On account of the great difference between the nature and effects of the concentrated and uniform loads the writer believes they should be considered separately, in allowing for impact, and would suggest the following method:—

1. Concentrated Live Loads.—In fixing on a maximum concentrated load for a particular bridge one should be selected which is not only probable but that is reasonably possible. It is unnecessary to design a bridge for an emergency load which there is no likelihood of it ever having to carry. To the estimated static stresses produced by the chosen load the writer would add 50 per cent. as the allowance for everything usually covered by the impact increment. The stresses so obtained will control in the design of all spans up to about 30 feet, and it is just as necessary to provide for them in a 30-foot span as a 10-foot span or in a section of a 300-foot span.

2. Uniform Distributed Live Load.—If a reasonably heavy concentrated load is used a comparatively light uniform load can be assumed, for rural bridges. Furthermore, the practice of decreasing the uniform load in proportion to the span for spans over 100 feet seems reasonable and has proven satisfactory in the past. Why not extend this practice and increase the load in the same proportion for spans under 100 feet? This is virtually what is done by the use of any of the straight-line impact formulas, but why waste time over a tedious, meaningless formula when the same result can be accomplished by this simple method? Assume a uniform live load of 80 lbs. per square foot for all spans 200 feet and over. For spans under 200 feet, increase the live load three pounds for every 10 feet decrease in length. This would give us as designing loads to be used without any other impact allowance, 110 lbs. per square foot for a 100-foot span, 125 lbs. for a 50-foot span, 137 lbs. for a 10-foot span, etc. These loads would provide ample strength for congested crowds on sidewalks and for trusses they would give practically the same stresses that have been found satisfactory in the past.

A bridge designed by the above rules, with proper details, will be capable of carrying, without danger, a 100 per cent. overload in its floor system and all parts affected by it, and yet have a light, economical truss, and these are the main requisites for efficiency and long life, as far as they are influenced by design.

While the discussion has been limited to highway bridges not carrying electric railways there is no reason why these rules could not be used for city or town bridges where the speed of loaded cars is restricted to 10 miles an hour.

Excessive allowance for impact is sometimes excused on the grounds that the extra metal adds to the rigidity and leaves a margin for rust, etc. But there are ways of obtaining better results by a more intelligent use of the material, as, for example, the following:—

The usual requirement found in all specifications fixing the minimum size and thickness of material might be extended by requiring that all members be increased 1/16 inch beyond what the figured stresses call for.

More attention should be given to the question of vibration of long members. It would be advisable under some circumstances to use diagonal lacing on all long tension members instead of small tie plates, as now allowed.

All members, and the span as a whole should be designed so that the moment of inertia of a cross-section divided by the length of the member should not be less than a certain ratio. In other words, the members should be designed to resist lateral deflection and vibration.

The lateral bracing should be designed not merely for strength to resist the wind but its deflection as a horizontal truss should be limited to a certain amount under full load. The use of high unit stresses for laterals may be quite safe and economical, but it means greater elongation when loaded and consequently more deflection. Laterals placed at too small an angle with the chords permit deflection.

Attention to a few such minor points would greatly increase the stiffness of a bridge and at less expense than by a wholesale increase of 10 per cent. or 20 per cent. of material in the main members.

Formula *1: $I = \frac{L^2}{L + D}$

Formula *2. $I = \left(0.40 - \frac{S}{500}\right) \frac{L^2}{L + D}$

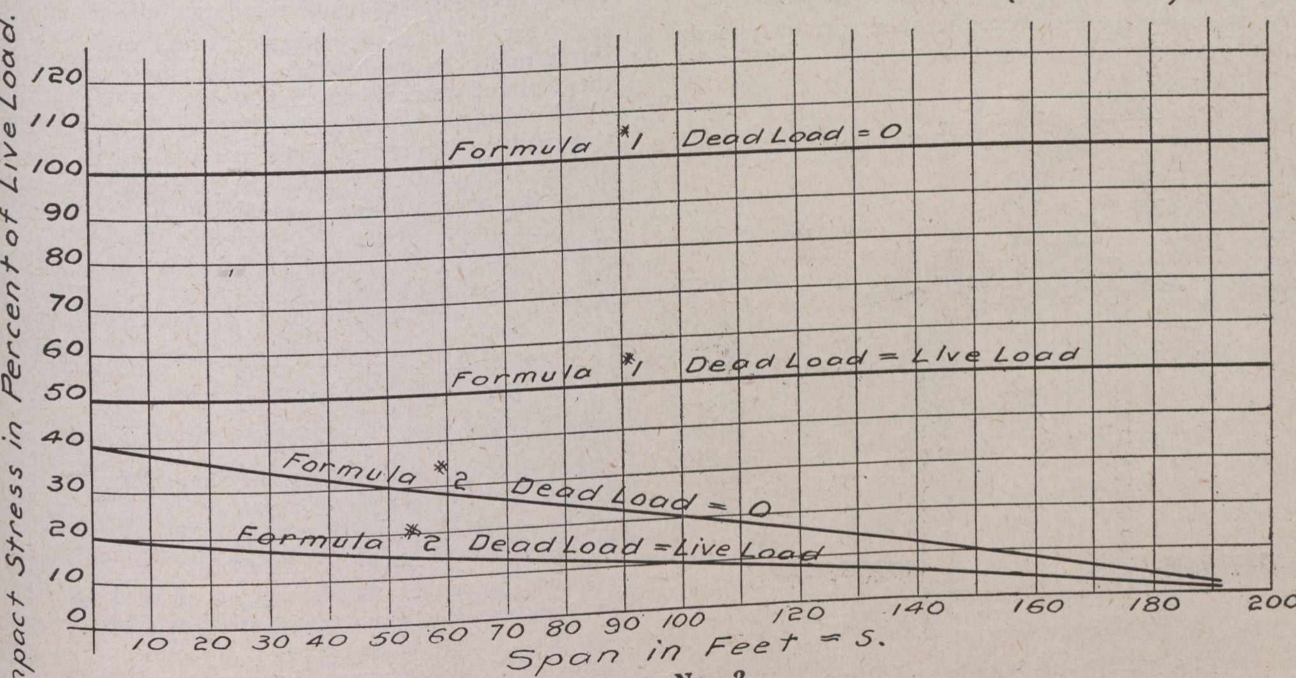

Diagram No. 2.