International Journal of Technical Innovation in Modern Engineering & Science (IJTIMES)
Impact Factor: 5.22 (SJIF-2017), e-ISSN: 2455-2585
Volume 5, Issue 05, May-2019

DETAILED SURVEY OF UNIVERSITY CAMPUS USING ADVANCED SURVEYING INSTRUMENT-TOTAL STATION

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Abstract— Now a day surveying instruments are advanced and more accurate. These instruments have precision which gives less erroneous data, and have capabilities to analyse data and prepares maps with ease. Total station is one such instrument which is widely used because of its long distance reading and quick measuring ability. It measures distance with an accuracy of about 1.5 millimetres +2 parts per million over a distance of up to 1,500 meters. Reflector less total station can measure distance to any object that is reasonably light in colour, up to a few hundred meter. Manual errors involved in reading and Electronic display unit is capable of displaying various values when respective keys are pressed. Each point data can be stored in an electronic note book automatically. This instrument can be especially used for two types of work namely general survey i.e. collection of data from field, and stakeout data on field. This paper presents a surveying work carried out using advanced electronic surveying instrument - total station. This work has been done in two stages. In the first stage surveying work on field is carried out to collect the actual ground. In the second stage the data has been analysed and map was prepared using commercial software.

Keywords— Surveying, Total Station, GPS, GIS, DGPS

I. INTRODUCTION

Total station is a unique instrument consisting of a combination of Electronic Distance Measurement [EDM] and theodolite.
As the name indicates it can be used for all kind of works which requires to a Station. It has high precision, but it is expensive and is sensitive instrument. It require skilled operator and much care is required handling

The five types of data which can be collected using Total station are:

i) horizontal angle
ii) vertical angle
iii) horizontal distance
iv) vertical distance
v) sloping distance

This data can be stored in its memory automatically and can be retrieved as when it is required for analysis. The output in the form of digitized maps and layouts can be obtained easily. The main feature of this instrument is its range which is around two kilometres.

The instrument used for carrying out the University survey was Trimble M3 DR 5" total station.

II. PARTS OF TOTAL STATION

i) Carrying Handle
ii) Objective lens
iii) Eyepiece focus
iv) Touch display
v) Keyboard
vi) Vertical circle
vii) Vertical circle screw
viii) Horizontal circle
ix) Horizontal circle screw
x) Tribrach
xi) Tribrach foot screws
xii) Tribrach lock
xiii) Base

xiv) Peep sight
xv) Data input/output connector
xvi) Focussing ring

III. COMPONENTS OF TOTAL STATION

i) Tripod stand
ii) Prism
iii) Prism rod
iv) Total station machine

III. STEPS INVOLVED IN CARRYING OUT OPERATION WITH TOTAL STATION

4.1 Two types of operations are carried out in this present work:
i) Staking out, and ii) General survey

4.2 Staking out of campus boundary line:
The steps involved in staking out the boundary line are as follows:

i) To carry out this operation the first step is to set up the instrument.
ii) The instrument was set up by giving input in the form of three inputs, i.e.
a) Easting
b) Northing, and
c) Elevation
iii) These inputs were entered in the Total Station so as to setup the instrument.
i) The machine input in the form of co-ordinate system [EASTING, NORTHING] for at least two points is required (i.e. the control points). The location of these two control points must be known in the map.
ii) For back-sight reading the north direction (i.e. azimuth as zero-degree) was used and thus the setup of instrument was completed.

iv) To know the coordinates of these two control points a commercial software was used. Using this commercial software the coordinates of these two points were determined which are shown in fig. 1.These points can also be established using advance surveying instrument, like DGPS, IKET etc.
i) The available map was aligned along with these established control points in Auto-CAD.
ii) The required coordinates of the points on boundary line of the map were traced out using the available map in Auto-CAD. A sample of these traced out points in Auto-CAD is shown in fig. 2.
iii) These traced out points in Auto-CAD were staked out on ground using total station.

i)

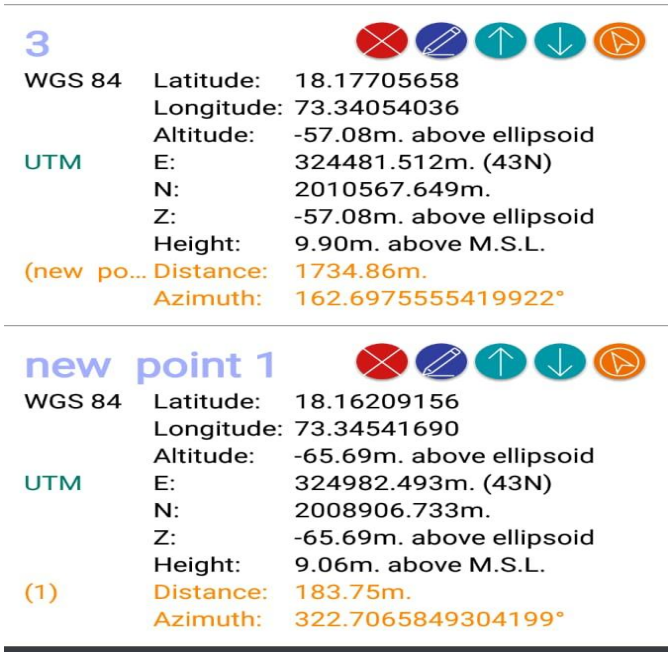

Fig. 1 Coordinates of control points

sr.no.	X	Y
1	324876.88	2009014.22
2	324747.71	2008957.63
3	324375.42	2008793.11
4	324198.85	2008716.43
5	324141.42	2008678.08
6	324065.99	2008678.08
7	323860.70	2008602.35
8	323713.44	2008553.27
9	323649.14	2008531.76
10	323562.67	2008723.53
11	323492.02	2008885.77
12	323440.56	2009005.58
13	323416.17	2009069.74
14	323395.58	2009125.51
15	323359.84	2009223.75
16	323327.72	2009261.61
17	323255.46	2009263.97
18	323234.94	2009260.08
19	323203.80	2009285.86
20	323170.09	2009277.06
21	323151.77	2009271.38
22	323112.95	2009334.92
23	323072.21	2009403.84
24	322982.37	2009554.44
25	322922.69	2009655.76
26	322854.44	2009770.05
27	322869.11	2009884.20
28	322874.78	2009931.83
29	322840.58	2009966.35
30	322808.47	2009997.71
31	322797.62	2010062.68
32	322994.67	2010119.70
33	323143.10	2010161.27
34	323612.05	2010292.30
35	324007.56	2010407.89
36	324245.44	2010484.81
37	324415.00	2010540.09
38	324456.30	2010403.57
39	324557.99	2010058.95
40	324625.12	2009841.02
41	324666.24	2009703.10
42	324754.37	2009399.67
43	324842.01	2009155.62
44	324863.88	2009067.50

Fig. 2 Points traced out using Auto-CAD

4.1 To Carry Out General Survey using Total Station.

Following steps are involved in this operation:

i) To start this operation the instrument was first. The procedure mentioned above for setting up the instrument in stake out operation 4.2 (i –iii) was followed.
ii) The surveying work was carried out to collect the data of different points on ground. The data information collected gets automatically stored in the machine in the form of spreadsheet.
iii) After completion of field work, the data collected in machine is transferred to Auto-CAD. Fig. 3 shows the collected data. Fig. 4 shows the plot of data points in Auto-CAD.
iv) Using this information in AutoCAD the map was prepared.
v) After completion of field work, the data collected in machine is transferred to Auto-CAD. Fig. 3 shows the collected data. Fig. 4 shows the plot of data points in Auto-CAD.
vi) Using this information in AutoCAD the map was prepared.

	A	B	C	D	E	F	G	H
1	Sr.no	Easting	Northing	Code		Point Command		Text Command
2	1	1000	2000	ST		POINT 1000,2000		-TEXT 1000,2000 1 0 ST
3	2	1003.525	2000	N		POINT 1003.525,2000		-TEXT 1003.525,2000 1 0 N
4	3	1142.038	2103.158	RD		POINT 1142.038,2103.158		-TEXT 1142.038,2103.158 1 0 RD
5	4	1160.092	2066.769	RD		POINT 1160.092,2066.769		-TEXT 1160.092,2066.769 1 0 RD
6	5	1166.346	2029.352	RD		POINT 1166.346,2029.352		-TEXT 1166.346,2029.352 1 0 RD
7	6	1166.723	2018.386	RD		POINT 1166.723,2018.386		-TEXT 1166.723,2018.386 1 0 RD
8	7	1165.63	2011.595	RD		POINT 1165.63,2011.595		-TEXT 1165.63,2011.595 1 0 RD
9	8	1170.897	2022.071	RD		POINT 1170.897,2022.071		-TEXT 1170.897,2022.071 1 0 RD
10	9	1158.665	1980.558	RD		POINT 1158.665,1980.558		-TEXT 1158.665,1980.558 1 0 RD
11	10	1162.464	1980.342	RD		POINT 1162.464,1980.342		-TEXT 1162.464,1980.342 1 0 RD
12	11	1152.413	1952.467	POOL		POINT 1152.413,1952.467		-TEXT 1152.413,1952.467 1 0 POOL
13	12	1150.519	1943.455	POOL		POINT 1150.519,1943.455		-TEXT 1150.519,1943.455 1 0 POOL
14	13	1156.159	1948.233	POOL		POINT 1156.159,1948.233		-TEXT 1156.159,1948.233 1 0 POOL
15	14	1158.074	1958.341	POOL		POINT 1158.074,1958.341		-TEXT 1158.074,1958.341 1 0 POOL
16	15	1146.465	1918.585	POOL		POINT 1146.465,1918.585		-TEXT 1146.465,1918.585 1 0 POOL

Fig. 3 Points Given by Total Station

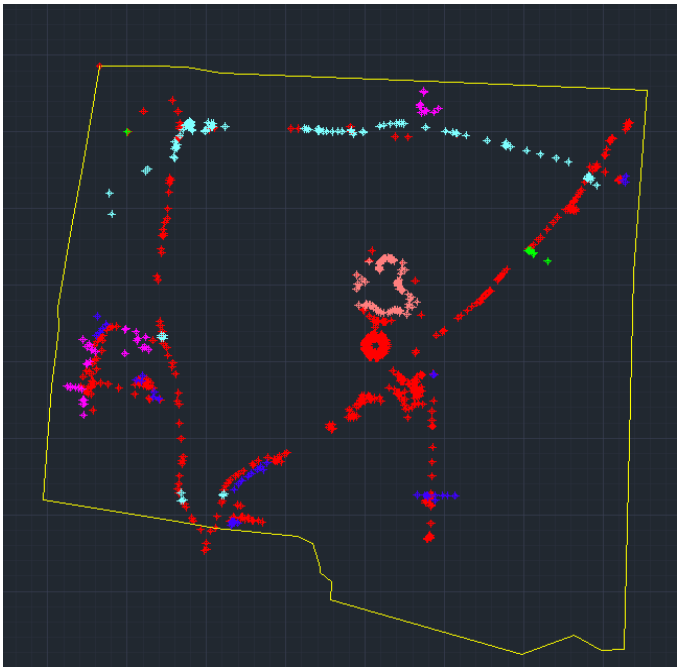

Fig. 4 Plot of data points

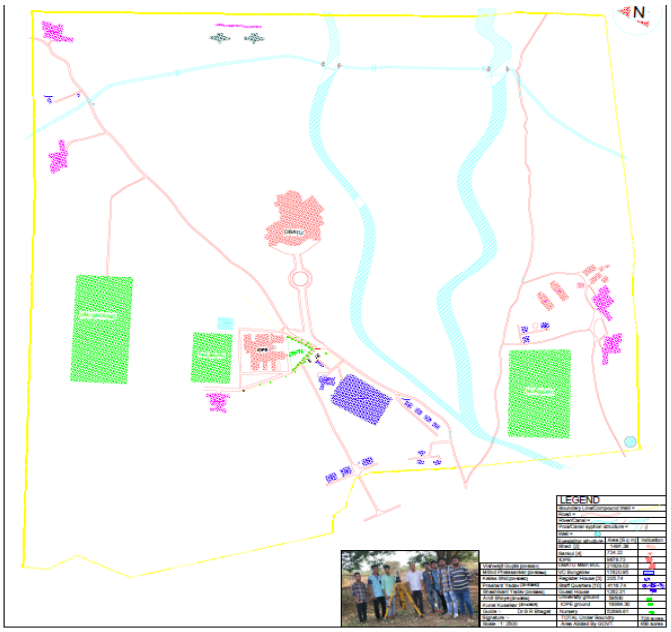

Fig. 5 University Campus Map

V. OUTPUT OF WORK

The data collected using the stake out and general surveying operation is plotted to develop a map using Auto-CAD. The plotted map using the surveyed area is shown in Fig. 5.

VI. CONCLUSION

Now a day the total station has remarkable performance in land survey work. It gives very precise readings, and the total station is very popularly used. Upgraded version of total station is robotic total station which eliminates the requirement of prism rod-man. From the survey carried out of the University campus, it can be concluded that the map prepared using the Total station matches exactly with that of existing map. The total areas surveyed using total station was 697 Acres. Finally it can be concluded that the advanced surveying instrument total station is not only saves time but also it gives very precise measurements.

ACKNOWLEDGEMENT

The authors would like to thank to the University authorities and the faculty and staff of the Department of Civil Engineering of the University.

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