GEO SMART INDIA 2021

THEME ADVANCING THE ROLE OF GEOSPATIAL KNOWLEDGE IN INDIAN ECONOMY

24-26 August 2021

HICC Hyderabad, India

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LIDAR Technologies

Dec 2019

R. Ramakrishnan

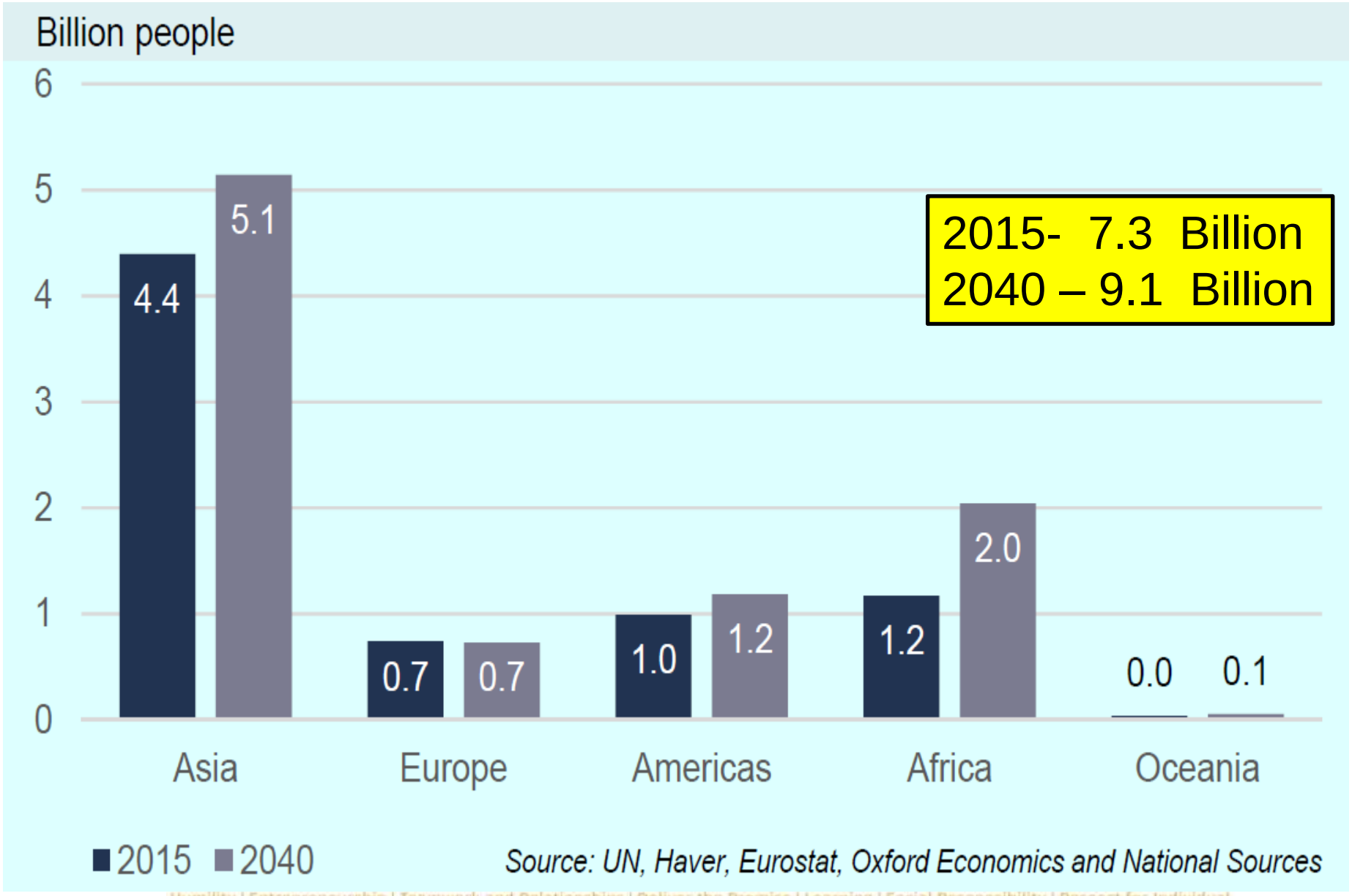
Outline

- Global Infrastructure –A Snapshot
- GMR Group
- GMR Group’s investment in LIDAR Technology
- Success Cases - LiDAR by Geokno
- Future as we see

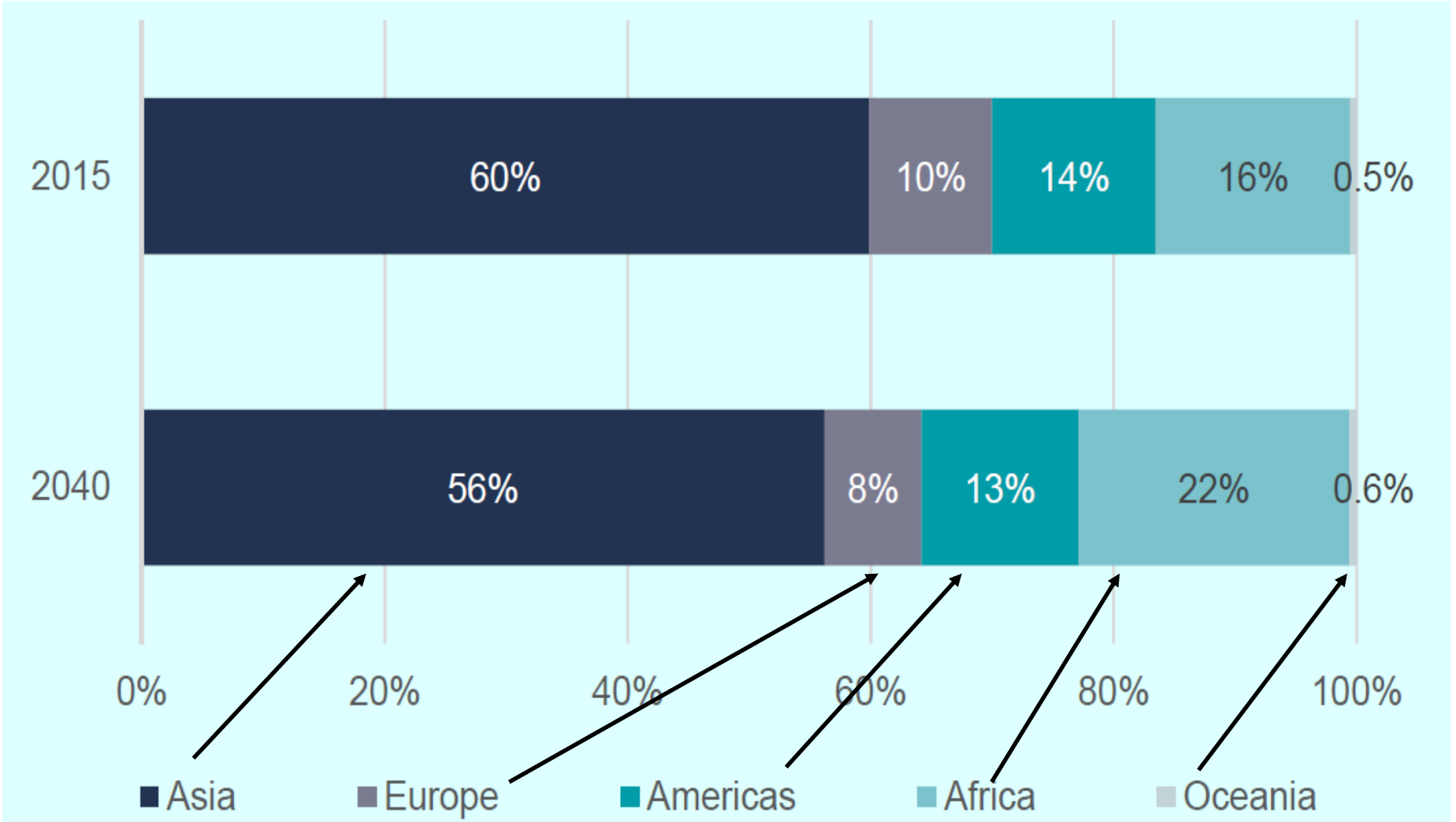
1

Global Infrastructure –A Snapshot

Population by Region -2015 & 2040

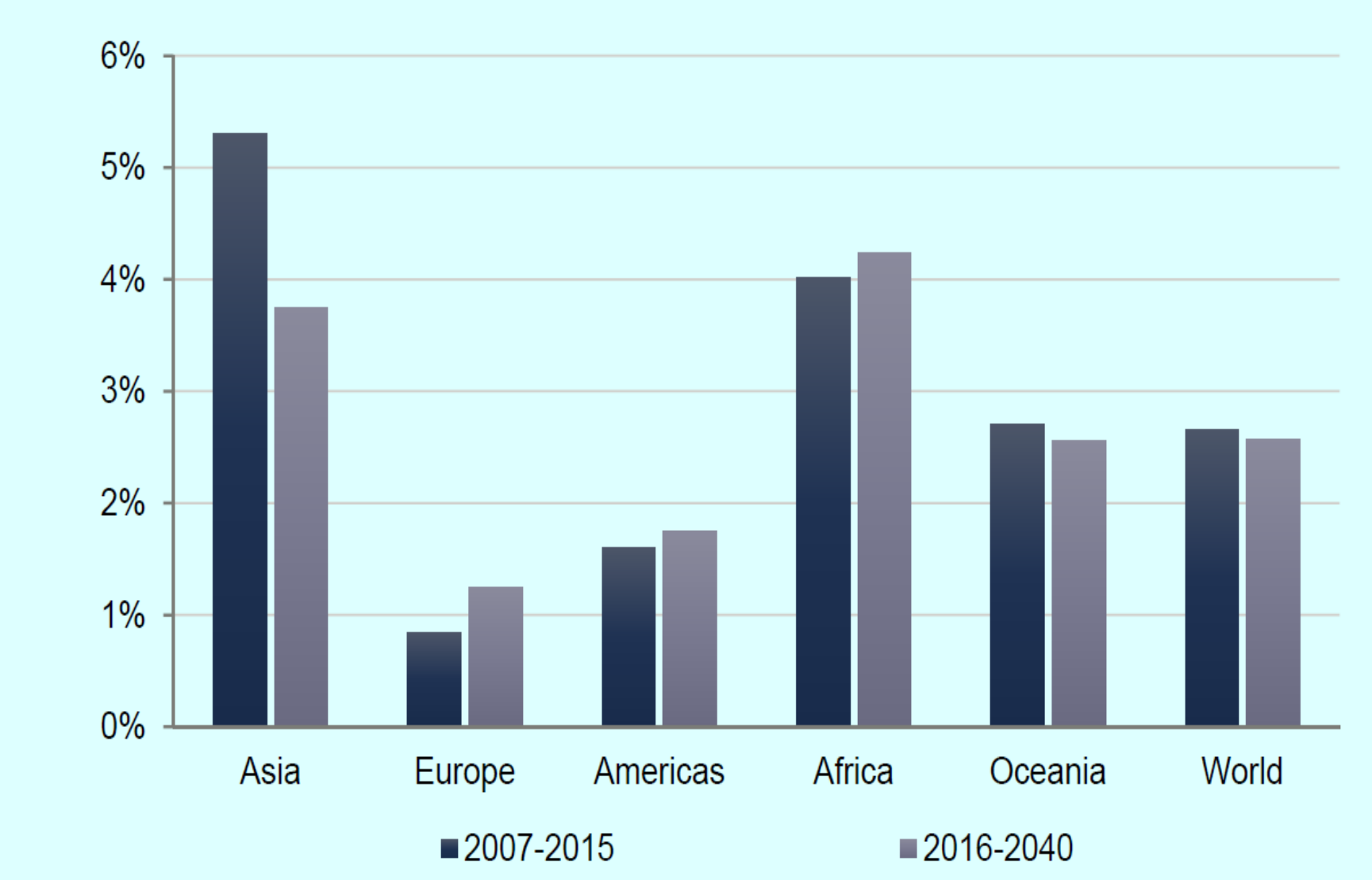


Share of Population by Region



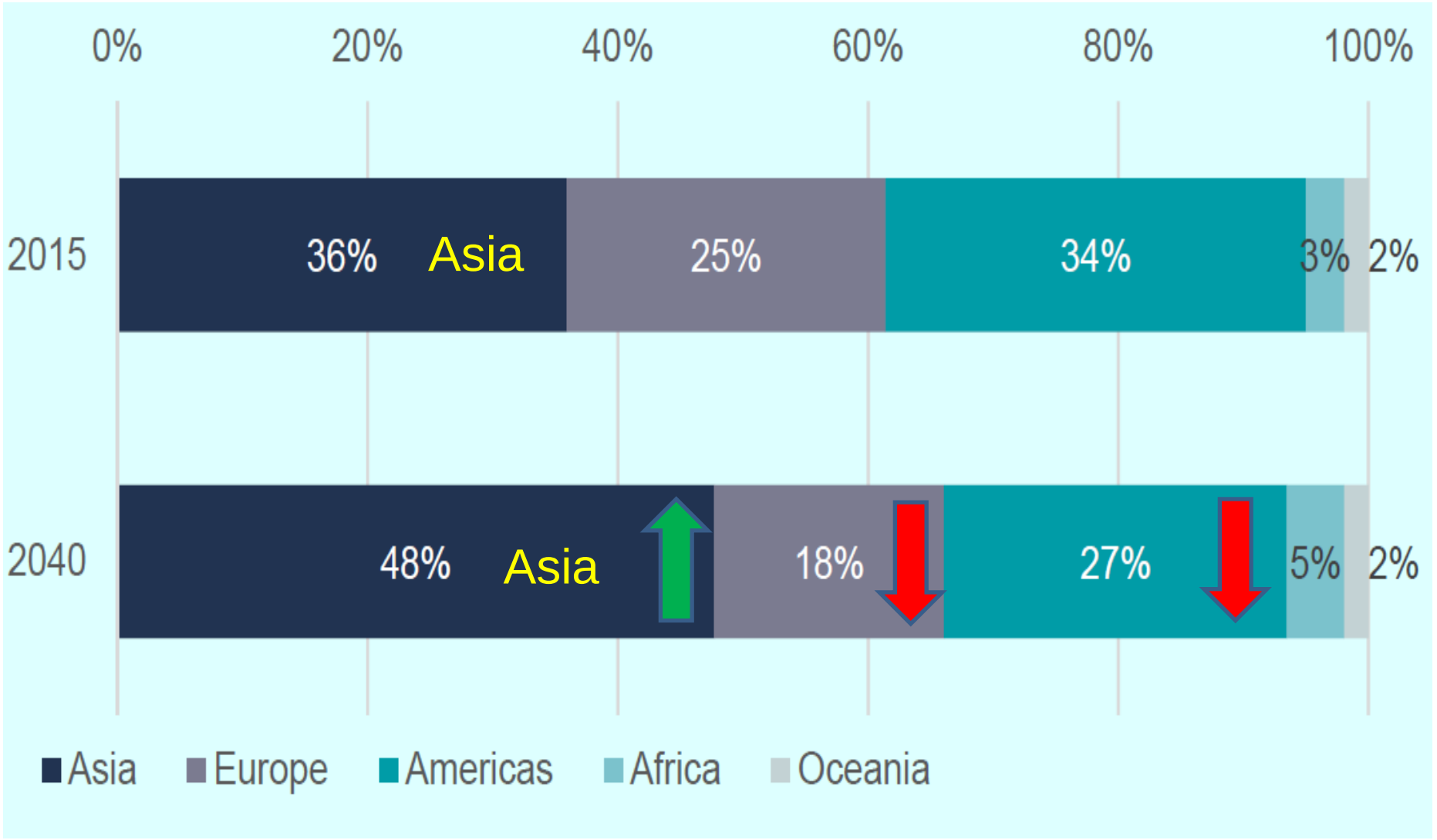
Source: UN, Haver, Eurostat, Oxford Economics and National Sources

Average Annual GDP growth by Region-2016-2040



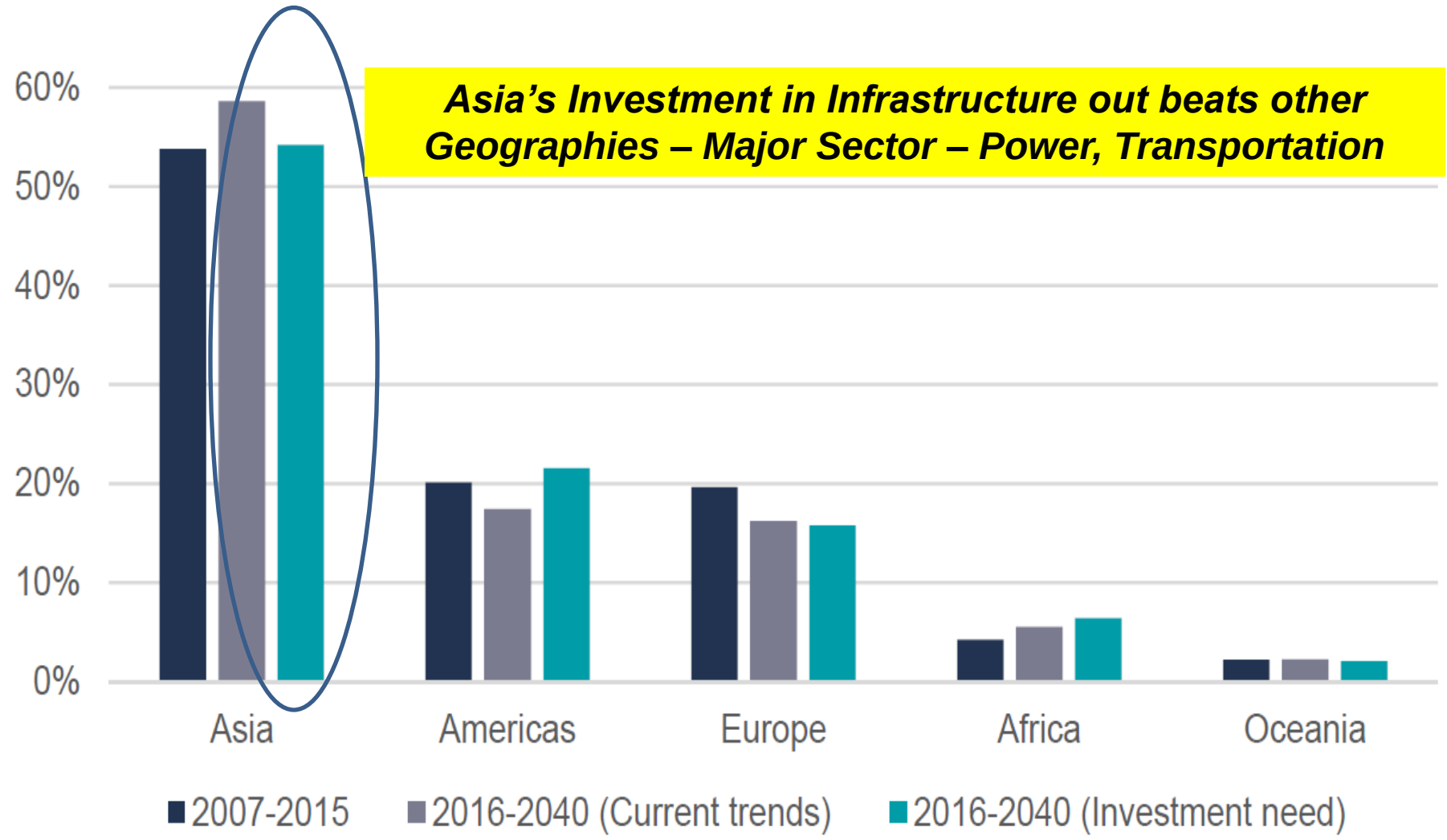
Source –Oxford Economics

Regional Share of GDP -2015 &2040



Source –Oxford Economics

Regional Share of Global Infrastructure Investment – 2016-2040



Asia's Investment in Infrastructure out beats other Geographies – Major Sector – Power, Transportation

Source –Oxford Economics

Global Infrastructure

- Globally countries are facing infrastructure deficit.
- From 2016 through 2040, the world needs to invest about 3.5 percent of GDP, (current trend 3% of GDP) or an average of $3.7 trillion /year, (US $ 94 Trillion) in economic infrastructure just to support expected rates of growth.
- This is 19% higher than the current rate.
- Emerging economies –Asia accounts for 54% of that investment.
- But if the current trajectory of underinvestment continues, the world will fall short by roughly 11 percent, or $350 billion a year.

Creating tomorrow today

2

GMR Group

GMR Group

Airports	▪ 4th Largest Airport operator in World ▪ 3 Airports in Operation ▪ 2 Airports under development ▪ ~100 million Passenger Capacity ▪ Nagpur & Boghapuram on cards
Energy	▪ 4400 MW power generation capacity ▪ 2300 MW power projects under development ▪ 4 Coal mines – 2 each in India & Indonesia ▪ Transmission Lines & Power Trading
Transportation Construction	▪ 4 Highways under operation (approx. 1824 KMs) ▪ Executing 400 KM+ Eastern DFCC Corridor Railway section worth 4000 Cr
Property & SEZ	▪ 230 acres at DIAL ▪ 1500 acres at GHIAL ▪ 13,800 acres of land bank at Krishnagiri & Kakinada

- Owing over $ 5 Billion worth of Assets
- Revenue ~$2 Billions with EBITDA of $ 0.67 Billion
- Over 10,000 employees

Geospatial Technologies in AEC Sector

Planning	• Survey for terrain information • DPR generation
Execution	• Setting out & quality control • Construction progress monitoring
Operation	• Operational efficiency • Project health monitoring

An Integrated approach to infrastructure development – Bringing all the components , sub-systems into one functional system

Paradigm Shift in AEC industry with Geospatial - GMR Experience

Quality

Time saving by 15%

Cost Saving by 15-20%

Assured Quality

3

Investment in LIDAR

GMR Investment in LiDAR Technology

2011- Understood utility of LiDAR technology

2012- Invested in IIT Kanpur incubate company

2019- Company now “Leader in LiDAR” in this part of the world.

Geokno owns state-of-the-art LiDAR sensors for Aerial, Mobile & Terrestrial platforms—100% Indian Team

LiDAR Sensor

Riegl LMS Q780

Camera 100 MP

Phase One Industrial

Positional System

IGI AeroControl

Geokno HeliMapper: Only machine in India with Aerial LiDAR capability

Over 45,000 sq km per annum capability

Geokno Mobile Mapper

Geokno Terrestrial LiDAR

Extensive LiDAR Experience

30,000 sq.km

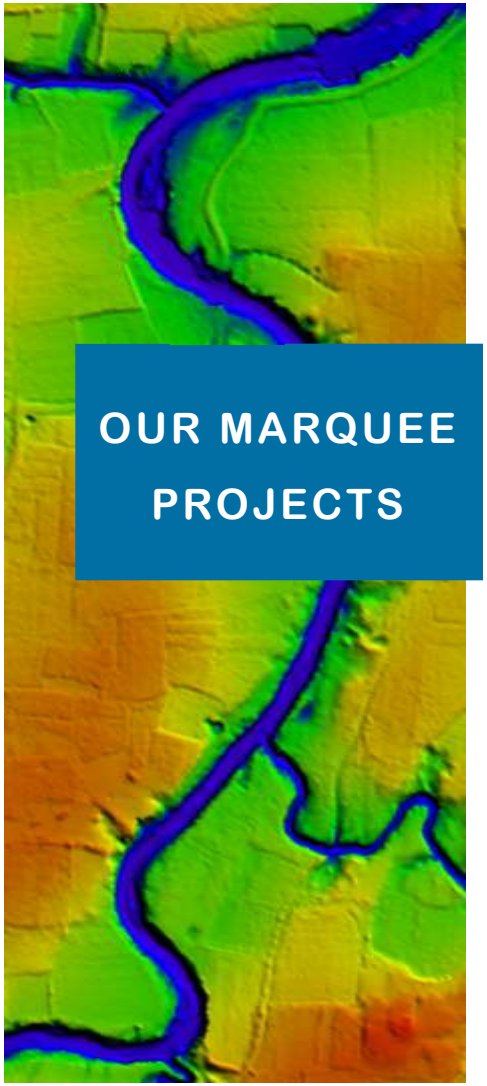
Aerial LiDAR

17,000 km

Mobile LiDAR Survey

137+

Projects Delivered



OUR MARQUEE PROJECTS

DISASTER MAPPING OF UTTRAKHAND FLOOD

First large scale Aerial LiDAR project for diasaster assessment in India

MUMBAI – AHMADABAD BULLET TRAIN

3D data of 5 cm accuracy delivered to design India's first Bullet Train Corridor

CHANDIGARH SMART CITY

First digital replica of an Indian city created using Aerial and Mobile LiDAR

BANGALORE SOLAR ROOFTOP POTENTIAL

Solar power generation potential calculated using in-house developed tools.

MICRO-LIFT IRRIGATION

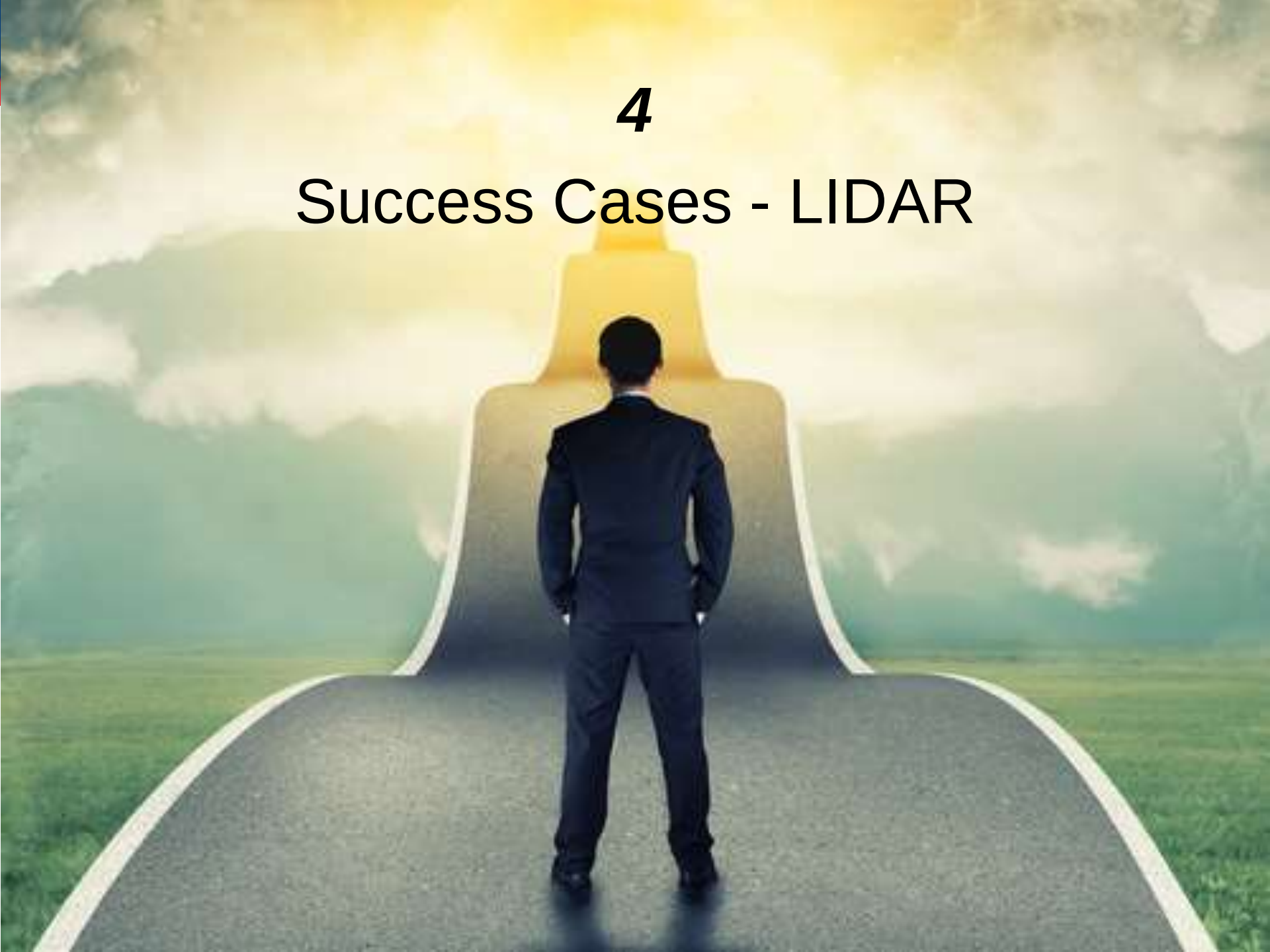
Completed Aerial LiDAR survey of 5,00,000 Hectares in 60 days to help design the micro-lift irrigation scheme in Madhya Pradesh.

INTER-LINKING OF KRISHNA AND PENNA RIVERS

Delivered highly accurate Digital Elevation Model to help AP government to execute India's first interlinking of river project.

GMR Experience-We found LiDAR best !

Parameter for comparison	TS/ GNSS	Drone Photogrammetry	Satellite	LiDAR
Accuracy				
Speed				
Completeness				
Reliability of data				
Cost effectiveness				
Suitability for inaccessible terrain				
Suitability for wooded terrain				
Automation				
Human dependence				
Need to revisit field				
Disturbance to ongoing operations				
Exposure of surveyors				
Suitability for small area				
Suitability for large area				



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Success Cases - LIDAR

Success Cases: Irrigation, Telangana

Geokno helped Govt. of Telangana ink pact on Godavari water projects with Maharashtra

Geokno team presenting project outcomes to Hon'ble Chief Minister along with WAPCOS

THE HINDU

Telangana, Maharashtra CMs ink pact on Godavari water projects

Mr. Chandrasekhar Rao explained how they had been working for over an year including conducting a LiDAR (Light Detection and Ranging) survey for identifying locations to tap water of Godavari and its tributaries to minimise submergence in Maharashtra so that disputes could be avoided.

THE NEW INDIAN EXPRESS

Hope Springs as Telangana, Maharashtra Set to Script Water-sharing Treaty

"The actual negotiation process for Medigadda and Tummadi Hatti barrages started three months back. After TS government conducted Lidar survey, the Maharashtra officials too conducted a ground survey. They were convinced and accepted our viewpoint," top sources in irrigation department told Express.

Sequence of Events : Irrigation, Telangana

- Undivided AP – 2005 – Estimated project cost INR 17875 crores – Irrigation potential of 12 lakh acres .
- Year 2008 – the DPR was prepared the project cost was revised to INR 38500 crores- 16.4 lacs acres – Lifting 165 TMC ft. water.
- Year 2010- Project cost revised to INR 40300 crores
- Only Canal work was taken up since Maharashtra strongly opposed the height of barrage to 152 M as it would submerge a large area in its territory , including wild life
- Year 2014 – No change in the stand of Maharashtra govt when approached by Telangana
- CWC revised its report on water availability to 165 TMC ft.- Maharashtra share 63 TMC ft.
- Hon. CM – LIDAR Survey was the answer – To study flow of water of Godavari.
- Outcome – Lift Irrigation project – 195 TMC
  - Series of Barrages across Godavari River
  - Water conveyor system consisting of Gravity canals & Tunnels
  - Lift system
  - Reservoirs
  - Distributary Network system

Success Cases: River-Interlinking, Andhra Pradesh

Geokno CEO presenting benefits of LiDAR technology to Hon'ble Chief Minister

THE HINDU

VIJAYAWADA

'Linking Godavari and Penna high on agenda"

With the linking of the three rivers - Krishna, Godavari, and Penna, Mr. Naidu would create a new history.

Irrigation Minister Devineni Umamaheswara Rao on Tuesday said that Chief Minister N. Chandrababu Naidu's main aim was to complete the linking of the Godavari-Penna rivers as early as possible.

Speaking to the media here, the Minister said that with the linking of the three rivers - Krishna, Godavari, and Penna, Mr. Naidu would create a new history.

Geokno completed River Interlinking project using Aerial LiDAR

Project Title	Aerial LiDAR survey for linking River Godavari & River Penna
Project Details	▪ Awarded 1,800 sq km ▪ Complete project to be referenced to Survey of India benchmarks ▪ LiDAR scanner: Riegl LMSQ780 ▪ Camera: Phase One 100 MP
Data specifications	▪ LiDAR: 10 points per sq m ▪ Images: 10 cm GSD Orthophotos
Significant project achievements	▪ 3rd Indian state after Telangana & Rajasthan to use LiDAR technology for River Basin projects ▪ To use completely Indian team and Geokno owned equipment
Project Learning	▪ Success of our projects in Telangana & Rajasthan shows the strength of LiDAR technology and Geokno's delivery for Aerial LiDAR projects in India

Success Cases: River-Interlinking, Rajasthan

Geokno completed the Eastern Rajasthan Canal Project using Aerial LiDAR

दौसा में चल रहा नदियों को जोड़ने का सर्वे

वेबकॉस कम्पनी कर रही हेलिकॉप्टर से सर्वे

पत्रिका न्यूज नेटवर्क
rajasthanpatrika.com

दौसा. राज्य सरकार राजस्थान की नदियों को जोड़ने, नदियों में पानी की मात्रा, गुणवत्ता व उपयोगिता को लेकर इन दिनों अनुबंधित कम्पनी वेबकॉस की ओर से सर्वे कार्य करा रही है। इन दिनों सर्वे के आधार पर दौसा जिले की बाणगंगा, गंभीरी, बनास, मोरेल, ढूण्ड सहित अन्य नदियों को परस्पर जोड़ने को लेकर हेलिकॉप्टर से सर्वे कार्य चल रहा है। सर्वे टीम में सिंचाई विभाग के कार्यकारी अभियंता राकेश गुप्ता सहित तकनीकी विशेषज्ञ डीपीआर रिपोर्ट बनाकर सरकार को पेश करेंगे। कार्यकारी अभियंता गुप्ता ने बताया कि नदियों को जोड़ने, उनमें पानी की मात्रा, गुणवत्ता कैसी है। पानी पेयजल के योग्य कितना है, सिंचाई के लिए कितना व कहां उपयोग किया जा सकता है।नदियों के जल संतुलन को लेकर रिपोर्ट बनाकर सरकार को पेश किया जाएगा। दौसा जिले में अभी दो दिन और सर्वे किया जाएगा।

दौसा सर्किट हाउस के समीप सर्वे के लिए आया हेलिकॉप्टर।

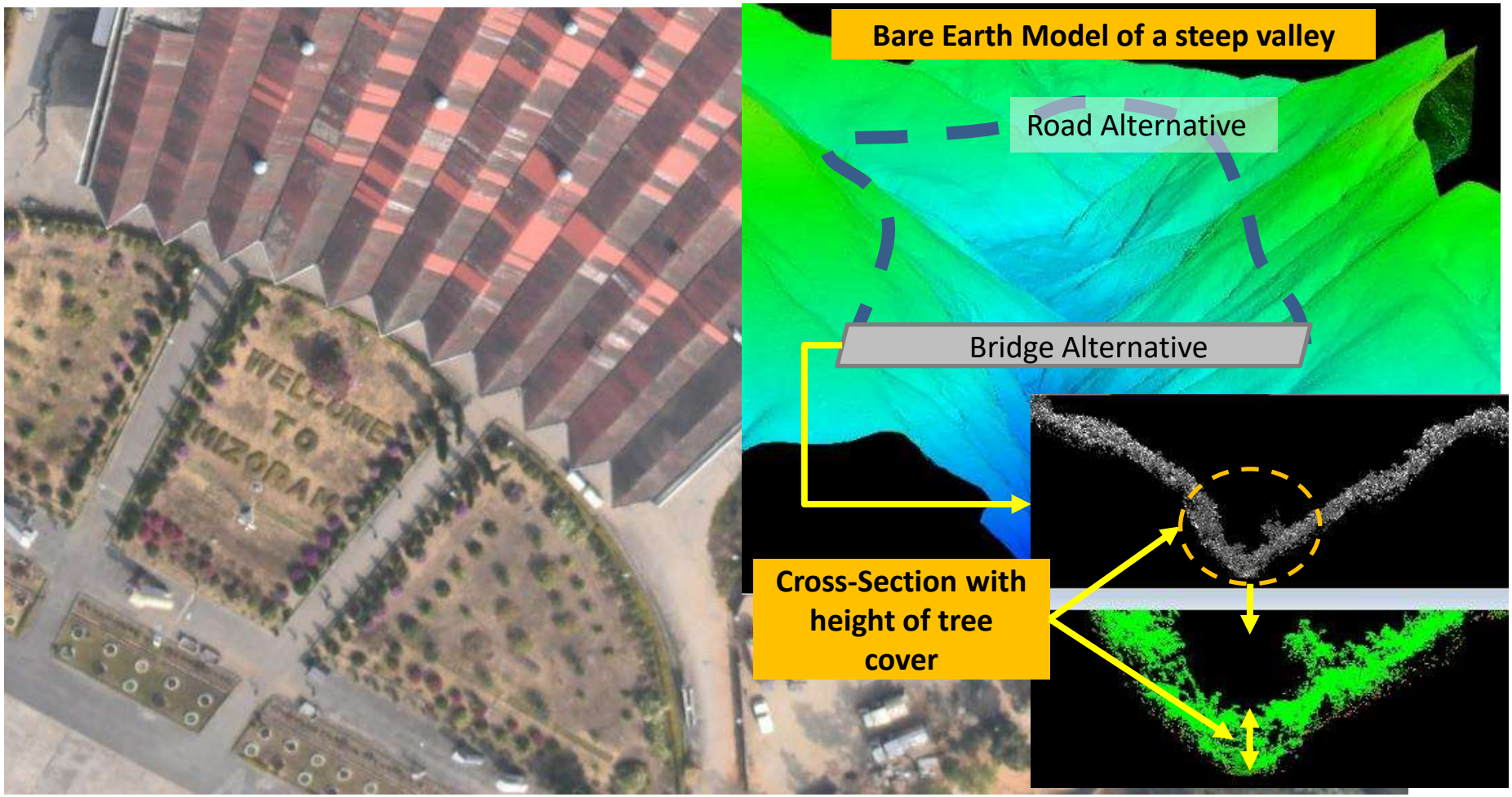
तकनीकी सर्वे एक्सपर्ट कम्पनी कर रही काम

वेबकॉस ने देश की एकमात्र तकनीकी सर्वे एक्सपर्ट कम्पनी जियोनो को यह काम सौंप रखा है। जियोनो के पास सर्वे की विशेषज्ञतीन हेलिकॉप्टर के आगे के हिस्से में लगी है, जो नदियों से जुड़ी तमाम तकनीकी जानकारी जुटा रही है।

Project Title	Aerial LiDAR survey for Eastern Rajasthan Canal Project to link rivers Chambal, Parbati & Kalisindh
Project Details	▪ Initially awarded 850 sq km ▪ Phase I of the project got extended to 2,200 sq km ▪ Further project extended by another 700 sq km for a **total of 2,900 sq km** ▪ Complete project referenced to Survey of India benchmarks ▪ LiDAR scanner: Riegl LMSQ780 ▪ Camera: Phase One 100 MP
Data specifications	▪ LiDAR: 10 points per sq m ▪ Images: 10 cm GSD Orthophotos
Significant project achievements	▪ Used completely Indian team and Geokno owned equipment ▪ Phase 1 of project data captured within one month of MoD clearances ▪ First major river interlinking project completed using LiDAR technology
Current project status	▪ Security vetting scheduled for Phase I ▪ Phase II data capture to start soon
Project Learning	▪ Completely Indian resourced solutions can achieve faster project completions

Success Cases- Himalayan Greenfield Roads, Mizoram

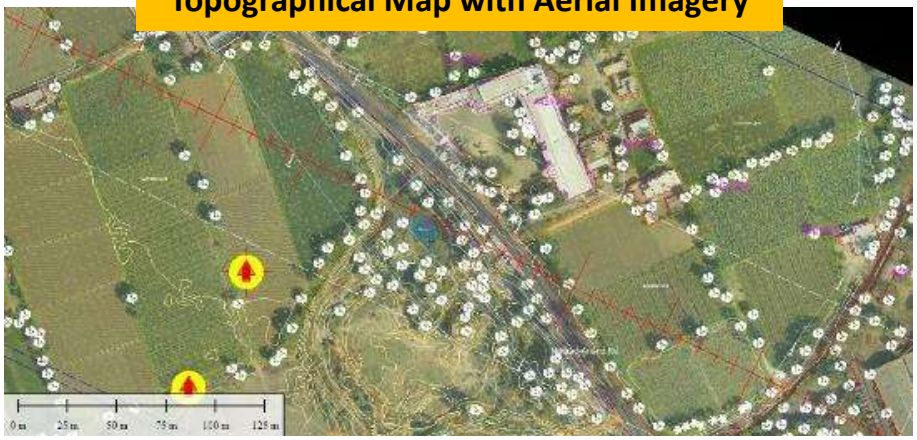
Geokno completed Aerial LiDAR Survey for thickly forested & remote highway corridor



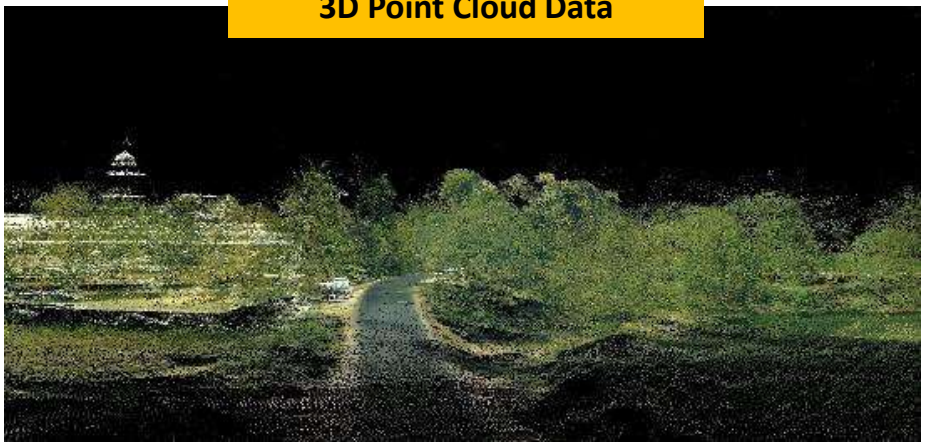
Case Study: Bullet Train, Railways

Geokno saved over 6 months for the prestigious Ahmedabad-Mumbai High Speed Rail Corridor

Topographical Map with Aerial Imagery



3D Point Cloud Data



RITES
THE INFRASTRUCTURE PEOPLE
A Government of India Enterprise

NHSRCL
National High Speed Rail Corporation Ltd.

JICA

Rlys will use hi-tech survey for high-speed train corridor

Mahendra Singh
@timesgroup.com

New Delhi: The railways will use LiDAR technology — which involves conducting an aerial survey and is known to give accurate data on the contours of land, even below vegetation — to expedite work on India's first high-speed train corridor between Mumbai and Ahmedabad.

The use of Light Detection and Ranging, or LiDAR, will allow the survey of the 508km corridor to be completed in 9-10 weeks against the normal 6-8 months. It will help the national transporter start ground work on the Modi government's dream project by 2018.

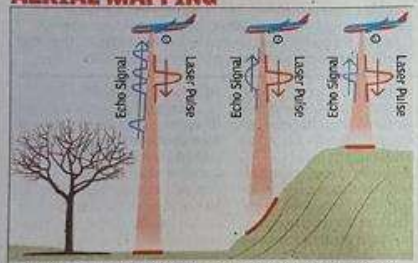
According to the plan, almost the entire corridor will be on an elevated track, except 21km that will be underground. Of the 21km, 7km will be undersea.

The survey will be conducted by a helicopter, which carries equipment, including a high-resolution digital camera (100 megapixel), a laser scanner and a data recorder. An official said LiDAR was a remote-sensing technology that measured distance by illuminating a target with a laser and analysing the reflected light. The GPS unit interacts with GPS satellites to finalise the ground control points.

"The total flying time for covering the full corridor will be 30 hours. The preparatory work and time taken in processing of data is quite high, but still the process allows the survey of the full 508km in 9-10 weeks instead of 6-8 months," Mukul Mathur, executive director (PPP), railway board, said. The exercise is highly accurate and enables capturing data of buildings and forest," Mathur said, adding that this technology would be used for the survey of a rail line for the first time. For the survey, the helicopter will fly at a height of 500 metres while identifying 15.6 points per square metre.

As the survey generates very accurate data, the permission of the defence ministry and the DGCA will be sought, an official said . The LiDAR survey is among four surveys — geo-technical investigation, hydrological survey and land plan preparations — being conducted by RITES at a cost of Rs 40 crore to finalise the alignment of the corridor. Nearly 81% of the funding for the project, estimated to cost Rs 97,636 crore, will come by way of a loan from Japan.

AERIAL MAPPING



The time duration gap in returning echo signal (sound waves) and concentration of laser pulse which are coming back after hitting the ground will give details of contours of land (sloping or flat etc) even below vegetation

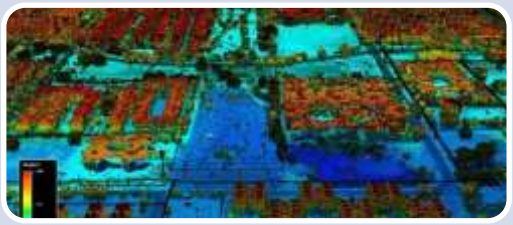
5

Future ....

Future as we see….

Virtualize the Earth - ***Through Aerial Surveys and Solutions***

Highly accurate data for doing engineering



Comprehensive data for finest details of terrain

Precision applications where satellite data fail

One-stop Data and Solution for all Sectors

Geospatial Technologies in AEC Lifecycle

Plan

- Satellite Remote Sensing
- Total Station
- GIS
- LIDAR
- Photogrammetry
- BIM/CAD
- Drones/UAVs
- GNSS

Design

- BIM
- CAD
- GIS
- Point Clouds

Build

- LIDAR
- Total Station
- Ground Penetrating Radar
- Machine control
- 3D Printing
- Drones/UAVs

Operate

- Enterprise GIS
- BIM
- GNSS
- Total Station
- LIDAR

Challenges

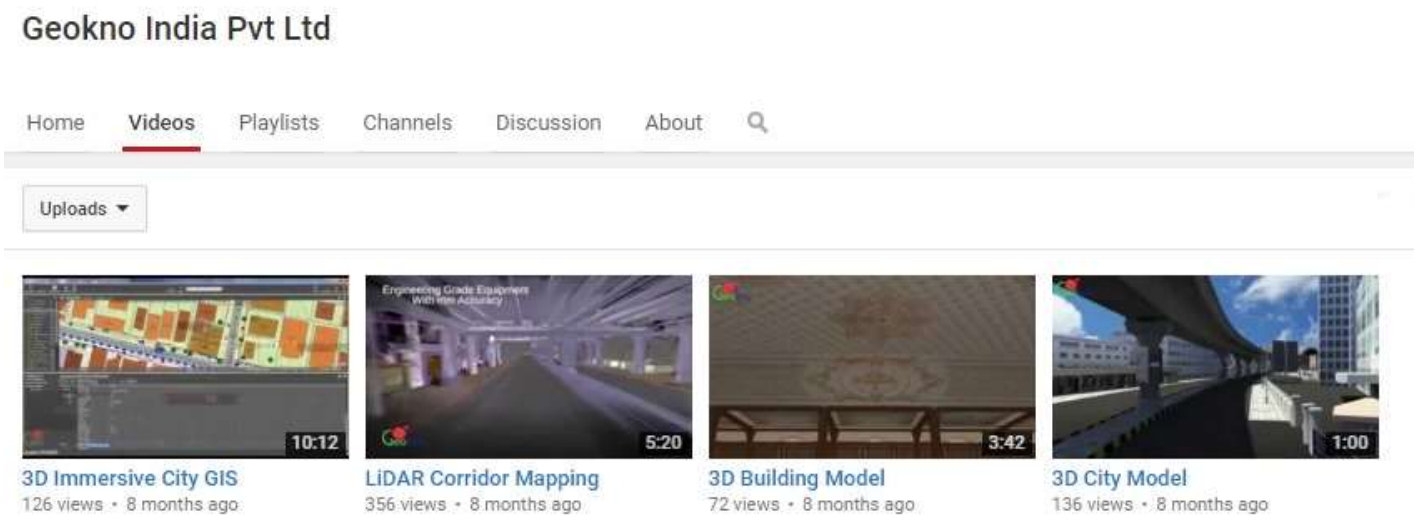
- The ever-growing population has only increased urbanization, overburdening the infrastructure and resources, and posing a serious threat to the future of Humankind.
- Challenges of climate Change that only adds to the element of uncertainty.
- Globally all Governments and policymakers are struggling to find ways to ensure a good today and a better tomorrow.
- ***Digitalization – Least in AEC sector- Things are transforming- BIM, AI, Cloud, Digital Twin, Drones, Augmented Reality , Virtual Reality, Mixed Reality will be the drivers.***
- ***Development of Talent – People resources***
- In such a scenario, the Architecture, Engineering and Construction (AEC) industry has a crucial role to play in both building and strengthening the modern world.

The Architecture, Engineering and Construction industry is among the top contributors to the global economy. It has the potential to transform our present and future, provided it takes the path of collaboration and adopts Geospatial Technology

It shall impact the Human Kind for a better living

Thank You

Geokno on YouTube:
https://www.youtube.com/channel/UCTcHSwRhGvusB3NxACelY3g/videos



Geokno has executed multiple challenging projects and is contributing towards Nation's growth

Survey of India	▪ Disaster Mapping of Uttrakhand Flood impacted area (3,600 sq km) ▪ First Airborne LiDAR Project for Major Disaster Assessment in India
Govt of Telangana	▪ Aerial LiDAR Survey of over 10,000 sq km in Telangana ▪ Project helped in shortening DPR preparation time from 3 years to 6 months with more accurate results
Govt of Rajasthan	▪ Aerial LiDAR survey for over 3,000 sq km for Eastern Rajasthan Canal System.
Govt of AP	▪ Completed over 1800 sq km of river interlinking project
Govt of Mizoram	▪ Completed Aerial LiDAR Survey for Mizoram State Roads Project
RITES Ltd (Bullet Train)	▪ Executed prestigious project for Ahmedabad-Mumbai High Speed Rail Corridor (Bullet Train). Helped to speed up design phase significantly
C-STEP	▪ Completing prestigious project for Aerial LiDAR data capture for Bangalore city for Solar Rooftop potential modelling project
Chandigarh Administration	▪ Executing prestigious project for Aerial and Mobile LiDAR mapping project for Chandigarh for complete 3D GIS data generation
Goa Airport	▪ Completed mapping of greenfield airport at Mopa, Goa
PWD Karanataka	▪ Survey of over 4000 km of roads completed ▪ More than 1000 km in pipeline
Tehri Hydro	▪ Survey of very steep slopes in Pipalkotti (Uttrakhand) for planning