PRASHANT SURVEYS

(Advanced Land Survey & Geospatial Solutions)

Precise asset mapping above and below the ground, using Hybrid technology of Mobile LiDAR & GPR System along with PPK UAVs / Drones in India.

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Geospatial World Forum, LiDAR Point Cloud : Smart Application**;**

TAETS ART & EVENT PARK, AMSTERDAM, **3rd April 2019.**

ISO 9001 : 2015

Geospatial World Forum,

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Prashant Alatgi, Head : Technical & Business Develop.

Prashant Surveys,

Pune, India.

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Agenda :

1. About “Prashant Surveys”.
2. Our advancement in Mobile LiDAR technology.
3. Smart City Mission in India.
4. Precise 4 D mapping above & below the ground.
5. Mobile LiDAR, GPR, PPK UAV/Drones, GNSS.
6. Terrestrial LiDAR for shadow areas.
7. Seamless Integration of the above captured data.
8. Applications.

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About “Prashant Surveys” :

- One of the leading and most experienced (28 years) Land Surveying and Mapping Company in India.
- Started in 1991 by the Founder Mr. Shivanand Alatgi, Retd. From Survey of India after serving for 24 years.
- Completed about 25,000 Km of Roads and highway surveys by using Leica Total Stations & DGPS since 1998. (about 21 years).
- Adopting the most advanced Land surveying and mapping Techniques (Mobile LiDAR) available in the market.
- Strive to achieve the maximum accuracy in minimum time and optimum cost.

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Assets of our Company :

- Leica ‘Pegasus Two’ Mobile LiDAR / NSV systems. : 02 Nos.
- DGPS / GNSS Receivers (Dual frequency). : 15 Nos.
- UAV / Drone, Lookout VTOL™- X-Mapper Series. : 01 No.
- Leica Electronic Total Stations. : 12 Nos.
- Leica Digital Levels ‘Sprinter 150M’. : 02 Nos.
- Leica ‘Infinity’ / TBC for GNSS data processing. : 08 Nos.
- Leica ‘Mapfactory’ licenses for Arc GIS. : 08 Nos.
- Leica ‘Auto P’ & ‘Waypoint Inertial Explorer’ licenses. : 02 Nos.
- Pix4d Professional & ‘3D Reshaper’ license. : 03 Nos.

CERTIFICATE OF REGISTRATION

TNV United Kingdom

This is to certify that the Quality Management System of

PRASHANT SURVEYS

204, Mayfair Arcade, 563 Nana Peth, Besides Chacha Halwai, Laxmi Road, Pune 411002, Maharashtra, India

has been assessed and registered by TNV UK Ltd. As conforming to the requirements of:

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For the following Scope

“Land Surveying, Mapping & Consultancy Works, Using Advanced Mobile LiDAR Technology”

Certificate Number : 1608090910101
Issue Date : 09th Aug. 2016
Certificate Expiry Date : 08th Aug. 2019

TNV Certification UK Ltd.
Auth. Signatory

CERTIFIED ISO 9001 CERTIFIED

AB-CAB ACCREDITED

Authorised Signatory
TNV Certification UK Ltd.
Regd. Off: Armstrong House, First Avenue, Robin Hood Airport, Doncaster, South Yorkshire, England, DN9 3GA, United Kingdom,
Phone: 00-44-20 3239 8991, 00-44-20 3290 8991
Certificate can be verified on Accreditation Board website: www.abcab.org and on CAB's website www.tnv.uk.com

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Our advancement in Mobile LiDAR technology :

- First Company in India to Procure ‘Leica Pegasus’ Mobile Mapping System in March 2015.
- Only Land Surveying and Mapping Company in India to own Two numbers of ‘Leica Pegasus Two’ Mobile LiDAR systems, with about 4 years of LiDAR Survey experience.
- Completed about 10,000 Km of Mobile LiDAR Surveys of Highways in India.
- Site data collection team of about 15 members, assisted with 3D point cloud data processing team of 18 members.
- Capable of data capturing about 4,000 Km of 2 lane Highway network in a month using our Two numbers of ‘Pegasus Two’ Mobile LiDAR systems.

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Smart City Mission in India :

- Smart City Mission, is an urban renewal and retrofitting program by the Government of India with the mission to develop 105 cities across the country making them citizen friendly and sustainable.

- The Union Ministry of Urban Development is responsible for implementing the mission in collaboration with the state governments of the respective cities.

- The purpose of the Smart Cities Mission is to drive economic growth and improve the quality of life of people by enabling local area development and harnessing technology.

- Application of Smart Solutions shall enable cities to use technology, information and data to improve infrastructure and services.

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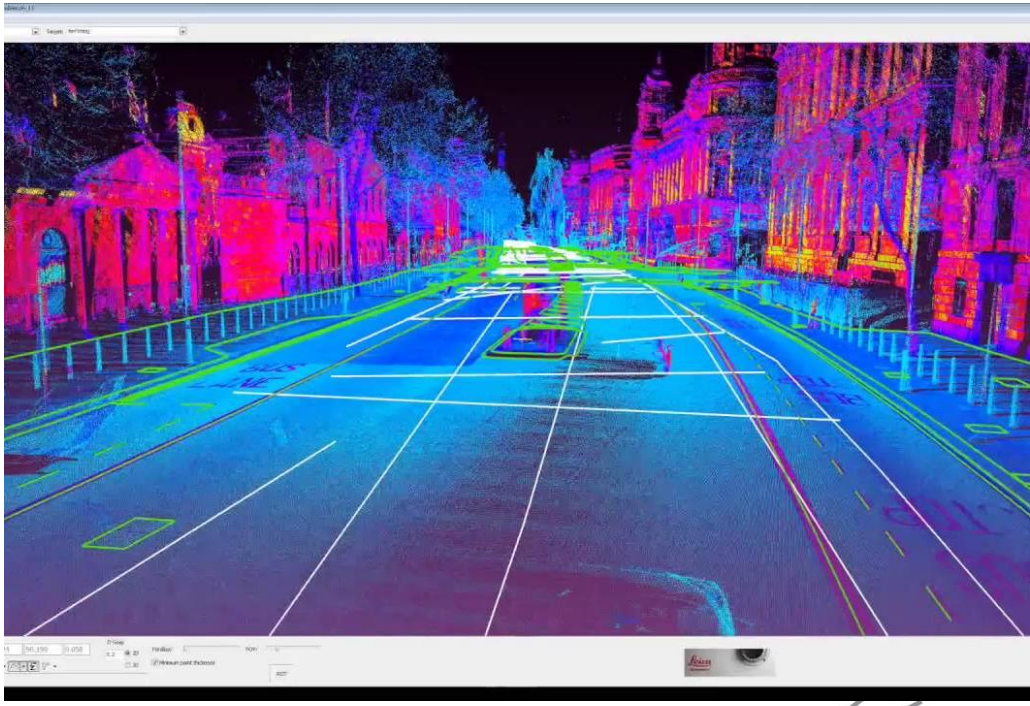
Precise 4 D mapping above & below the ground :

- Precise 4D mapping (X, Y, Z & depth) of all the existing assets above and below the ground is of utmost importance for any Smart City development project.

- The base map prepared should be accurate, dynamic, rich in content and seamlessly integrated so as to depict the actual existing site conditions which will help in preparing precise work plan for the further smart city development.

- The goal is to bring positioning and underground detection tools together to provide accurate location for underground infrastructure.



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About Mobile LiDAR System :

- Mobile LiDAR is an advanced mapping solution used to collect survey grade 3D point cloud data quickly & accurately.
- Incorporates the most advanced LiDAR sensors, Cameras & position / GNSS / GPS receivers.
- Mobile mapping : is the process of collecting geospatial data from a mobile vehicle, typically fitted with a Mobile LiDAR system.
- Output after processing include; Geo-referenced 3D point cloud data, digital 3D maps in Autocad *.dwg or Arc GIS *.shp files, images / Panaromic views & Videos.

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Data Captured by Mobile LiDAR system :

- The mobile LiDAR System can capture :

(i) ‘3D Scan point cloud data’ in 360 degrees

(ii) ‘High Resolution photographs’ in all directions.

(iii) ‘Trajectory file’ / position information, (GNSS Receivers).

- Above data can be captured for about 50 to 80 Km per day depending upon the road & site conditions for single pass.
- DGPS base stations observations are required.
- Requires proper logistics planning for DGPS & LiDAR teams.
- LiDAR scan point cloud Resolution is about 6 mm.
- Overall accuracy of the LiDAR data is upto + / - 2 cm.

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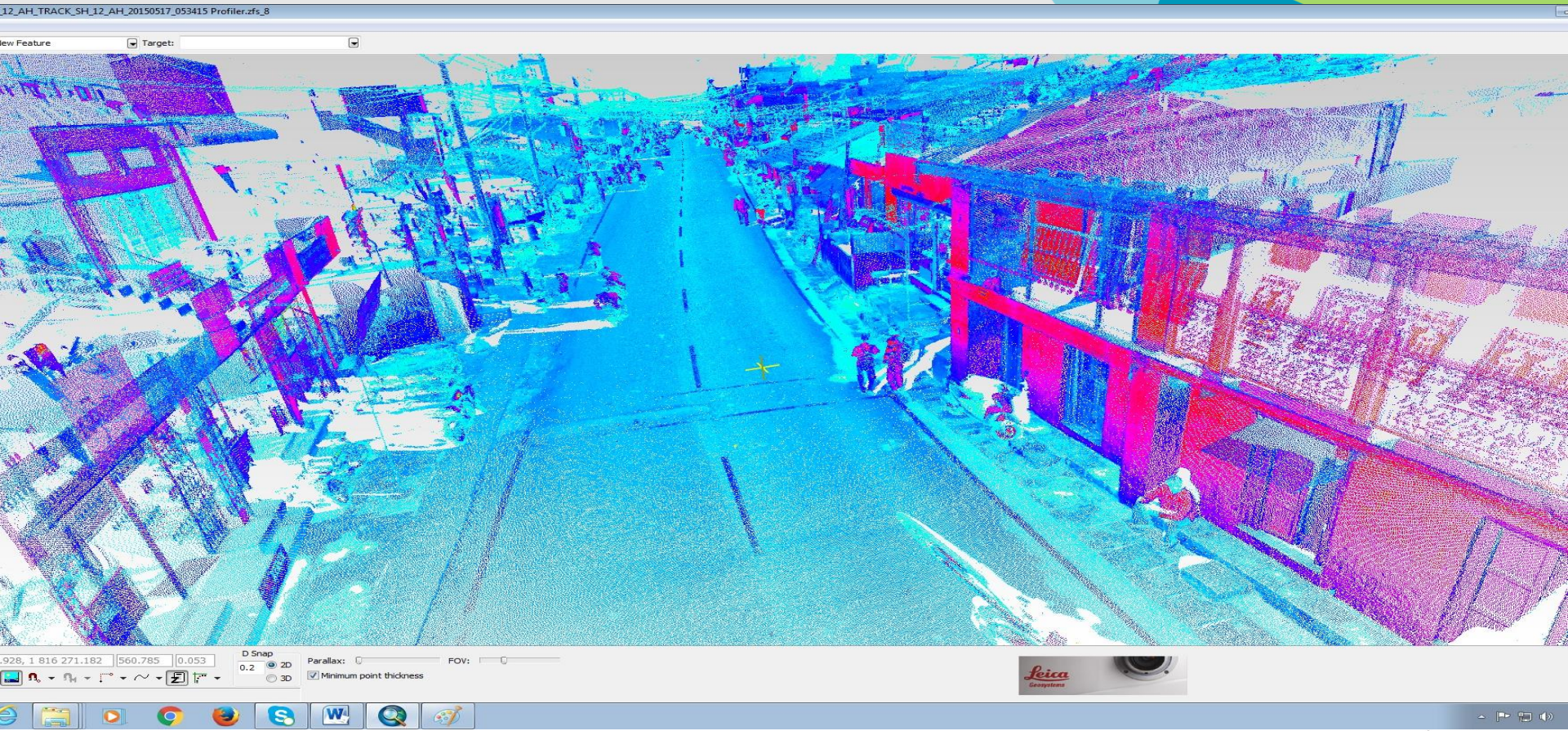

‘3D Scan point cloud data’ captured by using Mobile LiDAR ‘Leica Pegasus Two’

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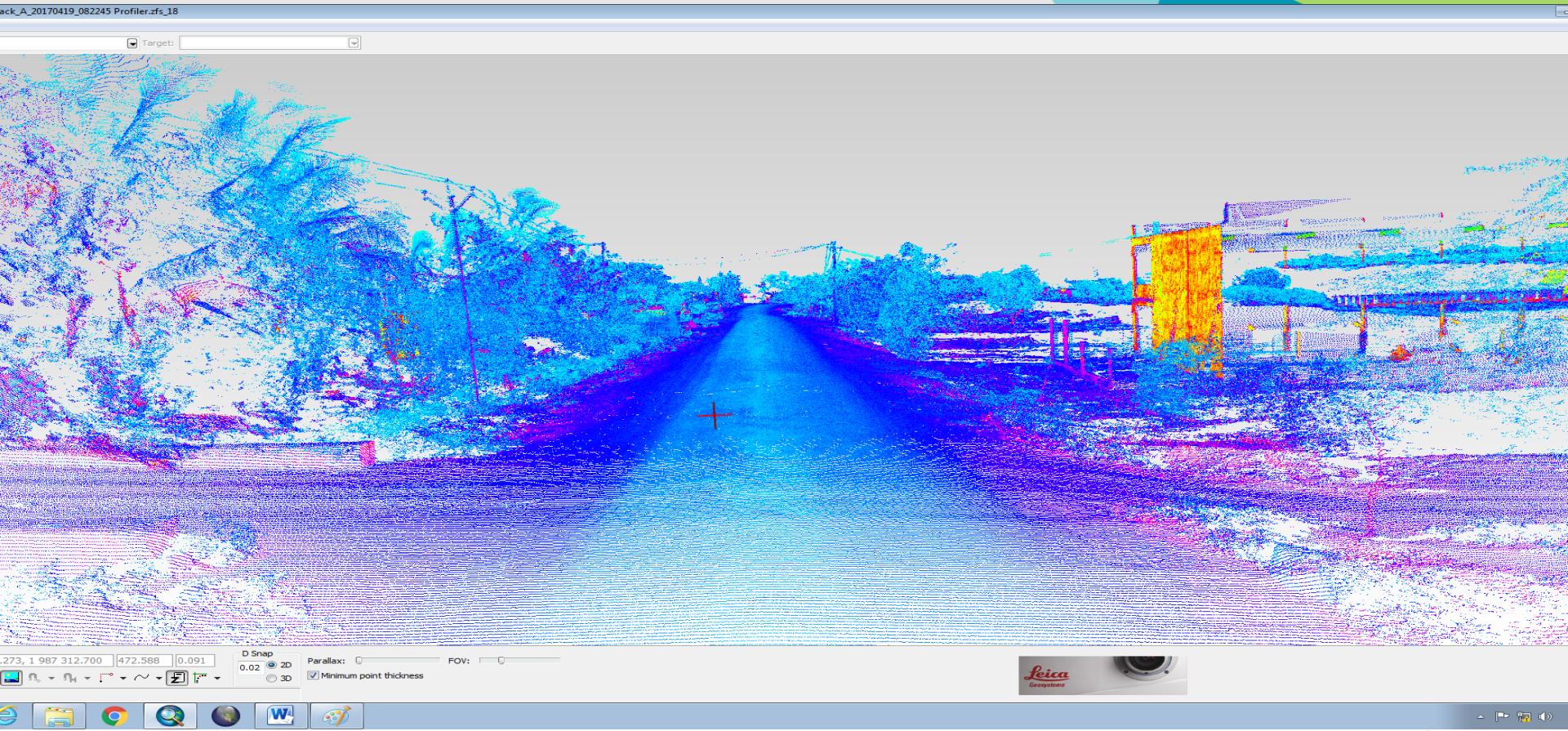

‘3D Scan point cloud data’ captured by using Mobile LiDAR ‘Leica Pegasus Two’

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‘High Resolution Photographs’ captured using Mobile LiDAR ‘Leica Pegasus Two’:

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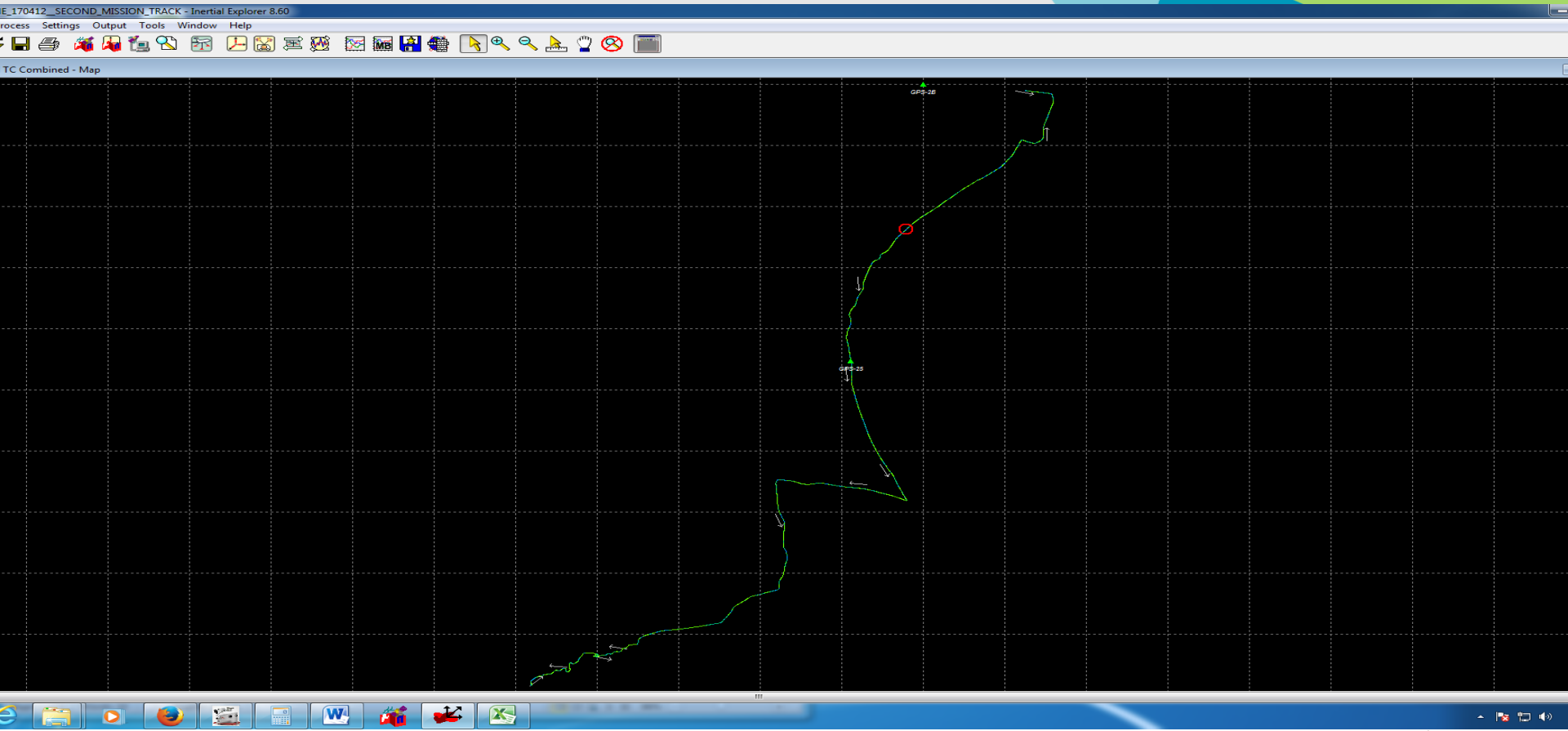

‘Trajectory file’ generated using Mobile LiDAR ‘Leica Pegasus Two’:

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Data processing, feature extraction & 3D Output :

- **Data processing is done for generating ‘3D point cloud data’ & ‘feature extraction’ for plotting all existing features along the highways, using workstations as follows :**

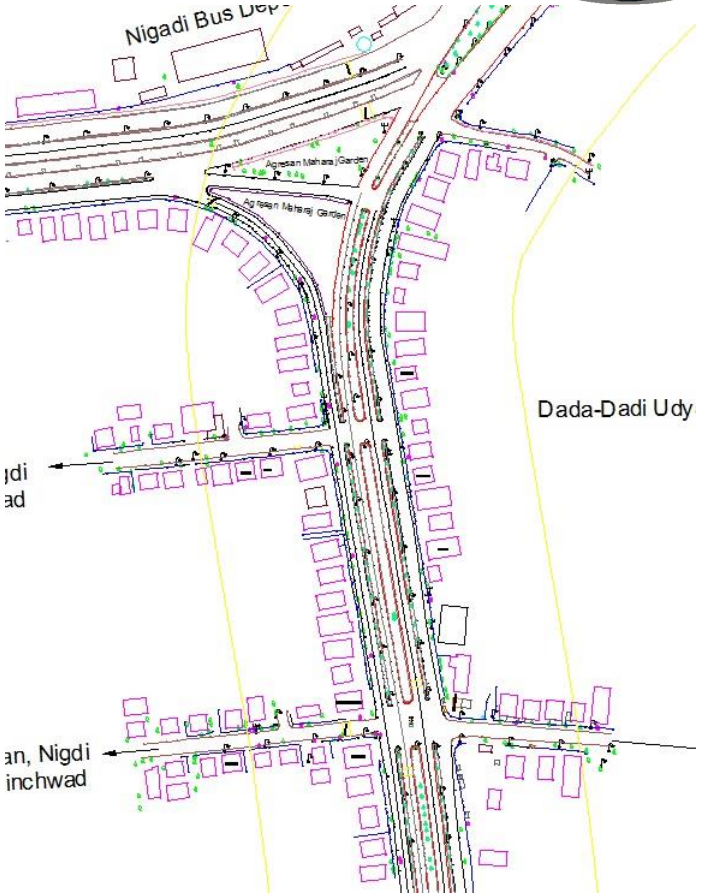
- Using the GPS and IMU data, the precise trajectory is computed by ‘Way point inertial explorer’ software.

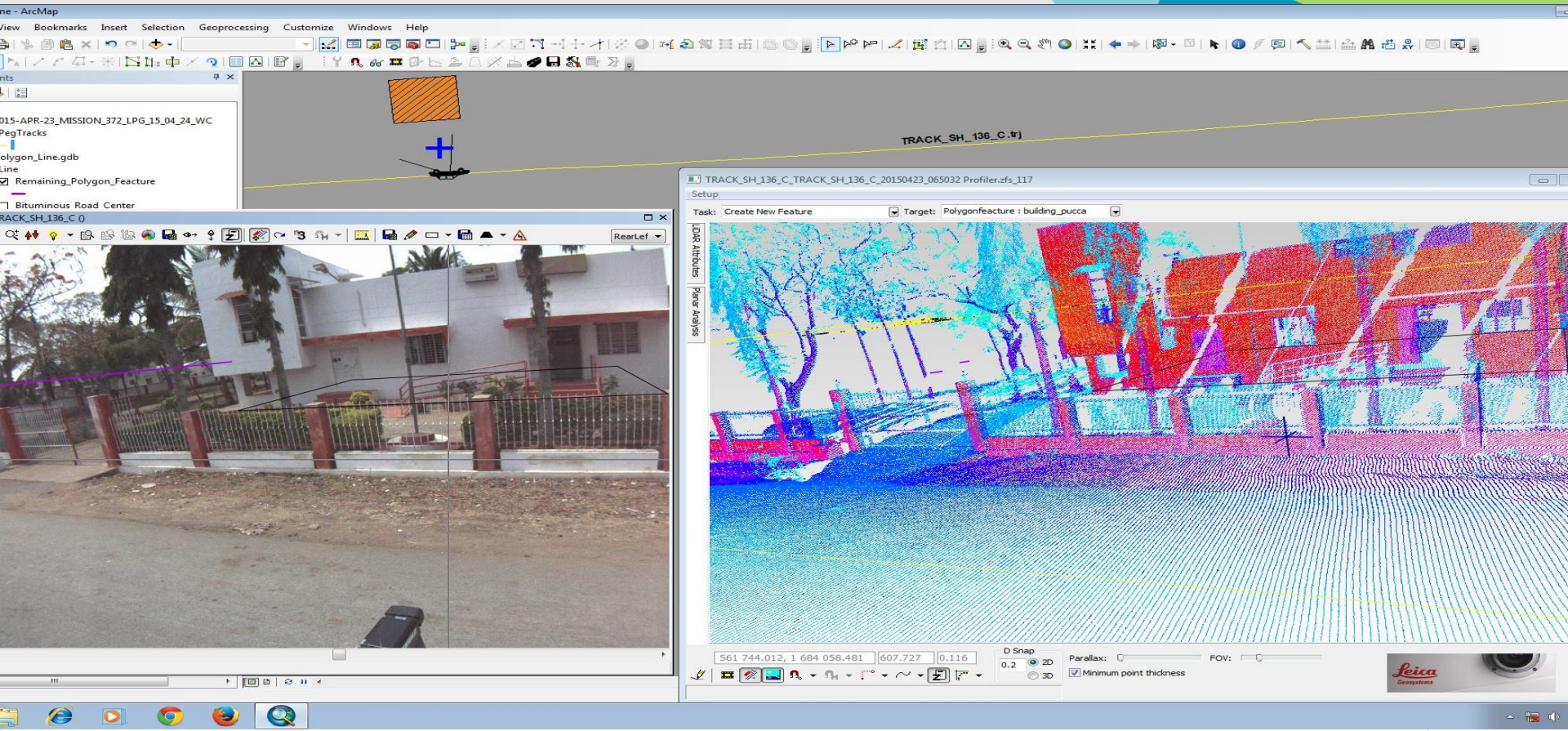
- The 3D point cloud data is prepared using ‘Leica Auto PP’, from the captured scan files, the images files & the trajectory files.

- The required features along the highway are extracted in the Arc GIS environment using ‘Leica Map Factory Advanced’ software.

- The extracted features are then exported to Autocad *.dwg format for further drafting works. L-Sections and Cross-Sections are generated by using ‘3D Reshaper’ software.

- The 360 degrees panoramic view of the camera & the point cloud data can be viewed in ‘Pegasus Manager’ software.





Screen Shot of ‘Photographs’ & ‘3D Scan point cloud data’ in ‘Leica Map Factory’

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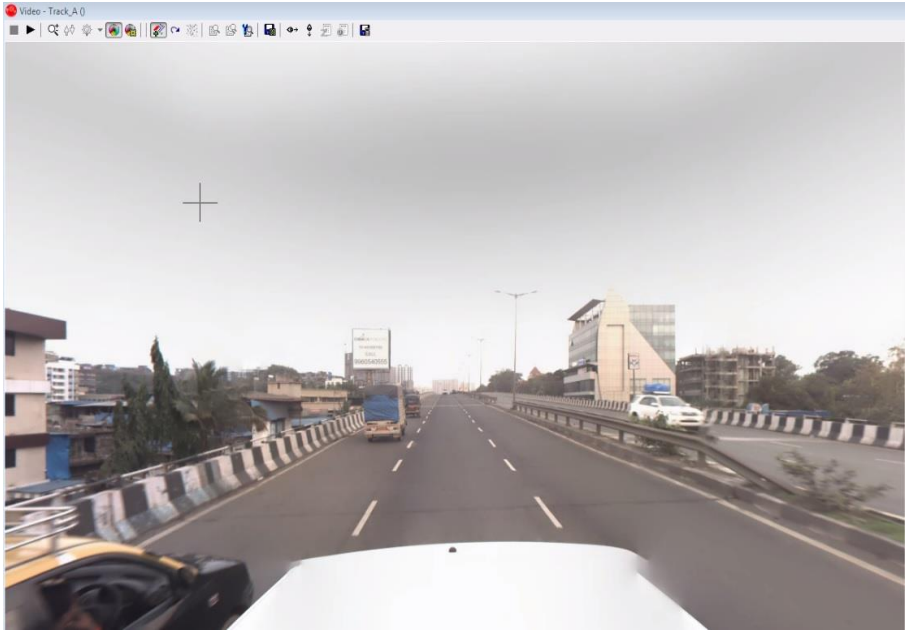
Contd… 3D Deliverables from Mobile LiDAR Survey :

- 3D Plan showing point, line and polygon features; in Arc GIS *.shp file or Autocad *.dwg files.
- Registered 3D point cloud data in *.hpc or LAS format.
- L-Sections and Cross-Sections of the road / Highway.
- Contours / DEM / TIN of the surface surveyed.
- The 360 degrees panoramic view of the camera data with the point cloud data superimposed on it.



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GPR (Ground Penetrating Radar) :

- Pegasus: Stream array, Designed to be towed by a vehicle at speeds up to 15 km/hr, the device provides simultaneous above and below-ground 3D scanning.
- It includes a mobile laser scanner with laser scanners, optical cameras and GNSS receivers (Leica Pegasus: Two) for above-ground features and a Stream EM GPR array for below-ground objects.
- For detection of underground utilities off the roads, hand pushed GPRs can be used.
- In some cases Induction locators or echo sounding devices can also be used to detect metallic utilities under the ground.

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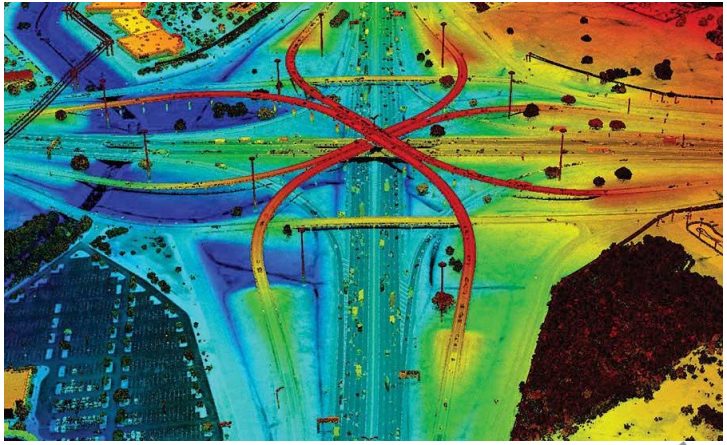
PPK UAV / Drones :



- PPK or RTK UAV / Drones can to be used either with Camera or with LiDAR Sensors, or using both; for the areas where Mobile LiDAR cannot capture the data.

- Though the Mobile LiDAR is much precise (upto + / - 2 CM) the UAV / Drones when used with PPK or RTK GNSS systems, can yield us accuracy upto + / - 5 to 10 CM, which is quite sufficient for city mapping applications.

- Usually most of the utilities are laid besides the existing roads, which are captured by Mobile LiDAR with high precision, where as the other features like the property boundaries, trees etc. which are not captured in mobile LiDAR, can be captured by the UAV / Drones.

- The GNSS network of base stations are to be kept same in both the above methods for uniform integration of datasets.

GNSS / DGPS Base Stations / Ground Control Points (GCP's) :

- The precise GNSS / DGPS Base Station network sometimes called Ground Control Points (GCP's) is the backbone of all the data capture methods (Mobile LiDAR, UAV / Drone, GPR).
- These have to be established by Dual Frequency Survey Grade GNSS receivers with triangulation method and proper adjustments.
- Usually they are established in 3 levels of accuracy and density, Primary, Secondary and Tertiary based on the requirements of the project.
- The Primary, Secondary and in some cases even the Tertiary control points are established on permanent structures or monumental pillars and database maintained for future references.

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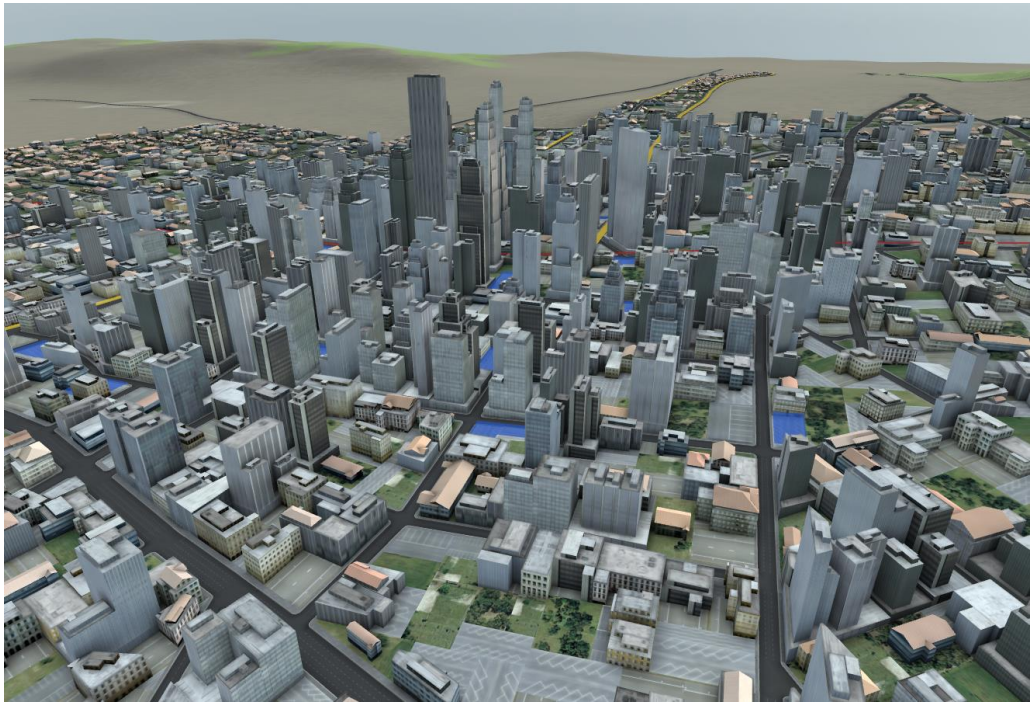
Terrestrial LiDAR for shadow areas :

- For some shadow areas neither covered by Mobile LiDAR nor by UAV / Drones, Terrestrial LiDAR should be used.
- These can scan upto two million points per second and create dense point cloud which can be merged with the Mobile LiDAR database.
- The range of the Terrestrial scanner varies from few meters (short range) to few Kilometers (long range), which can be selected depending upon the site conditions and the applications.
- The same set of Ground control points are to be used for Terrestrial Scanner as well, for accurate registration of the point cloud data with that of the mobile LiDAR or UAV / Drone data.

Seamless Integration of the above captured data :

- The data captured using various technologies, above and below the ground, needs to be seamlessly integrated, to result into a single uniform dataset.
- The accuracy for merging these data sets depends upon the usage of precision GNSS and DGPS network, which is common in all the technologies.
- Creating a 3D model and walk through using the above integrated data.
- Developing customized GIS applications & tools for urban Governments & local bodies.
- Useful for the 105, 3D Smart City projects, which have been recently launched in India.



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Applications :

- 3D City modeling, Smart City surveys
- As built surveys for the highways and roads.
- Airport runways, taxiways and adjoining areas Survey

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Thank You !!

Questions & Answers

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