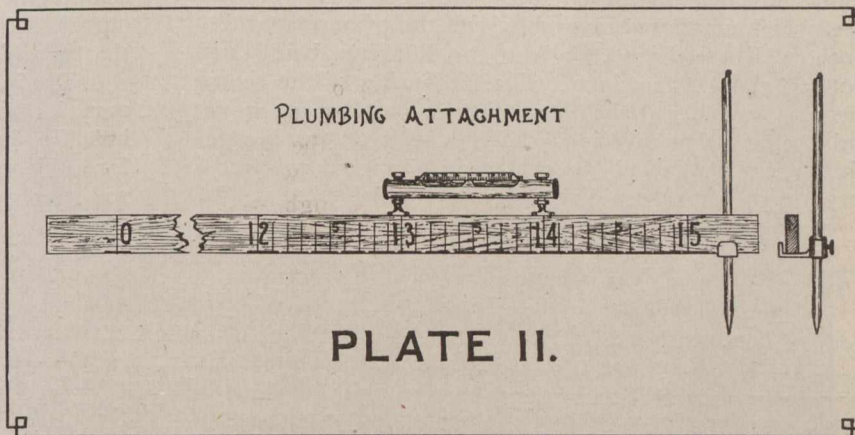


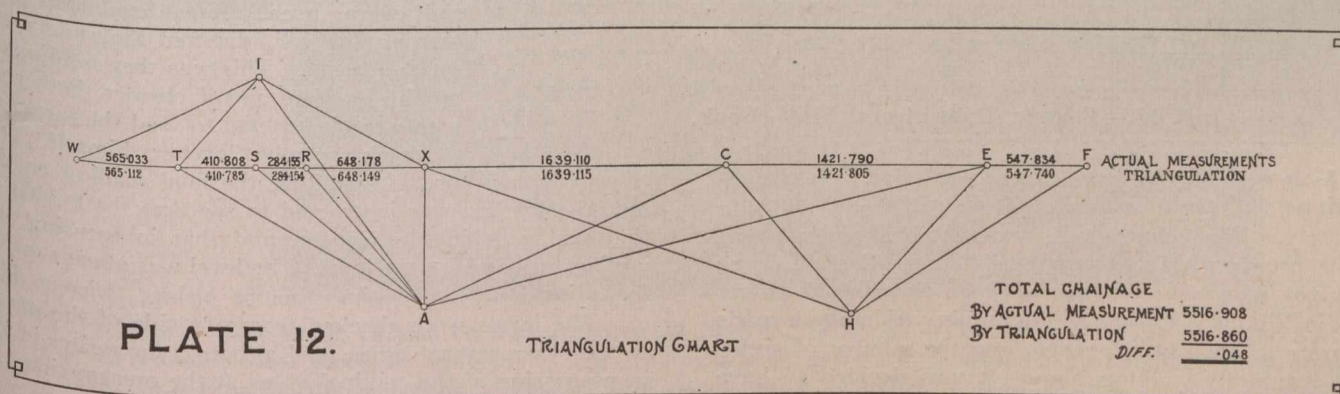
15-ft. stations were set, it was found necessary to start a new level of stakes about two feet lower than the first set, as the ground was found to be falling slightly in the direction of C. It was also found necessary, after this level of stations had been set for about six hundred feet, to raise the balance of the distance to a higher level. Measurement was carried from one level to another by using a fine plumb-bob protected by a canvas wind shield. See plumbing arrangement, Plate 11.

The method of measurement was as follows: Hub X, being the initial point, was set in concrete deeply planted in the ground as a safeguard against its being shifted, and a fine tack with a scratch across its face was made to indicate its chainage. The first set of level stations was measured after two transit points had been taken on the head of each stake, and these joined by a pencil line. This was in order that the transit need not be used while measuring was being done, so that the transitman could keep notes carefully and watch the work. With the zero end of the rod at the starting point, a tack was placed in the first station so that the 15-ft. distance would come upon its head, a fine scratch in the form of a sharp arrow was made on the tack with a small blade of a pocket knife, and this was checked to see that the 15-ft. graduation on the rod exactly coincided with the point of the arrow on the tack. To avoid confusion, no two marks were made on the same tack. The rod was then moved ahead to the second pair of stakes, and so on until a portion of the line was measured, but in no case was this distance too great to be checked three times the same day. Measurements were recorded by the transitman. The man at the zero end of the rod was then moved to the front end, the front man being moved back to take the rear end, and the measurement checked carefully through. If any discrepancy was found, the recorder took one end of the rod and both rodmen jointly took the other end. When any differences were found, new tacks were used to receive

From C to E a great deal of steep and irregular ground was encountered, and on account of the small distance measured each time, and of the frequent uses of the plumb-bob as well as the winds, it was decided that no horizontal measurements should be taken. Some of the ground was as steep as 1 to 1½, and it would not have been practicable to have shielded the plumb line each time a measurement was taken. Slope measurements were taken in all cases, careful levels were taken over the stations and the horizontal measurements calculated. (See sample of notes, Fig. 13.) Wherever it was



possible with some little grading to get two or more stations on the same slope, this was done. This simplified calculations, also reduced liability of error. On some slopes that were somewhat uniform, by a little grading it was possible to get as many as five or six stations on the same slope. The tops of these stakes were carefully lined in to the uniform slope by using a level and target rod. Wherever a change was made from one slope to another, the station where the change took place was called a "change," and this was written on the stake so that when levels were taken for the calculation of the horizontal measurements, the respective elevations of the changes only were required. The measured chainage of



the scratches. After a chainage was decided upon, the measuring rod was again checked into the standard 90-ft. base, and if found to be correct, the chainage previously agreed upon was allowed to stand.

After a final measurement had been agreed upon as far as hub C, a triangulation base was laid off south of, and at 90 degrees to the centre line from hub X, and this was carefully measured—759.270 feet in length, and from triangulation X-C was found to be 1639.115 as against 1639.110 measured with the measuring rod. See triangulation chart, Plate 12.

this portion of the bridge length was 1421.790 feet, as compared with 1421.805 feet which was computed from triangulation.

From E to F, the distance measured with the measuring rod was 547.834 feet, compared with 547.740 feet from triangulation. The west end of the work which was in the direction of X-W, was measured and triangulated in a similar way to the way in which the east end was done, the only difference being that point W was not visible from either X or A, and for this reason, a secondary base line had to be established by triangula