above) the horizontal neutral axis of the centre sills, and draft stops riveted to the centre sills. The distance between the neutral axis of any member of the car and the centre line of strain acts as a lever arm, through which bending effect is added to direct tension or compression. Strains which do not act in line with the neutral axis of car members will be designated

"eccentric strains." The ratio of stress to I X S M strain is - plus -

A

A represents area, in square inches. represents lever arm, in inches.

SM represents section modulus of section.

Centre sills which are not properly tied together at rear draft stops, located at some distance from bolster, are subject to eccentric strains, which has a tendency to deflect them outward or away from the centre line of car between draft stops and bolster.

Compression strains acting on car through draft gear, or car ends, as the case may be, create strut action in the members of the car framing. Long struts are liable to buckle under compression, for which reason it is customary to set limits for ratio of length to radius of gyration of struts, in order to restrict the excess stress caused by this buckling tendency. The members or parts of members of car framing which require consideration are generally flanges of channels or I beams, and plates. Their cross sections are rectangular, or sufficiently close to rectangular to be so considered in order to avoid theoretical computations.

Your committee recommends the adop-tion of a ratio of 70 for length to radius of gyration, which corresponds closely with a ratio of 20 for length to depth d of a rectangular section. This depth must be

The anchorage of centre sills may be accomplished in various ways, the more com-mon methods being by means of cover plates, or diagonal braces. The value of such braces increases the value of the centre sills. Cover plates add direct value, and diagonal braces add partial value, depending on their angularity. Braces at the functions of centre sills, and must be subject to the same rules. The value of braces at point of minimum strength may be added to the centre sill area, taking effect in the horizontal plane in which such value lies.

RECOMMENDATIONS. - Existing steel or steel underframe cars, which have less







Fig. 2.-Reinforcement of Wooden Cars to Replace Broken Ends.

measured in the direction in which buck-ling may take place. To fulfill the restric-tions just given, the length of a member should not be greater than 20 d., or the member must be securely anchored at in-tervals not exceeding 20 d.

right angles to centre sills add no value to the centre sill area, unless specifically designed as horizontal girders of sufficient strength to transfer all of the end strains from the draft to the side framing, in which case the side framing must perform

strength than that specified below, should be classified with wooden cars, and subject to the same rules for combining defects:—Area of centre sills not less than 16 square inches. Ratio of stress to end strain not more than 0.09. The length of centre