

## 1: A Study of Mine Surveying Methods and Their Applications to Mining Engineering

*Lecture notes (Class Note 1) for MINE - Mining Surveying at Virginia Tech (VT).*

Nowadays real-time monitoring systems based on robotic total stations and GPS, digital photogrammetric techniques, high resolution satellite imagery, satellite, airborne and terrestrial laser scanners devices are able to give a set of powerful tools for the geometric surveying and modeling. The paper focuses the new trends in surveying gadgets and their applications in mine surveying, which has been pushed up in the latest years by the diffusion of the information technology. INTRODUCTION Mine surveyors are involved in every aspect of mining operations; this includes initial exploration, initial construction of mine operations, on-going mining works, rehabilitation of site and abandonment stage after mining is completed. Technological developments in the field of computer science, information technology and satellite technology have created new hopes for surveying and geoinformatics. The coming of global positioning system GPS, total station and digital theodolites has made the acquisition of data much simpler and faster than hitherto was the case. The Remote Sensing technology has been extensively used in mapping the regions affected by underground fires in Jharia and its surrounding areas. This technology integrated with GIS, has become an effective tool for developing and implementing rehabilitation plan for the region. In particular this paper is focused on the new trends in surveying gadgets and their applications in mine surveying, which has been pushed up in the latest years by the diffusion of the information technology, capable of measuring points as far as a few hundred meters from the instrument standpoint to the site to be studied with the desired precision. General features These theodolites are of transit type with a micrometer fitted to it. The centering is done with the help of an optical plummet. It is suitable for almost every type of survey work. It has a well-illuminated optically reading system. A micrometer screen is attached with it. With the help of this micrometer screw or fine adjustment screw the accuracy of the reading taken are increased. It has the major advantage in the case of measuring the horizontal angle or vertical angle. But it is slow compared to GPS surveying and requires users to set multiple control points in sight of where the survey work is to be performed. The Global Positioning System GPS is a worldwide satellite-based system that can be used to measure the three-dimensional position of a point anywhere on Earth. The system uses over twenty orbiting satellites, so that anywhere in the world and at any time there will be enough satellites in the sky above to reliably measure the position of a portable satellite receiver. One receiver can be used to obtain low accuracy positions, while two or more receivers and advanced data reduction techniques can be used for high accuracy work. GPS can be very well used in mine surveying in opencast mines only. It is a tool which can determine on its own without any relation to the topography or otherwise the position which it occupies both in respect of meridian and datum. What all needed is open sky, minimum 4 satellites and proper selection of the method of survey. GPS like any other precise survey instrument can be mounted on a tripod and centered on the exact point whose location is required. GPS receiver data can be transferred to a computer, which has post processing software programs. The programs calculate the positions and heights of points in the desired grid system through suitable transformation software. The advantages of using the satellite based GPS techniques for surveying are: That is in one go, we get the horizontal and vertical position of the point, unlike in conventional surveying where we need two operations viz. GPS offers many advantages compared with conventional survey methods. Because there is no need for a rod person, each surveyor can work alone when necessary. GPS also requires much less setup time than did traditional surveying equipment, so the crew can use its time more efficiently. It can also keep a much more flexible schedule and move from one area to the next or one pit to another as needed. Establishing National Grid bases at new areas: Establishing boundaries in case of mining lease areas 3. Documentation of land holdings 4. Establishing control stations around OCPs 5. Training the present generation to face future challenges 6. Surveying the positions of benches b. Surveying the positions of the working faces, to monitor the production c. Monitoring the Positions of Machines in the Mine, d. Measurement of Stock piles, f. Detail Surveying on the Surface, g. Monitoring the pit slopes for Stability, h. Delineating the position of water in the sump. Surveying the positions of boreholes, drilling sites etc. Strengthening the Survey Control Network.

Clear view of sky needed, not applicable in underground mines, obstructed sites. Total Stations Total Station is the combination of an electronic distance measurement, electronic theodolite and a programmed calculator and may be said to be an electronic tachometer theodolite. Distance Electromagnetic modulated beam or wave is generated in the main instrument held at one end of the line to be measured. S6 Trimble [4] and model: This helps to eliminate as far as possible the effects of graduation errors. The other parameters like horizontal distance, co-ordinates, levels etc. The display may be alphanumeric and graphic as well. A number of trigonometrical functions and setting out parameters can also be performed. Initial setting parameters like bearing of a line, co-ordinates and height of the station occupied, the height of instrument and that of the reflector height needs to be input in the instrument memory before starting the actual measurement. It can also be used in trekking mode for continuous measurement on a moving reflector for setting out points of interest. Observations A number of functions, settings and adjustments are available in the control panel mounted on the system to set up the Total Station for specific tasks. Co-ordinates, height, and horizontal direction angle of instrument stations can be stored in the theodolite and are then available as station co-ordinates for the next traverse stations. Given the volume of points and high sampling frequency, laser-imaging systems offer surveyors and photogrammetrists an unprecedented density of geospatial information coverage. For this reason, there is enormous potential for use of this technique in applications where such dense data sets could provide great insight into the valid representation of the region. Mining Industry Applications Two factors that are common in all mining and minerals operations make laser mapping a rapid and cost effective technology for this industry. Firstly, mining involves moving volumes of material from one place to another - and the only way to know what is really going on is to measure the in-situ excavated volume of that material. Using conventional surveying technology, mine surveyors spend a great deal of time surveying spot heights in order to calculate volumes. Secondly, most mines have areas that are difficult to access and are therefore difficult to survey. Laser mapping allows to undertake high accuracy surveys from a safe distance. It gives more detail, which opens up possibilities for using the data in more detailed design work or in geotechnical assessments. A weak link in many projects is the accuracy of the terrain model used. Leica HDS scanner Both terrestrial and airborne laser scanners give as an output XYZ coordinates and picture of laser intensity determined by scanning about million points easy and accurate become surfaces by using appropriate software. A terrestrial laser scanner determines the distance between a large number of object points and the scanner by emitting laser pulses in different directions and detecting the echoes from the objects. So-called pulsed scanners measure the travel time of the pulse towards an object and back. This technique therefore uses the intensity of the light signal to detect when an emitted signal returns to the scanner. Leica claims an accuracy of 6mm at 50m for the Leica HDS In order to receive accurate information about the point position in plan and height three different measuring systems are used. The laser scanner only measures distances according to its position. The planimetric accuracy of the laser points is approximately 0. The accuracy in height is 0. In mines where the direction of mining is consistent and there are suitable vantage points, it is possible to make considerable productivity gains through the use of remote surveying. A long range laser scanner is mounted in a secure position maybe inside a building looking through a window at a vantage point over looking the mining area. A standard serial data link baud is set up between the instrument and a CAD workstation in the office. It is possible to use radio modems for this purpose. On the CAD system a polygon can be defined outlining the area to be surveyed, along with other scanning parameters. The results of the scan can be seen directly in the CAD system. Both pre- and post-blast measurements, as well as stock pile volumes, can be collected much more effectively using laser scanning technology. The standard eyepiece gives 32x telescope magnification. It has a course and fine motion. Fine pointing is by means of the endless horizontal drive screw. The drive has knobs at each side for use with either hand. Applications The sphere of application of Auto Levels extends as follows: Advantages Following are the advantages of precise leveling instruments. Digital Level Digital levels are generally precise leveling instruments equipped with electronically high-speed camera having coding and decoding facilities in terms of distance and height. The instrument has memorized the coded staff, which may be decoded by visualizing the staff in sufficient width and corresponding measurement by the instrument. Readings are displayed on monitor, stored in instruments as well as PCMCIA

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Card and may be downloaded to PC with the help of downloading softwares provided with the system. Digital levels provide a tool, which can be quickly learnt and effectively used to complete the leveling work. With the ability to record measurements in as fast as 3 seconds, productivity can be substantially improved. Using the digital levels one can save up to 50 percent of time and costs, through reduced reading errors, writing errors, calculation of the limits, values - all measurements and calculations are very fast. The surveyor has to carry out astronomical observations to determine the true bearing on the surface, which is only possible in clear and starry nights. Use of magnetic bearings measured with compass are liable to gross errors and are open to objections because of low accuracy of measurement, variation in magnetic declination and erratic behavior of compass near known or unknown magnetic fields. Transferring of bearing in the underground by conventional methods is a skilled as well as a laborious job and high accuracy is also not achievable. The invention of gyro-attachment has helped in overcoming the above difficulties. Gyrotheodolite Gyrotheodolite is a surveying instrument used to orientate an underground survey base line relative to true North.

### 2: Surveying & Leveling Civil Engineering Surveying Lectures & Course Notes

*Under revision LECTURE 1 Introduction: Surveying is defined as "taking a general view of, by observation and measurement determining the boundaries, size, position, quantity, condition."*

### 3: Mine Surveying Lab | Department of Mining Engineering

*Mine Plans and Sections: Legal requirements as to mine plans in India, preparation and preservation of plans and section, Representation of geological and other features in mine plans and sections, Tridimensional drawing, Enlargement of plans, Use of edigraph and pentagraph preparation of mine modes.*

### 4: NPTEL :: Mining Engineering - An Introduction to Underground Mine Environment and Ventilation

*CIVL Engineering Surveying Lecture 1 Introduction to Surveying Reference: Engineering Surveying, Chapter 1, pages 1 to 17 (examinable) 1 Introduction This first lecture will define the purpose of surveying, introduce the various branches of surveying, highlight the basic principles of surveying and discuss briefly the techniques and instruments used to take measurements in surveying.*

### 5: What are the duties of the mine surveyor?

*Surveying: To carry out surveying specific for opencast and underground mining purposes Chain Survey Chain survey is the simplest method of surveying. In this survey only measurements are taken in the field, and the rest work, such as plotting calculation etc. are done in the office.*

### 6: Full text of "A study of mine surveying methods and their applications to mining engineering"

*Surveying has to do with the determination of the relative spatial location of points on or near the surface of the earth. It is the art of measuring horizontal.*

### 7: Lecture Notes: MINE Virginia Tech (VT): Koofers

*The origin of the mine survey control network and its initial establishment were retrieved from the Anglo American survey archives. The secure documented history of the original survey network had a significant impact on the transition of the.*

### 8: MODERN SURVEY INSTRUMENTS AND THEIR USE IN MINE SURVEYING | Sunil Kumar - www.eng

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*The purpose of these notes is to show how mine surveying enters into all the other phases of mining engineering and what methods are best adapted to each kind of.*

### 9: lectures for mining engineering degree - Mineral Processing EPC

*Land Surveying Class Lectures - Survey Class Lecture Notes Free Download The history of surveying started with plane surveying when the first line was measured. Today the land surveying basics are the same but the instruments and technology has changed.*

*The new Smiths Bible dictionary. Cover letter for university application I knew Id sing Heather McHugh Edward Bennett Williams for the defense An A.D.D. Guidebook Marks essentials of medical biochemistry 4th edition From curiosity to closure: eight cognitive tasks Baby Piggy and giant bubble Beyond the comfort zone Septic system owners manual Concise history of Malta Web api 2 book Experimental approaches to multifactorial interactions in tumor development The role of play in individual psychotherapy from childhood to adolescence The establishment of schools and colleges in Ontario, 1792-1910. The blind see only this world This is not a letter and other poems Skeletal Growth Factors Electronic musical instruments Forming a Liturgical Choir Behringer 1204 mixer manual Waiving points of order against the conference report to accompany the bill (H.R. 2126 Department of Defe Spiritual Community Constructing the Egyptian past Nanoparticles synthesis characterization and applications Owl and the Pussy-Cat, The SIGGRAPH 82 conference proceedings Aquarium care of goldfish Selections From The Adventures Of Sh H Ca Attack of the Drow Britain and America united in the cause of universal freedom DO I DARE TO EAT A PEACH? Research title in environmental microbiology A discourse of the general rule of faith and practice Trials of Oscar Wilde Gunfighters return Better Change Special Ed A Nashville night to remember The Temple mount in the Lowlands Gary Schwartz The Issue of the Union of the Consummated Spirit of the Triune God and the Regenerated Spirit of the Beli*