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Study on Topographic Surveying by Using Total Station and DGPS

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ABSTRACT: Mapping the boundaries and topography of an area is now considered essential for its development. In a recent study, the focus was on conducting surveys for the SKM Wind Farm area in Tiruppur. Topography encompasses various features of the Earth's surface, such as elevation, water bodies, roads, and vegetation. The primary goal of this project was to create accurate boundary and topographic maps of the region, serving as crucial tools for future planning, design, and engineering endeavors. Advanced technologies like DGPS were employed for delineating the boundary lines, while total stations were utilized for collecting precise land coordinates. The outcomes of this project not only benefit the SKM administration but also provide invaluable resources for upcoming campus development initiatives.

I. INTRODUCTION

1.1 GENERAL:

- To prepare a Detailed project report of Topographic surveying by using Total station and Differential Global Positioning System (DGPS), which is performed in and around our SKM Wind Farm, Tiruppur. Accurate topographic map of our college campus is provided.
- The type of survey, the size and location of the property, the level of detail and accuracy required.

1.2 ABOUT TOPOGRAPHIC SURVEYING:

- Firstly, the process involves delineating the survey area's boundaries, defining the necessary level of detail, and outlining any particular deliverables or prerequisites.
- A topographical land survey entails precisely measuring and cataloging the locations and attributes of both natural and man-made elements within a designated land area.
- After completing the survey, the collected data is meticulously charted into a comprehensive plan, capturing details of man-made structures like property lines, adjacent buildings, pathways, and road networks.

1.3 METHOD OF SURVEYING:

There are many methods for doing surveying process:

- Triangulation method.
- Resection method.
- Traversing method.
- Longitudinal and Cross section method.
- Trigonometric method.

II. LITERATURE REVIEW

Mackovin, peter, and martin jurek (2021) collaborated on a thorough investigation into the archival records concerning the extensive mapping of czechoslovakia between 1921 and 1950. During this period, there was a concerted effort to update older maps inherited from the austro-hungarian monarchy while also initiating new large-scale mapping projects. Advancements in surveying techniques, including the utilization of aerial photography, played a significant role in this endeavor.

In a separate study, levin, eugene, and william roland (july 10, 2022) highlighted the enduring importance of field data collection by professional surveyors, despite remarkable advancements in artificial intelligence and automation within geospatial data acquisition.

Expanding on the significance of topographic maps, hurni (2024) emphasized their widespread utility. Topographic maps, distinguished by their depiction of land elevation through contour lines, are among the most commonly used maps. The term "topography" itself derives from the fusion of two English words: "topo," relating to the earth's surface, and "graph," representing information. This unique feature sets topographic maps apart from other map types and underscores their essential role in understanding terrain characteristics.

III. SCOPE AND OBJECTIVE

3.1 Scope

With a view that the final year project of a Bachelor's Degree programme should comprise of the cumulative knowledge (both theory & practical) gained during the course period, this project has been delivered. The scope of this project is as follows:

- To prepare a Detailed project report of Topographic surveying by using Total station and Differential Global Positioning System (DGPS), which is performed in and around SKM campus SKM Wind Farm, Tiruppur
- Accurate topographic map of our SKM campus is provided
- The type of survey, the size and location of the property, the level of detail and accuracy required.

3.2 Objective

- This includes things like wind mill, roads, sidewalks, parking lots, trees, shrubs and other physical objects.
- This map can be used for a variety of purposes, such as planning and design for new construction or renovations, landscaping projects, and emergency preparedness.

IV. TOTAL STATION

4.1 DEFINITION:

- The total station is the latest instrument that was used in the field of surveying. It reduces the time and manpower required for the survey works. The basic principle of the total station is that the distance between any two points can be known once the velocity and the time taken by the light (infrared ray) to travel are known.
- For the process of electronic distance measurement (EDM) is done by the components
 - a) Electronic theodolite
 - b) Microprocessor
 - c) Electronic display and
 - d) Prism

4.2 SETTING PROCESS:

The steps for fixing the total station are:

- Elongate the stand up to the chest level and lock the knobs, the knobs must be locked in such a way that it won't move further.
- Open the stand and keep one stand as fixed and other two are adjustable. The fixed leg must not be moved.
- Take the instrument from the cover and fix it carefully on the stand by using the screw provided in the stand. While fixing, the instrument must be held firmly by one hand and then by using the other hand, it must be fixed at the bottom.
- After fixing the instrument fix the center point for the instrument using the bottom view eyepiece by adjusting the two legs which are movable. After fixing the legs, their positions must not be disturbed otherwise the center point coincidence will be affected.
- After fixing the center point adjust the instrument by releasing the knobs to ensure the horizontal level of the instrument. During this work, the fixed legs should not be moved from their positions and only their height is increased or decreased with respect to the bubble, which ensures that the instrument was closer to horizontal.
- Finally tilting is done using the adjusting screws in the instrument to calibrate the instrument to perfect horizontal level. The minimum and maximum values for tilting are 0'10" and 0'30". After tilting adjustment using the foot screws, the instrument is said to be perfectly horizontal.

V. DGPS

Differential Global Positioning System (DGPS) is an enhancement to the standard Global Positioning System (GPS) that improves the accuracy and reliability of GPS positioning. It works by comparing the measurements from a GPS

receiver at a known location (the reference station) with the measurements from a GPS receiver at an unknown location (the roving station) to correct for errors caused by factors like atmospheric conditions and satellite clock errors. Here are the key operations and merits of DGPS.

VI. TOPOGRAPHIC SURVEY

6.1 DEFINITION:

A topographic survey, also known as a land survey, terrain survey, or topo survey, is a type of survey that maps the boundaries, features, and levels of a site. It is a detailed and accurate representation of the surface of a piece of land, including all natural and man-made features such as trees, buildings, roads, and rivers.

6.2 FEATURES OF TOPOGRAPHY SURVEY:

- Topographical surveys provide valuable information that can assist in the development of construction and planning projects.
- It ensures that important factors such as terrain and building elevations are considered during the design process.
- It helps in achieving an in-depth and accurate picture of the building, land, and other structures of the land.

6.3 COORDINATES IN TOPOGRAPHICAL SURVEYING:

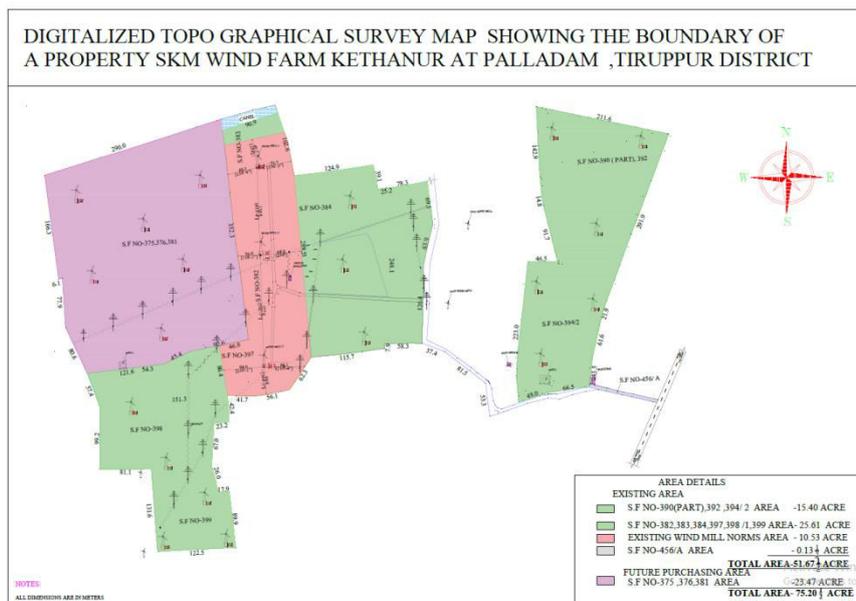
Coordinates indeed serve as essential markers for pinpointing locations accurately, whether on a map, in navigation systems, or within a grid-like structure such as a chessboard or spreadsheet. They typically consist of numerical values denoting distances from perpendicular axes, with the point of origin serving as the reference point. In three-dimensional contexts, height adds another dimension to the coordinates. This systematic approach facilitates precise location identification and navigation across various domains.

6.4 DETAILED TOPOGRAPHIC MAP:

- Topographic maps conventionally show Buildings, lamp post, EB, roads & water tanks.
- We created a detailed map of the campus using the data collected from our surveys.
- This data included measurements of the buildings and boundaries.

6.5 DATA COLLECTION IN TOPOGRAPHICAL SURVEYING:

A topographic survey sounds like a comprehensive way to understand the lay of the land. It's essential for various purposes, from urban planning to construction projects, ensuring accurate representation of the terrain and its features.



AUTOCAD OF TOPOGRAPHIC MAP



6.6 TOTAL AREAS CALCULATION:

Collecting Total Topographic Area	= 75.20 ½ Acre
Acres FMB [SF.No-390,392,394/2] Area	= 15.40 Acre
FMB [SF.No-382,383,384,397,398/1,399] Area	= 25.67 Acre
EXISTING WIND MILL NORMS AREA	= 10.53 Acre
SF.No - 456/A AREA	= 0.13 ½ Acre
FUTURE PURCHASING AREA	
SF.No – 375,376,381 AREA	= 23.47 Acre
TOTAL AREA	= 75.20 ½ Acre

VII. CONCLUSION

The topographic survey of the SKM Wind Form campus was successfully completed using a combination of total station and DGPS technology. The survey data was used to create a detailed and accurate map of the campus, which will be valuable for a variety of purposes, including planning for future development, maintaining the campus infrastructure, and managing the campus grounds. The total station survey was used to collect data on the location and elevation of points on the campus buildings and grounds. The total station is a highly accurate surveying instrument that can measure distances, angles, and elevations with great precision.

The total station data was used to create a three-dimensional model of the campus, which was then used to generate contour lines and other map features. The DGPS survey was used to collect data on the location of points on the campus grounds. The DGPS is a satellite-based navigation system that can provide very accurate positioning data. The DGPS data was used to supplement the total station data and to check the accuracy of the total station data.

REFERENCES

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2. Li, Z., Zhu, J., & Zhao, C. (2008). Using both total station and GPS/DGPS for topographic mapping is a powerful combination, offering accuracy and efficiency. "Journal of Surveying Engineering" likely provides valuable insights into this integration, covering methodologies, case studies, and advancements in the field. It's a great resource for professionals seeking to optimize their surveying techniques, 134(12), 703-708.
3. Liu, X., Zhang, Z., & Ning, B. (2012). That sounds like an interesting combination of technologies for topographic mapping. Total stations and DGPS (Differential Global Positioning System) can offer high precision and efficiency in surveying, 138(7), 383-389.
4. "Reading and Analysis" by Phillip C. Muehrcke and Alan H. Robinson sounds like an excellent resource for understanding map reading and analysis, particularly focusing on topographic maps. It's crucial knowledge for anyone interested in geography, navigation, or outdoor activities.



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