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STUDY ON PREPARATION OF TECHNICAL DOCUMENTATION REQUIRED TO DESIGN ROAD DC 36 UPGRADING -STANESTI-STOILESTI, VALCEA COUNTY

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ABSTRACT

This paper aims at showing how to achieve the necessary technical documentation to design of the studied road upgrading works, using the technologies such as that GPS. Topo-cadastral works made so yielded high accuracies comparable to those obtained using total stations, but with a much higher yield and much less human, financial and material effort,. Measured data were processed with specialized software that allowed a rapid and accurate large-scale topographic plans, they create the opportunity that designer to take the best and effective design solutions and the constructor to perform work in the best conditions.

INTRODUCTION

Stoileşti village is located in the eastern part of the county of Valcea at administrative boundary with Olt county, between CFN Bucharest - Craiova - Timisoara and from DN65, DJ 641and D.J. 652. The village is bordered by: - South - Olanu common Olt County; - To the east - common Danicei Olt County; - To the north - common Nicolae Balcescu - west - Galicea and Olanu commune.

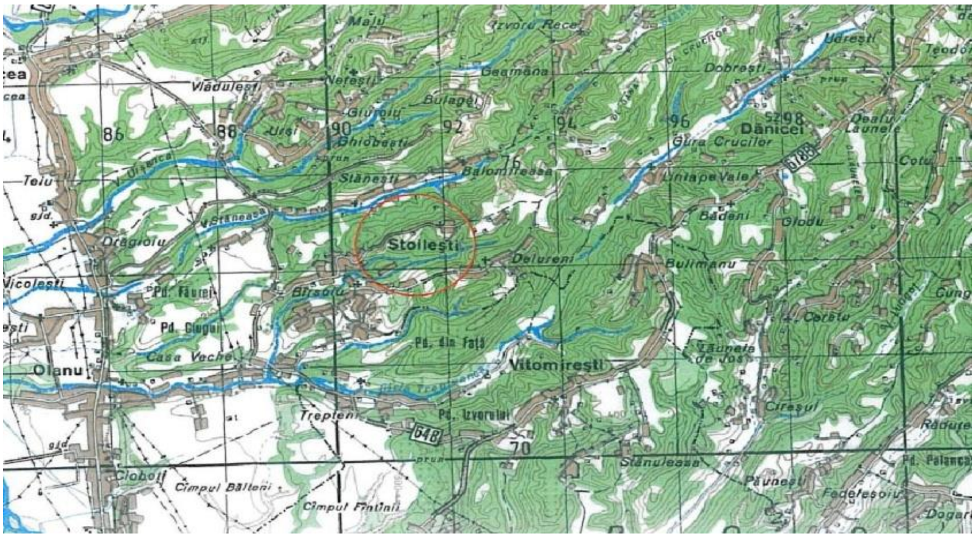

Figure 1. The work location in the area

The land on which is situated the work consists of silty sand with gravel and cobble elements according to STAS 1243, is characterized as a good or medium material, in terms of quality earthworks and material behavior under frost and defrost.

Local road proposed for upgrading, we provide a link between the county road DJ 678 H and the administrative center of the commune Stoilesti. The necessity communal road asphalting D.C. 36 Stanesti - Stoilesti from Stoilesti commune, with a total length of 3.77 km, has emerged as a priority due to poor technical condition of the road platform, presence of bumps in the roadway, lack of water collection channels on parts, clogging them where there , which favors the road puddles or water leakage.

PURPOSE AND METHODS

Aim of topo-cadastral raising was to accurately determine the points on the contour of communal road DC 36 Stanesti - Stoilesti, to design the modernization works and drawing the situation plans.

The design is performed according to design theme that includes: - Study of technical and economic substantiation; - Field research; - Studies - Surveys; - Existing projects.

Using this technical documentation prior design, elaboration of the draft is usually done in two phases: - Technical and economic study TES; - Conceptual design C.D .

Topo-geodesic studies consist of detailed study of the land in the area, surveying and execution of stakeout works, the development of geodetic base, the location on the map of geological prospecting and alignments.

The following main topographic materials are required preparing their projects:

1. Topographic plans of the territories scale of 1: 25,000 or 1: 50,000 to indicate the construction location;
2. Topographical plans at large scale to compile the project, resulting from surveying;
3. Topographic elements of the terrain in the construction area (altitudes, coordinates, lengths, angles);
4. Longitudinal and cross profiles of the land.

Terrain documentation must meet the following conditions:

1. Accuracy of topographic work must meet the requirements of the different phases of design and purpose;
2. Scale of topographic documents must match the precision of position determination for topographic points and relief;

3 The area of land that rises must established requirements imposed for each phase of the design, being linked with the length of the various works.

The particularity of topo-geodetic work performed for the purpose of construction, is that they precede and accompany all stages of construction, the general meaning of the word.

On the topographic plan must be represented topographic points with determined elements by local road bridges linking neighboring properties, concrete pillars of network overhead, metallic poles, culverts, road axis, fountains, property boundaries of adjacent communal road axis.

On the plans were drawn topographic grid of 10 x 10 cm, binding in such topography works, which was attached a rectangular coordinate system with x axis on the abscissa, y axis on the ordinate and on the right, at the scale 1: 500, characteristic of such works.

In order to perform properly called raising, axle road was picketed with iron bolts, and then detail points were determined for each transversal profile from the side, perpendicular to the axis of the road, at a distance of 15-30 m between profiles. Topographic survey was executed in 1970 Stereographic projection system and the station points were evidenced by metallic pickets signaled with red paint.

RESULTS AND DISCUSSION

The effective raising achievement involves picketing road axis with iron bolted and signaling by red paint in all characteristic points. Raising points of detail from each transversal profile separately, perpendicular to the axis of the road, in all characteristic points at 15-30 m, depending on terrain.

To achieve planimetric survey we went on the field where we set the points to be measured and we determined approximately the number of points to be raised. Topographic survey was executed in 1970 Stereographic projection system and the station points were evidenced by metallic picket signaled with red paint. All points of detail and breaking were determined using the polar coordinates method (Păunescu C. and colab., 2012).

The station point was completed the following steps:

- Centering the device is such that the center of the machine to be on station point and the mass of device to be as horizontal;
- Leveling device, the device ZZ axis coincides with a plumb line passing through landmarks.

It specifies that if not done correctly the leveling operation of the device, it will give an error message and will not record any measurement. After putting the device in station, GPS antenna is screwed, and start, also the controller, and will set and store all data regarding the present location and determining method of points: STATIC - 4 points.

The residence time for determining the points 1000, 2000, 3000 and 4000 was 30 minutes for each point station to fixed stations: Craiova and Slatina. Is started controller by pressing the ON, the main menu is displayed, and the operator can choose, depending on the purpose of the work, submenus, programs or subprograms required (Călina Jenica and colab., 2013).

All these data are saved in JOBS that are similar with folders, they contain measured data per separately sessions and they can be managed individual and can be viewed, edited or deleted separately.

All data that is recorded by defining the job is submitted in this folder, and the date and time are entered automatically by the system and can not be modified and validate with OK. By using the values in the internal memory device user is away from introducing erroneous data. The programs use both known points and static measured points (1000, 2000, 3000, 4000).

Compensation method used was indirect weighted observations method, which requires block compensation of differences coordinate (Dx and ΔY), resulting from GPS measurements and data processing.

GPS stations 1000, 2000, 3000 and 4000 were determined GNSS (GPS) using the static method according to Decision no. 1 of 2010.

Table 1

The coordinates of support points stationed in stereo 70 system

Point no.	Stereo 1970 coordinates	
	X (m)	Y (m)
1000	450496.2630	379052.2130
2000	450363.9380	378991.2170
3000	446956.5210	377960.5610
4000	446929.5710	378035.9470

To achieve thickening and rising network wasstationed in GPS 2000 with guidance visa on GPS 1000 from where started a traverse supported through stations 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, 2031 closing on the GPS 3000 visa control on GPS 4000.

In stations 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025 2026 2027, 2028, 2029, 2030, 2031 and 3000 were taken contour and detail points required for the site location plan.

Table 2

Coordinates used to correct records of GPS points static determined

		GEODETIC NATIONAL FUND				
GPS permanent stations (class A)						
			ETRS 89			
	Geocentric cartesian coordinates			Ellipsoidal coordinates		
Name	Xc	Yc	Zc	B	L	He
CRAI	4181965,332	1841376,450	4435131,344	44°20'16.82528"N	23°45'52.37671"E	143.085
Stereographic 1970 coordinates						
	X	Y	Z(MN1975)			
	316112.418	401599.492	102.617			
		GEODETIC NATIONAL FUND				
GPS permanent stations (class A)						
			ETRS89			
	Geocentric cartesian coordinates			Ellipsoidal coordinates		
Name	Xc	Yc	Zc	B	L	He
SLAT	4156437,737	1882548,097	4441916,355	44°25'21.65378"N	24°22' 00.79258"E	228.9789
Stereographic 1970 coordinates						
	X	Y	Z(MN 1975)			
	324965.109	449706.008	189.744			

Topo-cadastral operations performed:

-The used coordinate system was Stereographic 1970 and Black Sea 1975

- We used GPS SOUTH S82; ;(Păunescu C., 2001)

- The device used was LEICA TC 705

- To calculate the coordinates WGS 1984, was used records from fixed stations: Craiova and Slatina.

GNSS data processing was performed using Leica GeoOffice specialized program. Coordinate transformation from ETRS system 89 in stereo 1970projection system was made using the program TransDatRO var. 4.04. Following the GPS measurements, have resulted stereographic coordinates on ellipsoid WGS 84. These coordinates were transcalculated in official reference system of Romania, using coordinates of points 1000-2000 - 3000-4000, static determined (Călina A. and colab., 2014).

To determine the absolute rectangular coordinates of all the points of the station and sideshot points was started from stereographic coordinates of station point 1000, determined by static method. All details available on the surface and its proximity were taken using Leica TC 705 total station.

Table 3

GPS information in accordance with Annex 15, generated by the program Leica GeoOffice

PARAMETERS: GPS SOUTH S82	**EQUIPMENT PARAMETERS: GPS SOUTH S82**
Kinematic: Horizontal 10mm + 1 ppm Vertical 20mm + 1 ppm **Static:** Horizontal 5mm + 0,5 ppm Vertical 10mm + 0,5 ppm Initialization time : 0° 08' 02"	GPS : L1, L2 , (Cod C/A, P,C) - TPS 1200 SmartTrack + Antenna L1 and L2 - SBAS (EGNOS, WAAS, MSAS, GAGAN). **Frequency :** GPS L1 1575.42 MHz GLONASS : L1, L2 , (Cod C/A, P,narrow) L1 1602.5625 MHz-1611.5 MHz
PROCESSING SUMMARY	**PARAMETERS SUMMARY**
RAPORT :	**RAPORT :**
Manually occupied points: **1000; 2000; 3000;4000**	Manually occupied points : **CRAIOVA ; SLATINA**
PROJECT NAME : Comuna **STĂNEŞTI Modernizare**	**CRAI – GPS500 Reference: CRAI Rover: GPS501**

drum D.C 36	**Receiver type** :
PROCESSING GPS STATIC	/ S/N: aX1202 / PRN / 22,23
Date created: 15/03/2014/ Time zone: 12° 10' 03" - 18° 26' 41"/ PM/	Count : 882590/870484/7133/ / Percentage: 98,63/0,81 Count : 981/3365/ / Percentage: 0,113/0,387
Coordinate system name: E-TransDatRO 4,01	Count :142/114/ / Percentage: 0,021/0,017 Count :2359/2430/ / Percentage: 0,271/0,279 Count :158/157/ / Percentage: 0,024/0,024
Application software: LEICA Geo Office 7.0	Antenna height: 1.8000 m
Start date and time: 15/03/2014/ /12:16:03/ PM/ End date and time: 15/03/2014/ /18:25:39/ PM/	**Reference coordinates:** Latitude: 44° 20' 16.82528" N
Duration: 06° 06' 38"	Longitude: 23° 45' 52.37671" E
Processing kernel: PSI - Pro 2.0	Ellip. Hgt: 143.0850 m
Date processed: /26/03/2014/ Time zone: 12° 10 ' 03" - 18° 26' 41"/ PM/	Start date and time: 15/03/2014/ /12:16:03/ PM/ End date and time: 15/03/2014/ /18:25:39/ PM/
Parameters Selected :	Total duration: 01° 00' 00"
Ephemeris type: Broadcast	
Solution type: Automatic	
GNSS type: Automatic	
Frequency: Automatic	
Min. distance: 104,796 km	

After proper processing and compensating all relative and absolute coordinates, on their basis was drawn the location and boundary plan (Figure 3) and from horizontal distances and points altitudes were drawn longitudinal and cross profiles of the road, on which have been shown with high fidelity and precision all the constructive elements (Figure 4).

Description of the designing

Technical design solution, pursue the appropriate technical characteristics of the class which includes road, improvement of circulation, which will provide a faster access of Stanesti and Stoilesti villagers to facilities that can provide the administrative center of the village and an easier access to city Rm. Valcea.

According to OM 45 / 27.01.1998 approving technical standards for the design, construction and modernization of roads pts. 2.2.h the proposed work falls in terms of functional and administrative as village road with the following geometry: - design speed 50 km / h; - Minimum radius 20 m; - Maximum longitudinal slope 9.24%; - Minimum radius for convex vertical connections 300 m; - Viewing distance 300 m; - 7.00 m width road platform; - Roadway width of 5.50 m; - Convoy computing V 80; - Road will follow the existing site.

Into plan designed solution sought to comply with existing road footprint limits. The way in a horizontal plane is shown in Figure 2. Axle road alignments are connected to each other by curved arc of a circle. Platform enlargement is done consistently throughout the length of the curve, and does not affect the width of the verges, they keeping the current width from alignment.

Longitudinal profile by the design solution achieved a maximum gradient of 9.24% and a minimum longitudinal slope of 0.15% and the minimum design step length is 30.50m.

Traverse profile in alignment has two slopes and the following geometry: - 7.00 m width road platform; - Roadway width of 5.50 m; 2 x 0.75 m wide verges; - Roadway cross slope of 2.50%, 4.00% incline across the verges (figure 4.);

CONCLUSIONS

1. Rehabilitation and modernization of the road has a great importance because in addition to the development of settlements from all points of view, the citizens have easier access to all public services, offers improved access easy and safe for all vehicles running on this route.

2. Wider using of the GPS technology in topo-cadastral work lately due to lack or low number of existing triangulation locally and nationally points, because their destruction unknowingly or because unconsciousness of authorities in the field and of citizens, and also due to precision currently comparable to that total stations.

3. Using GPS technology in performed surveyng yielded very small measurement errors that were perfect within the tolerances permitted and very high efficiency in work execution.

4. Automatic data processing was performed with a Leica Geo Office software specialized Level-Proc option program that allows processing and compensation of network simultaneously, which yielded accurate results and a high stability and confidence proposed solutions.

5. Based on the absolute coordinates of the points was drawn the situation plan at 1: 200 scale, which renders existing high fidelity full details on the ground, thus allowing the development of accurate and relevant design and tracking solutions to the rehabilitation and modernization of studied road section.

BIBLIOGRAPHY

1. Călina A. and colab., 2014 – *Topografie inginerească*, Editura Sitech, Craiova;

2. Călina A. and colab., 2013 - *Study on topographic survey of a forest area using combined technology GPS and total station*, Annals of the University of Craiova - Agriculture,Montanology, Cadastre Series) Vol. XLIII 2013,ISSN: 1841-8317;

3. Călina Jenica and colab., 2013 - *Topographical surveys for systematically registration of the property in Mischii territorial administrative unit*, Annals of the University of Craiova - Agriculture,Montanology, Cadastre Series) Vol. XLIII 2013,ISSN: 1841-8317;

4. Leu I. and colab., 1999 - *Topografie şi cadastru agricol*, Editura Didactică şi Pedagogică, Bucureşti;

5. Mihaila M. and colab., 1995 - *Cadastru general şi publicitate imobiliară*, Ed. Ceres, Bucureşti;

6. Păunescu C., 2001 - *Curs de Geodezie- Topografie. Vol.II*, Edit.Univ. Bucureşti.

7. **Păunescu C. and colab.,**, 2012 - Sistemul de determinare a poziției utilizând sateliţii GNSS, Editura Universităţii din Bucureşti, Bucureşti

8. Ediţie îngrijită de Cons. Fac. de Geodezie Bucureşti , 2002 – *Măsurători terestre – Fundamente - Vol. I - III.*,Edit. Matrix Rom, Bucureşti;

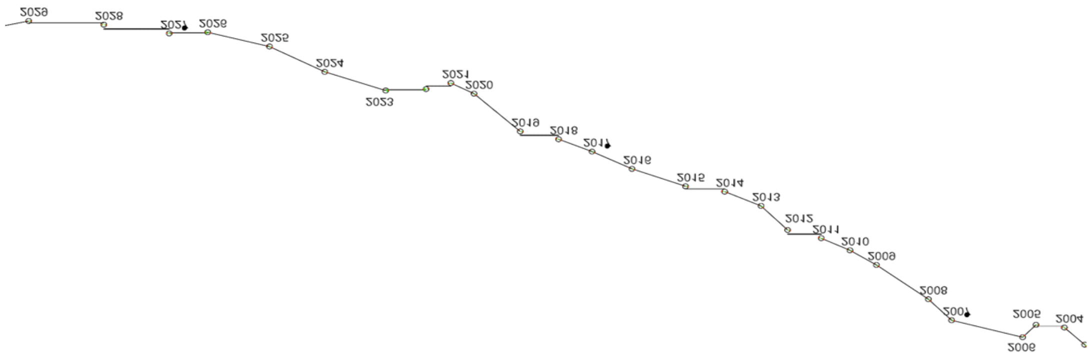

Fig.2. Surveying route

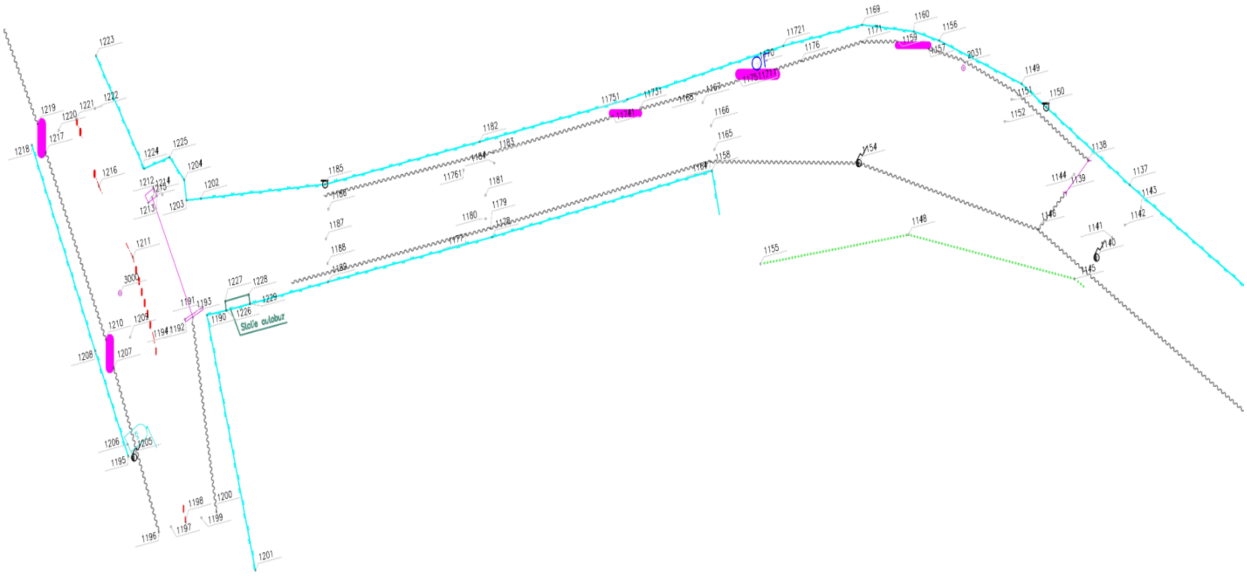

Fig.3. Topographical plan

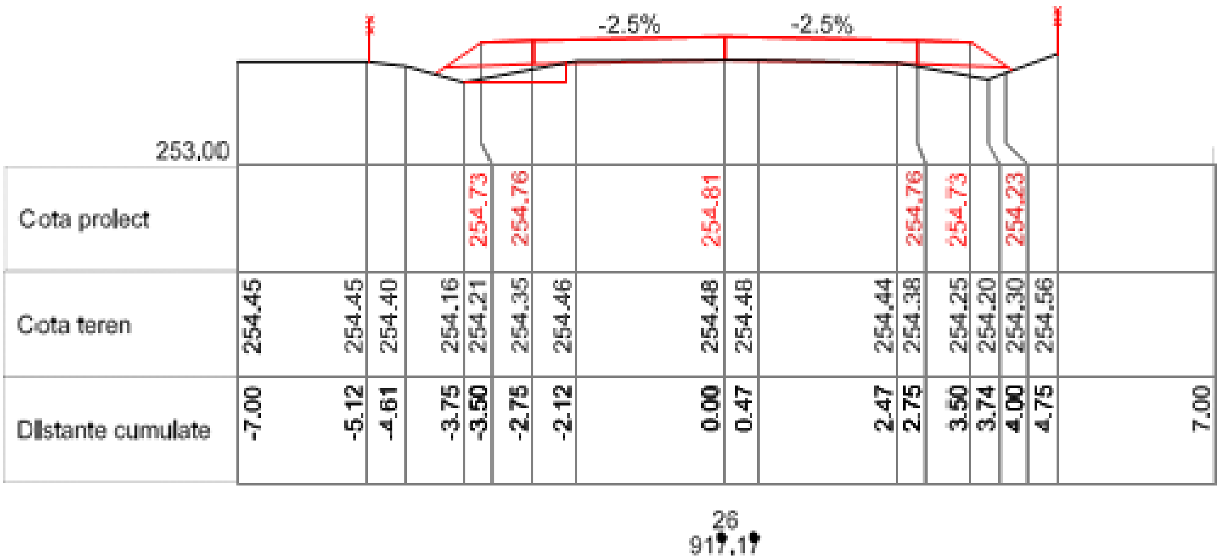

Fig.4. Transversal profile