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(54) **EXPANSION JOINT SYSTEM**

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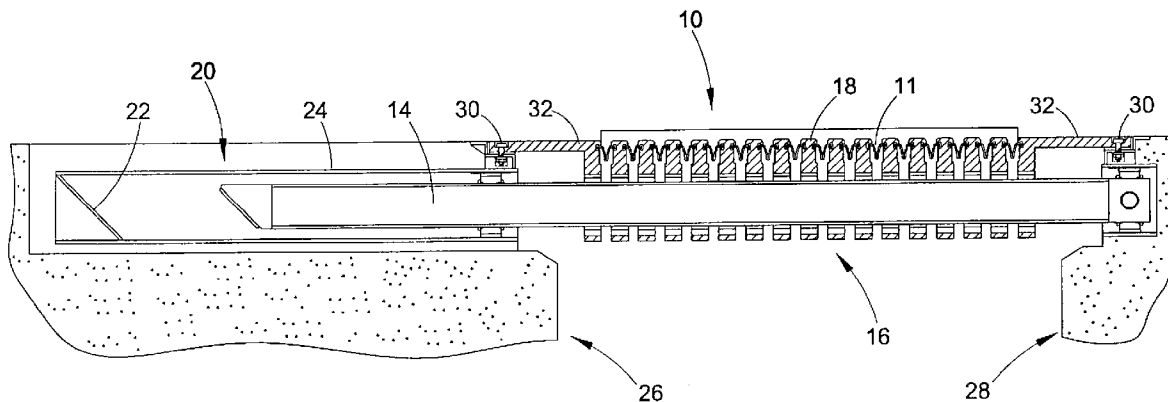
(57) **ABSTRACT**

An expansion joint system including mechanically fused elements for bridging a gap between spaced-apart adjacent structural members is provided. During an emergency operation that is caused by large movements occurring within the vicinity of the expansion joint gap, one or more mechanically fused elements may break away to improve system predictability, or to limit damage to the expansion joint system, the surrounding underlying structural members, or both.

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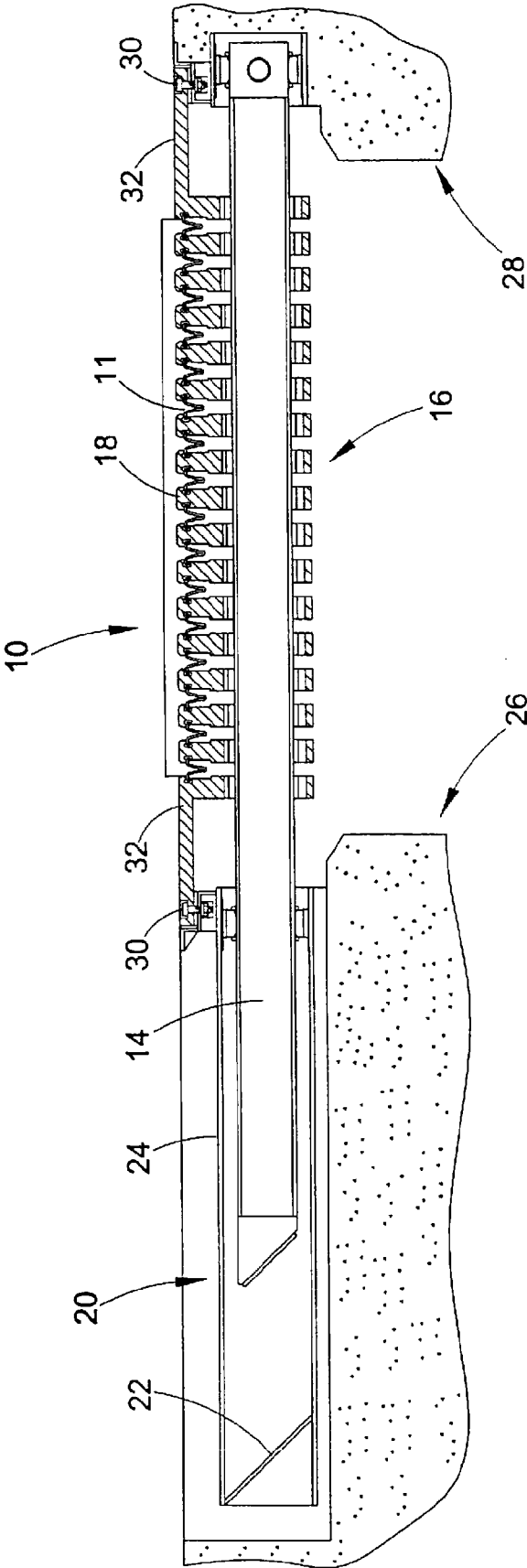


FIG. 1

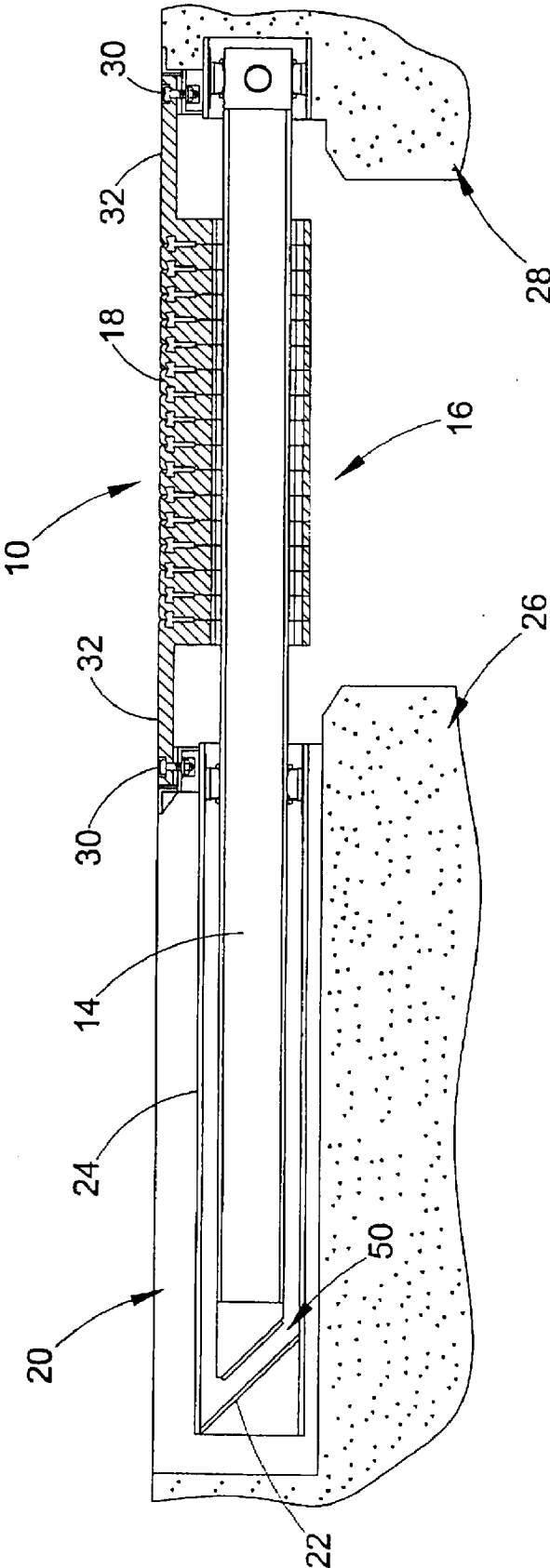


FIG. 2

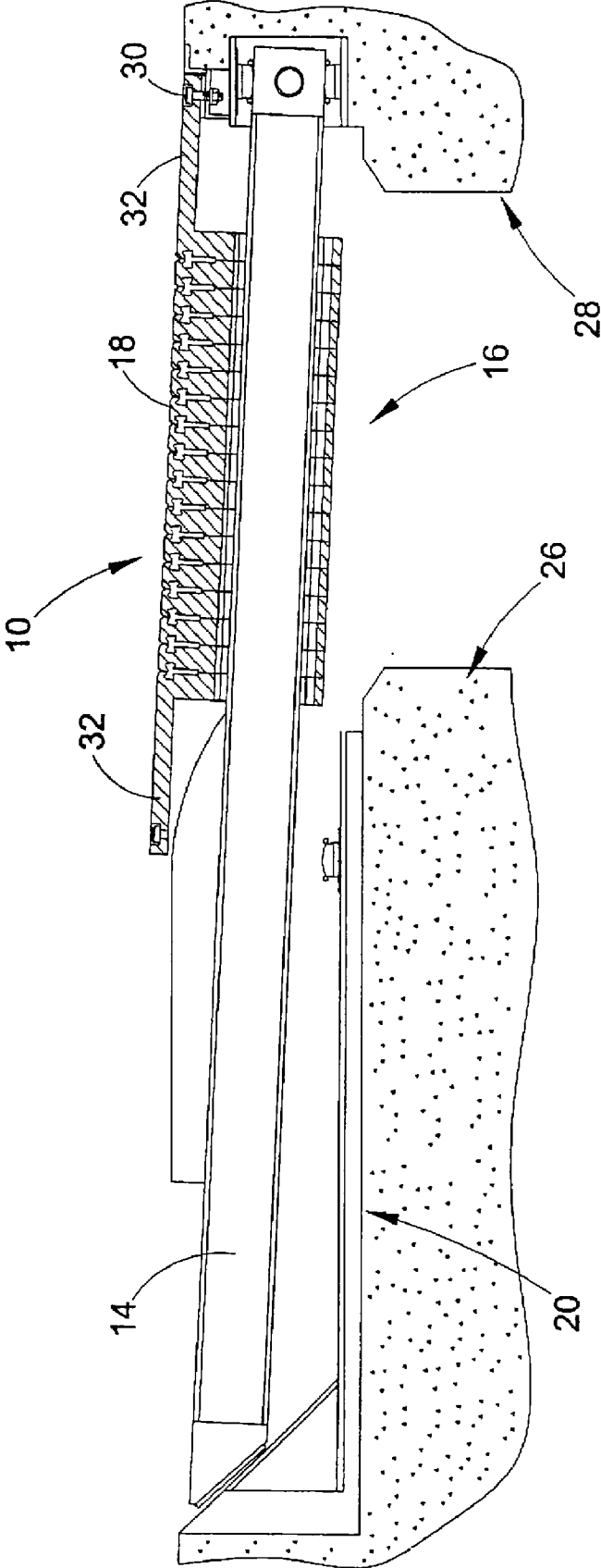


FIG. 3

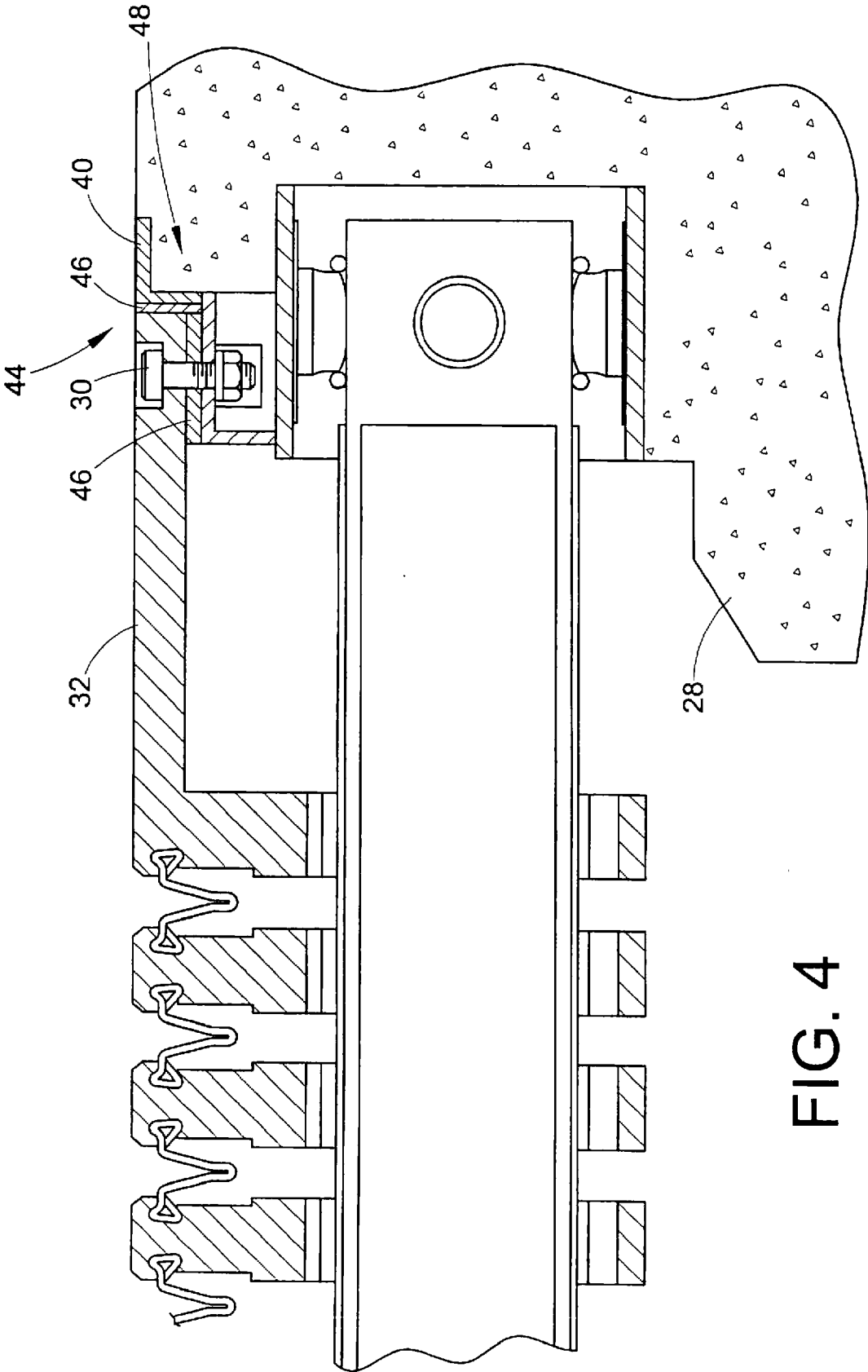


FIG. 4

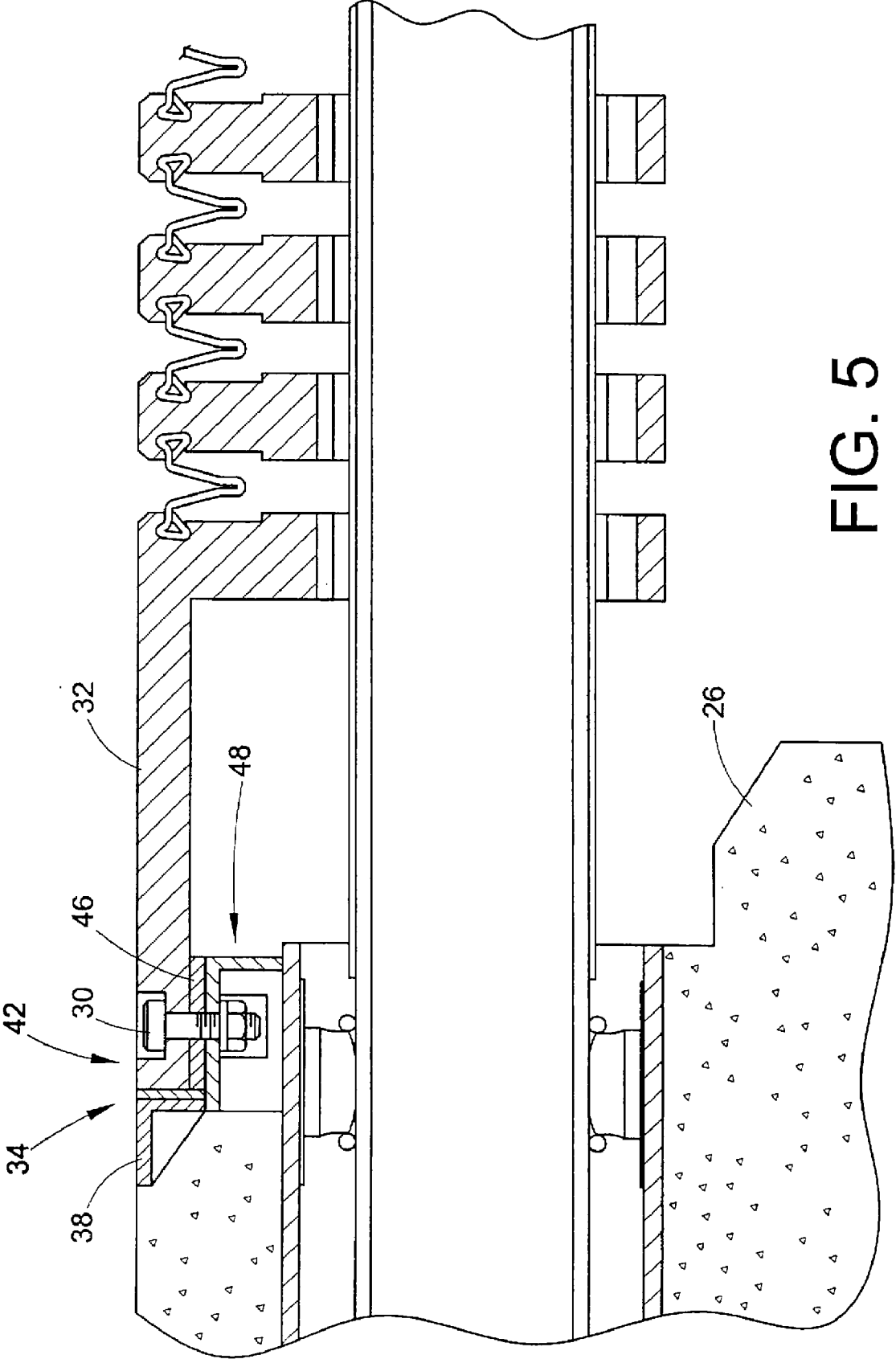


FIG. 5

EXPANSION JOINT SYSTEM

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of the filing date under 35 U.S.C. §119(e) of U.S. Provisional Application For Patent Ser. No. 60/874,759 filed on Dec. 13, 2006.

TECHNICAL FIELD

[0002] A mechanically fused expansion joint system for bridging a gap between spaced-apart, adjacent structural members is provided. The mechanically fused expansion joint system is useful in constructions such as roadway constructions, bridge constructions, and other constructions where it is desirable to accommodate large movements that occur in the vicinity of the expansion joint gap between the structural members.

BACKGROUND

[0003] An expansion joint gap is purposefully provided between adjacent structural members for accommodating dimensional changes within the gap occurring as expansion and contraction due to temperature changes, shortening and creep caused by pre-stressing, seismic cycling and vibration, deflections caused by live loads, and longitudinal forces caused by vehicular traffic. Expansion joint systems may be utilized to accommodate the movements in the vicinity of the gap, but still permit flow of traffic across the gap.

[0004] Roadway and bridge constructions typically are designed to withstand particular maximum movements and forces without damage. As the level of movement and forces to which a construction is designed to endure without damage increases, the expense of the expansion joint design to accommodate the movements and forces increases. High energy events which produce large movement and large forces in these constructions, as a result of seismic activity, tsunamis, freak waves or rogue waves, strong winds, or other activity, are rare and as the energy level of an event increases, the rarity of the event also increases. As such, designs to fully accommodate high movements and minimize damage due to high movements and forces from high energy events can become unreasonably expensive in light of the rarity of these high energy events.

[0005] During a high energy event resulting in large movements occurring within the vicinity of the expansion joint gap, the entire expansion joint system and surrounding underlying structural members are typically damaged. Not only do such events result in substantial costs to repair the damaged structural members but the expansion joint system usually needs to be replaced as well.

[0006] Therefore, the relevant industry still demands a cost-effective expansion joint system to accommodate large movements and forces in expansion joint gaps in response to high energy events, whereby the expansion joint system can effectively mitigate damage from rare large movements and large forces in constructions resulting from high energy events.

SUMMARY

[0007] Provided is an expansion joint system for bridging a gap between adjacent structural members, the system comprising a member for bridging a gap between two spaced apart structural members and mechanically fused housings and/or

mechanically fused connectors that are designed to break in response to the application of pre-determined loads to the system.

[0008] According to certain embodiments, the expansion joint system for bridging a gap between spaced-apart structural members comprises a load bearing member bridging said gap; a housing having a fused portion; and a support member positioned below said load bearing member and bridging said gap, said support member at least partially housed within said housing and slidable therein.

[0009] According to further embodiments, the expansion joint system for bridging a gap between spaced-apart structural members comprises a load bearing member bridging said gap, wherein said load bearing member is engaged by a mechanically fused connector to a mechanically fused portion of said structural member.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] FIG. 1 illustrates a side elevational view of one illustrative embodiment of the mechanically fused expansion joint system.

[0011] FIG. 2 illustrates a side elevational view of another illustrative embodiment of the mechanically fused expansion joint system.

[0012] FIG. 3 illustrates a side elevational view of another illustrative embodiment of the mechanically fused expansion joint system after the mechanically fused elements have fractured.

[0013] FIG. 4 illustrates an enlarged side elevational view of a mechanical fuse in one illustrative embodiment of the mechanically fused expansion joint system.

[0014] FIG. 5 illustrates an enlarged side elevational view of another mechanical fuse in one illustrative embodiment of the mechanically fused expansion joint system.

DETAILED DESCRIPTION

[0015] Disclosed is an expansion joint system that is installed in a gap between adjacent structural members. The expansion joint system includes mechanically fused components that are designed to break or otherwise yield in response to the application of loads that exceed design limits for the system. The fused components permit the expansion joint system to break away from the underlying structural members with limited damage to the expansion joint system or the structural members.

[0016] The expansion joint system may be utilized in roadway, bridge, and tunnel constructions to accommodate large movements in the vicinity of the gap. Depending on the particular application, the expansion joint system may be a modular type, a cover plate type, an interlocking finger type, or any other type. Because the expansion joint system is not damaged, it can be reinstalled to the underlying bridge or roadway structure after the high energy event.

[0017] A modular type expansion joint system comprises a plurality of transversely extending, spaced-apart, vehicular load bearing members; longitudinal support members positioned below the vehicular load bearing members and extending longitudinally across the expansion joint gap; and a housing for accepting ends of the longitudinal support members for controlling the movement of the ends of said support members. Seals are generally provided between the vehicular load bearing members and between vehicular load bearing members and edge members.

[0018] The seals may be flexible and compressible and, therefore can stretch and contract in response to movement of the vehicular load bearing members within the expansion joint gap. The seals may be made from a durable and abrasion resistant elastomeric material. The seals are not limited to any particular type of seal. Suitable seals that may be used include, but are not limited to, strip seals, glandular seals, and membrane seals.

[0019] The housings for accepting ends of the support members may include structures such as, without limitation, boxes, receptacles, chambers, containers, enclosures, channels, tracks, slots, grooves or passages, which include a suitable cavity for accepting the end portions of the support members and permits the desired movement of the support member within the housing. The top wall of the housing may be mechanically fused to provide a break-away portion in response to an emergency high energy condition.

[0020] Expansion joint systems are designed to accommodate movement of adjacent structural members relative to one another such that, as the gap between the adjacent sections changes in size or shape, traffic may still flow across the gap. Generally, the amount of change in the gap which an expansion joint system can accommodate is limited such that there is a minimum gap condition and a maximum gap condition which may occur without causing some damage to the expansion joint system, or the adjacent structure, or both. As used herein, an operation which closes the gap below the above referenced nominal minimum gap condition or opens the gap beyond the above referenced nominal maximum gap condition will be referred to as an "emergency operation". Expansion joint systems which comprise mechanically fused elements include elements, assemblies, or both that are designed to break at or above predetermined loads produced by emergency operations. Furthermore, the elements and assemblies are designed to break in specific ways in order to limit damage to the system, its surroundings, and/or to improve system performance predictability. According to certain embodiments, mechanically fused elements or assemblies are designed to break in a predetermined sequence during an emergency operation.

[0021] According to certain embodiments, the expansion joint system include housings for accepting components of the expansion joint system and which include fused portions that are designed to break away in response to the application of an excessive load. The expansion joint system may comprise a modular-type expansion joint system including housings for accepting components of the expansion joint system and which include fused portions that are designed to break away in response to the application of an excessive load. The modular-type expansion joint system includes a plurality of transversely extending vehicular load bearing members, longitudinal support members having opposite ends extending longitudinally across the expansion joint, and housings having fused portions for accepting ends of the longitudinally extending support members. The longitudinal support members have one end slidably housed within a mechanically fused housing. The mechanically fused housing is embedded within the structural member or within elastomeric concrete in the block-out region of the structural member. During an emergency operation, a portion of the mechanically fused housing breaks or yields in some pre-selected manner in order to limit damage to the expansion joint system and its surroundings.

[0022] According to other embodiments, the expansion joint comprises mechanically fused connectors which connect the expansion joint system to adjacent structural members. Without limitation, the expansion joint system comprises a modular-type expansion joint system including mechanically fused connectors which connect the expansion joint system to adjacent structural members. The modular-type expansion joint system includes a plurality of transversely extending vehicular load bearing members, longitudinal support members having opposite ends extending longitudinally across the expansion joint, and housings having fused portions for accepting ends of the longitudinally extending support members. The longitudinal support members have one end slidably housed within housings. The mechanically housings are embedded within the structural member or within elastomeric concrete in the block-out region of the structural member. The expansion joint system further includes edge members, which are known in the relevant industry as "edge plates". The edge members are disposed on opposite longitudinal sides of the transversely extending vehicular load bearing members. The edge members are connected to the underlying structural members by mechanically fused connectors. During an emergency operation, a portion of the mechanically fused connectors break or yield in some pre-selected manner in order to limit damage to the expansion joint system and its surroundings.

[0023] According to further illustrative embodiments, the mechanically fused connectors join the edge members of the modular-type expansion joint system to mechanically fused portions of the underlying structural elements. The joint comprises mechanically fused connectors which connect the expansion joint system to adjacent structural members. The modular-type expansion joint system includes a plurality of transversely extending vehicular load bearing members, longitudinal support members having opposite ends extending longitudinally across the expansion joint, and housings having fused portions for accepting ends of the longitudinally extending support members. The longitudinal support members have one end slidably housed within housings. The mechanically housings are embedded within the structural member or within elastomeric concrete in the block-out region of the structural member. The expansion joint system further includes edge members, which are known in the relevant industry as "edge plates". The edge members are disposed on opposite longitudinal sides of the transversely extending vehicular load bearing members. The edge members are connected to the underlying structural members by mechanically fused connectors. During an emergency operation, a portion of the mechanically fused connectors and/or fused portions of the underlying structural members break or yield in some pre-selected manner in order to limit damage to the expansion joint system and its surroundings.

[0024] The mechanically fused expansion joint system will now be described in greater detail in conjunction with illustrative FIGS. 1-5. The mechanically fused expansion joint system is not intended to be limited to the illustrative embodiments shown in FIGS. 1-5.

[0025] FIGS. 1-3 illustrate a modular-type expansion joint system 10 incorporating a mechanically fused housing 20 for a support member 14, mechanically fused connectors 30, underlying structural members 26 and 28, mechanically fused portions 34 and 36 of structural elements, longitudinal support members 14, vehicular load bearing members 18, edge members 32, and seals 11. The mechanically fused

housing 20 accepts a portion of a longitudinal support member 14 that extends across the gap 16 between two adjacent structural members 26, 28. During normal operation, changes in the size of the gap 16 cause the longitudinal support member 14 to slide within the housing 20. During normal operations, the gap 16 may be at the nominal minimum gap, the nominal maximum gap condition, or, as shown in FIG. 1, somewhere in between.

[0026] At the nominal minimum gap condition, as shown in FIG. 2, the longitudinal support member 14 extends into the housing 20 to the maximum extent possible for normal operation. Any further insertion of the longitudinal support member 14 into the housing 20 would constitute emergency operation. The nominal minimum gap shown condition coincides with the fully-closed condition of the vehicular load bearing members 18. By contrast, during an emergency operation in which the gap 16 width is less than the above referenced nominal minimum gap, longitudinal support member 14 will be forced toward the rear of the housing 20 and make contact with the rear wall 22 of the housing 20. In the embodiment shown, the rear wall 22 of the housing 20 comprises an angled or sloped surface which guides the longitudinal support member 14 against the top wall 24 of the housing 20 as the longitudinal support member 14 extends further into the housing 20. In certain embodiments, at least a portion of the top wall 24 of the housing 20 is designed to break in response to a load from the longitudinal support member 14 due to an emergency operation. As shown in FIG. 3, at least a portion of the top wall 24 of the housing 20 breaks rather than constraining the longitudinal support member 14 within the housing 20.

[0027] Referring to FIG. 2, the expansion joint system 10 is shown at the nominal minimum gap condition. The connection between the expansion joint system 10 and structural element 26 comprises a mechanically fused connection 30, the connection between the expansion joint system 10 and structural elements 26, 28 comprises a mechanically fused connection 30. In addition, the top wall 24 of the housing 20 of the longitudinal support member 14 also comprises a mechanically fused element. As shown in FIG. 2, any further closure of the gap 16 will increase the shear load in the mechanically fused connections 30. Under the conditions illustrated in the embodiment shown in FIG. 2, the dimension of the gap 16 has not yet produced contact between the longitudinal support member 14 and the rear wall 22 of the housing 20. A design margin 50 of some positive distance exists between the end of the longitudinal support member 14 and the rear wall 22 of the housing 20. In other embodiments, the design margin may be of some other positive distance, or it may be zero, or it may be negative. In embodiments in which the design margin is negative the longitudinal support member 14 makes contact with the rear wall 22 of the housing 20 at some gap width greater than the nominal minimum gap condition.

[0028] The mechanically fused connectors 30 may comprise fasteners, welds, brazings, or adhesives engaging the edge members 32 of the expansion joint system 10 with the structural elements 26 and 28. Without limitation, fasteners may include bolts, screws, rivets, nails, and pins. Without limitation, the fasteners may comprise materials selected from the group consisting of steel, aluminum, brass, bronze, titanium alloys, magnesium alloys, or combinations thereof. In some embodiments, the mechanically fused connectors 30 are designed to undergo a tensile, compressive, or shearing load sufficient to cause tensile, compressive, or shearing

breakage of the mechanically fused connectors 30, thereby freeing the expansion joint systems from the underlying structural members 26, 28.

[0029] As shown in FIGS. 4 and 5, mechanically fused connector 30 is designed to undergo shearing loads sufficient to cause shearing breakage in the event of an emergency operation. During an emergency operation in which the width of the gap 16 is less than the above referenced nominal minimum gap, the edge member 32 will be subject to lateral forces such that the mechanically fused connector 30 is subject to a shear load.

[0030] As shown in FIGS. 4 and 5, the portions of the structural members 26 and 28 which the edge members 32 are abutting comprise mechanically fused portions 34 and 36. As used herein, the term "abutting" refers to material in close proximity in a substantially horizontal plane. Mechanically fused portions 34 and 36 of structural elements 26 and 28 are connected to the structural elements 26 and 28 by material which is designed to break from the structural elements 26 and 28 in a desired way or along a desired boundary once the forces to which they are exposed exceed a predetermined level. In certain embodiments, the mechanically fused portion 34 or 36 is separated from the remainder of the structural elements 26 or 28 by a boundary region (not shown). A boundary region (not shown) is locally weaker than the surrounding material with respect to the type or types of loads for which the mechanically fused portion 34 or 36 is designed to break from the structural elements 26 and 28.

[0031] The boundary region is defined by one or more boundary elements 38 and 40. A boundary element 38 and 40 may be any component which creates a boundary region. In certain embodiments, the boundary element 38 and 40 is a plate, strap, beam, angle, channel, rod, tube, bead, fiber, or strand. The boundary element 38 and 40 may comprise a metal, a polymer, a ceramic, a glass, or a composite material. The boundary element 38 and 40 comprises steel, aluminum, brass, or bronze. In certain embodiments, the boundary element 38 and 40 intentionally creates a region of weakness coinciding with the boundary region. Without limitation, regions of weakness may be established by creating stress risers, stress concentration points, perforations, or otherwise selectively weakening a particular region. In certain embodiments, the boundary element 38 and 40 intentionally creates a region of strength coinciding with a region bordering the boundary region. Without limitation, regions of strength may be established by eliminating stress risers, eliminating stress concentration points, addition of reinforcement materials, or otherwise selectively strengthening a particular region.

[0032] In certain embodiments, the expansion joint system 10 comprises terminal margins 42 and 44 between structural elements 26 and 28 and edge members 32. The terminal margins 42 and 44 separating the structural elements 26 and 28 from the edge members 32, may be at least partially filled with a transmission material 46 selected from the group consisting of steel, aluminum, tungsten carbide, silicone, polyurethane, or some combination thereof. Transmission materials 46 may be applied along the shearing region 48 between the edge members 32 of the expansion joint system 10 and the structural elements 26 and 28. As shown in FIG. 5, transmission materials 46 may be omitted from the shearing region 48 between the edge members 32 of the expansion joint system 10, or omitted from the terminal margins 42 and 44, or omitted from both.

[0033] A difference in the types of materials selected for transmission materials 46 may be used to determine the sequence in which mechanically fused elements break during an emergency operation. Other variables being equal, in a system wherein the transmission material 46 in one terminal margin 42 or 44 is softer than the transmission material 46 in the opposing terminal margin 42 or 44, the mechanically fused connection 30 on the side having the softer transmission material 46 will break before the connection on the side having the harder transmission material 46. A person of ordinary skill in the art can select these design criteria without undue experimentation in order to produce a desirable breakage sequence amongst mechanically fused elements. As shown in FIG. 5, the engagement elements between the terminal element 32 and the structural elements 26 and 28 comprises a mechanically fused connector 30. FIG. 5 also shows that there is no transmission material in the terminal margin 42. As shown in FIG. 4, the connection between the terminal element 32 and the structural elements 26 and 28 comprises a mechanically fused connector 30. FIG. 4 also shows the inclusion of transmission material 46 in the terminal margin 44. Because the transmission material 46 shown in the terminal margin 44 in FIG. 4, is harder than the empty space shown in the terminal margin 42 in FIG. 5, the fastener 30 shown in FIG. 5 will break before the fastener 30 shown in FIG. 4.

[0034] As shown in FIGS. 4 and 5, an expansion joint system 10 is engaged with structural elements 26 and 28 using mechanically fused connectors 30 which are bolts. In the embodiment illustrated in FIG. 4 the terminal element 32 of the expansion joint system 10 is separated from the abutting portions of the support sections 26 and 28 by a terminal margin 42 and 44 filled with some very soft material 46, such as silicone.

[0035] During emergency operations producing gap widths less than the nominal minimum gap condition, the strain which the mechanically fused connector 30 will encounter prior to breakage will result in only low stresses in a soft terminal element material 46 and therefore the edge members 32 transfer only low stresses to the abutting portions of the structural elements 26 and 28. During emergency operation at gap widths greater than the nominal maximum gap condition, the terminal margin will open and therefore the edge members 32 transfer no stresses to the abutting portions of the structural elements 26 and 28.

[0036] Some materials used in conventional construction have very predictable design characteristics as compared to other materials used in conventional construction. One such material is steel. A designer can specify the shape, material, and installation of a steel component and predict its performance criteria with very high precision. In applications where high precision prediction of a particular performance criteria is critical, one option to promote such predictability is to include materials having very predictable properties in such a way that their performance controls overall performance. In certain embodiments, the selection of breakage sequence of mechanically fused elements composed of materials having predictable properties is used to increase the predictability of an entire system. Without limitation, and for purposes of illustration only, a predictable mechanically fused element having a breakage load that is well known may be used in conjunction with a less predictable mechanically fused element having a breakage load that is less well known in such a way that the predictable mechanically fused element breakage occurs before the less predictable mechanically fused

element and in such a way that breakage of the more predictable mechanically fused element subjects the less predictable mechanically fused element to a load very likely to cause its breakage. By so doing, the predictability of breakage criteria of the entire system mirrors the predictability of breakage criteria of the more predictable mechanically fused element.

[0037] While the mechanically fused expansion joint system has been described above in connection with the certain embodiments, it is to be understood that other embodiments may be used or modifications and additions may be made to the described embodiments for performing the same function of the mechanically fused expansion joint system without deviating therefrom. Further, all embodiments disclosed are not necessarily in the alternative, as various embodiments may be combined to provide the desired characteristics. Variations can be made by one having ordinary skill in the art without departing from the spirit and scope of the mechanically fused expansion joint system. Therefore, the mechanically fused expansion joint system should not be limited to any single embodiment, but rather construed in breadth and scope in accordance with the recitation of the attached claims.

1. An expansion joint system for bridging a gap between spaced-apart structural members comprising:
 - a load bearing member bridging said gap;
 - a housing having at least one fused portion; and
 - a support member positioned below said load bearing member and bridging said gap, said support member at least partially housed within said housing and slidable therein.
2. The expansion joint system of claim 1, wherein said housing comprises a top wall, a bottom wall, side walls, and a rear wall, wherein said top wall is mechanically fused.
3. The expansion joint system of claim 3, further comprising at least one edge member supported by said longitudinal support member, said edge member being engaged by a mechanically fused connector to one of said structural members.
4. The expansion joint system of claim 3, wherein said edge member is engaged by a mechanically fused connector to a mechanically fused portion of a structural member.
5. The expansion joint system of claim 4, wherein said mechanically fused portion of said structural member is separated from the remaining portion of said structural member by a boundary region created by a boundary element.
6. The expansion joint system of claim 5, wherein said boundary element is selected from the group consisting of a plate, a strap, a beam, an angle, a channel, a rod, a tube, a bead, and combinations thereof.
7. The expansion joint system of claim 6, wherein said boundary element comprises a material selected from the group consisting of metal, metal alloy, polymer, ceramic, glass, composite material, and combinations thereof.
8. The expansion joint system of claim 7, wherein said boundary element creates a region of weakness coinciding with the boundary region.
9. The expansion joint system of claim 8, wherein said boundary element creates a region of strength coinciding with a region bordering the boundary region.
10. The expansion joint system of claim 4, wherein said mechanically fused connector comprises a connector selected from the group consisting of a mechanical fastener, a braze, a solder, a weld, and an adhesive.

11. The expansion joint system of claim 10, wherein said mechanically fused connector comprises a mechanical fastener.

12. The expansion joint system of claim 11, wherein said mechanical fastener is selected from the group consisting of bolts, screws, rivets, nails, pins and combinations thereof.

13. The expansion joint system of claim 12, wherein said mechanical fastener comprises a material selected from the group consisting of steel, aluminum, brass, bronze, titanium alloys, magnesium alloys, and combinations thereof.

14. The expansion joint system of claim 4, comprising a terminal margin between said edge members and said structural members.

15. The expansion joint system of claim 14, wherein said terminal margin is at least partially filled with a transmission material.

16. The expansion joint system of claim 15, wherein said transmission material is selected from the group consisting of a metal, a metal alloy, a polymeric material, a composite material, and combinations thereof.

17. The expansion joint system of claim 3, comprising a plurality of mechanically fused elements.

18. The expansion joint system of claim 17, wherein at least a portion of said mechanically fused elements are designed to break in a particular sequence.

19. The expansion joint system of claim 4, comprising a plurality of mechanically fused elements.

20. The expansion joint system of claim 19, wherein at least a portion of said mechanically fused elements are designed to break in a particular sequence.

21. An expansion joint system for bridging a gap between spaced-apart structural members comprising:

a plurality of transversely extending, spaced-apart load bearing members;

a housing having a fused portion; and

a support member positioned below said transversely extending, spaced-apart load bearing members and extending longitudinally across said gap, said support member at least partially housed within said housing and slidable therein.

22. The expansion joint system of claim 21, wherein said housing comprises a top wall, a bottom wall, side walls, and a rear wall, wherein said top wall is mechanically fused.

23. The expansion joint system of claim 21, further comprising at least one edge member supported by said longitudinal support member, said edge member being engaged by a mechanically fused connector to one of said structural members.

24. The expansion joint system of claim 23, wherein said edge member is engaged by a mechanically fused connector to a mechanically fused portion of a structural member.

25. The expansion joint system of claim 24, wherein said mechanically fused portion of said structural member is separated from the remaining portion of said structural member by a boundary region created by a boundary element.

26. The expansion joint system of claim 25, wherein said boundary element is selected from the group consisting of a plate, a strap, a beam, an angle, a channel, a rod, a tube, a bead, and combinations thereof.

27. The expansion joint system of claim 26, wherein said boundary element comprises a material selected from the group consisting of metal, metal alloy, polymer, ceramic, glass, composite material, and combinations thereof.

28. The expansion joint system of claim 27, wherein said boundary element creates a region of weakness coinciding with the boundary region.

29. The expansion joint system of claim 28, wherein said boundary element creates a region of strength coinciding with a region bordering the boundary region.

30. The expansion joint system of claim 24, wherein said mechanically fused connector comprises a connector selected from the group consisting of a mechanical fastener, a braze, a solder, a weld, and an adhesive.

31. The expansion joint system of claim 30, wherein said mechanically fused connector comprises a mechanical fastener.

32. The expansion joint system of claim 31, wherein said mechanical fastener is selected from the group consisting of bolts, screws, rivets, nails, pins and combinations thereof.

33. The expansion joint system of claim 32, wherein said mechanical fastener comprises a material selected from the group consisting of steel, aluminum, brass, bronze, titanium alloys, magnesium alloys, and combinations thereof.

34. The expansion joint system of claim 24, comprising a terminal margin between said edge members and said structural members.

35. The expansion joint system of claim 34, wherein said terminal margin is at least partially filled with a transmission material.

36. The expansion joint system of claim 35, wherein said transmission material is selected from the group consisting of a metal, a metal alloy, a polymeric material, a composite material, and combinations thereof.

37. The expansion joint system of claim 23, comprising a plurality of mechanically fused elements.

38. The expansion joint system of claim 37, wherein at least a portion of said mechanically fused elements are designed to break in a particular sequence.

39. The expansion joint system of claim 24, comprising a plurality of mechanically fused elements.

40. The expansion joint system of claim 39, wherein at least a portion of said mechanically fused elements are designed to break in a particular sequence.

41. The expansion joint system of claim 21, comprising seals extending between said transversely extending, spaced apart load bearing members, and between said transversely extending, spaced apart load bearing members and edge sections of expansion joint system.

42. The expansion joint system of claim 41, wherein said seals are flexible and compressible.

43. The expansion joint system of claim 42, wherein said seals comprise an elastomeric material.

44. The expansion joint system of claim 43, wherein said seals are selected from strip seals, glandular seals, and membrane seals.

45. The expansion joint system of claim 44, wherein said seals are strip seals.

46. An expansion joint system for bridging a gap between spaced-apart structural members comprising:

a load bearing member bridging said gap, wherein said load bearing member is engaged by a mechanically fused connector to a mechanically fused portion of said structural member.

47. The expansion joint system of claim 46, wherein mechanically fused connector and mechanically fused portion of said structural member are designed to break in a particular sequence.

48. The expansion joint system of claim 47, wherein the load bearing member comprises a plurality of transversely extending, spaced-apart load bearing members; and the system further comprises support members positioned below said transversely extending, spaced-apart load bearing members and extending longitudinally across said gap; housing

for accepting ends of the longitudinally extending support members; and edge members engaged by mechanically fused connectors to a mechanically fused portion of said structural members.

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