transverse load, such a member shall be designed to sustain the combined stresses arising under such circumstances of loading.

All members sustaining alternate tension and compression shall be designed to carry the largest stress added to six-tenths, the smallest.

The greatest shearing stress in any rivet or pin shall not exceed 7500 pounds per square inch.

The greatest bearing stress allowed on any rivet shall not exceed 12,000, multiplied by its diametrical bearing area before driving. This clause shall also apply to the bearing of pins.

The bending stress of tension or compression on the extreme fibres of pins shall not exceed 15,000 pounds per square inch for wrought iron, nor 20,000 pounds per square inch for steel.

All structures whatsoever shall be provided with complete and efficient systems of lateral and transverse bracing.

**QUALITY OF MATERIAL.**

Wrought iron shall be uniformly tough and fibrous in character, and shall possess a limit of elasticity of not less than 25,000 pounds per square inch.

The ultimate resistance of prepared specimens of 1 square inch in sectional area for a length of 10 inches, taken from full-sized bars of not more than 4 square inches in area of section, shall be not less than 50,000 pounds per square inch. A reduction of 500 pounds per square inch for each additional square inch of full-sized bar area will be allowed in similar specimens taken from bars of greater sectional area than 4 square inches, down to a minimum ultimate resistance of 48,000 pounds per square inch. In all cases the stretch shall be not less than 18 per cent. in 10 inches.

Specimens not over 1 square inch in area of cross-section, taken from shapes and plates under 24 inches wide, shall give an ultimate resistance of not less than 48,000 pounds per square inch, and a final elongation of 15 per cent. in 8 inches; tests being made in the direction of the fibre.

Similar specimens from plates over 24 inches in width shall give a resistance of not less than 46,000 pounds per square inch, and an elongation of not less than 12 per cent. in 8 inches; tests being made, as before, in direction of the fibre.

All iron used in tension must bend cold 90 degrees without cracking to a curvature whose radius is about the thickness of the metal, and not less than one-third of such specimens shall bend to 180 degrees under the same conditions. Plate and shape specimens must bend cold 90 degrees to a radius one and a half times the thickness without cracking.

All iron, when nicked and bent by blows from a hammer, must show a structure nearly all fibrous.

**HIGHWAY BRIDGES.**

All highway bridges shall be proportioned to carry their own weight, added to 80 pounds per square foot of clear roadway and sidewalk, as moving load for spans of less than 125 feet, or 60 pounds per square foot for spans over 125 feet. In all cases the floor system shall be designed for a moving load of 100 pounds per square foot of clear roadway or sidewalk.

The greatest allowable stresses of the various kinds shall be determined by increasing those for railway structures to the extent of 20 per cent.

The general excellence of the work and material shall fully equal that required for railway structures.

**THE WEIGHTS OF LOCOMOTIVES AND CARS.**

Although the weights of locomotives and loaded cars vary widely according to circumstances of location and traffic, the more common values found in connection with the heaviest as well as the ordinary traffic carried by either the standard or narrow-gauge roads are completely given on the adjoining plate. These values are not only of very considerable interest in themselves, but are of the greatest importance in the design of bridge structures. The old method of a uniform moving load with locomotive excess in front no longer meets the requirements of the best structural design. The wheel concentrations must be taken as they are, and that position assumed which will give the greatest value to the stresses sought. These observations possess special force in connection with the design of the floor systems of railway bridges.

The wheel concentrations shown on the plate give correct ideas of the proper weights or loads to be taken, in addition to the weights of structures, within the ordinary limits of the best practice for either standard or narrow-gauge roads.