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A DGPS Based Surveying and Mapping Command Area – A Case Study of Khadki M.I.Projct, Washim District, Maharashtra, India.

Ramesh M.Nikum[1], Ravindra V. Shrigiriwar[2], Deepakkumar K. Meshram[3], Mangesh M. Khairnar[4] , Santosh G.Wagh[5]

[1] *Chief Engineer, Design, Training, Research and Safety(DTRS), Nashik,* Cedtrs_nashik@wrd.maharashtra.gov.in
[2] *Superitending Engineer & Joint Director, Maharashtra Engineering Research Institute (MERI), Nashik* sejdmerinashik@gmail.com
[3] *Research Officer, Remote Sensing & Geo-informatics Division, MERI, Nashik,* merirsgid@gmail.com
[4] *Assistant Research Office, Remote Sensing & Geo-informatics Division, MERI, Nashik,* mangeshmkhairnar@gmail.com
[5] *Assistant Engineer Grade-II, Remote Sensing & Geo-informatics Division, MERI, Nashik* sanganwagh@yahoo.co.in

Abstract—Various structures such as Dams, Canals are constructed by Water Resources Department with available maps and traditional surveying. For designing and mapping various inputs are needed. In area and volume estimation elevation data is most important. Most common methods of surveying like total station, dumpy level, theodolite etc are used for collecting the data. The survey by using above methods are traditional and time consuming. Mapping and calculation of the data is tedious and requires more human resources. In the recent years GPS and GIS systems have emerged as a powerful tool for conducting large scale survey for mapping and to create spatial data base of the Geographical area in any scale. Differential Global Positioning System (DGPS) provide the field engineers reliable XY Coordinate with elevation for mapping and designing. The technology have advantage over traditional surveying that time and human resources required for doing detailed survey can be reduced and mapping can be done in lesser time. Hence this technique can be implemented with fair degree of accuracy.

One such study of Khadki Minor Irrigation Project, Washim District, Maharashtra, India using DGPS technology has been recently completed. It is found that DGPS Surveying is fast, reliable, and cost effective as compared with the command area survey by conventional method. Attempts are made to generalise the technique so that it can be effectively used in WRD projects. Paper focuses on methodology, ground survey with DGPS, use of software and generation of statistics and maps.

Keywords- DGPS; Survey; Alignment; Command area; Elevation; Contour; Digital map.

I. INTRODUCTION

The existing practices of carrying out field survey by dumpy level, theodolite, total station, auto level and generating observed database is very lengthy and time consuming process. Skilled personnel are required to set the instruments. The entire process of point observation, bisections, and calculations is also a tedious one. Clear atmospheric weather condition and site inervisibility is needed for field survey by above methods. Three dimensional surveys, night observations with high precision is not possible with the existing practices.

Maharashtra Engineering Research Institute, MERI, Nasik a wing of Water Resouces Department Government of Maharashtra has decided to survey the canal alignment and command area of Khadki minor irrigation project by DGPS technique. By this technique it is observed that a survey team can generate the necessary analysis and statistics in short time whereas the same task by conventional methods may take few days to few weeks. The methodology used for this study will be helpful for identifying and mapping spatial/ non-spatial details accurately in lesser time. With the present study alignment survey for 3 km and command area survey for 100ha could be easily managed in 4 days with less number of manpower. Hence the survey by DGPS has become increasingly fast, reliable and cost effective.

II. OBJECTIVE

1. The objective of the present study is to envisage the DGPS based survey for mapping the correct canal alignment with longitudinal profile.
2. To identify the extent of land survey number wise to be benefited by this project.

III. STUDY AREA

It is decided to construct the canals, sub canals, distributaries under the command areas of Khadki M.I. project. Khadki M.I. tank is located at 20^0 11' 51'' North latitude and 77^0 05' 34'' East longitude near Khadki-izzara village of Malegaon Taluka in Washim District, Maharashtra shown in figure 1. The main canal proposed for survey was 3.75 Km, distributary 1.2 Km and the command area therein. The command area of project covers the two villages named as Khadkiizara and Masala.

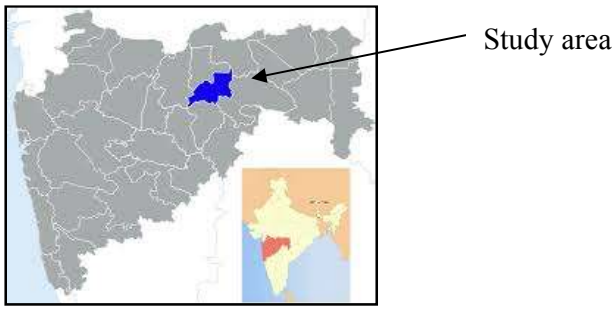

Figure. 1. Washim district

IV. METHODOLOGY

Differential GPS (DGPS) is set of two GPS which are operated sub sequentially. One that stationed as a base and other roving around for measurement of latitude, longitude, height of a point as a rover. The stationary receiver i.e. base is the key it receives all the satellite measurement and combines into a stable local reference. The base receiver measures the timing error and then provide the correct information to the rover receiver. In this way all errors can be eliminated from the system. The idea is simple. Put the base receiver on to a point that has been very accurately surveyed. This base receiver receives the same GPS signals as the rover receiver but instead of working like a normal GPS receiver it operates the equations backwards.

4.1 Field survey

In the present work DGPS survey was conducted from the Khadki project to collect ground levels. The field survey conducted to record the various positions connected to the canal alignment and village control points for geo-reference purpose. The GPS receiver used in the survey was Trimble R-4. The post processing kinematic method of surveying is used. The

readings are taken along the alignment at a distance of every 30m and cross section readings were also taken at Left and right side of the alignment for every 5m, 10m and 15m intervals. Command area readings are taken along the nallas, and in the fields.

The field information recorded in base and rover receivers are imported in Trimble Business Center (TBC) software. The rover readings are relatively corrected with the base receiver as shown in fig 2. The summary result sheet of the baseline processing report is shown in fig 3 which shows the horizontal and vertical accuracy of the surveyed data.

Figure.2. Baseline processing result

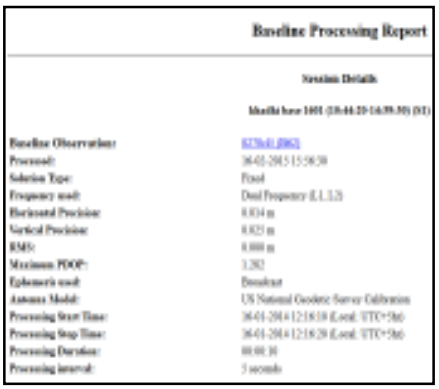

Figure. 3. Summary of baseline processing report

After the rover receiver readings corrected with base receiver the processing results are generated and levels are computed as shown in table 1.

Table.1. Post processed data of Khadki project

Sr.No	Point I.D	Northing	Easting	Elevation
1	0010c	718720.897	2234748.501	518.572
2	0030c	718736.954	2234752.825	517.789
3	0030cl10	718733.748	2234761.958	518.090
4	0030cl15	718732.061	2234766.749	518.285
5	0030cl5	718735.430	2234757.313	517.891
6	0030cr10	718741.471	2234741.855	517.556
7	0030cr15	718741.388	2234738.385	517.383
8	0030cr5	718740.073	2234746.416	517.668

c- Centre cl- Left of centre cr- Right of centre

4.2 Software used for processing and mapping

All the processed data is now imported in TBC software as shown in fig 4. The canal alignment of the project is now prepared by using create alignment tool as shown in fig 5.

Figure. 4. GPS points of alignment

Figure. 5. Creating canal alignment

Rectified digital level cadastral maps in vector format of the village Khadkiizara and Masala are used for the present work for georeferencing purpose as shown in fig 6. ARC-GIS software is used for georeferencing the canal alignment on village map by using control points collected during field survey. The georeferenced canal alignment is shown in fig 7.

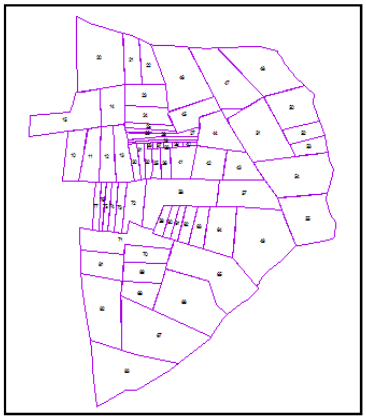

Figure. 6. Village map

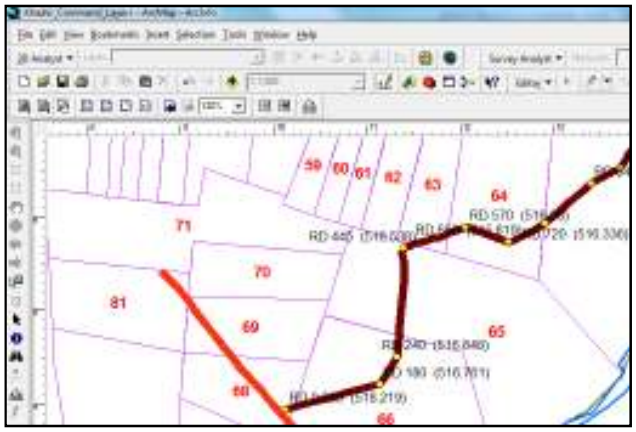

Figure. 7. Georeferenced canal alignment on village map

Topographical map published by survey of India of scale 1:25000 is used for the present work. Toposheets provides the information such as major roads, rivers, nallas, district boundaries, forest areas, contours as a ground reference data. By using above information the contour map of the area is created in TBC software by surface creation tool as shown in fig 8. And finally the probable gross command area map of the project is created shown in fig 9.

Figure 8. Contour map of the area

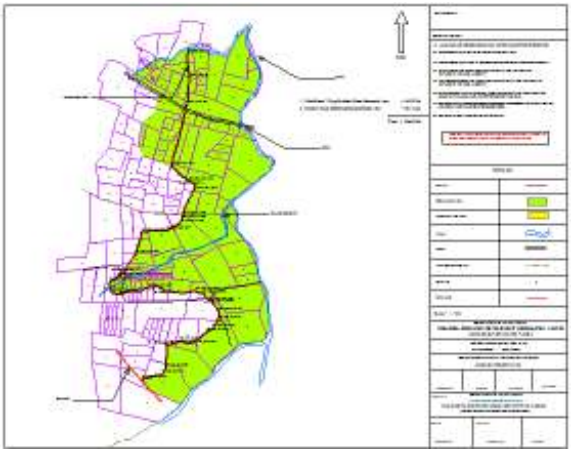

Figure 9.Command map of the project

Moreover the information which is useful to field authority for execution of canal alignment is tabulated. Table 2 shows the bearing statement of the points at the apex level. The probable gross command area of the project is calculated at the village level. The probable GCA of khadkiizara village and Masal village benefitted by this project measures to be 116.35 ha and 120.14 ha respectively. Total probable GCA of the khadki M.I project measures to be 236.49 ha.

Table.2. Apex Point Bearing Statement

Sr. No	Field Apex Point I.D	Length	North Azimuth
1	0.000		
2	180	180	75°06'13"
3	240	60	32°04'46"
4	445	205	3°21'45"
5	570	125	71°37'54"

V. RESULTS

The statistics generated of the work are,

1. Elevation of observed points.
2. Bearing of apex point with respective to north azimuth.
3. Contour maps of command area.
4. Survey number wise probable GCA of the project.

VI. CONCLUSION

1. With the present study alignment survey for 3 km and command area survey for 100ha could be easily managed in 4 days.
2. The entire process of mapping and generation of required statistical data are in digital environment and maintenance of data is very convenient.
3. Permanent and any number of copies at any time could be generated in short time.
4. The expenditure could be reduced in comparison with conventional procedures.
5. Less number of manpower can handle the field work.

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