# MAPS TODAY

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## Why is adoption of GIS slow in India?

GS Kumar, Retd Director, Survey of India; Editor, Maps Today

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## Standards Are a Great Help for Establishing Land Administration -

https://www.gim-international.com/.../standards-are-a-great-help-for-establishing-land...

GIM International Interviews Christiaan Lemmen Mathias Lemmens

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## Indians & Others in USA

Which other nationalities live and work in different states?
https://www.ba-bamail.com/content.aspx?emailid=33209

# Overview

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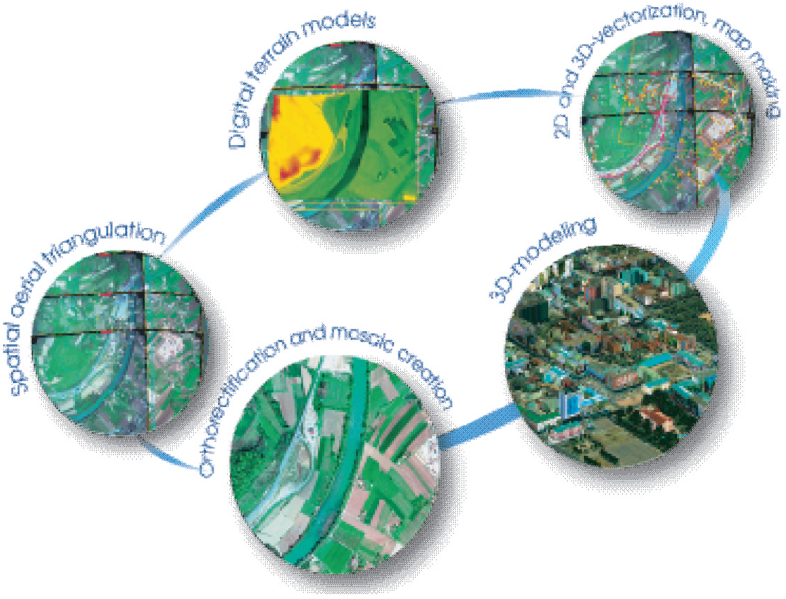


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The PHOTOMOD software family comprises a wide range of products for the remote sensing data photogrammetric processing. This state-of-the-art software allows the extraction of geometrically accurate spatial information from almost all commercially available types of imagery, whether obtained by film or digital cameras, UAS, high resolution satellite scanners.

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# MAPS TODAY

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**CONTENT**

# *Editorial*

GeoSpatial Technologies have emerged as the most essential part of all types of planning and development. Read a thought provoking article on why GIS is slow in adoption in India.

Restrictions on maps, Remote Sensing and other data has been debated for decades. With emergence of drones and ability to capture spatial data with high resolution and accuracy, the existing policies need changes. An interesting article on policies related to GIS from a legal analyst are included. Case study of use of LiDAR is included to show that in spite of restrictions, digital mapping is happening in India. LIDAR survey of Godavari was undertaken for Kaleswaram Lift Irrigation Project and also for Ganga poroject.

Under the National Map Policy (2005), dual system of maps - Defence and Civil use has been introduced. Open Series Maps (OSM) for civil use, has a different numbering system and this has been given in this issue.

Mohan's Musings and Students Forum continue to add value to the journal

A special appeal has been made to the readers to be part of the rapidly growing Geo Spatial Technologies. Becoming subscriber is a direct way of strengthening the mission.

ISRO'/s Chandrayaan-2 launch on July,22nd 2019 is another historic event Kudos to ISRO.



Views of the authors of articles may not be shared by editors and members of Maps Today.


**Declaration:**

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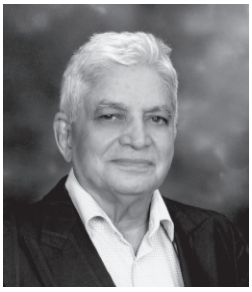
---- *Editor* ***G.S. Kumar***

# *Why is adoption of GIS slow in India?*



**GS Kumar,**
**Retd Director, Survey of India;**
**Editor, Maps Today**

Whenever one opens a newspaper, it is full of news about development and violations. All this generally happens with involvement of common people. Some head and sub-head lines are picked up from The Deccan Chronicle of 11 July 2019. These relate to violations and indicate how use of GIS can prevent or expose violations. See paper clippings of head lines on the next page.

**Item 1 - DNC Infra 'fakes' invoice to evade GST, is booked**

**Extract from the news item**

*The Directorate General of GST Intelligence has booked a case against citybased DNC Infrastructure Private Limited, for creating fake invoices to the tune of '9 crore. After the fraud was discovered '6 crore has been recovered. The company, whose promoter is Naresh Chowdhary Dirishala, allegedly claimed input credit through fake invoices. The promoter is currently absconding, according to officials?.*

If GIS is used, it will track and link all stages of operations with attribute data. Fake invoices are possible only due to self interest and manipulation by some – including the common man !!

**Item 2 - Encephalitis deaths not just a healthcare issue**

**Extract from the news item**

*The recent tragedy in Bihar, in which 162 children died due to acute encephalitis syndrome (AES), is the result of a combination of circumstances — poverty, illiteracy, malnourishment and a dysfunctional system for public healthcare. However, much of the blame for the deaths has fallen on the health sector that failed to respond appropriately to the situation. Commentators have been quick to point out the weakness in Bihar's public health system in terms of infrastructure, manpower, health financing and so on. But the fault lines run deeper — and across other sectors.*

Use of GIS in the above situation could have been very beneficial. Obviously it is the common people who are part of such preventable mishaps

**Item 3 - Migration to surge, we need smarter policies**

**Extract from the news item**

*Though India's fertility rate — that is, the average number of children a woman expects to have in her lifetime — is going down, it is not going down at the same rate everywhere in the country. Disparities continue between various states on not just the rate at which their population is growing or not growing, but also in the pace of their development.*

***xxxxxxxxxxxxxxxxxxxxxxxxx***

*But in practice, things are a lot more complicated when people move from poor and populous states to those more developed and with lower populations.*

GIS based mapping will help not only in analyzing but also take appropriate policy decisions at regional and national levels.

**Item 4 - Assam flood submerges 145 villages**

Crops spread over 3,435 hectares damaged; IMD predicts more rains in NE

**Extract from the news item**

*With massive rainfall across the Northeastern states, the flood situation on Wednesday deteriorated in Assam.*

*Informing that the flood has affected over 62,000 people across eight districts of the state, the Assam State Disaster Management Authority (ASDMA) in its bulletin said that 145 villages are under water and 3,435 hectares of crop areas have been damaged*

GIS provides solutions to reduce floods and its damging effects

**Item 5 – China's terrifying surveillance tech**

**Extracts from the news item**

*On assignment for the BBC, I found myself wandering the stalls of Europe's largest international security technology exhibition, filming for a new series on criminal justice.*

*As soon as I arrived in the main exhibition hall with the production team, we were greeted by roving cameras, high-definition displays, drones and every variety of audio and video surveillance kit. All bar a handful of stands were manned by Chinese representatives, smiling politely,*

*if somewhat stiffly, as we approached them.*

*xxxxxxxxxxxxxxxxxxxxxxxxxxx*

*Just as tear gas is fired on the streets of Hong Kong, the Chinese have brought a whole new level of surveillance technology right here in Britain.*

*……../ almost all of the equipment came with the capability to recognise and monitor the behaviour of every person, whether they like it or not.*

*Thermal imaging was another function on offer, alongside motion tracking, night vision and directional microphones*

*Xxxxxxxxxxxxxxxxxxxxxx*

*Every single movement of every person in sight of the cameras was being captured by the system. The information was then analysed and used to predict our next moves, based on previous behaviour.*

*Xxxxxxxxxxxxxxxxxxx*

*number-plate recognition systems and a profusion of other data sources.*

*"So you can really track everyone in society, wherever they go, whatever they do, 24 hours a day?" I asked. "Yes! Of course!" came the eager reply ……./*

*The UAVs on sale in London do not carry guided missiles, at least not yet, but they do have the same cameras we had seen earlier, with all those tracking and monitoring capabilities.*

*Xxxxxxxxxxxxxxxxx*

*Get ready to live in the new world of Big Data, where all that we do and all that we think feeds upwards into a cloud of data and down again into systems to be used for purposes not yet even conceived*

The above example shows how GIS is becoming an intimate part of individuals. China's terrifying surveillance technolog/y is a double edged sword with positive and negative dimensions.

**Item 6 - Panel to study law for doctors security**

**Extract from the news item**

*Last month, the Indian Medical Association (IMA) had held a nationwide protest following an assault on doctors at the NRS Medical College in Kolkata and demanded the enactment of a central law to check violence on medical professionals in hospitals.*

Laws for provision of proper services and to check violence on persons providing service already exist. GIS data bases expose shortcomings in services with evidence.

**Item 7 – 2 US marines smuggle migrants**

**Extract from the news item**

*Two of the migrants said they were planning to pay $8,000 to be smuggled into the country, the complaint says. One planned on traveling to Los Angeles, the other to New Jersey.*

**Concluding Remarks**

GIS helps in exposing violations. In every violation, involvement of common man is obvious. Is adoption of GIS desirable for most people ?

Attack on service providers like doctors, seems to be a direct way of showing dissent as legal measures are not feasible due to heavy costs and inordinate delays. In some countries justice is almost immediate.

British made judiciary immune from penalties. If judgments are reversed in higher courts, the judge who gave wrong judgment is not punishable in a normal way like in other departments. Modifications are essential to settle cases in a few months, to prevent violations.

In one of the report, it is said, … *the fault lines run deeper — and across other sectors.*

Let me end this note with the following:

- Smoking is injurious to health – Yet people smoke
- Yoga is good for body and mind – Yet most people don,t pracise Yoga
- GIS is good for efficient governance - Yet most people don't want GIS as most of us are part of violations.

# *Mohan's Musings*

## MOSAICS unscrambled

You are on a vacation. And witnessing the pristine beauty of jaw-dropping landscape. Immediate thing you like to do is to capture the scenery with your camera. You take a series of pictures from one end to the other. Each of them is good – but felt it could even be better if the entire scenery is presented in photo. But the field of view of the camera is limited! This calls for *mosaicing* of the photos. Bunch of little pictures make a big picture!

A mosaic is a photographic reproduction of a series of photographs put together in such a way that the detail of one photograph matches the detail of all its adjacent photographs. The simplest definition: Mosaic is a composite picture made from overlapping photographs.

We come across similar meaning terms such as collage, montage which appear to be synonyms to mosaic – only with subtle difference though.

Collage is a technique of an art production, primarily used in the visual arts, where the artwork is made from an assemblage of different forms, thus creating a new whole. The pats contributing to the collage can be as varied as newspaper clippings, parts of photographs and fragments of an envelope.

Montage is the process and the result of making a **composite photograph** by cutting, gluing, rearranging and overlapping two or more photographs into a new image. Sometimes the resulting composite image is photographed so that a final image may appear as a seamless photographic print.

An **aerial photomosaic** of a large area is made by carefully fitting together aerial photographs of smaller areas so that the edges match in location, and the whole provides a continuous image of the larger area.

Photo-mosaics may broadly be classified as uncontrolled and ortho-mosaic. Uncontrolled mosaic was often resorted to using bromide prints of raw photographs to have a synoptic view of the project area. Such a mosaic required a great care in cutting out the overlap area manually (with a sharp cutter) and then glue them together. As the name suggests, it doesn't require any GCPs to be used. Soon after flying and printing, an uncontrolled mosaic is possible to be made.

When individual photographs are corrected for geometric distortions, a superior mosaic is possible. The workflow will be: perform the triangulation, extract DEM, ortho-rectify and mosaic. Such a product is called orthophotomosaic or simply orthomosaic. I vividly remember the photogrammetric technicians physically rolling over the photographs spread out wall to wall in a laboratory to make an uncontrolled mosaic of a district in Andhra Pradesh where land resurvey was being done. A curious interaction of physics and art !

Let us revisit the process of preparing the orthomosaic using digital aerial photographs. With satellite imagery, the workflow or considerations do not vary noticeably.

1. Organise the photos in a folder. Weed out the ones with extreme overlaps or no overlaps. As the images contain geo-tags (coming from direct georeferencing instrumentation), analyse the ground coverage foot prints for adequate overlaps. Image pyramids are built at this stage to provide a view of the rough mosaic.

2. Exercise the options for no-data value, seamline option, feathering distance, colour matching, resampling technique.

We will see the significance of these options and more about processing in the subsequent musing. Cheers till then!

# *Geospatial technology to enable better planning of India's Ganga project*

By **News Desk**, 11/16/2018

https://www.geospatialworld.net/news/nmcg-plans-to-use-geospatial-technology-for-better-planning-of-ganga-projects/

The Indian government is looking at leveraging geospatial technology and remote sensing to give an impetus to its ongoing river cleaning work, reported Times of India. On the occasion of World Geographic Information System (GIS) Day on November 14, the Centre shared its plan of using technologies like LiDAR and GIS to attain high-resolution maps and data for the entire Ganga river basin by next year.

The National Remote Sensing Centre (NRSC) along with ISRO and Survey of India will also help to acquire precise geo-reference terrain features of the river basin.

Speaking on the occasion. Union water secretary U P Singh said, "Lack of reliable data is the biggest challenge in the water sector. It is important for monitoring, planning and taking feedback."

However, the decision does not come as a surprise as the National Mission for Clean Ganga (NMCG), a nodal authority to implement and monitor the government's ongoing 'Namami Gange' (Ganga rejuvenation) program, has already tied up with the Survey of India to have high-resolution Digital Elevation Models (DEM) to monitor the entire basin.

This would not only help in identifying the entire topography, but also help the policymakers to make more informed decisions. Giving a wider perspective, Rajiv Ranjan Mishra, Director General, National Mission for Clean Ganga said, "These models will provide valuable information for use not only in making urban river plans but also for identifying baseline of river floodplains and regulating them for their restoration and preservation."

Mishra further said, "We are using GIS technology in improving the work of Namami Gange. The high-resolution GIS-enabled data will help in regulating the proposed protected and regulatory zones along the banks of river."

The area of this project extends up to 10 KM on both sides of the banks of Ganga. The major task of the project is to unite GIS ready database along with administrative boundaries up to village level and make proper public drainage network database under it.

ISRO is also taking an active part in this project. Geospatial and remote sensing technology would be used to assess the water quality of the river. Currently, the ISRO backed Bhuvan Ganga Geoportal is actively playing its role in the monitoring of water quality, hydrology, geomorphology and bio-resource.

ISRO's GSLV-Mk III lift off with Chandrayaan-2 on July,22nd 2019 at 2.43pm from SDSC, Andhra Pradesh. It has a Rover, Lander (Vikram) and Rover (Pragyan) "Totally Swadeshi and Home grown Mission" ( Hon'ble PM : Modi)

# *Kaleshwaram Lift Irrigation Project-:*

**Facts on world's largest multi-purpose lift irrigation project**

https://www.indiatoday.in/education-today/gk-current-affairs/story/kaleshwaram-lift-irrigation-project-facts-worlds-largest-multipurpose-lift-irrigation-project-1553474-2019-06-21

World's largest multi-stage, multi-purpose lift irrigation project **Kaleshwaram** was dedicated to the nation on 28 June 2019 by Telangana Chief Minister K Chandrashekhar Rao. The project, constructed by Megha Engineering and Infrastructure Limited (MEIL) will start from July 2019.

**Kaleshwaram Lift Irrigation Project (KLIP)** was inaugurated in the presence of Governor ESL Narasimhan, Maharashtra Chief Minister Devendra Fadnavis and Andhra Pradesh Chief Minister YS Jagan Mohan Reddy.

The inaugural ceremony was held at the project site in Jayashankar Bhupalpally district near the borders with Maharashtra and Chhattisgarh.

Till date, the biggest lift schemes in the world were the Colorado lift scheme in America and the Great Manmade River in Egypt. The capacities of these schemes are in horsepower and they took over three decades for completion.

Now, the Kaleshwaram lift irrigation project, an Indian lift scheme has become the **world's biggest in terms of capacities.**

**LIDAR survey of Godavari begins**

DECCAN CHRONICLE

**Published**Sep 4, 2015,

The survey was begun from Yellampally irrigation project and was carried out till Kaleshwaram

LIDAR (Light detection and ranging) survey

The state government has decided to carry out LIDAR (Light detection and ranging) survey from Sriram Sagar Project to Bhadrachalam to study river Godavari and its basin for using water resources efficiently. The survey was begun from Yellampally irrigation project and was carried out till Kaleshwaram, using a special helicopter equipped with modern detecting and ranging technology, in district on Thursday.

SE of Yellampalli irrigation project N. Venkates-warlu said the helicopter, with the help of the detection and ranging equipment, would collect information from the earth by flying on the river. The depth of the water, length and width of the river's banks and direction of river current can be studied with photographs captured by the cameras fitted on the helicopter, he explained.

The survey will help irrigation authorities to identify suitable locations for erecting irrigation projects across the river that separates Karimnagar from Adilabad. Accordingly, submerging villages can be photographed with 3D and high-end cameras. The state government has hired Wapcos, a consultancy for water, power and development works, for taking up the survey, he added.

**The depth of the water, length and width of the river's banks and direction of river current can be studied with photographs captured by the cameras fitted on the helicopter**

The 15-day survey will also collect information pertaining to canals erected at various irrigation projects for supplying water. After completing studying Yellampalli project, Pranahita and Indravati, tributaries of Godavari, are likely to be focused on. An expert from Germany, 3 others including two engineers, of irrigation department are in the survey team.

# *Standards Are a Great Help for Establishing Land Administration -*

https://www.gim-international.com/.../standards-are-a-great-help-for-establishing-land...

**GIM International Interviews Christiaan Lemmen**

Mathias Lemmens

*In 2017 Dr Christiaan Lemmen, a former contributing editor of 'GIM International', was appointed as professor of land administration modelling at Twente University's Faculty ITC for Geo-Information Science and Earth Observation. He is the leading designer of the ISO 19152 international standard for geographic information – Land Administration Domain Model (LADM), the second edition of which has been in development since 2018. In this interview, he discusses the importance of LADM standards, poverty and tenure security, and the long and winding road to put well-functioning land administration in place in developing countries*.

**The Land Administration Domain Model is actually an international standard (ISO 19152). Why is it important to have a worldwide standard for land administration purposes?**

ISO 19152 defines a reference Land Administration Domain Model (LADM) covering basic information-related components of land administration. To understand its importance, this standard should be looked at as a knowledge model in which the semantics of the land administration domain are defined, but in a descriptive way rather than a prescriptive way. The people designing land information models, which are the core of a land administration system, are the brains of the land administration organization. They are faced with the question of what to include and how to structure a data model at conceptual level. To start from scratch is far more difficult then starting with an existing, conceptual model which can be adapted to local needs. LADM meets these needs by defining such a model and can be regarded as the common denominator in land administration. LADM supports system design, system development and system implementation. LADM is also aimed at facilitating communication between organizations and governments on various levels.

**There are many different land administration systems worldwide, which often consist of a conglomerate of divisions which may even belong to different ministries and agencies. Would standardization help in such a diverse world?**

Yes, definitely. In many countries, land administration is fragmented between many institutions which often operate from silos and under mandates that do not support cooperation and coordination. Some institutions may cover one part of the country while others cover adjacent administrative units; some institutions operate at central level, others at regional or local level. The types of tenure the institutions register may also differ. Countries with well-developed land administration show that proper land information models are desperately needed. However, reforming established institutions is very complex and requires political willingness, particularly to ensure good cooperation and workflows. Not only are there many inconsistencies among institutions at the operational level, but the data is also inconsistent and incomplete in many countries. Standards do help here and also enable GIS and database providers as well as open-source communities to develop and offer consistent products and applications. Today, this solution has been initiated in the Open Geospatial Consortium (OGC) with the domain working group for land administration. I expect this initiative to greatly help developing countries arrive at well-functioning land administration. Additionally, only paper-based approaches are legally valid in many countries; paper-based systems may have backlogs and as a result they are sensitive to 'motivation' fees. A completely digital system may eliminate this. Since a transition from paper to digital may affect the 'business

model' of officials and civil servants, objections to renewals will be met all along the winding road.

**People understand and sometimes even experience that land can be grabbed... but maybe it is not understood everywhere that land rights can be bought and sold**

**Would a non-corrupt land administration system supported by a proper legal system and population registration be able to contribute to the first two Sustainable Development Goals (SDGs): to end poverty and to end hunger?**

Tenure security means that there is no risk of land grabbing, forced evictions or expropriation without compensation in the form of money or land. If land rights are documented or perceived to be secure, people do not live in fear of such risks and are therefore more willing to invest in improving housing and starting businesses. All such initiatives induced by tenure security do indeed contribute to poverty eradication. Ending hunger may require large-scale industrial food production. This can, for example, be achieved through consolidation and readjustment of land where existing land rights are respected. Existing land rights may be used to organize shares in the profits and benefits from large-scale agriculture. One benefit may be that women can be exempted from heavy work in the fields, enabling them to exploit their talents and skills in a more sophisticated way in more comfortable environments. In all cases, proper land information systems are needed to support documentation of land rights and reallocation of them where needed.

**Why is it important that individuals – young and old, rich and poor, male and female – can own land?**

It is not only about ownership or freehold, but additionally about perceived security of tenure as is also formulated in the SDG indicators. Tenure may be related to all kinds of personal rights and to informal or customary land rights. The people should feel safe and enjoy the reassurance of tenure security. By the way, it is not only about secure people-to-land relations, but also the other way around: land-to-people relations – i.e. it is not just what the people harvest from the land and what the land can give to the people, but also about what the people can give to the land and what the land can get from the people. If all land rights are documented, then it is easier to stop new human footprints outside the territories with documented land rights.

**From a philosophical point of view, one may question whether individuals should be allowed to own land since there are good reasons to state that land belongs to all people or – viewed from another perspective – the divine. What are your thoughts on this?**

That is why customary land rights need to be recognized, documented and protected. Many land administration systems are not designed for these important tasks. At global level, there is agreement that change is needed. On the other hand, I believe that many people really prefer individual ownership above state-owned land.

**Does the right to own land not result in an adverse effect, namely to drive land into the hands of the rich and well-off? This process has been going on in Africa for decades and even seems to be accelerating due to the power shift from the West to the East.**

The principle of tenure security is understood everywhere, but there is indeed a risk in relation to land markets and land being viewed as a collateral. People understand and sometimes even experience that land can be grabbed... but maybe it is not understood everywhere that land rights can be bought and sold. I think there are cases where it may be wise to introduce land markets separately from establishing tenure security. Again, this is about good information models; it should be clear to investors where markets apply.

**It is fair to say that the LADM standard is in continuous development. On which aspects will the focus lie in the coming years?**

The second edition, which has been in development since 2018, includes a series of proposals on new or extended LADM functionalities. Apart from management of property rights, attention will be paid to valuation, inclusion of land value and even taxation. Restrictions to land and changes in responsibilities resulting from spatial planning and land management in a broader sense are also being considered. All these amendments have to be underpinned by proper data, which should not only exist but also be well maintained. Initial data acquisition for land administration will be key in many countries over the next decade. Blockchain may be implemented for land rights transactions, for example, or for conversion from social to legal tenure. The second edition will also pay attention to maritime limits and boundaries, 3D and 4D, indoor and building information modelling (BIM) and indicators for the SDGs. This huge standardization effort requires agreement among professionals, scientists, NGOs, governments and global organizations. We will work in teams. One very important benefit is that I can cooperate with Peter van Oosterom from Delft University of Technology and his team.

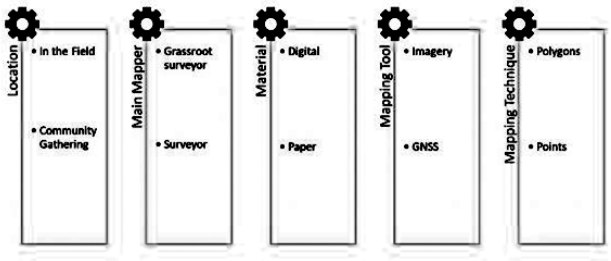



Figure 2: Mapping and recording options can be combined in data collection applications in many ways – but all should be supported by standards in exchange (source: Lemmen, Unger and Bennett).

**In a nutshell, what action is needed for the successful implementation of LADM standards over the coming decades?**

The OGC members have drafted a charter for a land administration domain working group which describes how to improve the effectiveness and efficiency of land administration systems by optimizing the use of OGC standards and complementary open standards. This development will enable land administration based on LADM to be operationalized and implemented in systems. OGC is really ambitious in this – it brings together experts and the geospatial industry. UN-GGIM is also very supportive here, as are FIG, UN Habitat, FAO and the World Bank.

**The proper protection of ownership rights requires a well-functioning cadastral system in which property boundaries are accurately mapped. Recording and georeferencing boundaries is a time-consuming endeavour. Which measures and modern techniques could avoid a recording process which would otherwise take a century or more?**

More flexibility will indeed be needed in initial data acquisition. Data may be collected in the field or gathered in the village, using aerial or satellite images or GNSS devices. Using imagery, the boundary surveys may be done by professional surveyors and legal experts or by supervised grass-roots surveyors and paralegals who are trained in subsidiary legal matters but not fully qualified. The process workflow may be fully digital or with interfaces to paper-based approaches. In GNSS-based approaches, the surveys can be done by the people themselves by walking along the perimeters of their parcels with a handheld device; points can be measured using an app with a very simple interface (see Figure). Therefore volunteer-based land administration and crowdsourcing needs support in LADM and in general processes apart from just data.

**You were a contributing editor of GIM International for nearly 20 years. What was your drive to contribute to this professional journal besides also being active in science and regularly publishing scientific papers?**

*GIM International* is a great magazine, renowned all over the planet. I'm active in the projects from my first employer, Kadaster International, with research and education at the University of Twente/ITC and also within Commission 7 of the International Federation of Surveyors (FIG). *GIM International* provides a very nice communication channel for sharing knowledge. I like the format as it gives readers a quick impression of the topics thanks to the attractive titles, summaries, headers and figures. The articles are very informative and to the point, but it's not a time-consuming read.

**About Christiaan Lemmen**

After completing his geodesy degree at Delft University of Technology (TUD), the Netherlands, in 1982, Christiaan Lemmen worked at the Dutch cadastre, first as information manager until 1999 and subsequently as senior land administration advisor until present. In 2012 he received a PhD from TUD after defending his thesis on 'A Domain Model for Land Administration'. In 2017 he was appointed part-time professor of land administration modelling at Faculty ITC, Twente University, where he had held positions as a part-time assistant professor and visiting researcher in cadastre and land management since 1999. Since 1995 he has conducted more than 60 short-term and long-term assignments in Central, Eastern and Southern Europe, South America, Africa and Asia. He was a contributing editor of *GIM International* for nearly 20 years (2000-2018). His life's work is the design of the Land Administration Domain Model (LADM), which has been an ISO standard since 2012. He is an honorary member of the International Federation of Surveyors (FIG) and an internationally renowned expert in the field of land administration.

# *Environmentally Sustainable Water Resource Development Using LiDAR Technology – A Case Study*

Dr. Bharat Lohani, Professor of Civil Engineering, IIT Kanpur

Sudharsan Ramamurthy; Rajasubramani Periasamy; Sasidaran; Sharvi Lohani, Geokno India Pvt. Ltd.

**Source**:THE Environment Management

A Quarterly E- Magazine on Environment and Sustainable Development

October – December, 2018

The ever-growing needs of our population, the recent KisanLongMarch and various food security schemes initiated by the Government of India, constantly remind us of the need to conserve our resources in a sustainable manner. Being the second most populous nation with agriculture being the major contributor to the GDP, India must be prudent about its water resources. India heavily depends on Monsoons for its water. The water resources of India are unevenly distributed in space and time. While some parts face severe droughts, the other regions are being inundated with floods. This surplus-deficit equation causes widespread socio-economic and political disparities among people. Construction of Dams and Inter-Linking of rivers have the potential to minimize these disparities. However, such efforts may have a direct or indirect impact on people from several states thus making political leaders wary of adopting these. In addition, water being an environmentally sensitive and scarce resource, any such project must go through stringent scientific scrutiny. A project of this nature includes handling interdisciplinary layers of hydrological, agricultural, and environmental data along with socio-economic and political aspects. The topographic data, also broadly referred to as Geospatial data, are integral and most important part of design and analysis for such projects. Considering the significance of topographic data, it is important that these data be collected accurately, covering entire project site, and at a finer

resolution, so that no important details are missed. Further, the data collection should be fast as delay in data collection results in delay in delivering the benefits of projects to people and loss to government exchequer.

**Aerial LiDAR Technology:**

Light Detection and Ranging (LiDAR) technology collects high-accuracy elevation data for large areas very quickly and at a lower cost than traditional methods. In LiDAR a Laser transmitter is used to throw a laser pulse, and a receiver is employed to detect the return of the pulse. The 'Time of flight' is then calculated and since the speed of light is known, the distance of the point can be calculated. Normally, based on its requirement, LiDAR can be used on three platforms namely Terrestrial, Mobile, and Airborne.

The aerial LiDAR technology can acquire highly accurate and dense elevation data of terrain surface quickly and accurately with support of high-precision GPS and Inertial Navigation System as shown in figure below. Therefore, a high-precision Digital Terrain Model can be built from it. LiDAR is emerging as a powerful tool for detailed hazard and resource mapping. The Digital Elevation Model (DEM) derived from LiDAR data has the highest spatial resolution amongst other available DEMs.

Aerial LiDAR system uses a combination of LiDAR equipment, GNSS unit for the position, Inertial Measurement Unit (IMU) for orientation and cameras for recording images (for coloring the output) The LiDAR unit is mounted on an aircraft/Helicopter as shown in Figure 1. This is useful for large area surveys such as irrigation, disaster mapping, flood mapping and corridor survey, alignment survey for irrigation canal and high-altitude roads. These data are highly useful in planning and designing greenfield infrastructure projects for mapping large tracts of land, which are otherwise not accessible with conventional technologies.

**CASE STUDY: The Tale of two States Sharing of Godavari Water**

The government of Telangana wanted to resolve the decade-old problem of river water sharing with Maharashtra, so that water getting discharged into the sea could be utilized for the benefit of both the states. The Government of Telangana had undertaken a complete

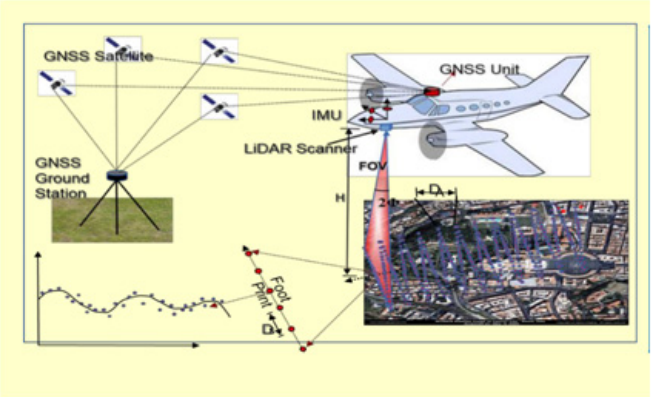



Figure 1: Principle of Light Detection and Ranging


Figure: 2 Sensors used for LiDAR Technology

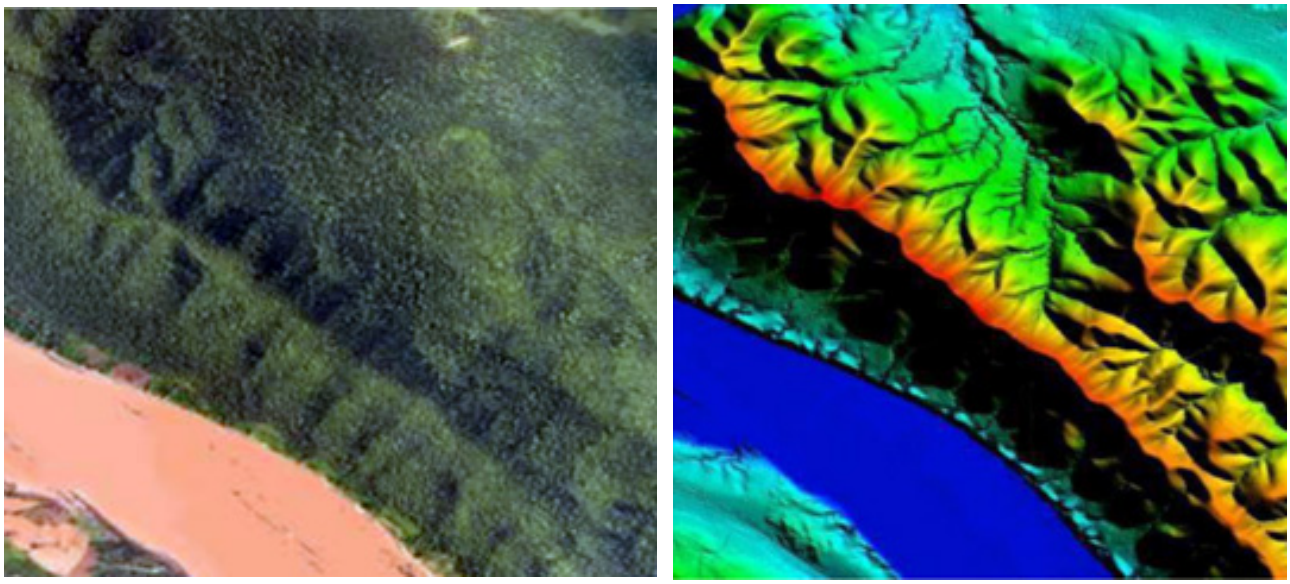


Figure 3: Left : Aerial photograph in which underlying ground details are not visible because of canopy cover; Right : DEM generated from LiDAR data wherein terrain is clearly visible and mapped including the area under forest cover

reevaluation of the earlier designed irrigation projects.

Godavari is the second largest river in India after Ganges. The drainage area of Godavari River is 312,812 sq. km of which 48.6% lies in Maharashtra, 19.04% in Telangana, 4.76% in Andhra Pradesh, 18.7% in Chhattisgarh, 5.5% in Orissa, 2% in Madhya Pradesh and 1.4 % in Karnataka. The goal of the project is to identify drought-prone, upland and backward areas of Telangana Region to provide irrigation facilities to several districts in Telangana.

One of the critical inputs needed for resolving the dispute was the Topographic data which would correctly identify the actual submergence in both the states once the dams are constructed. The other two being the generation of Digital Elevation Model (DEM) and Contour Map which give an idea of the basic physical characteristics like drainage networks and drainage flow and a better understanding of the elevation profile of the catchment.

Figure 4: Contour Map generated from LiDAR data which enables better understanding of the catchment area for the administrators

Traditional surveying technology is severely inadequate as the large area of survey would take much longer time besides accuracy issues. Most of the disputes in the past could not be resolved because the levels cross-verified by inter-state departments were never found accurate and mutually acceptable and hence decision making was hampered.

This was caused due to the short-comings of the traditional DGPS/Total Station technologies which are incapable of generating true contours as only a few, and far-spaced points would be available for this purpose. Furthermore, due to extensive manual work involved in DGPS/TS survey, the survey data are prone to human-induced errors. Alternatively, imagery-based technologies like Satellite and Drone-based photogrammetry would also fail as, besides poorer accuracy, it is not possible to measure points under vegetation hence making the resulting data not useful for irrigation projects. Considering the above, the Government of Telangana and WAPCOS decided that the Aerial LiDAR technology is appropriate for this prestigious project. Using LiDAR technology 100 sq km to 200 sq km area can be mapped per day to high degree of accuracy. Moreover, as LiDAR technology can map below vegetation through small gaps in tree canopies, data below vegetation also becomes available. This results in an accurate 3D mapping of the surface features and bare earth which are required for irrigation design. As the technology is free from human intervention, the captured data are free from manual errors.

WAPCOS identified Geokno India Pvt Ltd which has now 10 years of extensive experience in conducting accurate LiDAR surveys of engineering grade in India for this prestigious project. Geokno was incubated in IIT Kanpur to spread the use of the revolutionary LiDAR technology in India. Heli-Mapper aerial LiDAR system was deployed for surveying the project area. Since the survey started towards the end of the rainy season, there was an additional benefit of using the Heli-mapper as the helicopter could be flown below the clouds and still capture data. For this multiple flight plans were made so that the survey could be completed at the earliest.

Figure 5: Helicopter ready for surveying with sensors fitted

The survey of over 3700 sq km was completed in a short span of 4 months which would have otherwise taken 3 years using traditional method. The surveyed region is Naxal affected zones making it difficult to map by field based methods. Moreover, the larger portion of the project area is comprised of cultivation land and forest where the LiDAR technology performs best. The Aerial LiDAR survey has also helped to improve the design of multiple irrigation schemes. Telangana Government was extremely satisfied with the project outputs, and the original 700 sq km of the area was extended to more than 3,700 sq km. In Phase 2 further a survey of more than 4,000 sq km of area was carried out. All the issues relating to Aerial LiDAR survey vetting, utilization of water, submergence and project designs were analyzed by the officials of the CDO (Central Design Organizations) of the two states in detail and approved. The biggest achievement of this survey was that it resulted in an MoU being signed between the Governments of Maharashtra and Telangana within 5 months of the start of the Aerial LiDAR survey. This MoU benefits lakhs of farmers of the two states. The project is expected to irrigate 16.4 lakh acres in Telangana and over 50,000 acres in tribal areas of Maharashtra.

The economic progress of India is not only tied with agricultural development, but also with industrial development for which water resources play major role. As seen in the Kaleshwaram project discussed in this article LiDAR technology has potential to play a key role in the development of nationwide digital elevation dataset. These data provide better understanding of various issues related to water. On one hand water needs can be met by better design of projects while on the other hand a better design also ensures environmental sustainability of the water resources. Better terrain data through LiDAR technology is proving a blessing towards these goals.

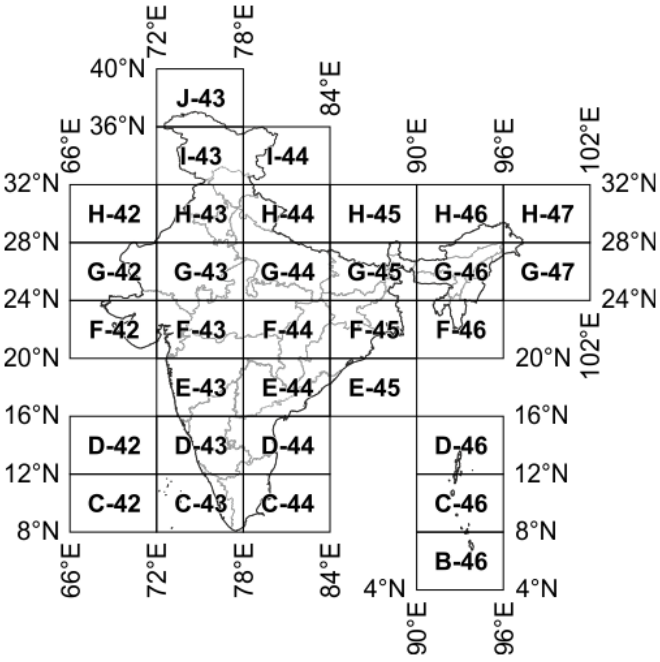
# Map Numbering in India

'Open Series Map' have been introduced as per the National Map Policy of 2005 by Survey of India. For the same a new map numbering system has been adopted instead of the previous India and Adjacent Countries (IAC).

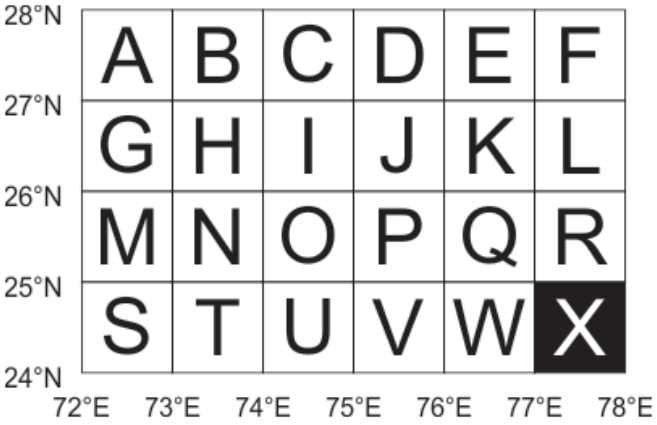
The map series is based on Transverse Mercator projection on WGS-1984 datum. A numbering system based on International Map of the World (IMW) is used.

Map numbering is of the form 'A-12A-1':

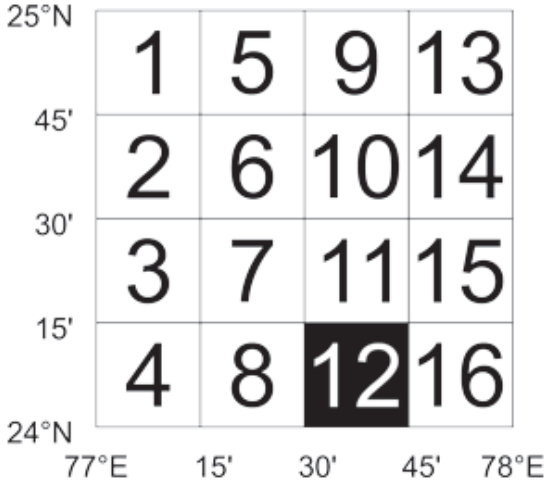
1. The IMW numbering system with minor modification is used upto 1°×1°/1:250,000 scale.
   a. Since the IMW map number for India will always start with 'N' (India being in the northern hemisphere), the first letter is omitted.
   b. The next alphabet and number of the IMW map number denotes the 6°×4° region of the IMW series. So sheet with Kalyanpur (77.65489°E 24.11981°N) would be in 'G-43' (from ~~N~~G-43):




   c. Each 6°×4° rectangle is further subdivided into 24 squares of 1°×1°. Each square is indicated serially by an alphabet increasing first towards east and then towards south, starting with 'A'. So sheet for Kalyanpur (77.65489°E 24.11981°N) falls within 'G-43X':




2. Each 1°×1° square is further divided into 16 squares of 15'×15' (15 minutes×15 minutes). Each square is indicated serially by a number increasing first towards south and then towards east, starting with '1' (similar to the system adopted in India and Adjacent Countries). So for the map sheet for Kalyanpur (77°39.293'E 24°7.187'N) would be 'G-43X-12':




Lookup Open Series Map map numbers in Map Number Lookup.

**Further Reading/References**

- Guidelines for Implementing National Map policy (has layout of OSM sheets on page 5, PDF - 904 KiloBytes).
- National Map Policy (PDF - 41 KiloBytes).
- Toposheet Number to OSM sheet Number (PDF - 655 KiloBytes).

Extracts

# Legal Challenges to Mapping in India #1 - Laws, Policies, and Cases

**Adya Garg** , law student at West Bengal National University of Juridical Sciences, Kolkata and

https://cis-india.org/.../legal-challenges-to-mapping-in-india-1-laws-policies-cases

**Introduction**

"Maps, like faces, are the signature of history." – Will Durant **[1]**

Throughout the course of history geospatial information has played an important role in technological, economic, political and cultural dimensions of the human society. With technological developments taking place, the field of mapping – that is collection, analysis, and representation of geospatial data – is continuously evolving.

Continuing from the colonial era, the political facet of mapping emerged significantly in the public discourse from the 1990s onwards as digital technologies amplified the ability of non-governmental actors to collect, generate, and share geospatial data, in the form of maps or otherwise **[2]**. This 'democratisation' of the ability to map and share private/user-generated maps structurally undermined the government's ability to have an authoritative and universal voice when it comes to geospatial depiction of the nation and its various components

Thus, till 1950s mapping was being governed by the colonial provisions which maps restricted to official use only **[6]**. With independence, the functions of the SOI shifted mainly towards providing information for the defense forces **[7]**.

An important change came in the form of orders and notifications by Ministry of Defence (hereinafter "MOD") during 1960s, the major one being the 1965 order that permitted distribution of maps of scale 1:4 M **[8]**. The Map Restriction Policy of the MOD, however, imposed categorical restrictions on sharing of maps, aerial photos, and all geophysical data for various parts of India - with a focus on international border areas in the North-Eastern state, and the coastal zone that included several large cities like Chennai, Kochi, Kolkata, and Mumbai **[9]**. Dr. Manosi Lahiri notes that "[t]his had a far reaching effect on the mapping culture of independent India and perpetuated the perception among many that maps were a security threat" **[10]**." By 1971, however, the functions of SOI extended to catering to inter alia all development activities and was hence brought under the ambit of Department of Science and Technology **[11]**.

The National Map Policy, 2005 (hereinafter, "NMP") was announced by the Central Government on May 19, 2005 **[12]**.

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Thus, the policy objectives include access to National Topographic Database (NTDB) **[14]** and promotion of geospatial based intelligence, subject to conformation to national standards of SOI.

In order to realize the security concerns, inter alia, a dual-classification was created amongst the maps, namely - i) **Defence Series Maps ("DSM")** and ii) **Open Series Maps ("OSM")**. While the former constitutes of topographical maps that mainly cater to defence and security requirements of the country, the latter supports developmental activities. Hence, DSMs whether in analogue or digital form, fall under the classified category and the power to issue guidelines pertaining to their use vests digit mainly for developmental purposes, they are not openly accessible by ipso facto and need to gain the 'unrestricted' tag after clearance from MOD

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On the face of it, creation of geospatial data seems to be an exclusive scientific and technological matter. However, the political and economic facets of geospatial data are often as predominant and complex as its scientific practice. Continuing from the colonial era, the political facet of mapping emerged significantly in the public discourse from the 1990s onwards as digital technologies amplified the ability of non-governmental actors to collect, generate, and share geospatial data, in the form of maps or otherwise **[2]**. This 'democratisation' of the ability to map and share private/user-generated maps structurally undermined the government's ability to have an authoritative and universal voice when it comes to

geospatial depiction of the nation and its various components. Similar to the other upsurges in the digitized world, which is often followed by an introduction of legal provisions in order to keep access to and use of digital data under mechanisms of monitoring and permission, mapping in India has also has subsequently been governed under policies addressing both terrestrial mapping and remote sensing. Concerns of national security, naturally, have driven much of these policies.

This post focuses on providing an overview of the present configuration of laws, policies, and guidelines that provides the legal framework in India for governance of creation and sharing of geospatial data in India. The post also studies these policies in action by describing the key legal cases around the creation and use of geospatial data. The next post of this series will document the reflections and opinions of the key geospatial industry actors in India, as well as the free and open source mapping community.

**Mapping the Legal Journey of Geospatial Data: Past to Present**

"We know every inch of the nation, because we map every inch of it!" – Survey of India **[3]**

Aforementioned slogan adopted by the primary organization responsible for mapping all geospatial data in India indicates the importance of the geospatial data and mapping the same. While it indicates the importance of having access to mapping data in order to be aware of the geospatial features of one's country, it also cleverly reveals the vulnerability that having access to mapped data brings. The phrase can be said to imply that mapping every inch of the country leads to information about every inch of the nation which is useful if in the hands of government agency but repugnant to security if in the hands of external agencies. This conflict between access to information about the country and the security concerns arising from such an open access has led to a rich evolution of legal policies governing the same.

Set up in 1767, Survey of India (hereinafter "SOI") was required to map the terrains of India to fulfill the commercial and political convenience of the East India Company **[4]**. During these colonial times, maps were considered to be essential for governmental purposes and thus their dissemination to unauthorized persons was barred by Clause 5 of the Official Secrets Act, 1923 **[5]**. Thus, till 1950s mapping was being governed by the colonial provisions which maps restricted to official use only **[6]**. With independence, the functions of the SOI shifted mainly towards providing information for the defense forces **[7]**.

An important change came in the form of orders and notifications by Ministry of Defence (hereinafter "MOD") during 1960s, the major one being the 1965 order that permitted distribution of maps of scale 1:4 M **[8]**. The Map Restriction Policy of the MOD, however, imposed categorical restrictions on sharing of maps, aerial photos, and all geophysical data for various parts of India - with a focus on international border areas in the North-Eastern state, and the coastal zone that included several large cities like Chennai, Kochi, Kolkata, and Mumbai **[9]**. Dr. Manosi Lahiri notes that "[t]his had a far reaching effect on the mapping culture of independent India and perpetuated the perception among many that maps were a security threat" **[10]**." By 1971, however, the functions of SOI extended to catering to inter alia all development activities and was hence brought under the ambit of Department of Science and Technology **[11]**.

However, the catalytic transformation came in the form of National Map Policy, 2005 which made SOI the nodal governmental agency for dealing with all processes involving geospatial data. While harping for open access to geospatial data, the policy accompanied by corresponding guidelines have largely restricted the power to map geospatial data to SOI. The Policy and the guidelines have been discussed in detail as under.

**2.1. National Map Policy, 2005**

The National Map Policy, 2005 (hereinafter, "NMP") was announced by the Central Government on May 19, 2005 **[12]**. The preamble of the policy identifies the importance of high quality spatial data in various facets such as socio-economic development, conservation of natural resources, infrastructure development etc **[13]**. Topographic map database constitutes the foundation of all spatial data and its production, maintenance, and dissemination has been assigned as a responsibility to SOI, which is to "liberalize access" to spatial data without compromising upon security concerns. Thus, the conflict between national security and right to have access to information regarding one's country is clearly highlighted in the policy as a need for enactment of the same. Thus, the policy objectives include access to National Topographic Database (NTDB) **[14]** and promotion of geospatial based intelligence, subject to confirmation to national standards of SOI.

**Thus, there is no single policy that acts as a deterrent for mapping in India but an accumulation of multiple policies, guidelines and legal provisions that are used by departments of government to restrict mapping in the name of security**

In order to realize the security concerns, inter alia, a dual-classification was created amongst the maps, namely - i) **Defence Series Maps ("DSM")** and ii) **Open Series Maps ("OSM")**. While the former constitutes of topographical maps that mainly cater to defence and security requirements of the country, the latter supports developmental activities. Hence, DSMs whether in analogue or digital form, fall under the classified category and the power to issue guidelines pertaining to their use vests digit mainly for developmental purposes, they are not openly accessible by ipso facto and need to gain the 'unrestricted' tag after clearance from MOD. A table specifying the distinction between DSMs and OSMs in detail has been provided below:

**2.3 Remote Sensing Data Policy (RSDP)**

In 2011, the confusion pertaining to applicability of NMP to both territorial and satellite mapping was resolved with the release of the Remote Sensing Data Policy (RSDP). The policy recognized the importance of remote sensing data and noted that it was largely used by government and non-government users from Indian and foreign remote sensing satellites. However, again banking upon the need for security considerations, the policy was released with the purpose of "…managing and/ or permitting the acquisition/dissemination of remote sensing data in support of developmental activities" **[17]**. Department of Science (DOS) was made the nodal government agency for all actions pertaining to remote sensing data under the policy.

A basic perusal of the policy indicates a parallelism between the RSDP and the NMP. Thus, similar to NMP, RSDP assures of a government managed Indian Remote Sensing Satellites (IRS) Programme, the data produced by which will be solely owned by the government and other users could only be provided with licences if need be. Any attempt at acquiring and/or dissemination of remote sensing data within India requires permission through the nodal government agency. National Remote Sensing Centre (NRSC) of the Indian Space Research Organisation (ISRO)/ DOS is vested with the authority to acquire and disseminate all satellite remote sensing data in India, both from Indian and foreign satellites. NRSC is also supposed to maintain a systematic National Remote Sensing Data Archive, and a log of all acquisitions/ sales of data for all satellites. Thus, nodal government agencies were created for both terrestrial mapping and satellite imagery, former being SOI and latter NRSC.

**Since the advent of restrictive mapping policies, numerous incidents have come forth when agencies have found themselves faced by legal actions for violating such policies**

**2.4 Civil Aviation Rule**

Aerial instruments and aircrafts act as important instruments for geophysical surveys and mapping. Thus, this area does not go ungoverned. While, till date, India doesn't impose an explicit bar on foreign registered aircraft overflying its territory for aerial photography and geo-physical survey, the same is subject to prior clearance under rule 158 and 158A of the Aircraft Rules, 1937 on account of safety and security concerns, the procedure for which has been given under Civil Aviation Rules (CAR) **[18]**. CAR is applicable to inter alia agencies undertaking aerial photography, geophysical surveys etc. An application is required to be made as per Annexure E which inter alia requires confinement of photography/ sensing to the exact area as applied and cleared by the Ministry of Defence. The application is forwarded by DGCA to the Ministry of Defence and other agencies responsible for issuing NOC.

DGCA's restrictions extends to voluntary geographic information with prohibition of civilian drones in India. Unmanned drones are an important equipment used for the purpose of collecting geo-spatial data. The ban on flying drones in India exist from October, 2014 but is not in common knowledge **[19]**. While it is argued that drones could harm people and lead to chances of crashing, the major argument has always been the use of drones by anti-national elements to peruse sensitive places for plotting terror attacks **[20]**. While there is an ambiguity regarding using drones in India, flying drones over defence establishments and historical places is completely banned **[21]**. Thus, civilians using drones for clicking pictures of monuments etc. have often been confronted by the police **[22]**.

Thus, there is no single policy that acts as a deterrent for mapping in India but an accumulation of multiple policies, guidelines and legal provisions that are used by departments of government to restrict mapping in the name of security. These restrictions have also witnessed incidents in their furtherance as detailed below.

3. Incidents of Legal Actions Faced by Agencies

Since the advent of restrictive mapping policies, numerous incidents have come forth when agencies have found themselves faced by legal actions for violating such

policies. In recent times, these incidents were publicly highlighted in 1998 when the sale of the CD-Roms of Delhi Guide Maps created by Eicher were prohibited **[23]**. Eicher has been one of the oldest players of the private mapping market, creating city and road maps for India in the private sector for public distribution. While having faced a ban in earlier times, it is also one of the few companies been able to access the SOI data for value addition. It works in collaboration with SOI now, often launching products in 'strategic alliance' with them. After the implementation of NMP, we have witnessed two major legal controversies, both involving SOI on one hand and Google on the other.

**3.1. Google's Mapathon in Legal Trouble**

…… an initiative launched for purely mapping purposes had to face a large legal hurdle in the year of 2013.

Google on the other hand said that its primary motive was to map local information of daily needs such as hospitals, restaurants, markets etc. and the competition was in tandem with national laws…….

…….However, the much hyped case did not have a substantial result and CBI had to close the probe on account of lack of evidence **[30]**.

**3.2. One Country - Two Boundaries**

Another major legal controversies in the field of geospatial mapping has been with regards to wrong depiction of international boundaries of India by Google

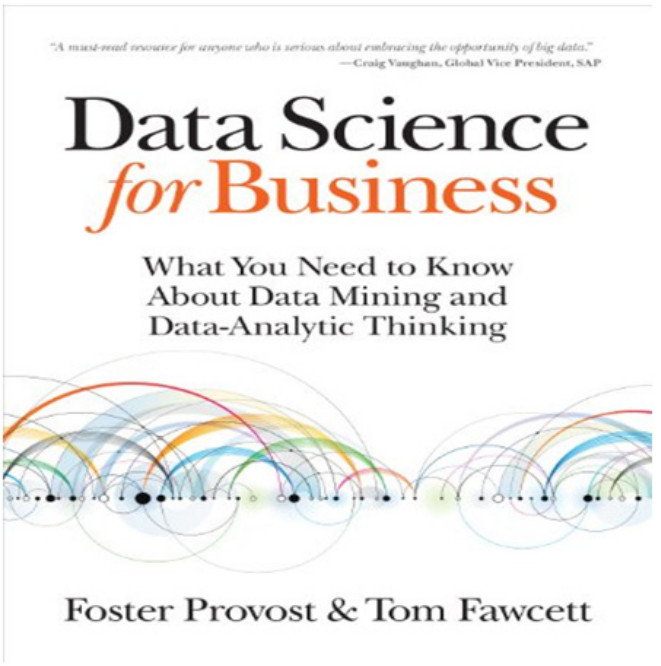
…… It was in the year of 2014, that on the directions of Department of Science and Technology, SOI filed a complaint against Google at the Dehradun Police Station for depiction of international boundaries not in a "wrong manner" i.e. not in compliance with Government of India authentication **[34]**. The result was that today Google shows different boundaries on Indian domain, in compliance with SOI and different on International domain.

Google was also involved in a controversy when in 2009, Google maps for India marked areas of Arunachal Pradesh, including its capital Itanagar and Tawang, in China **[35]**. It was followed by an apology from Google and an immediate rectification for Indian users. However, Google uses a different version for China and the world creating disparity in the boundary depiction **[36]**.

Google has not been the only platform having faced the anger of Indian community for wrong depiction. In 2011, copies of the Economist Magazine were seized for having depicted the map of Kashmir divided between India, Pakistan and China **[37]**. For similar reasons, Al-Jazeera was taken off air by the Indian government after a 5-day ban imposed under Section 69A of the IT Act **[38]**. Modi's visit to Queensland University of Technology was accompanied by an "unqualified apology" from the authorities for having depicting Indian map without portions of Kashmir **[39]**. Urban Development Department of Bihar also ended up show-causing one of its employees for putting up wrong map on its website and substituting the same with SOI's version after media attention **[40]**. India seems to be the country often having been angered due to wrong depictions of maps.

*contd.... next issue August 2019*

## Book review




Data Science is a multi-disciplinary field. It uses statistical methods, models, machine learning algorithms to analyse data to extract useful information.Written by renowned Data Science experts, *Foster Provost and Tom Fawcett.* It introduces the fundamental principles of data science, and takes through the *"data-analytic thinking"* necessary for extracting useful knowledge and add value to the data collected. It also helps to understand the many data-mining techniques to modeling in use today. The book is not-too-technical to read and understand. It is published in 2014 & distributed by Shroff Pvt.Ltd. The Kindle edition is priced for Rs 235/- and Paper Back edition costs Rs 850/- *( www.shroffpublishers.com)*

# Students Forum

**Brief on NCRACE-2019**

Department of Civil Engineering,JNTUH CEH,Hyderabad organized National Conference on ,' Recent Advances in Civil Engineering' on 05th,July 2019, at Kukatpally Campus, Hyderabad. It was held under TEQIP-III and the Twinning Activity with SMVD-University, Katra, Jammu & Motihari College of Engineering, Bihar. Dr K Manjula Vani, Professor, Department of Civil Engineering, JNTUH was the Convener of the conference. Dr A Govardhan, Rector, JNTUH inaugurated and released the Conference proceedings & CD containing 48 technical papers.

Dr P Sravana, Head, Civil Engineering chaired the Inaugural session. Dr M V Seshagiri Rao, former professor Department of Civil Engineering, JNTUH delivered first Key note speech on, *'Sustainable Concrete Technology'*. Dr N Srinivasa Rao Sr.Scientist, INCOIS, delivered the second Key note speech on, *'Civil Engineering Impact-Role of Ocean's and Atmospheric Observations through Remote Sensing'*. DrV Sapkal,Asst.Prof.SMVD University, briefed about the conference. Five themes were discussed in Two technical sessions. Dr V Raghavaswamy & Dr V Sapkal; Dr M V Seshagiri Rao & Dr E Saibaba Reddy chaired the respective technical sessions. More than 150 delegates have attended. Prizes were awarded to the Best Papers during the valedictory. The four Awardees were:M Madhuri from VITS, Hyderabad & L Ravi from CSIT/ JNTUH ; Ashritha B, JNTUH & Harapriya Pradhan GNIT, Hyderabad.

Technical Session of NCRAC-2019, JNTUH

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# EVENTS

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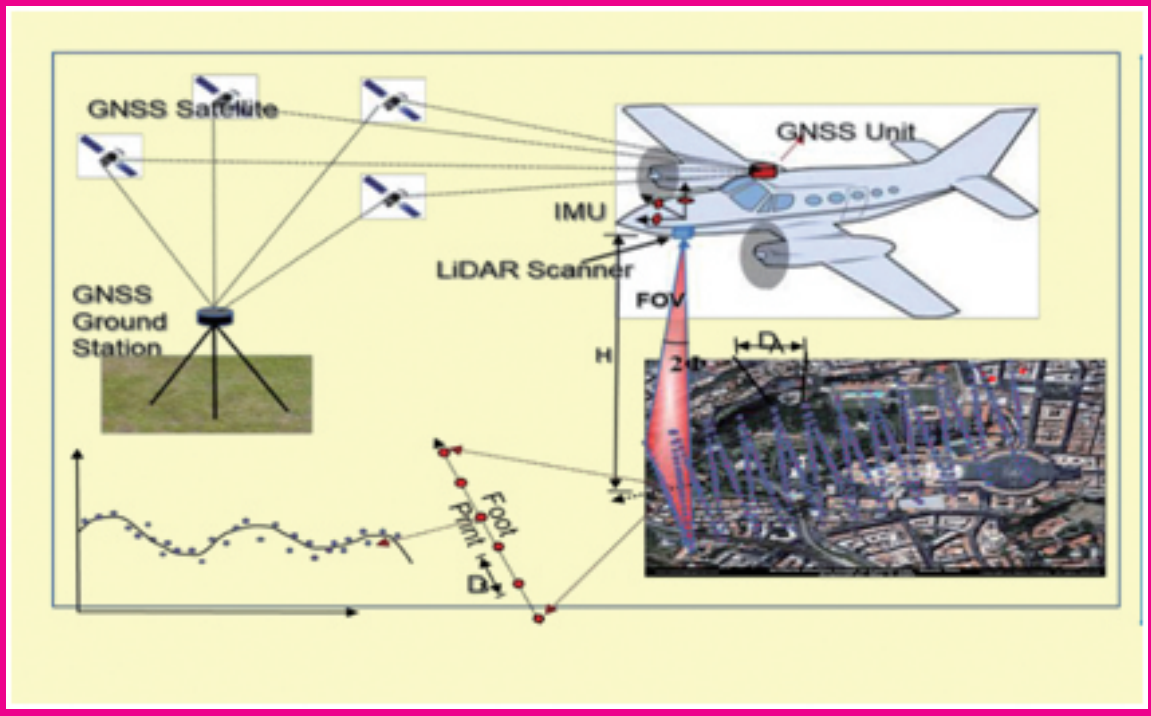
|---|---|---|---|
| ENVI Analytics Symposium | August 14-15.2019 | **Denver, CO, USA** | https://www.harrisgeospatial.com |
| Water Supply Network and Distribution | August 19-22 2019 | Hyderabad | Escihyd.org |
| URISA GIS Leadership Academy | Aug 19-23 2019 | Toronto, Canada | ttps://www.urisa.org/education-events/urisa |
| National Conference on Polar Sciences | August, 20-22nd, 2019 | Vasco-da-Gama, Goa | www.ncps2019.ncaor.gov.in |
| FOSS4G 2019 Bucharest | Aug 26-30 2019 | Bucharest, Romania | https://2019.foss4g.org/ |
| Coastal Vulnerability Mapping and analysis | Aug 26 – 30 2019 | Hyderabad | https://incois.gov.in/documents/ITCOocean/Li |
| **EUROGEO 2019 'Hidden Geographies'.** | Aug 28-31 2019 | Ljubljana, Slovenia | http://hiddengeographies |
| GeoInformation for Disaster Management | September 3-6, 2019 | Prague, Czech Republic | www.gi4dm2019.org |
| Future of Mining | Sep 4 -5, 2019 | London | https://www.globalminingreview.com |
| AGSE 2019 | Sep 11 - 14, 2019 | Stuttgart, Germany | http://applied-geoinformatics.org/ |
| Application of GIS, GPS & RS in Environmental Data Management | Sep 17 – 19 2019 | Hyderabad | Escihyd.org |
| INTERGEO 2019 | September 17th – 19th 2019 | Stuttgart, Germany | www.intergeo.de |
| International Symposium on Digital Earth | September 24-27, 2019 | Sesto Fiorentino Italy | www.gis-professional.com/content/event/11th-international-symposium-on-digital-earth-isde-11 |
| MVP BIM 2019 " Prague, Czech Republic | September 24-25, 2019 | Prague, Czech Republic | http://mvpbim2019.org/ |
| International Geographical Conference of DGS | September, 27-29, 2019 | Jaipur, Rajasthan | *www.thedeccangeographer.org)* |
| GIS-Pro 2019 | September 28 – October 2, 2019 | LA, USA | www.urisa.org/gis-pro |
| LADM 2019 Workshop<br>SDSC2019 - Conference on Smart Data and Smart Cities<br>GGT2019 - Geomatics Geospatial Technology | Oct 1-3 2019 | Kuala Lumpur, Malaysia | isoladm.org/LADM2019Workshop;<br>http://www.geoinfo.utm.my/geospatial2019 |
| GITA's Pipeline Technology Forum | October 2 – 3, 2019 | TX, USA | https://web.cvent.com/event |
| **GEOVET 2019** | October 8 - 10, 2019 | CA, USA | https://web.cvent.com/event |
| National Seminar Regional Studies | October 9-10, 2019 | Hyderabad | *(www : uohyd.ac.in)* |
| AGIC Education & Training Symposium | October 1 - 4, 2019 | USA | www.agicsymposium.org/ |
| International Conference of IGU | October, 19-21,2019 | Haryana, India | *(www.cuh.ac.in)* |
| IMAGERY TO DIGITAL REALITY: ERS & Photogrammetry | Oct 28-31 2019 | Seoel, Republic of Korea | http://conf.racurs.ru/conf2019/eng/ |
| Africa GIS 2019. | November 18 – 22, 2019 | Kigali, Rwanda | www.eis.africa/ |
| Amsterdam Drone Week, , | December 2-6, 2019 | Amsterdam | www.amsterdamdroneweek.com |
| Geosmart India 2019 | Dec. 3-5, 2019 | Hyderabad | www.geosmartindia.net |
| Conference on Cities | 11-13 Dec.2019 | Roorkee | www.icfc2019.com |
| 3rd Asian Regional Conference on Peri-Urbanisaton, , SPA , | **17-20 Dec.2019** | Bhopal | www 3rdperiurbanconference@spabhopal.ac.in |
| Indian Geographical Congress of NAGI | December , 28-30, 2019 | Sagar, M.P. India | nagi.org.in |
| InfraTech 2020 | 14-16 January 2020 | Germany | https://www.infratech.de |
| FIG Working Week 2020 - "Smart surveyors for land and water management | 10-14 May2020 | Amsterdam | http://www.fig.net/fig2020/ |
| FME International User Conference | 16-19 June 2020 | Vancouver, Canada | https://fmeuc.com/ |
| ISPRS Geospatial Week (GSW) 2021 | 21-25 March 2021 | Dubai, U.A.E. | https://www.isprs.org/ |

*Information about events has been compiled from different sources. Readers are advised to check correctness from the organisers*


*LiDAR scanning from air ( See details on page ...13)*

# SECON

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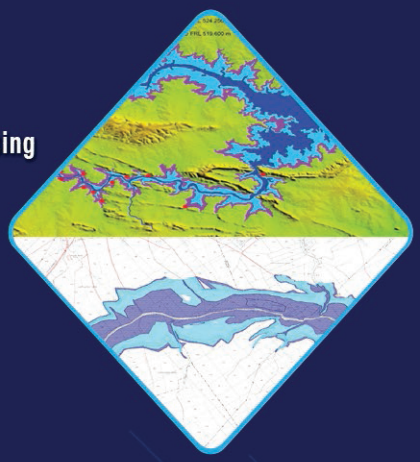
## GIS Driven Multidiscipline Engineering Consultancy

## SECON SERVICE OFFERINGS

### Design Consultancy and Engineering Services

- Highway Engineering & Construction Supervision
- Public Health Engineering
- Irrigation, Flood Control & Water Management
- Cross Country Pipeline Transportation, City Gas Network
- Environment Impact & Management Plan
- Town Planning, Electrical, Telecom & Utilities
- Right of Way Acquisition & Permitting and Clearance
- Software & Web Enabled Geoportal Development Services

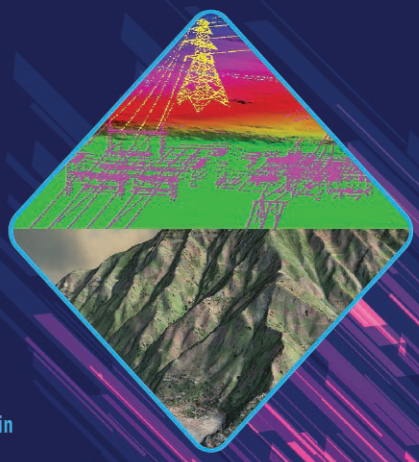


### Investigation and Services

- Photogrammetry, LiDAR & Remote Sensing
- Aerial LiDAR & Imagery, Mobile LiDAR data Acquisition and Processing
- Geotech Engineering and Geophysical Surveys
- Underground Utility Detection (GPR)
- Underwater Leak Detection and Turnkey Solution
- Airborne and Ground Geophysical Surveys
- Route Planning & 3D Corridor Mapping
- GIS/CADD Data Processing
- Geodetic, Topographic, Cadastral, Hydrological Surveys

## HONOURS & AWARDS

Geospatial World Excellence Award 2018
Best Professionally Managed Company 2014
Geospatial Company of the year 2013
National award for Excellence in Engineering Consultancy 2012
Project of National Excellence - Urban Infrastructure 2011
Export Excellence Award 2008 & 2010

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