On Optimization of Six-Segment Baselines

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SUMMARY

Additive constant and scale correction are two important corrections for systematic errors of Electronic Distance Meters (EDMs, including total stations). Therefore, it is of great significance to increase their calibration precision. Field baselines have been wildly used in engineering surveying to calibrate EDMs. There are three types of baselines, i.e. Schwendener-Heerbrugg, Aarau and Hobart. As far as each type of baseline is concerned, a number of design options are available for the baselines with different stations. A reasonable balance between cost and precision is obtained with six to seven stations. Golomb rules provide four design options for the six station baselines and five options for the seven station baselines. Even as far as only one design option is concerned, distances may have many different kinds of combinations. Could the same instrument get the same calibration result using different combinations under the same length? Which combination is the best?

This paper answers the above questions. Firstly, it introduces the most commonly used seven station (also called six-segment) comparative method for calculating the standard deviations of additive constant and scale correction from a least squares adjustment . Secondly, it studies and analyzes the layout schemes with different distance combination, using an example of a 768 meter long field baseline in Gansu Province of China. The total number of layout schemes with different combination distances is 322. Then the determination precision, which is the standard deviation of additive constant and scale correction of different layout schemes, is calculated and demonstrated. Finally, the optimized schemes of field baseline distance arrangement are suggested among 322 ones. The demonstrated results show that 322 schemes have different standard deviations of additive constant and scale correction, and thus, optimized schemes are those with lower standard deviations.