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STRENGTH OF THE NEW YORK AND BROOKLYN SUSPENSION BRIDGE.

The permission which has been granted by the trustees of the New York and Brooklyn Suspension Bridge to the Brooklyn trolley companies to run their cars across the structure has aroused opposition on various grounds, the most serious of which is that it is not strong enough to carry safely the increased loads which will be put upon it.

This is a most serious objection (provided, of course, that it is well founded) for the reason that all the others are based upon alleged inconveniences of a minor character, whereas this is one which can only be neglected at the peril of the lives of the citizens. If the bridge has already been loaded with greater weights than it was designed to carry, this is certainly no time to lay fresh material upon it.

We have been favored by a correspondent with sundry clippings from that section of the local press which has actively opposed the laying of the tracks with a request that we will state our opinion as to whether the safety of the bridge would be imperiled by running the trolley cars across it. In reply we must state that there is no evidence that the safety of the bridge has been endangered by the extra weights which have been placed upon it in the past, nor is it threatened by the present proposal to run a line of trolley cars across it in each direction.

It is urged that whereas the bridge was designed to carry only four rails on which to run cars it now carries eight rails, and that when the trolley cars are running it will carry twelve rails. To this is to be added the weight of four extra hauling cables, two in use and two in reserve, and also the weight of the various telegraph and telephone wires which cross the bridge. It is pointed out furthermore that permission has been given to lay two lines of 8-inch cast iron tubes for the service of the Tubular Dispatch Company, of New York. It is claimed that these additions to the structure will add from one to two thousand tons to the dead load and will strain it beyond the limit of safety.

It may be said in general regarding all reports of the insecurity of the greater engineering works, especially those in the domain of bridge building, that popular fears for the safety of a structure are apt to increase in proportion to its size and bulk. As a matter of fact, however, the larger bridge is likely to be the safer, especially in respect of overloading, because in the case of such a vast structure as the Brooklyn Bridge its own weight is so enormous that any additional loads which may be put upon it will probably add but a small percentage to the total weight of the structure. Thus, if the eight lines of rails, the four extra cables, the pneumatic tubes and the telegraph wires were to be laid across a country highway bridge weighing so many hundred pounds to the foot, they would make some inroads upon the "factor of safety" so called; but when this addition is made to a sixteen hundred foot span, weighing so many tons to the foot, as in the case of the Brooklyn Bridge, the increase in the strains upon the individual members of the bridge is so slight as to become a practically negligible quantity. The weight of the central span is 5878 tons. The combined weight of all the extra loads above mentioned which have been or are to be placed upon the bridge does not add more than about five or six per cent to the total estimated dead weight of the main span. In view of the fact that the bridge was made strong enough to carry four times its own weight, plus four times the weight of all the cars, loaded drays, and foot passengers that could come upon it before breaking down, it is evident that the increase in dead weight which has occurred in no-wise imperils the safety of the structure.

When we come to consider the question of the increase of live or moving loads, due to the weight of the trolley cars, the unexpected fact is disclosed that such a line of cars would not equal the assumed loading for which Mr. Roebling originally designed the floor of the structure. The floor is carried upon continuous latticed floor beams, which are spaced about 7½ feet apart and run transversely across the whole bridge. Each of these was designed to carry a maximum load of forty-four tons distributed as follows: Four tons on a pair of dray wheels placed next the outside cables, ten tons on a pair of wheels placed next the cable road trusses and eight tons on each pair of cable car wheels.

The maximum axle load of the Brooklyn trolleys, however, is only five tons, or just one-half that which was assumed in designing the floor of the bridge. Nor would the suspenders or the main cables be more seriously strained than they would under the maximum loading for which the bridge was designed. The weight of the moving trolley cars will be so distributed by the rigid floor beams and the longitudinal trusses that the strains in the suspenders and cables will vary but slightly from those due to the maximum assumed loads.

It is being urged that placing trolley lines on the inside of the roadway brings an undue share of the load upon the inner cables. The flexibility of the cables and the rigidity of the floor, however, so affect the distribution of the load that the effect upon the cables would be practically the same whether the tracks were laid on the outside or inside of the roadway. This is shown by a model which can be seen at the office of the engineers of the bridge. A strip of hard rubber, representing a floor beam, is suspended by scales at points representing the points of attachment of the suspenders to the floor of the bridge. If a weight be placed at two different positions, corresponding to the inside and outside of the roadway, the reading of the scales shows that the effect upon the inner cable will be no greater when the car is placed on the inside than when it is placed on the outside of the roadway.

The Brooklyn Bridge is a monument of the genius and skill of its builders, and the fact that it was provided with a margin of strength so liberal as to allow of another set of lines being operated whenever the increase of travel should demand it, is a testimony to the far-sightedness of its eminent designers and builders. Whether, in view of the great improvement recently carried out in the operation of the cable road, the time is yet ripe for the laying down of further lines, we do not undertake to say; but that the growing travel will soon demand this enlarged accommodation no one can seriously deny.

THE WEATHER BUREAU IN 1897.

The Weather Bureau of the Department of Agriculture is to the average citizen one of the most important of the bureaus, and it is remarkable that so much can be accomplished by an appropriation of $883,772. It is significant that the appropriation for 1896–97 was $109,748 less than in 1883. In 1883 the weather maps were not issued except at the central office in Washington, D. C. During the last fiscal year 4,315,000 maps were issued to eighty-one stations outside of Washington, D. C. In 1883, forecasts and warnings were sent to 8,094 places by mail, while during the last fiscal year the daily forecasts and warnings were sent to 51,694 places, by mail, telegraph, telephone, etc. In 1883 no information was collected respecting the weather as influencing crops; now climate and crop conditions are reported from about 8,000 places and results are summarized in the weekly Climate and Crop Bulletins, which are issued at each State center and published by practically the entire press of the country, both rural and urban. In the former year there were less than 300 voluntary observers in co-operation with the bureau, but last year there were about 3,000 voluntary observers, making daily readings of standard government instruments, the daily observations being collected and printed in tabular form at 42 State centers. There are now 253 stations on our sea coast and the Great Lakes where storm signals are displayed, against 41 in 1883. In view of this remarkable showing, it is little wonder that Willis L. Moore, chief of the Weather Bureau, states in his Annual Report that, to meet the public demands, all workers have been taxed to the limit of physical and mental endurance. It is to be hoped that the increase of $160,348 will be granted, as it is urgently needed.

The work of the bureau during the last fiscal year was conducted on lines tested and approved by the experience of former years. The usual forecasts of temperature, wind and weather were issued twice daily, as were also special warnings of cold waves, frost, severe storms and hurricanes, as occasion demanded. There were no violent storms of which timely notice was not given. The flood warnings issued by the bureau in connection with the disastrous floods that occurred in the lower Mississippi Valley in the spring of 1897 were most timely and effective, and on March 15, two weeks before the first serious break in the levees occurred, it was announced in a special bulletin. The local officials, under instructions from the central office, gave the widest possible distribution to these warnings by mail and telegraph throughout the threatened regions. A daily bulletin was given to the press, thus keeping the public informed of the extent of the flood. It would be impossible to estimate the value of live stock and movable property saved by these warnings.

In hydrography the work has been no less efficient. There have been maintained through the year 113 river and 42 rainfall stations, making daily observations and full monthly reports, together with such telegraphic reports as seemed advisable for the purpose of weather forecasting. Beginning with the issue of the Monthly Weather Review for 1896, there has been included in that publication a monthly report on the condition of the rivers of the United States. The river service is composed of twenty-two sections, each with a central office receiving reports from a definite area, and each making local forecasts for the river districts under its supervision. In the case of impending disaster the central office at Washington dictates the important warnings for distribution by the section centers.

The year was somewhat remarkable for the absence of severe cold waves and destructive frosts, for such as occurred were, as a rule, accurately forecast in good season. The system of recording the advents of cold waves from station to station was put in operation during the year over the eastern Rocky Mountain slope from Nebraska to Texas. Gratifying success attended