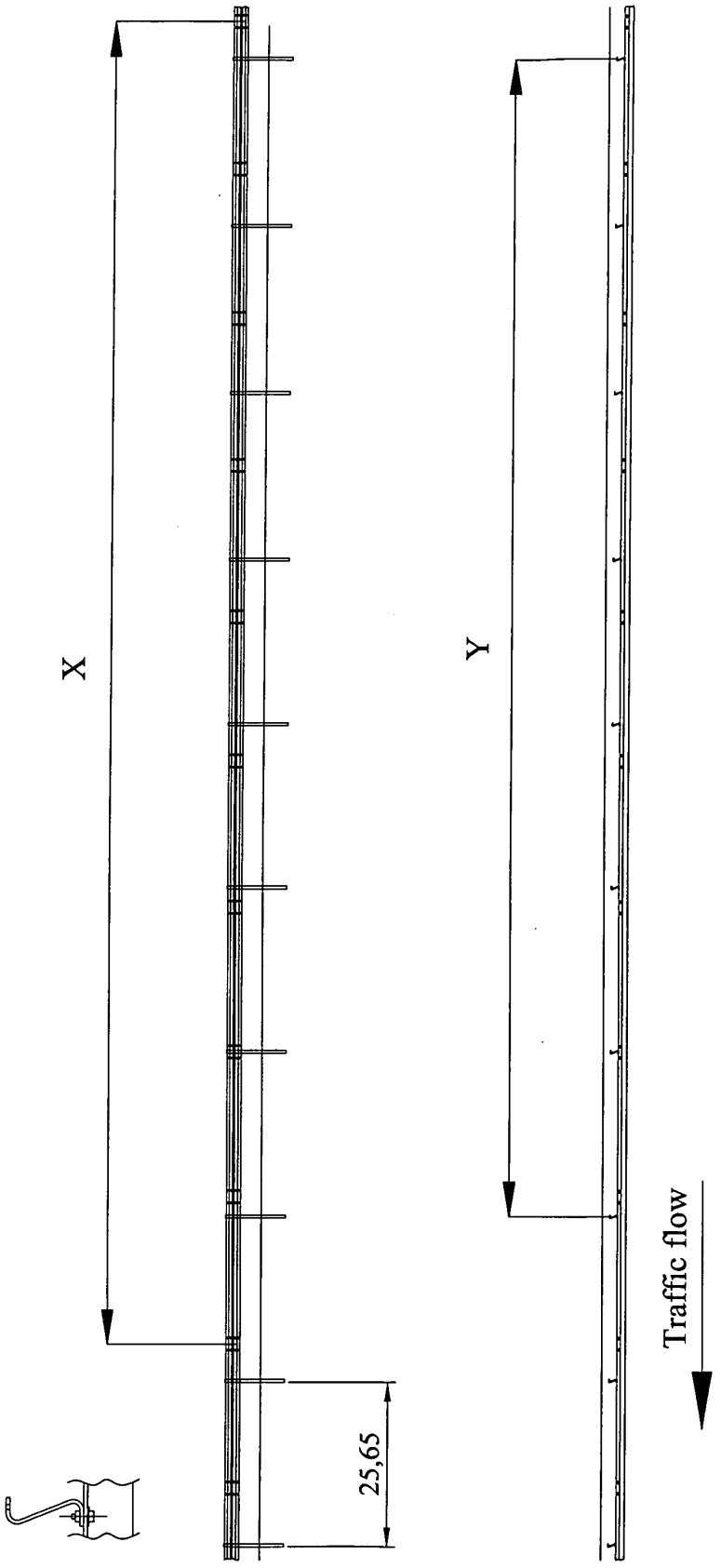


FIG 6

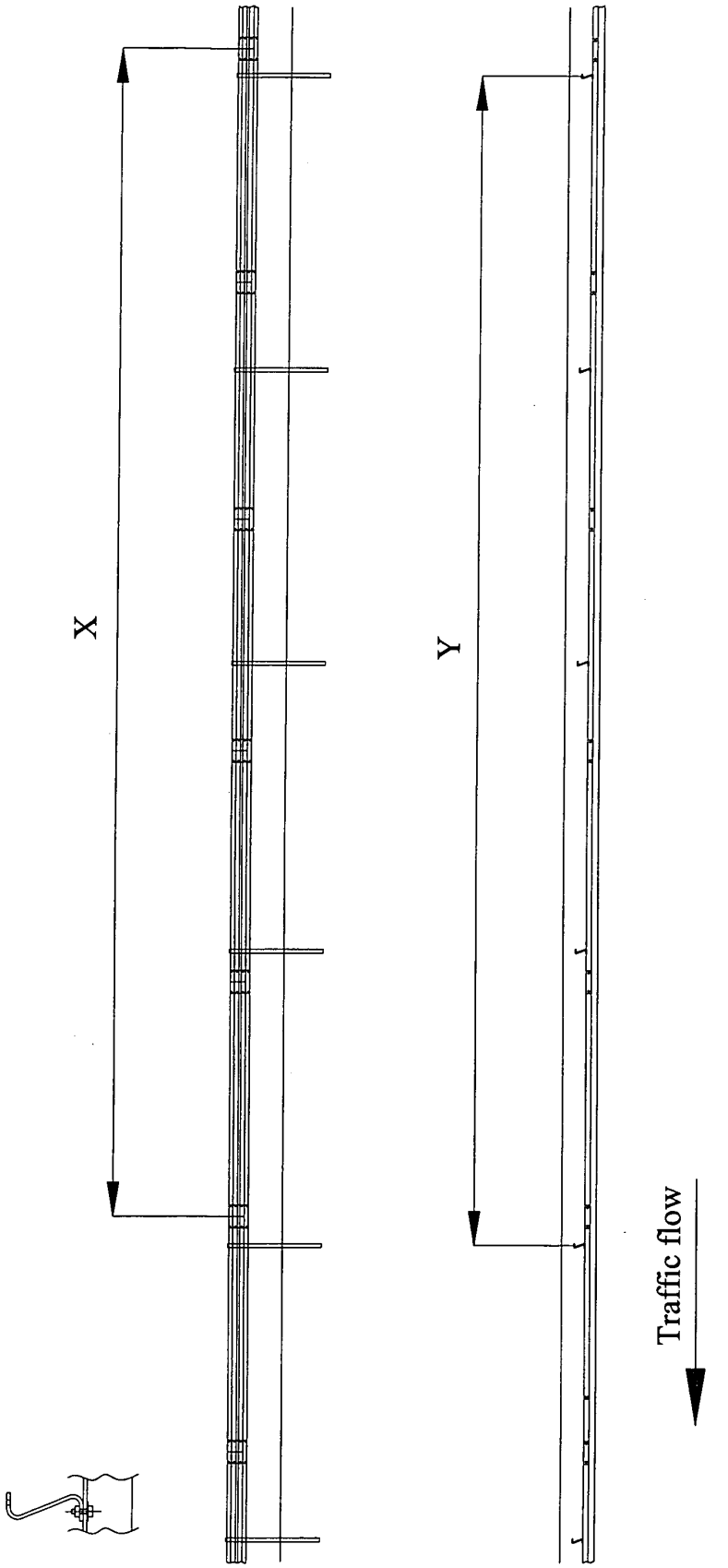


FIG 7