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Alberson et al.

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(54) **STEEL YIELDING GUARDRAIL SUPPORT POST**

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(51) **Int. Cl.**[7] **E01F 15/00**

(52) **U.S. Cl.** **256/13.1**; 404/6; 404/9; 404/10

(58) **Field of Search** 256/1, 13.1; 404/6, 404/9, 10

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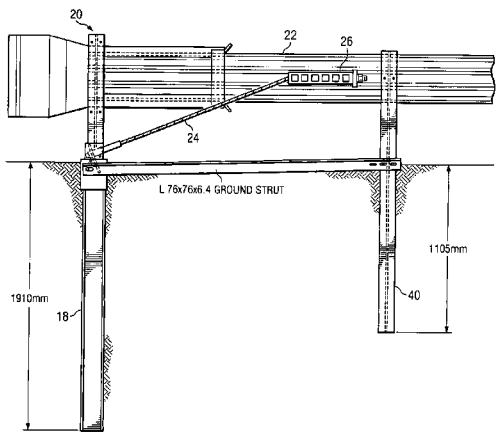
(57) **ABSTRACT**

A guardrail support post includes a continuous structural member having a top edge, a bottom edge, and a generally uniform cross section from the top edge to the bottom edge. The structural member includes first and second generally parallel flanges, and a web forming a coupling between, and extending generally perpendicular to the first and second flanges. The structural member includes a lower portion for installing below grade adjacent a roadway, and an upper portion configured to be coupled with a guardrail beam. A mid portion of the structural member is disposed between the upper portion and the lower portion. In accordance with a particular embodiment of the present invention, the first and second flanges include first and second cutouts, respectively, that occur within the mid portion. The cutouts are operable to weaken the structural member about an axis generally perpendicular to the flanges without substantially weakening the structural member about an axis generally parallel to the flanges.

25 Claims, 3 Drawing Sheets



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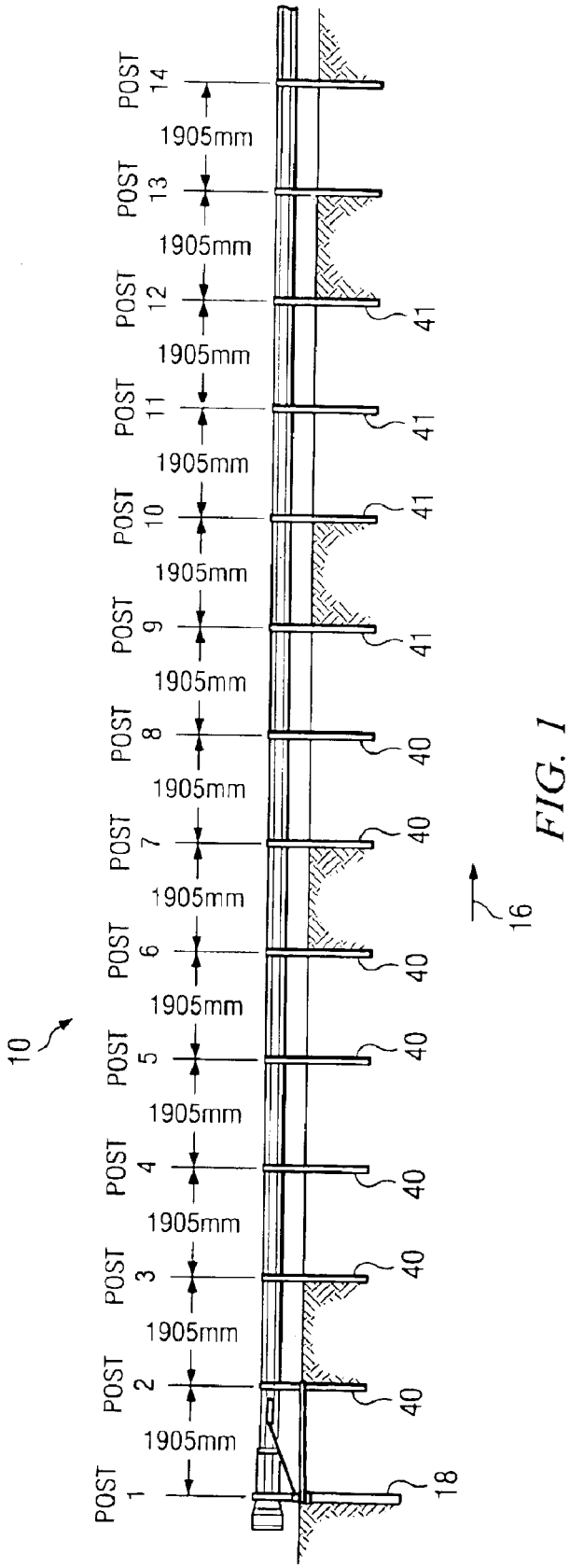
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FIG. 1

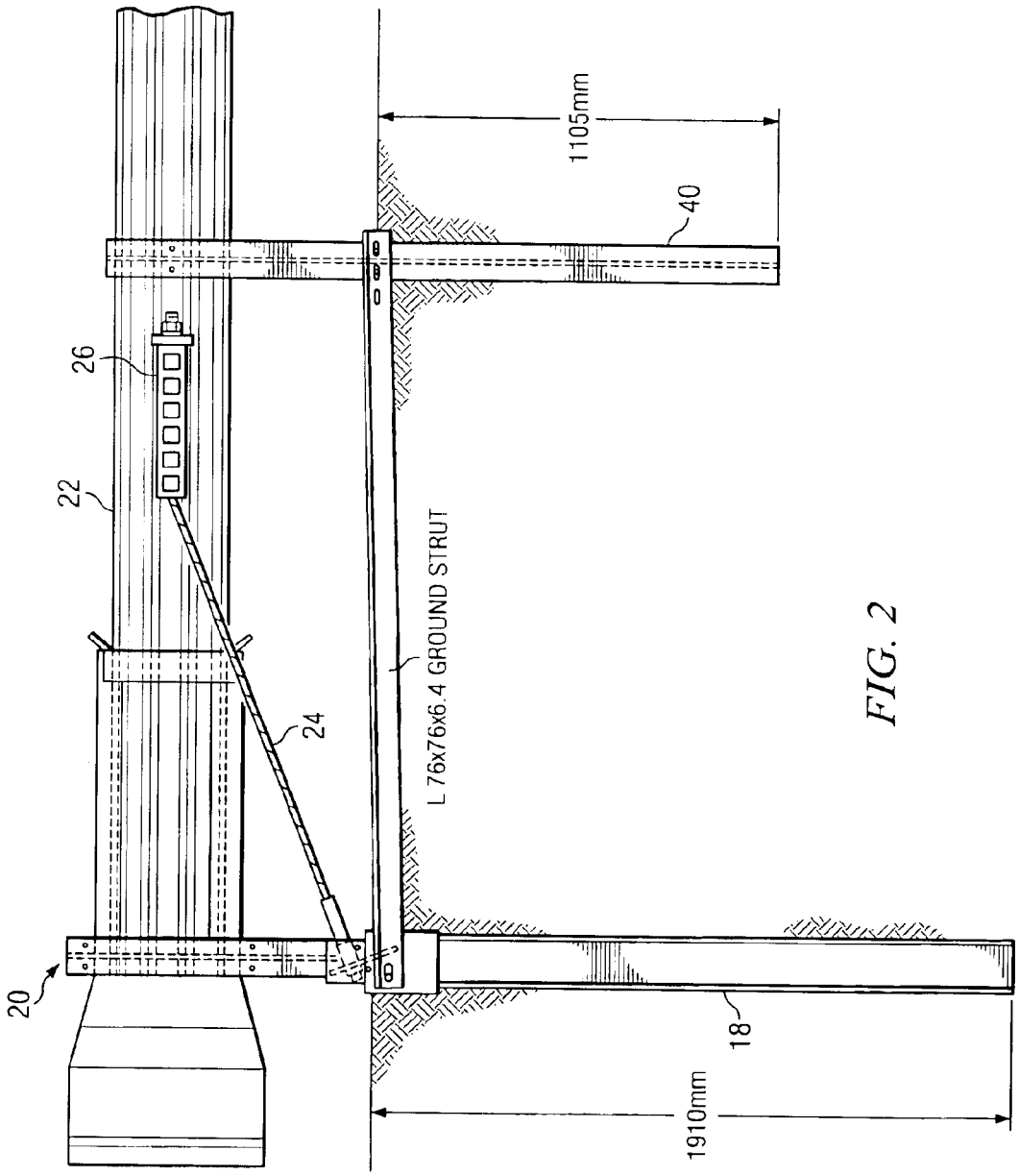

FIG. 2

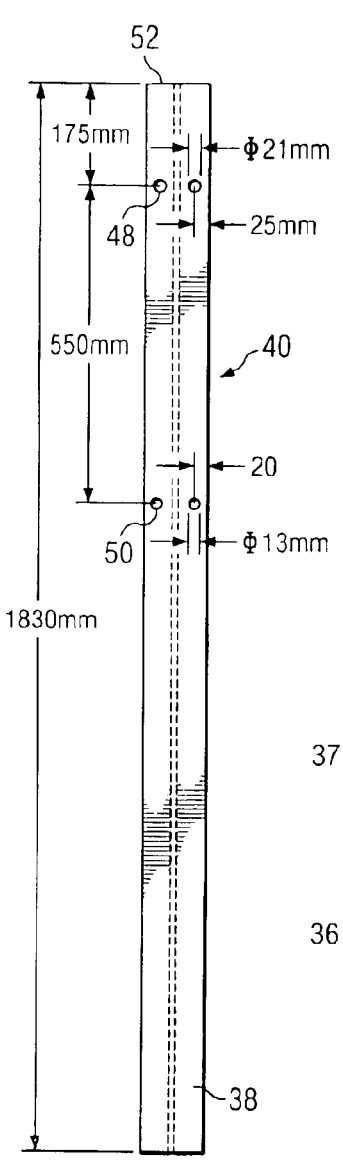

FIG. 3A

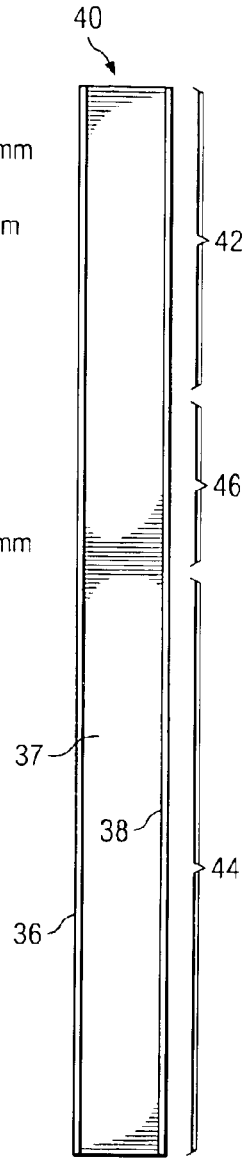

FIG. 3B

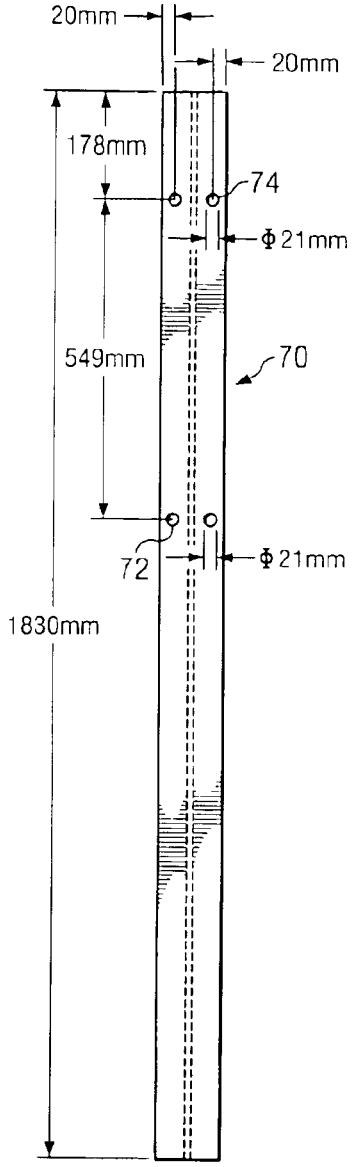

FIG. 4A

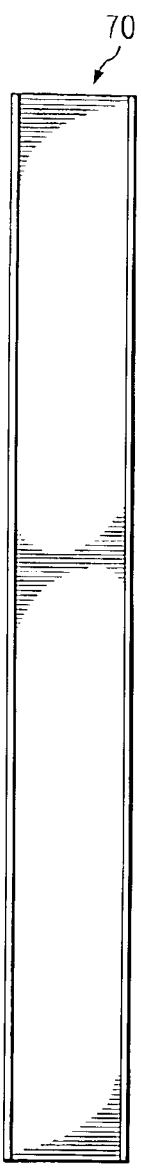

FIG. 4B

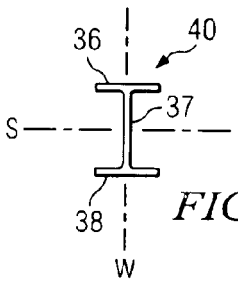

FIG. 3C

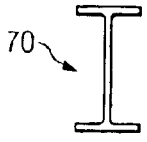

FIG. 4C

STEEL YIELDING GUARDRAIL SUPPORT POST

RELATED APPLICATION

This application claims the benefit of U.S. Provisional Application Ser. No. 60/334,286 filed Nov. 30, 2001.

TECHNICAL FIELD OF THE INVENTION

The present invention relates generally to guardrail systems and more particularly, to a steel yielding guardrail support post.

BACKGROUND OF THE INVENTION

Guardrail systems are widely used along heavily traveled roadways to enhance the safety of the roadway and adjacent roadside. Guardrail beams and their corresponding support posts are employed to accomplish multiple tasks. Upon vehicle impact, a guardrail acts to contain and redirect the errant vehicle.

For many years, a standard heavy gauge metal guardrail known as the "W-beam" has been used on the nation's roadways to accomplish these tasks and others. Named after its characteristic shape, the "W-beam" is typically anchored to the ground using posts made of metal, wood or a combination of both.

Wood posts are more readily available and more economical than metal posts in some geographical areas. In other areas, metal (e.g., steel) posts are more readily available and more economical, and are preferred for their ease of installation using driving methods.

Wood posts used in a terminal portion of a guardrail have been made to break away upon impact, thus producing a desired behavior during a collision by a vehicle at the end of the terminal section. However, in some environments, wood posts deteriorate more rapidly and alternate materials are sought. Commonly used steel posts do not break away in the desired fashion, and are not suitable for use in the terminal section of a guardrail system.

Break away steel support posts that are modified to allow for failure during a collision have recently become available. Examples include a "hinged breakaway post" and the "energy absorbing breakaway steel guardrail post" described in U.S. Pat. No. 6,254,063. Many such prior attempts require substantial time, money, and resources during fabrication, modification, and/or installation.

SUMMARY OF THE INVENTION

A guardrail support post is provided, for use in securing guardrail beams adjacent roadways. The guardrail support post has been modified to weaken the support post along a direction generally parallel to the flow of traffic. This allows for failure, or yielding of the guardrail support post during a head-on collision of a vehicle with a guardrail terminal, or other guardrail section. Accordingly, the support posts of a guardrail system will yield as a vehicle impacts consecutive support posts, and absorb kinetic energy of the vehicle, until the vehicle is brought to a stop.

In accordance with a particular embodiment of the present invention, a guardrail support post includes a continuous structural member having a top edge, a bottom edge, and a generally uniform cross section from the top edge to the bottom edge. The structural member includes first and second generally parallel flanges, and a web forming a coupling between, and extending generally perpendicular to the first and second flanges. The structural member may have a lower portion for installing below grade adjacent a roadway, and an upper portion configured to be coupled with a guardrail beam. A mid portion of the structural member is disposed between the upper portion and the lower portion. In accordance with at least one embodiment of the present invention, the first and second flanges include first and second cutouts, respectively, that occur within the mid portion. The cutouts may be operable to weaken the structural member about the axis generally perpendicular to the flanges without excessively weakening the structural member about an axis generally parallel to the flanges.

In accordance with another embodiment of the present invention, each of the cutouts includes a vertical dimension and a horizontal dimension. A ratio of the vertical dimension to the horizontal dimension may be approximately equal to or less than one.

In accordance with yet another embodiment of the present invention, the cutouts comprise generally circular cutouts. Each generally circular cutout may include a diameter of approximately thirteen millimeters.

In accordance with still another embodiment of the present invention, the generally circular cutouts may be sized approximately equal to bolt holes configured to receive fasteners for coupling the guardrail beam with the support member. For example, the generally circular cutouts may include a diameter of approximately twenty-one millimeters.

Technical advantages of particular embodiments of the present invention include a guardrail support post that is weakened about a "weak axis" such that the guardrail support post will fail or yield during a head-on collision with a terminal section of the guardrail. The guardrail support post may also have sufficient strength to redirect vehicles that collide along the length of the guardrail system at an angle to the flow of traffic.

Another technical advantage of particular embodiments of the present invention includes a support post that has been weakened at a particular point along its mid section. This allows the most likely point of failure of the support post during a head-on collision (parallel to the direction of traffic) to be predetermined and/or controlled.

Other technical advantages will be readily apparent to one skilled in the art from the following figures, descriptions and claims. Moreover, while specific advantages have been enumerated above, various embodiments may include all, some or none of the enumerated advantages.

BRIEF DESCRIPTION OF THE DRAWINGS

For a more complete understanding of the present invention, and the advantages thereof, reference is now made to the following brief descriptions, taken in conjunction with the accompanying drawings and detailed description, wherein like reference numerals represent like parts, in which:

FIG. **1** illustrates a side view of a guardrail system that incorporates aspects of the present invention;

FIG. **2** is a side view, with portions broken away, illustrating an enlarged section of a portion of the guardrail system of FIG. **1**;

FIG. **3** illustrates a guardrail support post suitable for use with the guardrail system of FIG. **1**, in accordance with a particular embodiment of the present invention; and

FIG. **4** illustrates another guardrail support post suitable for use with the guardrail system of FIG. **1**, in accordance with another embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

FIGS. **1** and **2** illustrate portions of a guardrail safety system **10** that incorporates aspects of the present invention. Guardrail system **10** may be installed adjacent a roadway, to protect vehicles, drivers and passengers from various obstacles and hazards, and prevent vehicles from leaving the roadway during a traffic accident or other hazardous condition. Guardrail systems incorporating aspects of the present invention may be used in median strips or shoulders of highways, roadways, or any path that is likely to encounter vehicular traffic. Guardrail system **10** includes a guardrail beam **12**, and support posts **14** that anchor guardrail beam **12** in place along the roadway.

In accordance with the teaching of the present invention, support posts **14** have been modified to decrease the strength of support posts **14** in a direction generally parallel to axis **16** (generally along the direction of traffic) without substantially decreasing its strength in a direction generally perpendicular to axis **16** (out of the page in FIG. **1**). Accordingly, if a vehicle impacts guardrail system **10** "head-on" adjacent terminal post **18**, support posts **14** will tend to fail (e.g., buckle), while allowing the vehicle to decelerate as it impacts consecutive support posts. However, if a vehicle strikes guardrail system **10** along the face of and at an angle to guardrail beam **12**, support posts **14** will provide sufficient resistance (strength) to redirect the vehicle along a path generally parallel with guardrail beam **12**.

Guardrail system **10** is intended to keep errant vehicles from leaving the roadway during a crash or other hazardous situation. In many instances, guardrail **10** is installed between a roadway and a significant hazard to vehicles (e.g., another roadway, a bridge, cliff, etc.). Therefore, guardrail system **10** should be designed to withstand a significant impact from a direction generally perpendicular to the roadway, without substantial failure. It is this strength that allows guardrail system **10** to withstand the impact, and still redirect the vehicle so that it is once again traveling generally in the direction of the roadway.

However, testing and experience has continuously shown that guardrail systems may actually introduce additional hazards to the roadway and surrounding areas. This is particularly true with respect to vehicles that impact the guardrail system adjacent its terminal section, in a direction generally parallel to the roadway. For example, if the guardrail system were rigidly fixed in place during a crash, serious injury and damage may result to the errant vehicle, its driver and passengers. Accordingly, many attempts have been made to minimize this added risk.

One such method used to reduce the frequency and amount of damage/injury caused by head on collisions with a guardrail system included a terminal portion that was tapered from the ground up. This effectively reduced the impact of head on collisions, but also created a ramp-like effect that caused the vehicles to go airborne during a crash.

Other methods include breakaway cable terminals (BCT), vehicle attenuating terminals (VAT), SENTRE end treatments, breakaway end terminals (BET) and the breakaway support posts of U.S. Pat. No. 6,398,192 ("'192 Patent"). Many such terminals, supports, end treatments and the like are commercially available from various organizations. Examples include the HBA post by Exodyne Technologies and Trinity Industries, and a breakaway support post similar in configuration to that described in the '192 Patent.

FIG. **2** illustrates a portion of the terminal section of guardrail system **10**, in more detail. This is referred to the terminal section since the guardrail section terminates at this point. The terminal section includes an end terminal assembly **20** that is specially configured to absorb the impact of a head on collision, to minimize damage and injury caused by such a collision.

End terminal assembly **20** is anchored to the ground using break away terminal post **18**. End terminal assembly **20** is slidably coupled with a section of guardrail beam **22**. Terminal post **18** is coupled with guardrail beam **22** using a cable **24** and coupling assembly **26**. A ground strut **28** couples terminal post **18** with guardrail support post **40**. As discussed above, guardrail support post **40** is configured to break away when a significant force is applied along its weak direction. The specifics of guardrail support post **40** will be addressed in more detail with respect to FIGS. **3** and **4**.

Referring again to FIG. **1**, guardrail system **10** includes one terminal post **18**, and seven guardrail support posts **40**. Collectively, this configuration forms the terminal section of guardrail system **10**. Standard guardrail support posts **41** may be used for the balance of guardrail system **10**. However, it should be recognized by those of ordinary skill in the art that support post **40** described herein is suitable for installation at any location within a guardrail system, within the teachings of the present invention.

FIG. **3** illustrates a guardrail support post **40**, in accordance with a particular embodiment of the present invention. Support post **40** includes an elongate, continuous structural member of a standard Wide flange configuration. Support post **40** includes two flanges **36** and **38**, that are generally parallel with one another, and in a spaced relation. A web **37** forms the coupling between flanges **36** and **38**. Flanges **36** and **38** include a generally identical configuration of bolt-holes **48** and cutouts **50**, therein.

With regard to a Wide flange shape used as a guardrail post, the cross section is typically shaped like the letter "H". The cross section has two major axes for bending. The "weak" axis generally refers to a central axis that extends through the web and is perpendicular to the flanges. The "strong" axis generally refers to a central axis that is perpendicular to the web and parallel to the planes of the flanges. The weak axis for a conventional installation of guardrail extends generally transversely to the road. The strong axis extends generally along the roadway.

In the illustrated embodiment of FIG. **3**, the Wide flange is a standard W6×9, which is commonly used in fabricating support posts for guardrail installations. In fact, one advantage of the present invention is the ability to re-use existing, standard equipment to fabricate, modify, and install support post **40**, without substantial modification to the equipment. Those of ordinary skill in the art will recognize that wide flange beams may be available in many different sizes. For example, a standard W6×9 Wide flange may have a nominal six-inch depth and weigh nine pounds per foot. However, a Wide flange having a six-inch depth and weighing eight and one-half pounds per foot may also be referred to as a W6×9 Wide flange and they are considered equivalent in the trade. The term "W6×9 Wide flange" is intended to refer to all sizes and configurations of guardrail posts that may be referred to as "W6×9" by a person of ordinary skill in the art. In addition, persons skilled in the art recognize other names used for wide flanges include but are not limited to "I-beam," "H-beam," "W-beam," "S-beam," "M-beam," or the term "shape" may be substituted for "beam."

Support post **40** includes a relatively "weak" axis W, and a relatively "strong" axis S. For the reasons described above,

support post **40** is normally installed along a roadway such that weak axis W is generally perpendicular to the direction of traffic, and strong axis S is generally parallel to the direction of traffic. Accordingly, support post **40** is typically able to withstand a significant impact (e.g., with a car travelling at a high rate of speed) about the strong axis S without substantial failure. However, support post **40** is intentionally designed such that failure will more readily occur in response to an impact about the weak axis W.

Support post **40** is approximately 1,830 mm long, and includes an upper portion **42**, a lower portion **44**, and a mid portion **46** which couples upper portion **42** with lower portion **44**. Upper portion **42** includes two boltholes **48** that are adapted to receive connectors for the installation of a guardrail beam (e.g., guardrail beam **12**) upon support post **40**. Lower portion **44** is suitable for installation below grade, as part of a guardrail support system. Mid portion **46** includes two cutouts **50**, which are configured to further weaken support post **40** about the weak axis W, to more readily allow for failure due to impact from a vehicle along that direction. The overall length of support post **40**, and its upper, lower and mid portions may vary significantly, within the teachings of the present invention.

Bolt holes **48** include a standard configuration that allow for the installation of widely used guardrail beams, upon support posts **40**. In general, bolt holes **48** align with the center of the guardrail beam, and maintain the center of the guardrail beam approximately five hundred and fifty millimeters above grade. However, the number, size, location and configuration of boltholes **48** may be significantly modified, within the teachings of the present invention.

Cutouts **50** are positioned within mid portion **46** to weaken support post **40** about weak axis W, adjacent grade (when installed). This will accommodate failure of support post **40** approximately at grade, allowing support post **40** to "fold" over from the point of failure, upward. Since lower portion **44** is below grade, it is not expected that the ground, or lower portion **44** of support post **40** will appreciably deflect during an impact.

Since cutouts **50** are intended to occur approximately at grade, and the center of bolt holes **48** are intended to occur five hundred and fifty millimeters above grade, bolt holes **48** occur five hundred and fifty millimeters above cutouts **50**, in the illustrated embodiment. It will be recognized by those of ordinary skill in the art that the size, configuration, location and number of bolt holes, cutouts, and their relationship with each other, may be varied significantly within the teachings of the present invention.

In the illustrated embodiment of FIG. **3**, cutouts **50** occur approximately seven hundred and twenty-five millimeters below a top edge **52** of support post **40**. However, the location of cutouts **50** may vary in accordance with the teachings of the present invention. The configuration of FIG. **3** envisions that cutouts **50** will occur approximately at grade level. In other embodiments, cutouts **50** may occur below grade or above grade. The depth of cutouts **50** below grade should not exceed an amount that will prevent support post **40** from failing at or near the location of cutouts **50**. At some depth below grade, the surrounding earthen (or other) material will reinforce lower portion **44** of support post **40** to an extent that will no longer accommodate such failure to occur.

The height of cutouts **50** above grade should not exceed a point at which support post **40** will fail at cutouts **50**, and leave a "stub" above grade which can snag vehicles, and otherwise cause excessive injury and/or excessive damage. Such a stub could be detrimental to the redirective effect of the guardrail system in which support post **40** is operating.

As described above, several attempts have been made in the past to allow for failure of a terminal guardrail post in the weak direction. Such attempts often include two-piece sections of support post that are welded or otherwise fastened together using plates, bolts etc. Such efforts have been focused upon accommodating failure of the support post at a certain area of the support post, when impacted in the weak direction. The present invention provides an enhanced alternative to such techniques.

For example, support post **40** is a single, continuous structural member that does not require any labor in field assembly, welding, or special handling. With the exception of boltholes **48** and cutouts **50**, support post **14** has a continuous, generally uniform cross-section from top edge **52**, to bottom edge **54**. Therefore, fabrication of support post **40** is simplified, with respect to other multiple component products. Furthermore, support post **40** can be shipped as one piece, and installed as one piece. Many prior attempts that included multiple components that were hinged, or otherwise connected could not be shipped, and/or installed as a single unit without damaging the support post.

Similarly, many such prior efforts required specialized equipment for proper installation, and often required a significant amount of field labor to perform such installation. In contrast, support post **40** of the present invention can be installed using traditional guardrail post installation equipment (e.g., guardrail post drivers).

Cutouts **50** of support posts **40** are configured to reduce the strength of support post **40** about weak axis W, without substantially weakening support post **40** about strong axis S. In the illustrated embodiment, cutouts **50** comprise generally circular openings that have been punched or drilled through support post **40**.

Previous attempts to accommodate failure of a guardrail support post have often weakened the support post about the strong axis S, which impacts the support post's ability to redirect a vehicle that collides with the support in a direction generally perpendicular to the roadway. For this reason, such support posts may be unacceptable for use along a roadway, and may fail to comply with governing federal standards bodies' requirements.

Patent Application PCT/US98/09029 ('029 Application) illustrates a support post having slotted openings disposed therein. These slots are substantially longer (vertically) than they are wide (horizontal).

Cutouts **50** provide an enhanced ability to control the point of failure of support post **40** during a collision with a vehicle. For example, the support post of the '029 Application may fail at any point along the slots, and failure may be based upon imperfections in the material adjacent the slots. By limiting the vertical dimension of cutout **50**, it is easier to dictate the precise point of failure of support post **40** along its vertical length.

Furthermore, the slots of the '029 Application require the removal of a substantial amount of material from the flange. This weakens the flange along directions other than perpendicular to the web. Furthermore, during a dynamic crash situation, in which the impact may come from any angle, twisting or bending of the flange may result in the flange changing its orientation in response to the initial impact. Accordingly, the support post having vertical slots similar to the '029 Application may fail prematurely along the strong axis and lose its ability to redirect the vehicle.

In accordance with the teachings of the present invention, the vertical dimension of cutout **50** is limited based upon the

horizontal dimension of cutout **50**. For example, a ratio of the vertical dimension of any particular cutout may be equal to, or less than three times the horizontal dimension. Alternatively, the ratio may be limited to two times the horizontal dimension. In the illustrated embodiment of FIG. **3**, the ratio is 1:1, since cutout **50** is generally a circular opening in the support post. The smaller the vertical dimension of the cutout, the more precisely the designer may dictate the point of failure along the vertical length of support post **40**.

Various configurations of cutouts **50** are available to a designer of support post **40**, in accordance with the teachings of the present invention. For example, rather than circular openings, cutouts **50** may comprise square, rectangular, triangular, oval, diamond shaped, or practically any other geometric configuration, and still obtain some or all of the benefits described herein.

The horizontal orientation of cutouts **50** within flanges **36** and **38** may also be altered significantly, within the teachings of the present invention. In the illustrated embodiment of FIG. **3**, cutouts **50** are located approximately twenty millimeters from outer edges of flanges **36** and **38**. However, in alternative embodiments, cutouts **50** may be located closer to such edges, or further from such edges. In one embodiment, cutouts **50** may be configured such that they extend all the way to the edge of the flange, such that there is a break in material beginning at the edge. In this manner, a traditional punch could be employed at the edge, to form a semi-circular opening that extends to the edge of the flange.

Alternatively, a sawcut could be employed from the outer edge of the flange, and extending inward, to form cutouts **50**. In this manner, the sawcut would form the starting point of the likely point of failure along the weak axis of the support post. Rather than a sawcut, a similar configuration may include a slot in which the longest dimension extends horizontally through the flange. Such a slot may begin or terminate at the edge of the flange, or otherwise be disposed completely within the material of the flange.

FIG. **4** illustrates a support post **70**, in accordance with another embodiment of the present invention. Support post **70** is a W8×10 Wide flange, and is therefore slightly larger and heavier than the W6×9 Wide flange of FIG. **3**. Support post **70** is very similar in configuration to support post **40**, although many of the dimensions of relative aspects and components are slightly different. Therefore, support post **70** will not be described in significant detail.

Cutouts **72** of support post **70** are slightly larger than cutouts **50** of FIG. **3**. In the illustrated embodiment of FIG. **4**, cutouts **72** are approximately twenty-one millimeters in diameter. In this configuration, cutouts **72** are the same size as boltholes **74**. Accordingly, fabrication of support post **70** is simplified, since the same tools that are used to punch bolt holes **74** may be used to punch cutouts **72**. Tooling costs are thereby reduced, since the tools need only be re-indexed to provide additional holes for cutouts **72**.

Two types of guardrail support members are described and illustrated within this specification: (I) W6×9; and (II) W8×10 Wide flanges. It should be recognized by those of ordinary skill in the art that practically any size guardrail support post may be enhanced by incorporating the teachings of the present invention. The size, weight and configuration of the support post are just a few factors to be considered to determine the appropriate location of cutouts, to allow failure along the weak axis, while maintaining sufficient strength along the strong axis to redirect impacting vehicles.

Although the present invention has been described by several embodiments, various changes and modifications may be suggested to one skilled in the art. It is intended that the present invention encompass such changes and modifications as fall within the scope of the present appended claims.

What is claimed is:

1. A guardrail support post, comprising:

a continuous structural member having a top edge, a bottom edge, and a generally uniform continuous cross section extending from the top edge to the bottom edge, the structural member including first and second generally parallel flanges, and a web forming a coupling between, and extending generally perpendicular to the first and second flanges;

the structural member having a lower portion installed below grade adjacent a roadway, an upper portion directly coupled with a guardrail beam, and a mid portion between the upper portion and the lower portion;

wherein the first and second flanges include first and second cutouts, respectively, that occur within the mid portion; wherein each of the cutouts are spaced from respective outer edges of the first and second flanges approximately at grade; and

wherein each of the first and second cutouts include a vertical dimension and a horizontal dimension, a ratio of the vertical dimension to the horizontal dimension approximately equal to or less than two.

2. The guardrail support post of claim **1**, wherein the cutouts comprise generally circular cutouts.

3. The guardrail support post of claim **2**, wherein the generally circular cutouts each include a diameter of approximately twenty-one millimeters.

4. The guardrail support post of claim **2**, wherein the generally circular cutouts each include a diameter of approximately 13 millimeters.

5. The guardrail support post of claim **1**, wherein the structural member comprises a W8×10 wide flange.

6. The guardrail support post of claim **5**, wherein each of the cutouts are spaced approximately twenty millimeters from respective outer edges of the first and second flanges.

7. The guardrail support post of claim **5**, wherein the cutouts are spaced approximately seven hundred and twenty-seven millimeters from the top edge of the structural member.

8. The guardrail support post of claim **5**, wherein the upper portion of the structural member further comprises a plurality of bolt holes configured to receive fasteners for coupling the guardrail beam with the structural member.

9. The guardrail support post of claim **8**, wherein the bolt holes are spaced approximately five hundred and fifty millimeters from the cutouts.

10. The guardrail support post of claim **1**, wherein the structural member comprises a W6×9 wide flange.

11. The guardrail support post of claim **10**, wherein each of the cutouts are spaced approximately twenty millimeters from respective outer edges of the first and second flanges.

12. The guardrail support post of claim **10**, wherein the cutouts are spaced approximately seven hundred and twenty-five millimeters from the top edge of the structural member.

13. The guardrail support post of claim **10**, wherein the structural member further comprises a plurality of bolt holes configured to receive fasteners for coupling the guardrail beam with the structural member, and wherein the bolt holes are spaced approximately five hundred and fifty millimeters from the cutouts.

14. A guardrail support system, comprising:

a continuous structural member including a wide flange having first and second generally parallel flanges, and a web portion forming a coupling between the first and second flanges, and maintaining the first and second flanges in a spaced relationship;

the structural member having a top edge, a bottom edge, and a generally uniform continuous cross section extending from the top edge to the bottom edge;

the structural member having a lower portion installed below grade adjacent a roadway, an upper portion receiving fasteners, directly coupling a guardrail beam to the structural member, and a mid portion disposed between the upper portion and the lower portion;

the first flange including first and second cutouts disposed approximately twenty millimeters from opposing outer edges of the first flange approximately at grade;

the second flange including third and fourth cutouts disposed approximately twenty millimeters from opposing outer edges of the second flange approximately at grade;

wherein each of the first, second, third and fourth cutouts includes a vertical dimension and a horizontal dimension, and a respective ratio of the vertical dimension to the horizontal dimension; and

each of the ratios is approximately equal to, or less than two.

15. The guardrail support system of claim 14, wherein the structural member comprises a W6×9 wide flange.

16. The guardrail support system of claim 14, wherein the structural member comprises a W8×10 wide flange.

17. The guardrail support system of claim 14, wherein the cutouts comprise circular cutouts, each circular cutout having a diameter of approximately 20 millimeters.

18. The guardrail support system of claim 14, wherein the cutouts comprise circular cutouts, each circular cutout having a diameter of approximately 13 millimeters.

19. The guardrail support system of claim 14, further comprising the guardrail beam coupled with the structural member.

20. The guardrail support system of claim 19, wherein the guardrail beam and the structural member form a portion of a guardrail terminal section.

21. A guardrail system, comprising:

an energy absorbing end terminal treatment;

a cable release post coupled with the end terminal treatment and installed at least partially below grade adjacent the end terminal treatment;

the end terminal treatment being slidably coupled with a section of guardrail beam;

a cable coupled at a first end to the cable release post and coupled at a second end to the section of guardrail beam;

a ground strut coupled at a third end to the cable release post and coupled at a fourth end to a continuous guardrail support post, the guardrail support post including first and second generally parallel flanges, and a web forming a coupling between, and extending generally perpendicular to, the first and second flanges the guardrail support post having a lower portion installed below grade adjacent a roadway, an upper portion directly coupled with the guardrail beam, and a mid portion between the upper portion and the lower portion;

the guardrail support post having a top edge, a bottom edge, and a generally uniform continuous cross section extending from the top edge to the bottom edge, the mid portion including a plurality of cutouts, each of the cutouts including a vertical dimension and a horizontal dimension, and a respective ratio of the vertical dimension to the horizontal dimension; wherein each of the cutouts are spaced from respective outer edges of the first and second flanges approximately at grade; and

wherein each of the ratios is approximately equal to, or less than two.

22. The guardrail system of claim 21, wherein the guardrail support post comprises a first guardrail support post and wherein the guardrail system further comprises second, third, fourth, fifth, sixth and seventh consecutive guardrail support posts configured identically to the first guardrail support post and operable to support consecutive sections of guardrail beam.

23. A guardrail system, comprising:

a cable release post installed at least partially below grade coupled with a section of slotted guardrail beam;

a cable coupled at a first end to the cable release post and coupled at a second end to the section of guardrail beam;

a ground strut coupled at a third end to the cable release post and coupled at a fourth end to a continuous guardrail support post, the guardrail support post including first and second generally parallel flanges, and a web forming a coupling between, and extending generally perpendicular to, the first and second flanges the guardrail support post having a lower portion installed below grade adjacent a roadway, an upper portion directly coupled with the guardrail beam, and a mid portion between the upper portion and the lower portion;

the guardrail support post having a top edge, a bottom edge, and a generally uniform continuous cross section extending from the top edge to the bottom edge, the mid portion including a plurality of cutouts, each of the cutouts including a vertical dimension and a horizontal dimension, and a respective ratio of the vertical dimension to the horizontal dimension; wherein each of the cutouts are spaced from respective outer edges of the first and second flanges approximately at grade; and

wherein each of the ratios is approximately equal to, or less than two.

24. The guardrail system of claim 23, wherein the guardrail system comprises a slotted rail terminal (SRT).

25. The guardrail system of claim 24, wherein the guardrail support post comprises a first guardrail support post and wherein the guardrail system further comprises second, third, fourth, and fifth consecutive guardrail support posts configured identically to the first guardrail support post and operable to support consecutive sections of guardrail beam.

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