

Single Base RTK Solutions Obtained Individually with GALILEO and Beidou as Well as in Combination with Other Fully Operational GNSS

Viktor Mihoković, Luka Zalović and Danijel Šugar (Croatia)

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SUMMARY

GNSS RTK positioning method is the most widely used and the fastest surveying method for coordinates determination on the surface of the Earth. Due to its speed and reliability, it has found a wide application within surveying and geodesy. Similar to other satellite positioning methods, the efficiency of the RTK method is highly dependent on the number of simultaneously visible satellites in certain epoch. Currently, GPS and GLONASS are the only two fully operational systems which are commonly used for conventional (base-rover) or networked RTK positioning. Two additional GNSSes – European Galileo and Chinese BeiDou – are planned to achieve their Full Operational Capability (FOC) by 2020. Although Galileo and BeiDou are still under development, the idea of assessing the possibility and feasibility of positioning by single base RTK method using this two satellite systems has arisen. The investigations about the feasibility of the single base (conventional) RTK positioning using individually Galileo and BeiDou satellites has been carried out and presented in this paper. Hence, two GNSS receivers (base and rover) of the Topcon's newest model HiPer HR with the capability of observing all available GNSS constellations have been used. In addition to the receivers, the field controller FC-5000 with the Topcon Receiver Utility (TRU) software was used enabling the selection of the GNSS constellation combination for positioning. Prior to surveying, the mission planning was performed pointing out those time windows with optimum number of visible Galileo and BeiDou satellites. Altogether 13 combinations of GNSS constellations were tested during two days of measurements enabling the subsequent accuracy and precision analysis. Static GNSS occupations carried out on the base and rover receiver stations prior to RTK observations (using GPPS CROPOS – national permanent GNSS network) enabled the underlying accuracy evaluation. The analysis of the results obtained with different 13 combinations of GNSS constellations has pointed out that the RTK fixed solutions were obtained in all combinations, including Galileo and BeiDou individually. Due to small number of available satellites and constellation under construction, Galileo and BeiDou as systems are still

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not ready for reliable individual RTK coordinates determination. The availability of numerous multi-constellation observations in the future will enable faster and more reliable ambiguity resolution and subsequent GNSS positioning.

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