Impact of Satellite Positioning Services on State Survey Control Networks

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SUMMARY

The introduction of satellite positioning has fundamentally altered the working procedures in engineering, legal, and topographic surveys. By using GPS reference stations from an active reference network, access to the geodetic reference frame is easily achieved. In the German state of Lower Saxony, investigations to disseminate corrections in real time started about ten years ago. By now, a complex infrastructure of 41 permanent GPS stations with different communication solutions has been established. A sophisticated satellite positioning service (SAPOS) is operational, providing network RTK corrections not only for precise detail surveys but also for various other applications beyond the traditional field of surveying. In contrast to classical control networks, the establishment and operation of satellite positioning services is no longer exclusively reserved for survey authorities. Private companies are able to set up their own independent service.

In some countries positioning services are solely provided by electricity or oil companies. Two interrelated questions that are discussed in this paper arise from these developments. The first question requires the examination of the organization and the tasks of state survey authorities as positioning service providers. The relationship with and interface to private service providers need to be defined. The second question that is focussed on in this paper concerns the future shape and significance of geodetic control networks. During the development of real time GPS positioning networks the intention was to thin out the control networks drastically in order to reduce the expenses for maintaining the monuments. There was also the idea to substitute the monumented networks by active GPS reference stations, since GPS is a 3D positioning system and therefore provides horizontal coordinates as well as ellipsoidal heights which can be converted to physical heights if geoid information is available. After a few years of experiences with operational positioning services, their impact on control networks need to be revaluated. GPS reference stations rely on a precise, homogeneous, and in the long-term stable geodetic reference frame. This frame needs to be adequately tied to the physical earth using appropriate monumentation. GPS antennas cannot meet these requirements, especially not in real time services, because of the various station dependent errors. In addition, experiences show that the reliability of geodetic networks can only be guarantied, if independent survey techniques are employed. Despite the fact that GPS enables the precise determination of height differences over larger distances, levelling and gravimetric measurements are still necessary to determine the physical shape of the earth. Therefore, satellite positioning services are changing the shape of geodetic control networks, but these networks will still be an essential infrastructure in the future.

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