Scientific Bulletin of Politehnica University of Timişoara

Transactions on HYDROTECHNICS

Volume 61 (75), Issue 2, 2016

Topographical Surveys and Data Use to Monitor with the Lidar Method the Corridor Aerial Power Line 400 Kv in Parța - Șag Locality, Timiș County

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Abstract: The purpose of this paper is to provide a 3D representation of the land based on satellite images type LIDAR (Light Detection and Ranging) compared and combined with modern topographical surveying and achieving longitudinal profile. Technology LIDAR is an active remote sensing technique by scanning and measuring distances that produces a DTM (digital terrain model) with the ability to "see through the trees" and to provide an exact modeling of land surface in areas inaccessible so far, combined with topographical surveys made in the field and comparing the data obtained. The technique LIDAR operates on the same principle as RADAR, except that RADAR uses the electromagnetic waves in radio matters, while systems LIDAR using light waves, generated by a laser in pulsed regime (electromagnetic energy generated by lasers is dispersed by molecules of atmospheric gas and particles in suspension). The length or lengths of wave used by a LIDAR system depends generally on the type of measurements and can be anyone in the field of UV - VIS - IR (355 nm - 1064 nm). By scanning LIDAR laser obtain a topographic map with an accuracy of up to 1.5m. In addition to the topographical surveying, technology can be used in topographical surveying, to evaluate alternative in construction, for education and research, and also for engineering. By processing data using satellite images LIDAR can generate 3D models, can be detected and removed points outside the area of interest, can be done soil surface modeling and filtering data, can be generate elevation profiles, DSM and DTM in raster format, TIN , level curves or types of slopes, can be achieved soil surface classification, classification of buildings, vectorization of buildings, types of vegetation classification (high, medium and low) as well as the detection and classification of towers and high voltage cables. To achieve this paper we conducted field measurements with Leica TC805 total station and where I had the possibility I realized land survey with the equipment GPS Leica 1200. The corridor that was made topographical surveys has a width of 100 m and a length of 3.8 km. In this paper was conducted longitudinal profile of the future LEA (aerial power line) 400 kV, will be presented all existing obstacles up to a distance of 50 m left / right front axle future LEA 400 kV, 18 poles LEA 110 kV and conductor the top and the lowest of the LEA 110 kV specifying the temperature at the time of topographic survey to calculate arrow conductors mentioned of LEA 110 kV. Data from measurements were compared with data obtained using LIDAR technology in order to achieve 3D terrain model based on LIDAR images. For this I used the program Global Mapper v16.1.2, using as source data set SRTM (Shuttle Radar Topography Mision - NASA) Worldwidw Elevation Data - 3 arc-second Resolution, launched by NASA and METI. Global Mapper is a visualization tool capable of displaying the usual sets of raster data, elevation or vector.

Keywords: LIDAR, RADAR, 3D Model, GPS, SRTM, DTM, Global Mapper, TransDatRO, WGS 1984, ProfLT.

1. INTRODUCTION

The European Union has stressed the importance of developing global energy market through a series of directives. A new study for the development of energy systems revealed "border congestion" in the European electricity market. Beyond this, the transit capacities are close to the limit and increasing the flow of power can only be achieved through stronger interconnection of these networks. As neighbors, Romania and Serbia started a project to develop interconnection between their energy systems, thereby ensuring quality and increased national and international transport services.

In this regard were developed three variants of 400 kV overhead line route between Portile de Fier and Resita city and the solution adopted in accordance with the 2004 ISPE study is Option 1:

- ✓ Making an overhead lines, LEA 400kV s.c. Resita - Timisoara, by transforming existing overhead power line, LEA 200kV - 73km;
- ✓ Making an overhead lines, LEA 400kV s.c. Timisoara - Arad, by transforming existing overhead power line, LEA 200kV - 55km;
- ✓ Making an overhead line, LEA 400kV – Sacalaz connection, on the current route of 220 kV connections – 13 km.

Switching on the 400 kV voltage of the Banat axis cannot be achieved without the construction of 400 kV overhead power line Portile de Fier – Anina - Resita [4].

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The paper described topographic works executed to achieve the routes and the methods used are compared.

2. MATERIAL AND METHOD

The overhead line (LEA) is an above-ground construction made of metal poles fixed in concrete foundations reinforcement, which will be retrofitted electric cables on specified size.

These route is shaped like an aisle, with the width determined according with NTE 003/04/00 - "Norms for the construction of overhead electricity voltages above 1000V - Art.no. 138, 139". So the aisle width is 54 meters when passing through forest land and 75 meters when passing through other land, which is placed on the shaft construction poles and electrical cables.

In woodland, power line corridor will be cleared in order to ensure the overhead line access equipment as well as operational safety [3].

During the construction phase of the overhead line, the technological flow which will take place on site is the specific civil works made of metallic industrialized, that are mounted on foundations of reinforced concrete "in situ", which will be executed in accordance of technical documentation carried out phase "technical project".

From surveying and mapping work shaft were made with electronic total stations, type Leica TC 805 and Leica TCR 802 ultra as well as Leica GPS 1200 Series dual frequency, GPS RTK dual frequency type South S82T [1] [2].

3 RESULTS AND DISCUSSION

This paper aims to achieve surveying for the changed route LEA 400kV on a distance of 3.8 km comprised two administrative and territorial unit (ATU), namely: Parta and Sag between points 339 and 428 on the map (Figure 1).

1970 stereographic points modified of the route are:

- ✓ to the North - X = 469651.765m; Y = 199203.669m
- ✓ at the centre - X =468043.715m; Y = 199143.684m
- ✓ to the South - X =466172.382m; Y = 200302.466m

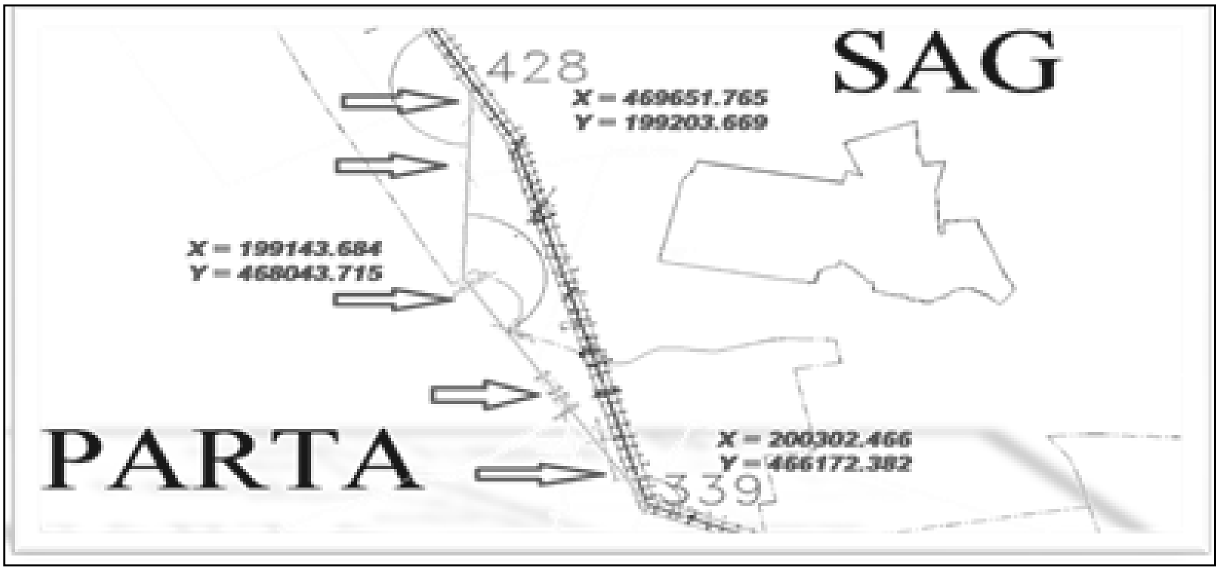

Figure 1. Presentation of route changed

These are the inflection points in new directions - incoming axis LEA.

For this modified section were conducted topographic surveys and the following works:

1. A longitudinal profile of the future LEA 400 kV;
2. A side profile left / right to approximately 8m of axis LEA- to highlight the slope side. The conductor's gauges of future LEA 400 kV were determined to highest rate of three points (LEA axis left and right of);
3. Were represented all existing obstacles up to a distance of about 50 m left / right to axis future LEA 400 kV.
4. At the intersection of LEA 400 kV to existing LEA 110 kV (Timiş.-Gătaia Timiş.-Giulvaz and Săcălaz - Cărpiniş) were conducted topographical surveys and was made a profile on each of the LEA with minimal two openings left / right to its point of intersection with the axis LEA 400 kV.
5. Were represented pillars LEA 110 kV and conductor poles uppermost and lowermost of LEA 110 kV. It was indicated temperature on that are made measurements for conductor arrows mentioned of the LEA 110 kV. Arrow was measured in sketch below (Figure 3).
6. Also were specified the pillars numbers of all lines crossed of future LEA 400 kV Icloda - Săcălaz.
7. At the intersection with LEA low voltage (LV), medium voltage (MV) or telecommunications (LTc), was conducted a longitudinal profile on the respective LEA, at least two openings left / right to the point of intersection with the axis LEA 400 kV. Were raised pillars and superior conductor to LEA LV or MV, indicated LEA type (single circuit - 3 conductors or double circuit - 6 conductors).

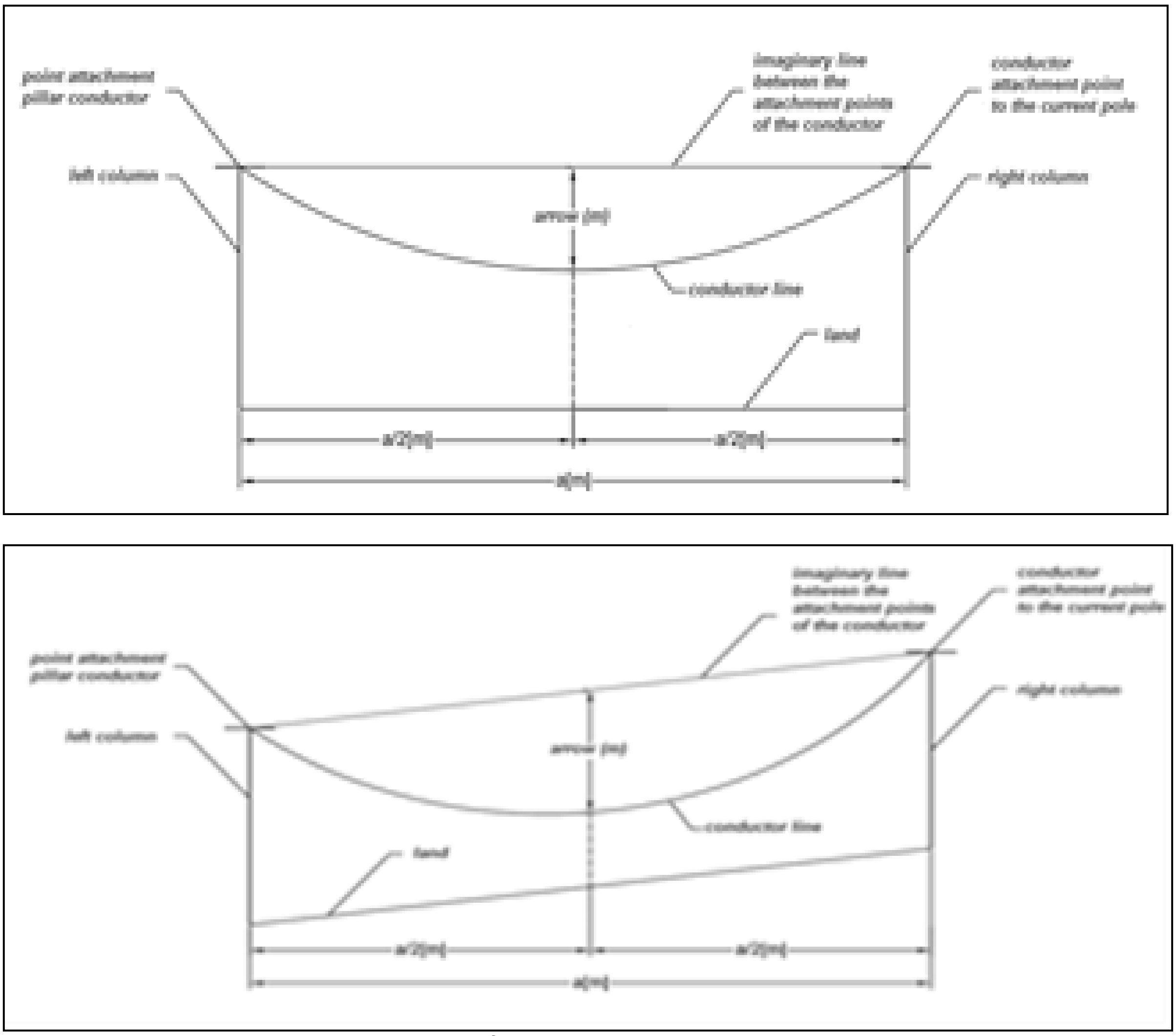

Figure 2.Scheme for measuring the conductor arrow

8. It was indicated temperature at which the measurements were made for arrows. Arrows were measured according to sketch from Figure 2.

9. At the intersection with the road (municipal, county, state, etc.) was raised section of road (through axis LEA 400 kV). It was given the name of the road and kilometres of road at which were made the intersection.

10. At the intersection with Railroad was developed a profile through Railway (on the axis LEA 400 kV) and were picked up the contact line pillars where necessary. Were made topographical surveys also on top quota of rail of Railway, were past and the name of Railway and km on Railway were happening intersection with the 400 kV.

11. At the intersection of rivers or canals was profiled river bed / channel and the banks, on the line of LEA 400 kV and was indicated also the superior quota at the time of measurement. Were determined (including quota) by topographical surveys and were represented trees on the banks.

12. It was measured distance between the axis LEA 400 kV and edges of possible forests or groups of trees and their height.

13. For any construction (buildings, fences - including material from which they are made -, etc.) was given distance from the axis LEA 400 kV and corresponding heights of these buildings.

14. At each end of the panel has been said also the angle between alignments (even if 200 g).

For PARTA 1 (Table 1), - Topographical surveys were conducted on 09.11.2015 at 12.00; - temperature 19 ° C; - the lowest rate was determined at pillar no. 70 of 85,07m; - The number of pillars for which the measurement and calculation were made to determine the arrow conductor: 70, 71, 72, 73;

For PARTA 2 (Table 2): - Topographical surveys were conducted on 11.09.2015 at 14.00; - temperature of 18.6 ° C; - the lowest rate was determined at pillar no. 11 of 82,94m; - The number of pillars for which the measurement and calculation were made to determine the arrow of the conductor: 8, 9, 10, 11, 12;

For PARTA 3.1 (Table 3): - Topographical surveys were conducted on 11.09.2015 at 12.00; - temperature 19 ° C; - the lowest rate was determined at pillar no. 70 of 85,07m; - the number of pillars for which the measurement and calculation were made to determine the conductor arrow: 112, 111, 110, 109;

For PARTA 3.2 (Table 4, Figure 3): - Topographical surveys were conducted on 11.09.2015 at 16.00; - temperature 17 ° C; - the lowest rate was determined at pillar no. 10 of 82,67m; - the number of pillars for which the measurement and calculation were made to determine the conductor arrow: 11, 10, 9, 8, 7;

Table 1.Topographical surveys for pillars 70, 71, 72 and 73, Parța 1

Section	Pillar name	Quota of the terrain (m)	The top quota of conductor (m)	Quota conductor arrow (m)	Arrow calculation (m)
Parta 1	70	85,07	97,55		
	conductor	85,40		94,08	3,902
Parta 1	71	86,33	98,50		
	conductor	86,04		94,99	3,703
Parta 1	72	85,75	98,88		
	conductor	86,10		94,99	3,743
Parta 1	73	86,48	98,58		

Table 2 .Topographical surveys for pillars 8, 9, 10, 11 and 12, Parța 2

Section	Pillar name	Quota of the terrain (m)	The top quota of conductor (m)	Quota conductor arrow (m)	Arrow calculation (m)
Parta 2	8	84,17	95,13		
	conductor	83,845		90,63	3,795
Parta 2	9	83,52	93,67 92,63		
	conductor	83,435		93,05	0,189
Parta 2	10	83,35	93,71		
	conductor	83,145		92,09	1,804
Parta 2	11	82,94	94,11		
	conductor	83,415		92,71	1,873
Parta 2	12	83,89	95,14		

Table 3. Topographical surveys for pillars 112, 111, 110 and 109, Parța 3.1

Section	Pillar name	Quota of the terrain (m)	The top quota of conductor (m)	Quota conductor arrow (m)	Arrow calculation (m)
Parta 3.1	112	85,68	95,15		
	conductor	84,485		92,33	2,750
Parta 3.1	111	83,29	95,01		
	conductor	84,472		92,51	2,763
Parta 3.1	110	85,655	95,56		
	conductor	96,297		92,43	3,256
Parta 3.1	109	84,94	95,85		

Table 4.Topographical surveys for pillars 11, 10, 9, 8 and 7, Parța 3.2

Section	Pillar name	Quota of the terrain (m)	The top quota of conductor (m)	Quota conductor arrow (m)	Arrow calculation (m)
Parta 3.2	11	85,28	86,39		
	conductor	83,975		93,56	1,850
Parta 3.2	10	82,67	94,43		
	conductor	83,385		93,26	1,785
Parta 3.2	9	84,10	85,59		
	conductor	85,205		94,91	1,779
Parta 3.2	8	86,31	97,99		
	conductor	86,395		96,29	1,812
Parta 3.2	7	86,48	98,23		

Figure 3. AutoCAD presentation of pillars and arrows calculation, Parta 3.2

4. CONCLUSION

Study prepared by ISPE in 2004, approved in CTEES Transelectrica Notice no. 29/ 24.02.2004, provide increased link capacity Porțile de Fier I-Reşița by building a new LEA 400 kV Resita, which runs in parallel with the current 220 kV D.C. PDF-Resita;

The subject of this paper is the presentation of the optimal solution crossing to 400 kV of existing LEA 220 kV D.C. Resita-Timisoara-Arad-Săcălaz;

Were considered mainly, variants of switching variants of stations Timişoara, Calea Aradului and Săcălaz;

In accordance with the aspects presented, also the results summarized version 1 is considered to be optimal;

In this context, stations Timisoara, Calea Aradului and Săcălaz and related LEA (links to Resita and Arad), will be passed on 400 kV voltage;

The analysis revealed that the future LEA 400 kV interconnection Romania - Serbia (from Săcălaz) is shorter with 26 km than in Timisoara;

The data obtained are used to monitoring route through the " LIDAR METHOD "

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