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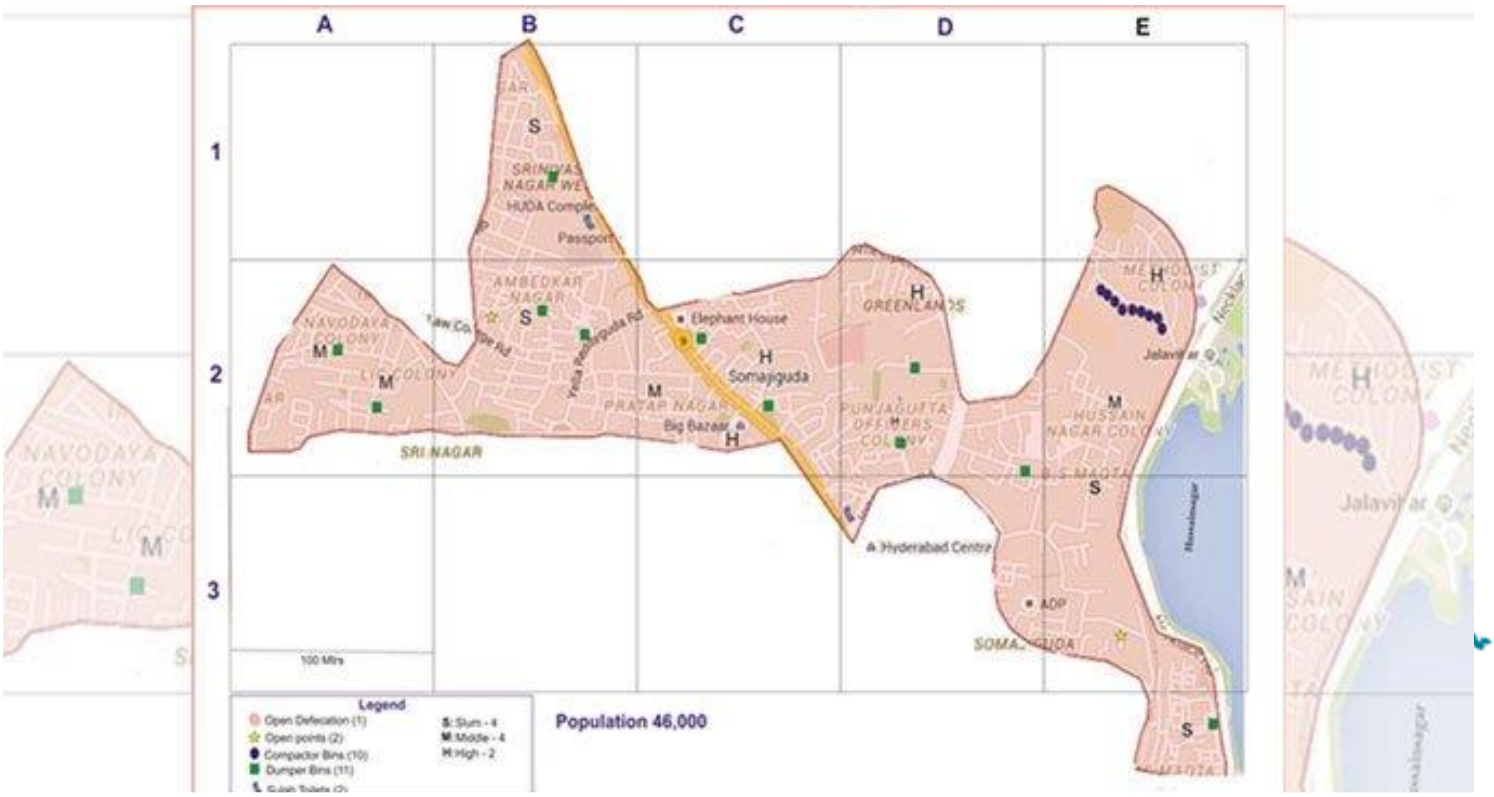
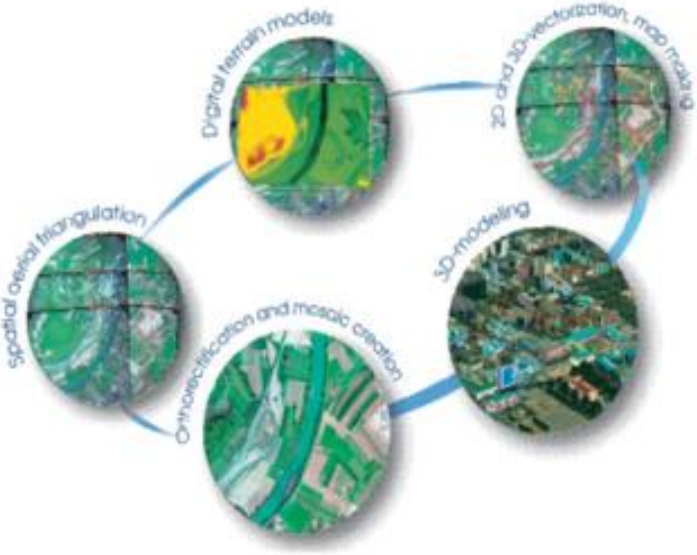


Overview

PHOTOMOD®



RACURS, Russia

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.

PHOTOMOD's flexible modular architecture and powerful import/export tools permit a variety of configurations: **Complete Digital Photogrammetric Workstation** (standalone configuration), high productivity distributed network environment for accomplishing large projects, complementary workplaces that can be used along with third-party systems to increase the overall productivity during the most time-consuming and labor-intensive operations like feature extraction and DTM creation.

Today PHOTOMOD is the most popular digital photogrammetric software in Russia and is also used in 70 countries all over the world. PHOTOMOD is the only digital photogrammetric system with the Russian Federation Ministry of Defense certificate and also the main digital photogrammetric software for the Federal Space agency of the Russian Federation (ROSCOSMOS) and Russian Federal Service for State Registration, Cadastre and Cartography (ROSREESTR)

General questions: info@racurs.ru

Editorial

August 2020 Maps Today

After decades of efforts to provide title of land/property to buyer /owner , is still an unresolved issue. Read an analytical article about this. Drone mapping by Hyderabad Municipal Corpn. attempted in June 2019 for indentifying properties appears promising . Some other cities also have done this. Read New items on this. Readers familiar with these projects may send reports on how drone mapping has helped in the Municipalities. Read about Geodetic Infrastructure by NK Agrawal from past issue of GIS India. Read about the need for a Policy on Remote Sensing. Extracts from a comprehensive article on this are given in this issue. At present high resolution RS satellite data of India acquired by private agencies in USA have to be obtained through ISRO. This must change. We have to suggest to the decision makers to make RS data accessible easily to the use community.This aspect was highlighted in the webinar on GIS & RS on 20 July 2020. Read brief on this in this issue.

Readers will find GIS application examples interesting.Don't lose interest. Keep going. GIS is important for our growth !!

Contents

Ward Management Plans- a GIS Perspective

-Maj Shiva Kiran

The recent announcement of the Minister for Municipal Adminsitration of appointing Ward officers brings focus on the concept of a ward, its components and management methodologies.

What is a Ward?

In our country ward is considered to be the unit for all planning. It is a geographic unit which was thought to be suitable for resource allocation and planning. To begin with in urban centres, an area with 20000 population constituted a ward. Over a period of time certain wards grew faster in terms of population as compared to other wards and this created management issues for Municipal bodies or Urban Local Bodies (ULBs). The population of an urban ward in 2011 census ranged from about 40000-60000 population. 84427 is the total number of wards in the country. In Telangana there are 2112 wards. GHMC alone has 150 wards.

The rationale behind ward as a unit was that allocation of resources and management could be better if a fixed population was to be serviced over a certain geographic area. It is probably the same reason why census is collected door to door, but presented on a ward basis for better understanding.

Another interesting phenomenon of the ward structure is that they have no names, only numbers. This was done with foresight that as wards grew and were to be delimited, names would be dysfunctional and a ward if it were to be named after a prominent in the area could fall in a different ward in the next delimitation exercise.

GHMC- A case in example

In the erstwhile MCH- Municipal Corporation of Hyderabad, the geographical area was about 173 Sq kms having 24 wards with a population of 35 Lakhs. Average population per ward was 1,46,000. In 2007 when GHMC was constituted with the merging of 13 peripheral municipalities, the area increased to 650 sq kms, with about 67 lakh population and 150 wards. Average population per ward reduced to 45000 . With the present estimated population of around one crore, average ward population could be around 67000. Through a process of delimitation wards were carved out for better decentralised management. The administration and election wards now have same boundaries. Hitherto the ward boundaries and election wards being different created confusion in jurisdiction and management.

ULB Services

Typically a Urban Local Body provides various services to the citizens, which include Urban Planning, Regulation of Land Use and Building Construction, ,Roads and bridges, Water Supply and

Sewerage services, Public health, sanitation and conservancy, Fire services, Urban forestry, Preventive health care, Provision of urban amenities and facilities such as parks, gardens, playgrounds Burials and burial grounds, cremations, cremation ghats/grounds and electric crematoria, Cattle pounds, prevention of cruelty to animals Vital statistics including registration of births and deaths, street lighting, Parking lots, bus stops and public conveniences, Regulation of slaughter houses and tanneries, Slum Improvement and Upgradation, Urban poverty alleviation, Protection of the environment and promotion of ecological aspects, Planning for Economic and Social development Safeguarding the interests of weaker sections of society, including the handicapped and the mentally retarded

The Chief Minister of Telangana has number of times spoken about the basic services an ULB / Municipality has to provide. Sanitation, Plantation, water management are the basic tenets of the flag ship programmes of the Telangana Government such as Mission Kakatiya, Haritha Haram, and Mission Bhageeratha.

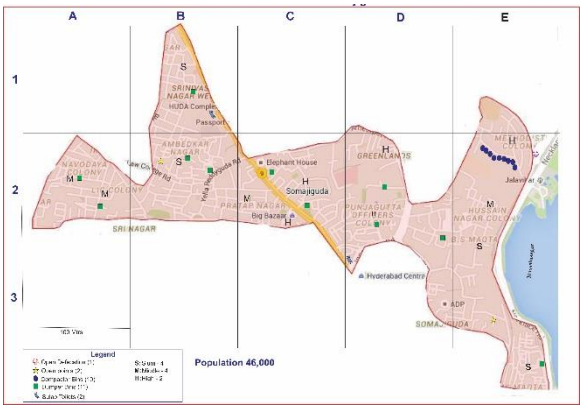
Need for Spatial Planning and Use of GIS

A careful look at the services to be provided to the citizens shows that all of them are location based. Where the building should be allowed? Where is the road infrastructure needed ? Where are the urban amenities required ? Where are the pipelines and sewerage systems to be laid? Where are streetlights required? Where should the lung spaces be created? The Operative word is “Where”. That is why precisely a GIS- Geographic Information System / Spatial perspective is needed for all planning. A ward level GIS – Map based planning methodology will enable a stakeholder inclusive approach, better allocation of resources and micro level planning which will contribute to better urban governance in the long run.

An Illustration of GIS based Ward level Planning for Sanitation

The author has organised this ward level planning exercise for sanitation planning, environment management and water resources for Functionaries of ULBs across the country to ingrain a spatial perspective. The georeferncing of data and geo tagging of ULB assets enable a transparent management methodology and ensure zero duplication.

Ward Solid Waste Management Plan



Technology Advantage

India is among the foremost countries generating spatial data of high resolution as good as one metre and an update frequency of 28 days. Bhuvan Geo Spatial portal developed by the National Remote Sensing Centre (NRSC) has several easy to use spatial tools which enable creation of maps at a ward, with features of different layers, vehicle tracking, measuring and visualisation tools, DEM (Digital Elevation Models), buffer creation, combining of existing Spatial data layers, hosting on the web using Open source tools. All this for free !!!

The right Tool for Hyderabad- Global city in the making

Ward level GIS planning has many advantages as Hyderabad aspires to reach the ranks of cities that are recognised for global living standards. The Minister for Municipal Administration has time and again emphasised for ward level planning, resource allocation and management. It is a tool which can enable Hyderabad leap frog into a ***Vishwanagaram*** (Global City).

(The author has a Phd in Development studies, is an Environment & GIS Consultant. majorkiran@gmail.com) If Needed (already included in the copy)

Table of Urban services

Urban planning including town planning	Yes	Yes	Yes
Regulation of land-use and construction of buildings	Yes	Yes	Yes
Planning for economic and social development	Yes	Yes	Yes
Roads and bridges	Yes	Yes	Yes
Water supply domestic, Industrial and commercial purposes	Yes	Yes	Yes
Public health, sanitation, conservancy and solid waste management	Yes	Yes	Yes
Fire services	Yes	Yes	No

Urban forestry	Yes	Yes	Yes
Preventive Health Care	Yes	Yes	Yes
Provision of urban amenities and facilities such as parks, gardens, playgrounds	Yes	Yes	Yes
Burials and burial grounds, cremations, cremation Ghats/grounds and electric crematoria	Yes	Yes	Yes
Cattle pounds, prevention of cruelty to animals	Yes	Yes	Yes
Vital statistics including registration of births and deaths	Yes	Yes	Yes
Street lighting	Yes	No	Yes
Parking lots, bus stops and public conveniences	Yes	Yes	Yes
Regulation of slaughter houses and tanneries	Yes	Yes	Yes
Slum improvement and up gradation	Yes	Yes	Yes
Agency Functions			
Protection of the environment and promotion of ecological aspects	Yes	Yes	Yes
Safeguarding the interests of weaker sections of society, including the handicapped and the mentally retarded	Yes	Yes	Yes

Urban poverty alleviation	Yes	Yes	Yes
Promotion of cultural, education and aesthetic aspects	Yes	Yes	Yes
Primary Education	Yes	Yes	Yes
Primary Health Care	Yes	Yes	Yes

A Map of one of the wards of GHMC is provided with the following details.

Population with Demographic Profile – Slums, Middle Class & Higher Income group.

Sanitation Information – OD areas, Open Dumping points, Dumper bin locations, Compactor bins & Sulab Toilets.

Design a **Ward SWM Plan** covering aspects of Door to Door collection, Segregation, location of Bins, Method of collection (Manpower and Vehicles), Treatment & Disposal, Revenue Model, and Sustainability

Securing property and land rights in India

August 5, 2020, 3:00 AM IST **Shreya Deb** in **Developing India** | **India** | TOI

https://timesofindia.indiatimes.com/blogs/developing-contemporary-india/securing-property-and-land-rights-in-india/

Secure property rights are fundamental to the economic and social development of any country. However, in India, we are faced with a curious conundrum where more than 70 percent of a household's assets are held in land and housing, yet there is insufficient data and research on people's property rights. On one hand, the government aspires to provide 18-20 million affordable housing units in urban areas, while on the other, more than 10 million housing units are lying vacant, as per the 2011 Census. The judicial pendency of land disputes is also high, with several million cases pending in Indian courts. Approximately 25 percent of all cases decided by the Supreme Court involve land disputes, of which 30 percent concern disputes relating to land acquisition.

All these factors, combined, result in insecure tenure for a large population, especially the poor and vulnerable, which in turn poses a complex set of challenges for effective governance. It also impacts the efficiency of our judicial system and our ability to attract investments. According to the 'Ease of Doing Business Rankings', India ranks

156th on the metric of ‘Ease of registration of property’—in contrast with its overall rank of 63 in the 2020 index. With the current rate of population growth and increasing competition for finite resources such as land, it is important to draw policy attention to these issues.

Related Article: Forest conservation vs land rights: A zero-sum game?

Land governance and property rights have been largely overlooked in India

Despite the severity and complexity of this issue, land governance and property rights have been largely overlooked within policy research and development initiatives in India. The reasons for this are many, ranging from historical to political. Historically, the bulk of the colonial government’s revenues came from taxing agricultural produce. Over time, as this revenue declined, the focus on rural land administration reduced. As our cities grew in an unplanned manner, we did not invest in building strong land administration systems. On a political level, land and housing are very valuable assets, which, when regulated poorly, attract corruption and violence.

In addition, land and housing often have deep emotional relevance for people, and access to these are, in some cases, dictated by old beliefs and traditional customs. For instance, patriarchal norms often hinder women from owning properties, even though studies have shown that when women own properties, families show better indicators of health, nutrition, and education. Similarly, when marginalised groups own land, they have better food security and gain increased respect from the local communities. However, these require shaking up some deep-rooted social norms, which can be very challenging for both nonprofits and donors.

While India has undertaken reforms in many sectors of the economy, land and labour—the core factors of production—have not seen reforms. For decades, we have witnessed the effect of broken land administration in our daily lives. With reportedly as much as 66 percent of all civil cases pertaining to property disputes, it wouldn’t be a stretch to say that every Indian family has faced a property dispute. The Covid-19 pandemic has borne testament to some of these issues as well, as we see the scale of the impact it has had on people living in informal settlements, where issues of poor sanitation and housing are fuelled by lack of tenure security. It is quite evident that a bulk of our current social and economic challenges are centred around the lack of secure access to land and housing rights.

Reforming the land rights regime is critical for India to secure high growth

The fundamental building block to define and secure land rights for anyone, is the underlying property record. This record should accurately reflect all pertinent information, including ownership, the geo-coordinated location and boundaries of the property, any mortgage claims, tenant claims, and disputes. Improving the accuracy of land records, including maps, should be the topmost priority. It is the basic infrastructure required for secure access to land and housing rights, and would bring in more confidence in land-related

transactions, reduce conflict, encourage more investments, and also improve the government's ability to deliver welfare schemes.

India also needs reforms in other critical land governance areas. We have progressive laws, such as the Forest Rights Act, 2006, which need to be implemented on the ground to ensure that more than 100 million people belonging to Scheduled Tribes are able to secure the *patta* (or land title) to their land and gain access to all welfare benefits that have not been made available to them till date. Organisations, such as ARCH Vahini in Gujarat, that work towards helping communities secure land *pattas* have observed significant improvements in agriculture production and incomes. We need more nonprofits working in Adivasi communities to help families apply for *pattas*, which will have multifold benefits in reducing poverty in these areas.

Land leasing is the third area where we need policy reforms. Given the small landholdings in India, millions of farmers lease additional land to enhance their farm output. However, these contracts are largely informal, and farmers with informal leases do not get access to any government benefits such as agriculture credit, PM KISAN, crop insurance, fertiliser subsidy, or Minimum Support Price procurement. A few states, including Uttar Pradesh, have recently amended their land leasing laws to allow tenancy to be formalised, thereby securing the rights of tenant farmers. Implementing these changes on the ground will require concerted efforts from civil society and government officials, as it requires changing decades-old practices.

Attention to reform in hitherto poorly focused areas, such as land and labour, will be critical for India to resume a high-growth journey. As we grapple with an economic slowdown due to COVID-19, the recently launched NCAER Land Record Services Index (N-LRSI) offers a step towards changing this. The N-LRSI is the first piece of research that carries out an in-depth analysis of land records in India. The index assesses the current status of digitisation, identifies the existing gaps in each state, and can help under-performing states implement specific remedial actions.

The report finds that in 28 states and union territories, digitisation stands at 86.3 percent. However, it also reveals considerable accessibility issues, such as changes in administrative units and mismatch of names/spellings, language and translation issues, and other user interface problems. We clearly have a long way to go, and the N-LRSI could become a bellwether of improved land governance in India.

Technology can be leveraged to secure property rights

Technology, especially geospatial technology, can also significantly drive change on the ground. Drones are perhaps the most exciting new entrants in this spectrum, as they offer great potential for innovation. Recently, the Odisha state government used drones to map close to two lakh households across the state. The whole exercise was completed in a matter of a few months, which by traditional methods would have taken several years.

Moreover, the drone imagery brought in transparency to the whole process and allowed the communities to engage with the maps to identify their own homes and community boundaries. This greatly helped in reducing information asymmetry and building trust. Nonprofits such as PRADAN have also employed geospatial tools to map land and help Adivasi families claim their *patta*.

"While there is no doubt that technology can be a force for good, it is also important to acknowledge its limitations in social impact and transformation."

The Government of India also recognises the importance of using technology, as seen from the Prime Minister's recent announcement of the Swamitva scheme, which aims to map rural inhabited lands using drones and issue property cards to those living in *abadi* areas (inhabited rural land) without a record of rights.

While there is no doubt that technology can be a force for good, it is also important to acknowledge its limitations in social impact and transformation. Technology is not a silver bullet, and needs to be complemented by non-tech solutions, if we want sustainable impact. Therefore, the focus needs to be on responsible technology, that is used in close engagement with a range of actors, from businesses, to governments, to civil society.

Land and property rights are often viewed as a very political issue, which may discourage donors from investing in research in this area. Cognisant of this research gap, we, at Omidyar Network India, have invested in supporting the Property Rights Research Consortium (PRRC) to create evidence-based solutions, without political biases.

We also believe that there is an opportunity for donors working on WASH, agriculture, and gender issues to include secure land tenure as a key component in their programmes. For example, a programme working to improve farmer income enhancement would need to identify and support tenant farmers to make it truly inclusive, and could include a component to identify tenants and help them formalise the tenancy agreement and access government benefits. Similarly, gender programmes can also try to include women's names in the property documents, since research shows that it reduces instances of domestic violence and increases women's confidence and agency. WASH programmes in urban slum communities also require access to land for sanitation infrastructure. Ahmedabad's Slum Networking Programme, which started in the late 1990s, demonstrated that providing secure tenure to communities can transform the sanitation and health conditions in informal settlements by leveraging government resources as well as community funds.

Recently, Ashif Shaikh, founder of Jan Sahas, aptly described land as a horizontal, cross-cutting issue across interventions. Evidence shows that developing programmes that address the land use challenges of target communities are able to significantly boost the overall impact of the programme on the lives of families for a sustained period. Therefore, it is time that we start taking concrete steps

towards securing land and property rights in India.

This article was originally published on India Development Review.

DISCLAIMER : Views expressed above are the author's own.

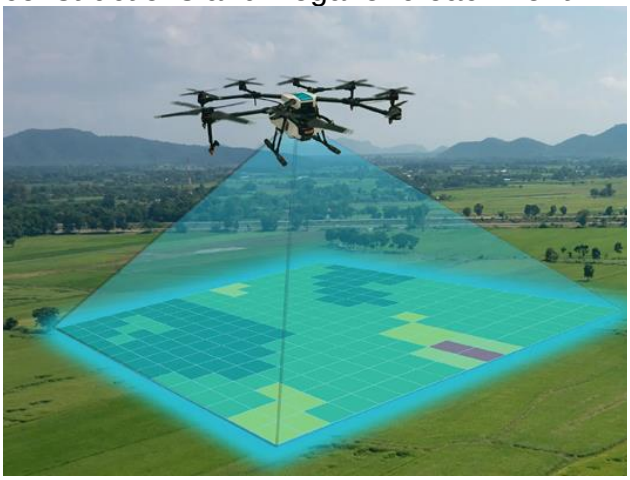
Drone Mapping of Hyderabad

First time ever, Hyderabad Municipal Corporation to use drones for mapping urban properties

http://urbanupdate.in/ghmc-to-use-drones-for-gis-mapping

By S Bachan Jeet Singh;Express News Service **16th June 2019**

The proposed drone mapping project in Hyderabad is expected to make a significant impact on unauthorised constructions and illegal encroachment



The proposed drone mapping project is expected to make a significant impact on unauthorised constructions, and illegal encroachment.

This would act against the people who are trying to evade taxes, by under-assessing their property. Apart from this, these drones will also keep an eye on city roads, drains, bin mapping, and street lights.

By using drone survey, GHMC has decided to prepare a base map for the city.

While, it may be the first time for Hyderabad to use such technology, a few other cities like Chennai, Bangalore, and Mumbai are already using drones for mapping urban properties and other facilities.

Talking about the new drone survey, GHMC officials said the corporation has decided to have a comprehensive base map for the city, which would be prepared by capturing the details either through drones or by a camera mounted

aircraft. “The drone survey would take a few months, whereas aerial mapping through camera mounted aircraft would just take a few days. However using aircraft for capturing data, requires a series of security permissions from various government agencies, from both Central and State governments, including Ministry of Defence, Ministry of Home Affairs and Ministry of Civil Aviation,” GHMC officials said.

The officials added that drone survey will be able to get high-resolution images within 5 cm, whereas aircraft will get images with an accuracy within 10 cm. “The 3D model will provide the exact details on an area or a building. Further, this survey will help in finding the properties which are not yet assessed. Some parties knowingly or unknowingly have recorded the area of property wrongly, and this will help in detecting such things. Once a map is prepared, it will have to be cleared by the Defence ministry,” officials said.

The survey will capture data with high-resolution cameras and with the help of software, convert the data into Auto CAD drawings. The carpet areas of each property will be captured by the latest survey instruments on site and the same will be geo-tagged to prepare base maps.

Satellite Remote Sensing Policy in India

Extracts from **Pie in the sky The Week , 28 June 2020**


Abhinav Singh

Space missions are expensive, and they are mostly done using taxpayers’ money. The participation of private players not only takes some burden off the public exchequer, but also gives an opportunity for entrepreneurs. This is exactly why India wants increased private participation in the space ecosystem

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As ISRO itself is a service provider for commercial launches through its subsidiary, NewSpace India Limited

(NSIL), many people see a conflict of interest.

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Private players are not comfortable with ISRO's opaque nature, either. This leaves limited avenues for private-public partnership, and even the open sectors are limited to contractors acting as outsourced manufacturing units

Currently, there are a myriad of problems for satellite builders such as GST, security clearances, orbital slotting, and liability and insurance. Similarly, for downstream companies, there are problems pertaining to data acquisition (you can buy only from or through the National Remote Sensing Centre, even if the satellite is a foreign-owned private asset), making the whole process slow, opaque and expensive,"

According to Divyanshu Poddar, co-founder of the space startup Rocketeers "India needs a better map policy and needs to liberalise access to and use of satellite data for private players. In the US, there is a single window clearance for all things and satellite data is freely traded by players like any other commodity. There are no government controls except with data pertaining to national security."

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Unlike India, most space faring countries have clearly defined space laws, and private companies are encouraged to build their capabilities. They get contracts from National Aeronautics and Space Administration (NASA) and the European Space Agency (ESA) for technology development (both industrial and R&D). Private companies in the US and Europe have access to NASA and ESA test facilities, patents and research grants. "In the US, the Commercial Space Launch Act facilitated the private enterprise of the commercialisation of space and space technology in 1984 itself. In other countries like China, Japan, Australia and the UK, the sector was opened up only in the past few years. Though we are late, it is good to see the government take this initiative," said Pawan Kumar Chandana, co-founder and CEO, Skyroot Aerospace Limited

Webinar on GIS & RS – Applications and Trends

https://cadl.nalsar.ac.in/event/application-of-gis-and-remote-sensing-technologies-trends-and-prospects/

Report by GS Kumar, Editor, Maps Today

National Academy of Legal Studies and Research (NALSAR) established in Hyderabad in 1998 has set up the Centre for Aerospace and Defence Laws (CADL) in 2005 with the objective of promoting the development of

aviation, space, maritime and defence laws and policies. Since then, NALSAR-CADL has been promoting the study of Aerospace and Defence Laws by introducing courses, conducting National and International Conferences, Moot Courts, Workshops and also publishing Newsletters, Journals, Books and Articles, besides awarding a few M.Phils. and Ph.Ds. in the said areas.

Indian Journal of Air and Space Law (IJASL) ISSN no. 2394-6091 is a bi-annual journal published by the Centre for Air and Space Law (CASL), NALSAR University of Law. This Journal is first of its kind in India venturing to encourage intellectual debate on the issues of relevance to the domain of Air and Space Law by creating a platform for the interested scholars to participate through their respective contributors. Indian Journal of Air and Space Law (IJASL) aim to steadily build a strong pool of Indian and foreign scholars specialized in the respective domains.

Centre for Aerospace and Defence Laws (CADL) NALSAR University of LAW organized webinar in July 2020 on Applications of GIS and Remote Sensing Technologies: Trends and Prospects. This was Moderated by: Ms. Priya Iyengar, Visiting Faculty Lecturer, CADL, NALSAR University of Law and founding partner, Compass Law associates.

Prof. Balakista Reddy**,** Registrar, Head, Centre for Aerospace and Defence Laws, NALSAR University of Law made introductory remarks. Panelists included experienced and eminent professionals.

Dr. Swarna Subba Rao, Former Surveyor General of India

Prof. I. V. Murali Krishna, Professor and Director R&D and Dr Raja Ramanna DRDO Distinguished Fellow

Dr. G. Sreenivasa Reddy, Additional Director General, Telangana state Remote Sensing Application Centre (TRAC).

ReghunathaMenon.K.P PhD , Group Head Training & Education Group, NRSC, ISRO, Hyderabad

All the four panelists emphasized the growing importance of RS and its applications in various sectors. Every one agreed on the need to have a better policy. Prof IVM spoke about evolution of RS and highlighted that huge data is acquired but sharing is restricted. He strongly supported the idea of bringing in new Space law. Dr SSR brought out how GIS and RS data is directly linked with economy of the country. Dr GSR explained how the government is using RS and GIS in various fields of development by various organizations. Dr Menon explained how RS supports sustainable development. While mentioning about shift of data acquisition to mobile platform he cautioned about credibility of spatial data.

Centre for Aerospace and Defence Laws of NALSAR deserves appreciations for conducting such evens and working owards “Space Law”.

Geodetic Infrastructure in India; what is wrong and what needs to be done

By

N. K. Agrawal, nande@rediffmail.com

Abstract

Geodetic Infrastructure in India is inadequate. There are many shortcomings. What is wrong and what needs to be done, has been discussed and possible solution suggested in this paper. It appears that, beginning has been made by the National Survey Agency, SURVEY OF INDIA, towards improving the geodetic infrastructure. It will be appropriate, if Survey of India puts on its website, the present status of Geodetic Infrastructure in India and also state as to what are their plans to put in place adequate geodetic infrastructure along with time frame.

Introduction

Geodetic Infrastructure in India is inadequate. It needs a fresh look and complete revision. Indian Geodetic Datum, The Reference Surface, Horizontal Control, The Vertical Datum, Height Control, Indian Geoid and Mean sea level, The Gravity datum, Projection System for Maps, and Indian Grid, are all inadequate or inappropriate.

Indian Geodetic Datum

Indian Geodetic Datum is based on Everest Spheroid as reference surface given by Sir George Everest, then Surveyor General of India in 1830. Kalyanpur in central India was chosen as initial point or origin. Coordinates of initial point and azimuth of a line were obtained by astronomical observations and leveling. The reference surface was however defined peace-meal at various times. Astronomical observations were carried out at least twice. More precise observations carried out later were accepted. Hence meridional and prime vertical deflection of vertical, were defined at Kalyanpur. Parameters of the datum are given below: -

Initial Point (Origin) Kalyanpur

Latitude of origin
$24^0\ 07'\ 11''.26$

Longitude of origin
77 39 17.57

Meridional deflection of vertical
$-\ 0''.29$

Prime vertical deflection of vertical
+ 2".89

Geoidal undulation
0 metres

Semi major axis
6,377,301.243 metres

Flattening f
1/300.8017

Azimuth to Surantal
190^0 27' 06".39

Value of Semi major axis and semi minor axis were given in feet as 20,922,931.80 feet and 20,853,374.58 feet respectively. These values were converted into metres using different conversion factors resulting in many values of a and b of Everest spheroid. The official conversion factor for India is 0.3047996 and should be accepted.

It is estimated that the center of Everest spheroid is about 1 km away from the center of gravity of the earth; hence it is not a geocentric datum. We therefore conclude that it is inaccurate system and needs redefinition. The present datum is especially not suited for many geodetic, geodynamic, geophysical and defence applications. One has either to use WGS84 for Geodetic monitoring of crustal movements, plate tectonic movements, development and deployment of missiles and many other scientific applications or redefine Indian Geodetic System/Datum. A project to redefine Indian Geodetic Datum was taken up in 1989 but nothing much appears to have been done so far. Redefinition project should be taken up and given highest priority. It should be time bound and completed in 2 to 3 years. In USA a similar project was taken up in 1974 by National Geodetic Survey and completed in 1983. It is known as NAD 83 and is used for all applications including Geodynamic and defense.

Horizontal Control

Horizontal datum in India is Indian Geodetic Datum based on Everest Spheroid as reference surface as mentioned in previous paragraph. Existing horizontal control in India is the result of Great Trigonometrical Survey of India consisting of 5 blocks with 2700 stations and 10 bases. Triangulation series were started from Kalyanpur. The Indian subcontinent was divided into five parts region-wise, four quadrilaterals (NW, NE, SW, SE) and the Southern Trigon. The quadrilaterals could not be adjusted together due to computational limitations at that time. Several corrections viz. for deflection of vertical, skew normal and geodesic also could not be applied. In 1937-38 an attempt was made to readjust the triangulation network but this also suffered from the same limitations. Though densification of control and filling of gaps has been done in addition to observation of more bases and Laplace stations, no fresh

adjustment has been carried out. This has resulted in the various series being inconsistent with each other. The horizontal control is therefore burdened with varying degrees of errors; say from a few metres to as much as 100 metres at places. Many stations are however supposed to of 1st order that is 1 in 50,000. Most of the stations of this control are on hills covered by jungles. Many stations have been destroyed and many others in poor condition, hence not suitable for geodynamic studies and zero/1st order geodetic horizontal control. The need therefore is to provide complete horizontal control of zero and 1st order afresh and adjust it by least squares for the whole country at one go, using available scientific adjustment software. BIGADJUST, the software used by National Geodetic Survey of USA has been obtained by Survey of India to adjust the present control but the same has not been completed and it is not known as to what are there plans regarding this.

It is suggested, that in addition to redefinition of Indian Geodetic Datum a project should be planned to provide horizontal control of zero, 1st and 2nd order throughout India. The following steps are suggested: -

1) Identify places for monuments. Care should be taken to choose places suitable for geodynamic studies also. Rooftops of permanent public buildings can also be chosen in preference to hilltops in many cases, as the control will now be provided using GPS.

2) Design suitable monuments and carry out construction of monument pillars. It should be seen that pillars are fixed to bedrocks to be suitable for future geodynamic studies.

3) Design network and observe all vectors using dual frequency geodetic GPS receivers in relative positioning mode.

4) Process the data using scientific software such as Bernese.

5) Adjust the data by least squares using network adjustment software such as BIGADJUST.

6) Compile the data in a suitable format for use for various purposes and for dissemination to public.

Vertical Datum and Height Control

In India, the vertical datum for heights has been chosen as the **mean sea level** at a group of nine tidal observatories situated at various Indian ports. Hourly tidal observations were carried out at these ports for a number of years and averages obtained.

It was assumed that the mean sea level at these ports, belong to the same sea level surface. All these ports served as

issue points for the first level net of India. Leveling net in India consists of first level net of moderate precision covering 18,000 miles started in 1858, and second level net of 16,000 miles based on first level net. Second level net was adjusted on to first level net wherever necessary. We can see clearly from the above that assumptions were incorrect. Precision was moderate and adjustment was not carried out properly. Choice of vertical datum was not unique and creates confusion. Gravity observations were not carried out which is necessary for National Level Nets of high precision and 1st order accuracy. The present heights are thus in varying degrees of error and are not of present day standards. These cannot be used as basis for geodynamic studies and many geodetic and geophysical studies where 1st order vertical control is required. It is therefore suggested that a fresh vertical datum be adopted and vertical control of 1st and 2nd order be provided by spirit leveling along with gravity observations. The following steps are suggested: -

1) Select a tidal observatory where hourly tidal observations of 18.6 years cycle of successive nodes of the moon are available. Construct a few permanent benchmarks near the observatory in stable and protected area. Provide heights of these benchmarks by 1st order spirit leveling from the chart datum to the benchmarks. These benchmarks should be taken as issue points for the fresh leveling network of India. The mean sea level obtained here should be the National Mean Sea Level for India at this observatory. Tidal observatory at Mumbai port may be chosen for obtaining the mean sea level. Design the network and construct the benchmarks along the routes selected for leveling in phases. Leveling of 1st order should be carried out along-with gravity observations using relative gravimeters throughout India.

2) Carry out adjustment of the network by least squares at one go and document the heights along with description of benchmarks.

3) Construct a few permanent benchmarks near other tidal observatories also. Find mean sea level at these observatories also and provide heights of the benchmarks constructed near the observatories from the chart datums of such observatories by 1st order leveling. These will represent the local mean sea level in those areas. There will be some difference between the national mean sea level heights and local mean sea level heights. The difference can be applied to heights in that area wherever needed based on sound statistical analysis. Scientific analysis of various mean sea levels and heights may be carried out for geoidal, geodynamic and geophysical studies.

4) All the monuments constructed for zero and 1st order horizontal control, should also be connected by 1st order spirit leveling. Monuments constructed for geodynamic studies should also be similarly connected.

Gravity Datum

Presently we do not have a gravity datum in India. The National Base Station of Gravity is at Dehra Dun. The gravity values at the base station were first provided by Lenox Conyngham from Kew reference station using Potsdam pendulums. The value obtained was 979.o63 cm/sec^2. The values of Dehra Dun base station were again provided in 1906, 1913, 1924, 1929, 1932, 1939 and 1948. The last value, provided by Woolard and Gulatee from Washington via Delhi using Worden and Frost gravimeters is also 973.063 cm/sec^2. Minimum value is 979.054 of 1924 and maximum 979.085 0f 1932. It can be seen from this that the gravity observations were not very reliable even for the National gravity base station. The spread of observations is 31 mgal and it is interesting to note that 1904 and 1948 values are the same. A precise gravity network of 42 stations was established in 1971 by Survey of India covering airports of the country with an uncertainty of + or – 0.05 mgal. These stations served as reference for future gravity surveys in India. This gravity network was adjusted within the framework of International Gravity Standardization Net 1971

(IGSN 71). La-Coste and Romberg model G gravimeters were used for observations.

Until recently we did not have any absolute gravimeter. Recently NGRI has acquired one absolute gravimeter, which is being used by them for scientific research. We have to plan establishment of absolute gravity datum in India and connect existing gravity stations to the absolute gravity station/stations as we can see from the above paragraph that gravity values in India are not so reliable. It is hoped that NGRI will take leading part in this project. All first order horizontal control monuments and 1st order leveling bench marks should be connected to gravity network so as to have 1st order gravity values. This will facilitate precise repeat gravity observations for geodynamic applications such as 1) Detection and interpretation of vertical ground motion in earthquake prediction. 2) Monitoring and interpretation of post earthquake motion. 3) Postglacial rebound studies. 4) Monitoring of movement of magma in volcanic areas along with leveling. 5) Reservoir depletion studies of all kinds. 6) Tectonic motions and crustal warping studies.

Indian Geoid

Presently no satisfactory Indian geoid is available. To obtain heights above MSL with GPS we need a geoid, which can give geoidal undulation accuracy of about 25 to 50 cm or better. It is therefore necessary that a project should be taken up to determine Indian geoid by gravimetric as well as by astro-geodetic methods.

Projection for Maps

All topographical maps in India are on polyconic projection. Assumptions and approximations applied to it make it a mockery if we say that a projection has been adopted. The sheets on 1:25,000; 1:50,000; and 1:250,000 topographical sheets are individually projected assuming that distortion along meridians can be neglected. There is no distortion along parallels. Besides these the meridians and parallels are joined by straight lines. This means that it is not a projection. It amounts to assuming that the earth is flat in respect of individual sheets. It has created a lot of problems in integration of different maps, compilation of maps, digitization and hence in GIS. National Map Policy has since been adopted; Open series maps are to be on Universal Transverse Mercator (UTM) projection on WGS 84 datum.

USA has adopted NAD 83 and not WGS 84. Likewise many other countries have adopted their own datum. It is not proper to adopt UTM projection for India, as all six degree zones covering India have origins on equator and not in our own country. Northing values in these zones become very high which is not desirable. We should design suitable zones in Transverse Mercator or Lambert Conformal Conic or both as in USA and have origins of zones in India. In place of WGS 84 accepted in the Map Policy, we should define our own Indian datum and adopt it for mapping. Further, It is also recommended that each state in India or combination of two are three small states be designed and adopted so that each state has only one coordinate system for all mapping in that state specially for cadastral maps.

In case UTM is adopted for states as in Andhra Pradesh we may have as many as three UTM zones resulting in three coordinate systems in one state which will present difficulties and will be nightmare for all those dealing with these coordinates and maps.

Indian Grid

Indian grid was designed during British days dividing India into 9 zones in Lambert Conformal Projection. The grid is not satisfactory as scale error at central parallels is 1in 850 and 1 in 650. Distortion is considered high. We should aim for 1 in 2500 but should not be more than 1 in 1000. Restriction of the grid is also irrational as parameters and all information about it is available to everyone anywhere in the world except in India. There is therefore an urgent need to design grids afresh. We should adopt either Lambert Conformal Conic or Transverse Mercator depending upon whether the area to be projected is greater in E-W extent or N-S extent. The present grid on maps of border areas with hostile neighbours is a security risk. We should immediately adopt a new grid immediately in such areas for our maps. Further it will be appropriate if a separate grid is adopted by each state

of India. Some such grids have already been designed e.g. for Andhra Pradesh, Tamil Nadu, Karnataka, Maharashtra etc. by the author.

Concluding Remarks

Geodetic Infrastructure in India is the same as provided prior to independence. All further work is based on this infrastructure, which is thoroughly inadequate for mapping requirements to support rapid development, growth, defence and scientific research viz. geodynamical studies, crustal movements, plate tectonics, earthquake prediction research.

In view of what is stated above, the following recommendations are made:

1. Transverse Mercator or Lambert Conformal Conic projection should be adopted.

2. Construction of appropriate monuments for horizontal control.

3. In place of WGS 84 accepted in the Map Policy, we should define our own Indian datum and adopt it for mapping In order to deal with the above basic issues, A national Committee of experts be formed to examine the above issues and come out with recommendations within a specified time-frame.

4. National Geodetic Institute be established at the earliest to supplement the geodetic activities of Survey of India.

(For list of references please send email to the author of this paper)

The prestigious event ISPRS virtual event is being held 31 August - 2 September 2020 and registration is free. See inside

Readers will find GIS application examples interesting.

Don't lose interest. Keep going. GIS is important for our growth !!

GIS-based land buying system

India will start GIS-based land buying system for international companies

By **News Desk**

-
https://www.geospatialworld.net/news/india-will-start-gis-based-land-buying-system-for-international-companies/ 07/23/2020

Indian government has decided to start Geographic Information System (GIS) based land buying service on a pilot basis to attract foreign companies.

According to an ET Realty report, Commerce and Industry Minister of India, Piyush Goyal is planning to start Geographic Information System (GIS) based land buying service

to encourage foreign companies to invest in India.

He also added that India will identify land for setting up industries through GIS-based tool. Mr. Goyal stated that the GIS system will have Google earth view where a person sitting in Iceland can locate land in India and can buy it.

An 'early harvest' agreement with the US was also pushed by the minister. He stated that the US and India need to sit down at the negotiating table and work towards a much more sustainable, and much more enduring partnership in the form of a Free Trade Agreement (FTA). He invites US companies to invest in India.

XXIVth ISPRS Congress Virtual Event of the 2020

31 August - 2 September 2020

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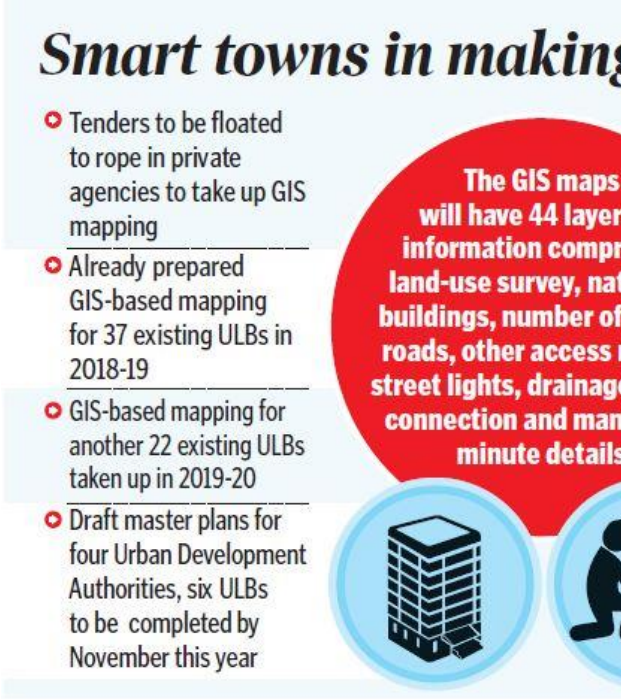
GIS-based master plans for 56 new ULBs in Telangana

It is aimed at ensuring planned development of urban centres across the State

As part of its efforts to ensure planned growth and infrastructure expansion in the newly-formed Urban Local Bodies in the State, the State Government is planning to make effective use of technology, including Geographic Information System (GIS) mapping to identify, map and demarcate different places and plan initiatives accordingly. Around 56 newly-constituted municipalities in the State will soon have GIS-based master plans aimed at planned development of urban centres across the State during the current financial year.

Tenders will be floated to rope in private agencies to take up GIS mapping exercise in the ULBs. Consultants will be engaged for preparation of these GIS- based master plans for the 56 newly-constituted municipalities, which would be divided into four packages.

A top official at the Municipal Administration and Urban Development Department told Telangana Today that GIS mapping was being used for preparation or revision of master plans in the State. The GIS maps will have 44 layers of information comprising land-use survey, nature of buildings, number of floors, roads, other access routes, streetlights, drainage, water connection and other such minute details. The authorities can gather and analyse data including spatial location that would facilitate them organise layers of information into visuals using maps and 3D scenes and help reveal patterns, relationships, and situations for smart decision-making.



“The GIS-based master plan will help us to prepare action plans for planned growth of these areas and ensure development of adequate infrastructure within the fixed time-frame. It will help us identify priority areas or issues which need immediate attention. We have already implemented GIS mapping successfully in several existing municipalities over the past couple of years,” the officials said.

In 2018-19, GIS-based mapping was developed in 37 existing ULBs under Telangana Municipal Development Project. The GIS-based mapping for another 22 ULBS was under preparation and satellite images for these towns had been procured. Under AMRUT scheme, consultants have been engaged for preparation of GIS-based master plans for four Urban Development Authorities including Nizamabad, Khammam, Karimnagar and Siddipet besides six ULBs including Miryalaguda, Suryapet, Nalgonda, Mahabubnagar and Ramagundam. The draft master plans will be completed by November this year, the official added.

Scanning 100 Dutch Railway Stations

The aim of this project was to gain an overview of the station equipment. Geomaat has developed a 3D BIM model from the point clouds so that ProRail can easily overlay the map of the ‘old’ situation with the new situation in three dimensions.

https://www.gim-international.com/content/article/scanning-100-dutch-railway-stations?utm_source=newsletter&utm_medium=email&utm_campaign=GIM+International

- 28/07/2020

Geomaat recently performed extensive 3D laser scanning and 3D modelling for the Dutch railway organization, ProRail.

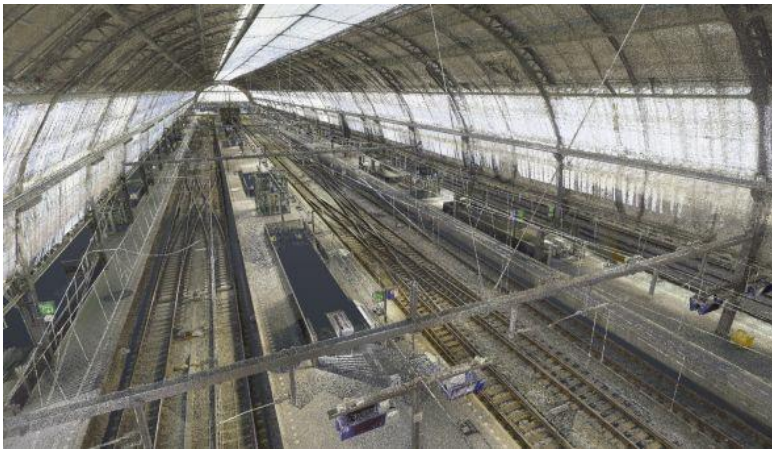
ProRail is the organization that takes care of the entire railway network in the

Netherlands, from construction to maintenance. It is essential that the data in the 'Basic Management Map' (Basisbeheerkaart) which is used to manage the network, is up to date at all times. ProRail works with various suppliers to map the railway network. One of those suppliers is Geomaat, which recently supported Arcadis on a ProRail project in order to add its own experience in 3D laser scanning and 3D modelling to Arcadis' extensive railway-related expertise.

Complex large-scale project

ProRail launched a project to bring – and keep – all the maps used to manage the rail network, including all railway stations, up to date. The project has been divided into three parts. The first part entails an aircraft flying above all the railway lines and stations. The second part entails scanning all objects in the vicinity of the rail network that are not visible from the air, such as in the covered areas at railway stations. The third part entails updating the Basic Management Map and processing all the gathered data (to incorporate the mutations). Geomaat is responsible for executing the second part, and Arcadis is incorporating the data into the Basic Management Map in the third part of the project.

Due to the huge scale of the project, an efficient workflow is essential. Geomaat drew up a plan of attack for scanning all the stations, based on four components per station: preparation, scanning, data processing and quality control. Needless to say, numerous safety risks are associated with working at railway stations, which is why all project members received safety training. Additionally, Geomaat informed each station manager about all the scanning activities in advance.



Lidar point cloud of Amsterdam Centraal Station.

Meeting high demands

ProRail can only work with data that contains a high level of accuracy. Additionally, the project is complex due to its large scale. Therefore, Geomaat provided a smart solution in order to meet ProRail's high quality demands in terms of the 360-degree images and also the 3D point cloud. Geomaat had to be inventive because there is no scanner currently available on the market that can deliver the images and point cloud with the required accuracy. In order to meet the client's needs, Geomaat conducted its own research and came up with an effective solution: a combination of a Leica RTC360 laser scanner with a separate high-resolution camera.

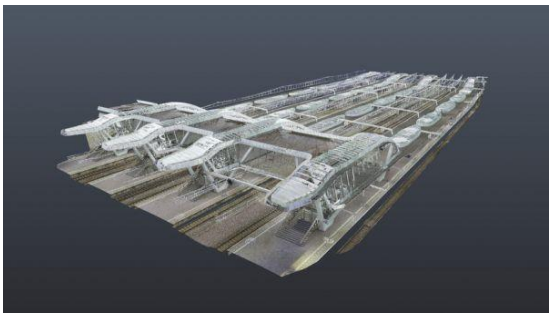
"Those new scanners have made it possible to create the point cloud from the gathered data directly in the field.

Besides that, we purchased a high-resolution camera so that we can capture even better 360-degree images," states Ernst ten Napel, project leader geo.

The success of this method is not without its challenges, such as different centre points and the extrapolation of the right rotation parameters. These are then converted into transformation vectors in order to incorporate the 360-degree images correctly. Geomaat has developed its own innovative way of doing this using tooling, as outlined below.

Innovative tooling

Geomaat supplies ProRail with a coloured RD/NAP-registered point cloud including the 360-degree images. The 360-degree images are incorporated into the point cloud with the utmost accuracy, because the photos and the point cloud must be an extremely precise 'fit' so that the point cloud can be accurately overlaid with the natural colours from the photos. However, the photos are not necessarily used horizontally. One of the characteristics of a 360-degree image is that it does not have a horizontal plane, nor does it have a fixed orientation such as north on a map. Geomaat's Research & Development department develops tools that simplify and improve workflows, and it produced such a tool for the ProRail project: "ProRail requires the panoramic images with north-up orientation so that they can also be used in its own software. A panoramic photo is made up of eight partial images, which means that all those images have to be corrected without altering the how they relate to one another. Matrix calculations are used to determine the rotation parameters for each partial image. This entails rotating the images around three axes, so that the panoramic photo has north-up orientation and all the partial images still fit together seamlessly," says Joukje de Haan, process & innovation specialist.



Arnhem Centraal railway station as a Lidar point cloud.

Checking data

It is very important to get the basics right in order to achieve the required quality, which is why Geomaat has made quality checks a top priority in the ProRail project, according to Niels Domhof, 3D specialist: "We perform lots of checks on the captured data. We always take cross sections along the x, y and z axes, so that we can make sure that all data is well aligned. We also remove all organic elements from the point cloud so that it is nice and clean. To link the registered point cloud to the RD/NAP network, ground control points have been set up at the stations. We also work in line with the four-eyes principle, which means that each point cloud is always examined separately by two different 3D specialists to ensure thorough quality control."

Coronavirus

The coronavirus pandemic has created many extra challenges in everyday life, but has actually proved advantageous for the project in some ways, continues Domhof: “It might sound strange, but the coronavirus outbreak actually came at a good time for this project. It meant that fewer people were present at railway stations and there were hardly any trains on the tracks. As a result, our point clouds were much ‘cleaner’ and we had to remove very few organic objects. Before the pandemic started, we captured Utrecht Central Station. We chose to do so on 2, 3 and 4 January because most people are still off work for the Christmas holiday so it’s a lot quieter than normal. You have to be very flexible in terms of planning when working on such a large-scale project.”

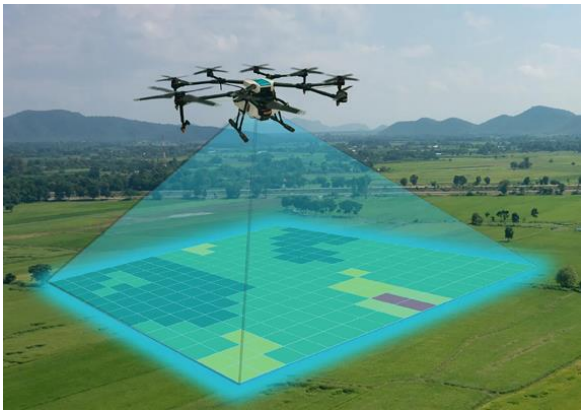
Why Geomaat?

Arcadis approached Geomaat because of its broad knowledge and experience. Over the years, Geomaat has captured approximately 50 railway stations, for various clients. The aim of this project was to gain an overview of the station equipment. Geomaat has developed a 3D BIM model from the point clouds so that ProRail can easily overlay the map of the ‘old’ situation with the new situation in three dimensions.

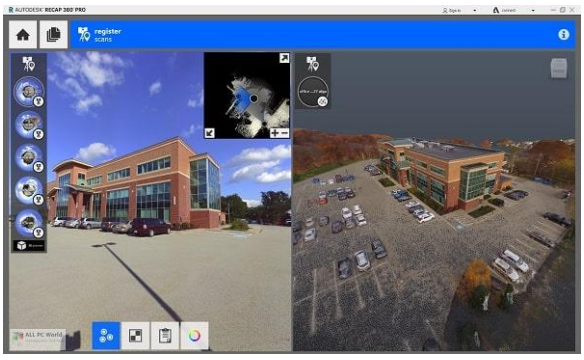
Completion

Geomaat has since completed all the outdoor scans scheduled for the first year. “We’re now in the final phase of completion and preparing the mutation scans,” says Ernst ten Napel, project leader.

Last updated: 29/07/2020



Autodesk ReCap (previously Autodesk ReMake) is a reality capture software developed by Autodesk, allowing you to create really accurate 3D models using reality captures. You can access advanced photogrammetry possibilities such as aerial photogrammetry, and you can measure and edit point cloud data. With Autodesk ReCap you can also access a wide range of tools and, for instance, clean the unwanted objects to work more specifically on a precise object!



Autodesk ReCap Pro 2019 Free Download

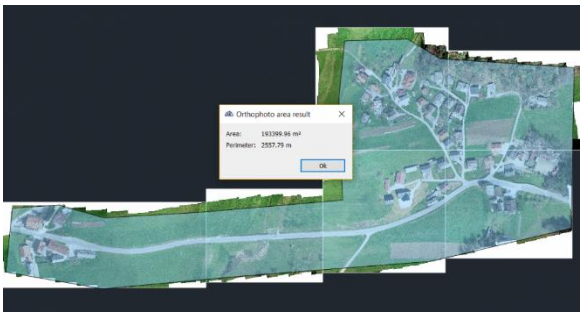
Drone-based 3Dsurvey Map for building a Sewage System

https://www.3dsurvey.si/case-studies/drone-based-3dsurvey-map-for-building-a-sewage-system

This case is showing a modern state of the art company's work case, which made a project for the selected area for the purpose of building a sewerage system. For completion of this project, they needed to measure the area in order to make a survey map which then served as a basis to complete the project.

Technical characteristics:

- The length of the road: 1.3km
- Size of the area: 20 Ha
- Number of flights: 3 flights (1250 photos taken)
- Number of GCPs: 24 – measured with a Total station
- Flight height: 80m



Work flow:

Terrain

1. Placing and measuring of the GCPs on the terrain (24)
2. Measuring of certain details, which are hard to determine on the point cloud – as for example corners of some buildings. All other details were obtained on photogrammetry data. There was no need to do a sketch of the terrain beforehand.
3. Drone overflight to measure the data.

Time spent on the terrain: 8 h, 2 persons