Reconstruction of the International Automobile Control Admission Point of Bachivsk Using Modern GNSS Equipment

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Abstract – The article focuses on researching on realization of the geodetic measurements and comparison the accuracy of control points at the reconstruction of international automobile control admission of Bachivsk use of modern GNSS of equipment.

Key words – GPS, GNSS, coordinates, base station, RTK mode, GNSS receivers, errors,

I. Introduction

Global satellite systems such as GPS (USA) and GLONASS (Russia) provide high accuracy and promptness of determining the coordinates of points and their altitude component of a geodesic sphere, and not only there [1].

Determination of spatial coordinates of objects of earth surface modern GNSS receivers purchased large popularity in Ukraine during a few last years. In particular it should be noted that the first appearance active network reference stations ZAKPOS in the West of our country for several years it has increased several times and covered the whole territory whose name now ZAKPOS -UA / EUPOS [2]. Thus classic geodesic methods were used less because they are considerably expenditures of labor than modern satellite methods.

At the international automobile control admission point of Bachivsk not conducted any geodesic works since the moment of its opening of 2002. The capacity of vehicles has increased significantly in the last period and that is why there was the need for reconstruction in particular expansion of admission stripes. As this checkpoint is on the border with the Russian Federation, there is an urgent requirement to improve the control of transport and goods that cross it.

One unresolved problem is the demarcation of the state border of Ukraine. Actually demarcation of border is conducted with our most states-neighbors, but problem area is part of border with Russian Federation. Therefore, this direction is extremely important [3-5].

II. A sequence of implementation of reconstruction is on an admission point

Bachivsk is a village in Ukraine, Hlukhiv district of Sumy region. Besides radiology, customs and border control international automobile control admission point of «Bachivsk" can perform sanitary, phytosanitary, veterinary, environmental services and control of international road transport. Point of admission presented in Fig 1.

Fig. 1. Location of admission point of Bachivsk

The first priority for the implementation our work was the expansion of lanes of admission point to increase the capacity of vehicles.

Before the beginning of implementation of the field geodesic works we have done recognition of flagstaffs with the known coordinates, in future we compared with that measurements. Currently the territory of Sumy region is not sufficiently developed infrastructure GNSS network and satellite observations therefore the process requires additional instrument for ensuring the quality of geodesic works.

Immediate satellite supervisions were conducted of dual-frequency GPS by the receiver of TOPCON GRS - 1. Works were executed in the mode of RTK on September, 15, 2015 [6, 7]. Terms for realization of such type of works were satisfactory, the amount of visible satellites hesitated from 6 to 11. RTK corrections were obtained from the nearest permanent station Novgorod - Seversky. Locations of the permanent station of our facility are presented in Fig. 2.

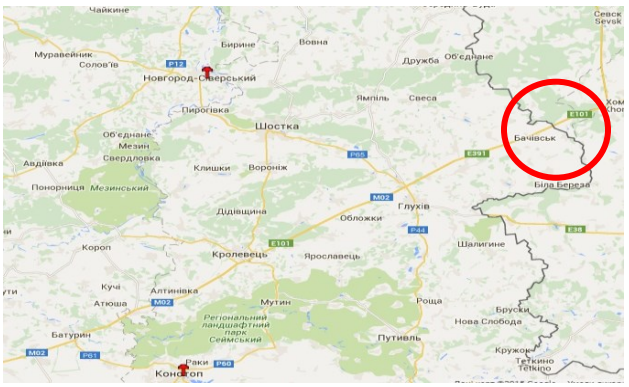

Fig. 2. Location of the permanent station Novgorod - Seversky

Distance from the station to the district of implementation of works reached about 50 kilometer that are possible, however at implementation of works in RTK mode errors larger more than possible (±a 10 cm is in a plan). On the territory of our facility are three flagpoles and rapper with known coordinates, which later served as control us. Scheme of arrangement are shown in Fig. 3.

The choice of height of rapper was set by a customer and set to basis of attachment of the field geodesic works. From this station there was the conducted attachment of our base transceiver that was in a direct closeness from the district of implementation of works.

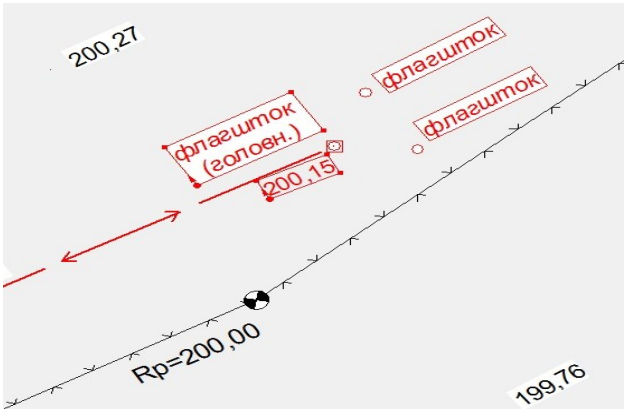

Fig. 3. Location of flagpoles and rapper

Installation of the own base station was executed with the aim of realization of the mode of STOP&GO. Both mode of RTK and STOP&GO allow considerably to shorten time of implementation of in fact of work the field geodesic works executed on a regime object where traffic movement is continuous.

III. Result and analysis of the conducted works

The main goal of our research work was to conduct RTK observations and compare the obtained data with the known coordinates of points. From the received 136 points 4 of which served as controls were compared with the generated coordinates in RTK mode.

Coordinates of base rapper and 3 flagstaffs are given in Table 1 in the system of coordinates of SK- 63.

TABLE 1

INITIAL COORDINATES OF MARK POINTS

Name of the control point.	X, (м)	Y, (м)	Z, (м)
The base rapper	5740830,080	5218883,510	200,00
Flagstaff I	5740838,250	5128889,79	199,99
Flagstaff II	5740841,340	5218887,78	200,08
Flagstaff basic	5740838,44	5218886,55	200,15

We got the coordinates of 136 points from conducted GNNS observations. Processing of file observations was conducted in the software Topcon Tools provided taking into account the precise satellite ephemeris.

As a result of comparison between the control coordinates of points and our observations there are the got differences is presented in Table. 2.

TABLE 2

DIFFERENCES OF COORDINATES CONTROL POINTS AND RTK OBSERVATIONS

Name of the control point.	ΔX, (м)	ΔY, (м)	ΔZ, (м)
The base rapper	0,012	0,019	0,024
Flagstaff I	0,021	0,036	0,059
Flagstaff II	0,034	0,042	0,063
Flagstaff basic	0,023	0,017	0,041

From this it follows that the quality of the surveying work is satisfactory and the difference between control points are within acceptable limits (from 1.2 cm to 4.2 cm in a plan, and from 2.4 cm to 6.3 cm in a height).

We have created a scheme of control admission point of Bachivsk in the program Digitals on the results processing of our observations (Fig.4).

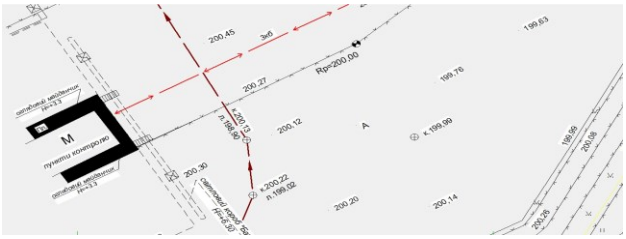

Fig. 4. Scheme of geodesic works of the international automobile control admission point of Bachivsk

The results of the survey works will be used for further reconstruction of international automobile checkpoint Bachivsk that will give an opportunity to increase the capacity of vehicles.

Conclusion

On the basis of the conducted survey works of reconstruction of international automobile control admission point of Bachivsk mean that the quality of the executed of works is satisfactory, and the difference between control points are in possible limits (from 1,2 cm to 4,2 cm in the plan, and from 2,4 cm to 6,3 cm in height).

The results suggest that the definition of coordinates of points in RTK mode is possible with sufficient precision, given the fact that the distance to the permanent station Novgorod-Seversky reached 50 km.

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