



**भारतीय भूवैज्ञानिक सर्वेक्षण**  
**GEOLOGICAL SURVEY OF INDIA**  
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## **3 डी स्थलीय लेजर (एलआईडीएआर) स्कैनर पर प्रशिक्षण** **Training on 3D Terrestrial Laser (LIDAR) Scanner**

(13<sup>th</sup> November, 2018 to 22<sup>nd</sup> November, 2018 at CHQ, Kolkata)

### **पाठ्यक्रम प्रतिवेदन / Course Report**

The Landslide Studies Division, Geohazards Research and Management (GHRM) Centre, Geological Survey of India (GSI), Central Headquarter, Kolkata has recently procured a 3D Terrestrial Laser scanner for operational use. 3D Terrestrial Laser (LIDAR) Scanner is a high end instrument based on LIDAR technology and is used for detailed geological mapping, topographical survey, change detection of slope morphometry, monitoring of slope deformation etc.

The 3D Laser Scanner procured by GHRM Centre is of make RIEGL VZ-4000 (4 km range at 90% reflectivity condition) with eye safe laser (Laser Class 1) and a Differential GPS attached for positioning. It has in built digital camera of 5 MP and detachable external NIKON 36 MP camera for simultaneous filming of terrain along with scanning. The instrument has field of view: Horizontal=360° and Vertical=60° (30° up and down) with an horizontal accuracy of 15 mm. The DGPS is used for obtaining coordinates of the base station and control points. This facilitates geo-referencing of the scan data in a Global coordinate system.

M/s Meatech Solutions LLP, the vendor of RIEGL VZ-4000, imparted ten days training to 13 Officials of GSI at CHQ, Kolkata (Annexure-I) for developing the core capacity to know the set-up and working of the instrument (3D Laser Scanner along with attached DGPS), data capturing in field and data processing using softwares (RiSCAN and Leica Infinity) for generation of precise Digital Terrain Models (DTMs). The programme of the training is given in Annexure-II.

Dr. Dinesh Gupta, Director General, GSI inaugurated the ten days field and lab based training programme on 13.11.2018 at Conference Hall, CHQ, Kolkata. The inauguration was attended by Dr S. Raju, ADG and NMH-IV; Dr. K. Jayabalan, DDG, MIVA; Directors from GHRM Centre and NCEGR, CHQ, Kolkata and thirteen trainee officers, including surveyors from CHQ and Eastern Region, GSI. The Director General, GSI addressed the august gathering and stressed that the technology in 3D Laser Scanner has immense potential and its utility and output has to commensurate with its speed and accuracy. He advised the entire participant to learn the techniques for field use and opined that the output from this

will help GSI to make use of this instrument in other Missions too. Shri G. Bandopadhyay, M/s Meatech Solutions LLP presented a brief about the instrument and its capabilities during the inaugural session. The training session commenced after the inaugural program.

The classroom-based training was imparted into two phases at CHQ, Kolkata: one between 13<sup>th</sup> and 16<sup>th</sup> November, 2018 in which concepts and principles of 3D Laser scanner were taught and another between 21<sup>st</sup> and 22<sup>nd</sup> November, 2018 in which the trainees carried out processing of the field data. The field based training was conducted at Maithon Reservoir, State: Jharkhand between 17<sup>th</sup> and 20<sup>th</sup> November, 2018.

In the classroom training concepts and principles of LIDAR Technology, basics of Scanner survey methodology and DGPS, introduction to various accessories of the Scanner and DGPS, utility of the accessories, configuration and set-up of the Scanner for data collection, calibration of the speed of Scanner and the laser pulse repetition rate for acquiring the desired density of point cloud based on the field condition, demonstration and preparatory hands-on-practice on the set-up of instruments for operation in field, basics of the softwares (RiSCAN and Leica Infinity) to be used for data processing were taught along with practical demonstration within the GSI office complex.

Following the comprehensive classroom training on the basics and handling of the Scanner as well as the attached DGPS, two days field training was conducted at Maithon Reservoir area, Jharkhand. During the field training, hands-on-practice on the set-up of base station and control points using DGPS under static survey mode, processing of DGPS data using Leica Infinity software for acquisition of real-time coordinates, configuration of scanner over the established base station, collection of scan data, logging and downloading of raw scan data, mapping of geomorphological as well as surfacial geological features using DGPS under RTK (Real Time Kinematic) survey mode were carried out. During field training attempt was made to map a small hill slopes with sufficient vegetation cover covering 0.25 sq. km area.

Post-field training, comprehensive classroom training for processing of the field data collected at Maithon Reservoir area was taught to the trainers at CHQ. Hands-on-practice for processing of field data using RiSCAN software following a sequence of steps like direct georeferencing of the raw scan data, data registration for preparation of polydata, multi-station adjustment of the prepared polydata, conversion of ellipsoid-height to ortho-height, different methods of georeferencing like back sighting, free station, multi-scan free station method, etc. for assigning of the desired coordinate system, cleaning/filtering of the polydata, triangulation of the filtered polydata, smoothing of the triangulated data for generation of the desired Digital Terrain Model (DTM) and creation of contours from the DTM. Exporting of the point cloud in excel format (.csv file) containing the x,y,z coordinates from the generated contours for compatibility in Arc-GIS was also carried out.

The objective of the aforesaid training was to understand the working procedure of the instrument as well as the time required for a topographical survey. The output generated from the training (Fig. 1) has enabled the formulation of a tentative timeframe that may be required for topographical survey using 3D TLS, as enumerated below:

1. Base station and Control point set-up: 3 days (depending on the distance between the study area and the nearest available permanent GPS stations of GSI).
2. Scanning: 1 day (depending on the area of study, availability of field of view).
3. Data processing: 6-7 days.

The utility of the high-end survey instrument, as understood and assessed during the training, can be applied in a number of projects of GSI involving:

1. Topographic survey in undulating and hilly terrain.
2. Mapping of geomorphological and surfacial geological features.
3. Volume calculation of landslides, glaciers, landfills, excavations, etc. (depending on the availability of multi-temporal data/pre- and post-activity data).

The comprehensive training on the use of 3D Terrestrial Laser (LIDAR) Scanner at CHQ, Kolkata concluded on 22<sup>nd</sup> November, 2018 through a valediction programme that was graced by Dr. Dinesh Gupta, Director General, GSI in the presence of Dr S. Raju, ADG and NMH-IV; Dr. K. Jayabalan, DDG, MIVA; Directors from PSS and M-IV, CHQ.

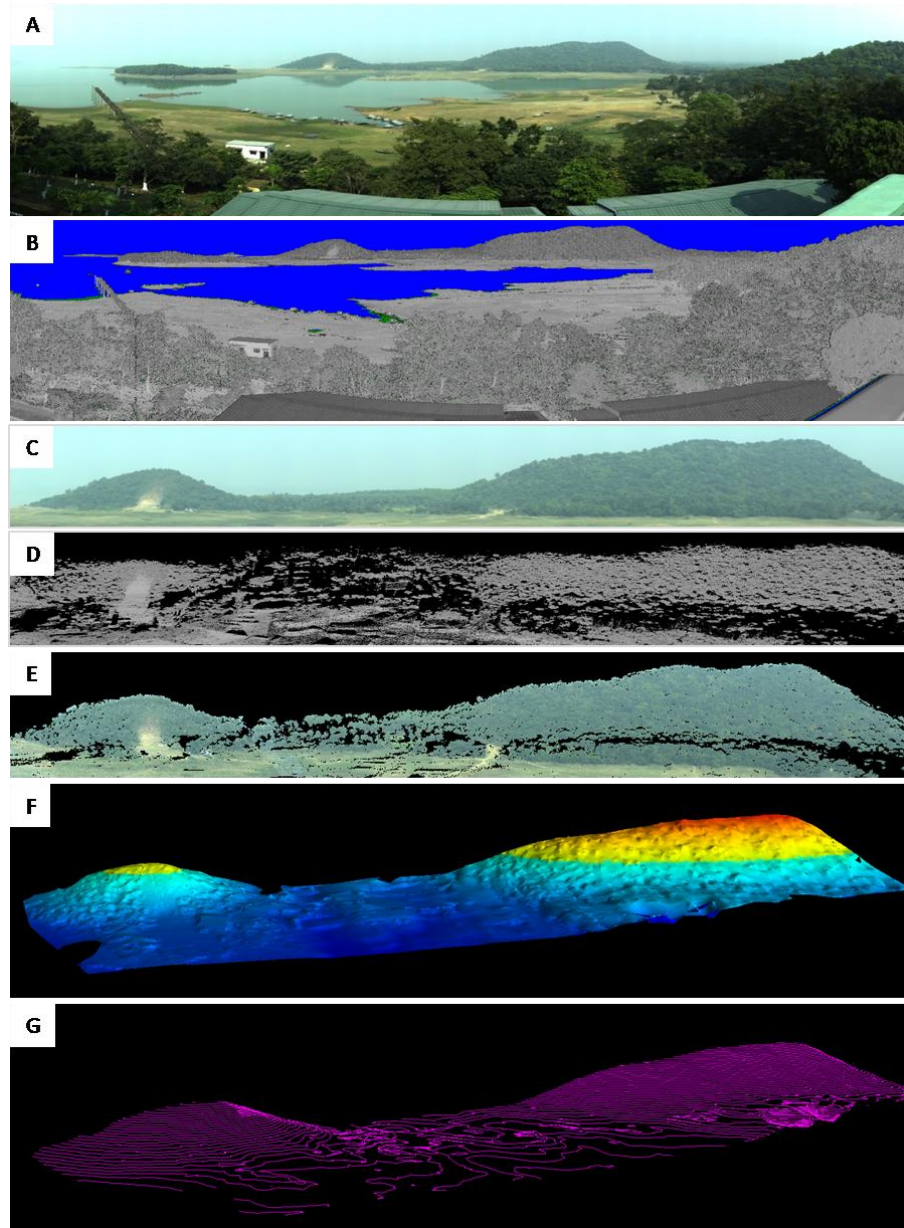


Figure 1. Output of the training: (A) Photographic image of part of Maithon Reservoir, Jharkhand, (B) Raw Scan data of part of Maithon Reservoir, (C) Photographic image of the study area, (D) Raw Scan data of the study area, (E) Registered polydata of the study area, (F) Generated DTM of the study area and (G) Generated Contour map of the study area.

## Glimpses of 3D Terrestrial Laser Scanner training



Dr. S. Raju, ADG & NMH IV welcoming Dr. Dinesh Gupta, Director General, GSI during inaugural function (A), Dr. Dinesh Gupta, DG, GSI addressing the gathering (B), Hands-on-practice at CHQ (C), Base station set-up of DGPS in field (D), Scanning of slopes using Laser scanner (E), Trainees during the valediction (F) and Dr. Dinesh Gupta, DG, GSI distributing certificates to trainee officers (G).

### Annexure-I

Sl. No	Name	Designation	Place of Posting
1	Shri Abhishek Kumar	Sr. Geologist	MIV-A, CHQ
2	Shri P.K.Theophilus	Sr. Geologist	LnSD, GHRM Centre, CHQ
3	Shri Megotsohe Chasie	Sr. Geologist	LnSD, GHRM Centre, CHQ
4	Shri Rabisankar Karmakar	Sr. Geologist	ER, Kolkata
5	Shri Mrinmoy Kumar Das	Geologist	LnSD, GHRM Centre, CHQ
6	Shri Sumit Kumar	Geologist	LnSD, GHRM Centre, CHQ
7	Smt. Gargi Singh	Geologist	LnSD, GHRM Centre, CHQ
8	Ms. Rajni	Geophysicist	SGDRPC, CHQ
9	Shri Shib Kanta Das	Asst. Survey Officer	LnSD, GHRM Centre, CHQ
10	Shri Subhra Chakraborty	Senior Surveyor	ER, Kolkata
11	Shri Sanjit Kumar Das	Senior Surveyor	ER, Kolkata
12	Shri Subrata Das	Senior Surveyor	ER, Kolkata
13	Shri Sourav Paul Chowdhury	Senior Surveyor	ER, Kolkata

### Annexure-II

Date	Training Subjects & Engagement	Remarks
13.11.2018	<ul style="list-style-type: none"><li>Inauguration</li><li>Introduction to LIDAR Technology and RIEGL Products</li><li>Introduction to RIEGL VZ-4000 TLS and its accessories</li><li>Introduction to scanner survey methodology</li><li>Installation of scanner and software</li><li>Basic handling of VZ-4000 scanner: scanner configuration &amp; setup, data collection</li></ul>	Classroom Training, Q&A session
14.1.2018	<ul style="list-style-type: none"><li>Basics and principles of GPS</li><li>Understanding DGPS GS14 and its accessories</li><li>Introduction to DGPS survey methodology</li><li>Demonstration and operation of Scanner</li></ul>	Classroom Training, Q&A session Outside
15.11.2018	<ul style="list-style-type: none"><li>Basic operations of DGPS survey under Static and RTK mode</li><li>Demonstration and operation of DGPS data capturing under Static and RTK mode</li></ul>	Training, Q&A session Outside
16.11.2018		Training, Q&A session
17.11.2018	<ul style="list-style-type: none"><li>Setting up of base station and control points using DGPS</li></ul>	2 days field training at Maithon,
20.11.2018	<ul style="list-style-type: none"><li>Configuration of DGPS with scanner</li><li>Field data collection of scanner and DGPS</li><li>Hands-on-practice with scanner and DGPS</li></ul>	Journey period
21.11.2018	<ul style="list-style-type: none"><li>Introduction to data processing software</li><li>Data downloading and processing</li></ul>	Classroom Training
22.11.2018	<ul style="list-style-type: none"><li>Hands-on-practice on scanner data processing</li><li>Hands-on-practice on scanner data processing</li><li>Hands-on-practice on advance option in data processing software</li><li>Valediction</li></ul>	Classroom Training