

The sole objection to this location lay in the southern approach, which made it necessary to leave the bridge on a sharp curve, and involved a cut 70 feet deep ; these were matters of little weight when compared with the merits just enumerated.\*

Great care was taken to ascertain the exact direction of the current and the bridge line. Observations were made with two transits simultaneously on a number of floats ; the result of these observations was mapped out on a chart, and the direction of the current was thus accurately determined. The course in mid-channel as thus obtained made an angle of  $72^{\circ}$  with the bridge line ; the piers were located parallel to the current, and the bridge built on a skew of  $18^{\circ}$ . The floats used were made by inserting a rod, to which a small flag was attached, in the neck of a bottle loaded with shot, the amount of shot being sufficient to sink the flag nearly to the surface of the water. These floats drew, on an average, about four feet, or the usual draught of a Missouri River steamboat ; they therefore gave the true navigable current. The direction of the current varies a little with the stage of the water, as well as with the different forms which the smaller sand bars assume in successive years, but during the season of navigation it has not been found to show any material divergence from the line thus determined and given to the piers.

The pivot pier was placed in the centre of the channel ; the piers were numbered from the southern end of the bridge, and the lengths of the several spans were as follows : a fixed span of 132 feet, extending from the shore to Pier No. 1 ; a pivot draw 363 feet long, each arm having a clear span of over 160 feet, as required by the Act of Congress ; a fixed span of 250 feet from Pier No. 3 to Pier No. 4 ; leaving a remaining distance of 577 feet divided in the original plans into three spans of equal length, though subsequently changed to two spans of 200 feet each and one of 177 feet ; to this must be added a shore span of 68 feet at the south end, extending over the width of a street and the Pacific Railroad track, and which made the total length of bridge from outside to outside of masonry 1,400 feet. The lengths of spans given here are gross distances taken from centre to centre of the adjoining piers. The nearness of the channel to the south bank made it impossible to place a span of 250 feet

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\* The profile and alignment are given on Plate II.