A Pilot Study on Levelling Network Adjustment of Multi-Dimensional Geodetic Control Points in Republic of Korea

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SUMMARY

Like most other countries, triangulation points and levelling benchmarks (BMs) have traditionally played a core role as the geodetic control to support compatible data collection for the geospatial disciplines. Due to a limitation of the traditional surveying techniques, such as triangulation, trilateration and spirit-levelling, these control points have had to be separately installed and maintained. While the triangulation points are mostly located on hilltops for the visibility, the BMs are established along major national and state roads for the surveying efficiency and precision; hence accessibility of the former is restricted, and spatial density of the latter is sparsely populated. To resolve this problem in Korea, the national geographical information institute (NGII) has designed and established the so-called the unified control points (UCPs) which enable to offer multi-dimensional geodetic coordinate sets with improved accessibility and accuracy. With the advent of the global navigation satellite systems (GNSS), the horizontal control points are no longer placed on the top of hills and mountains for the line of sight, and they can be instead installed in the low elevated areas. NGII initiated the UCPs establishment projects with GNSS, spirit-levelling and gravimetric campaigns in 2007. The implementation of the 1st-phase UCPs network was completed in 2011 with the uniform spatial density about 10km, and since then, the 2nd- densification has been underway for the spatial frequency about 3km to 6km. The UCPs will, therefore, supersede the legacy geodetic points after the full implementation under schedule to be 2025. While the GNSS technology can readily implement the horizontal geodetic network, there is a technical challenge to establish the vertical network due to characteristics of the geodetic levelling. To this end, a pilot study project had been carried out to design a new version of the UCPs-based levelling network as well as to demonstrate the effectiveness regarding accuracy and reliability. An experimental network around the vertical origin was designed in this study by using 621 points, and subsequently, a series of the network adjustments was conducted. In this contribution, concept and strategy of the UCPs based levelling network are briefly given with some examples. This is

followed by presenting details of the pilot network and its measurements together with the network processing procedure. Finally, results of the adjustments will be provided with emphasis on the impact of the UCPs-based network regarding accuracy, reliability and estimated heights.