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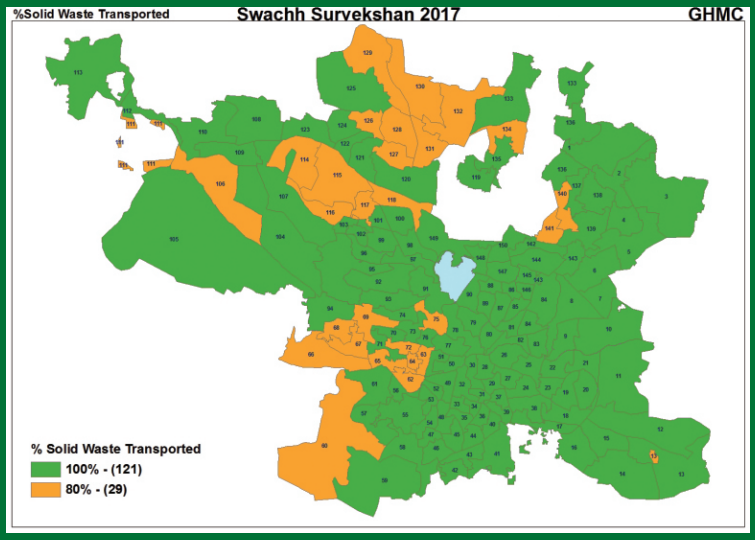

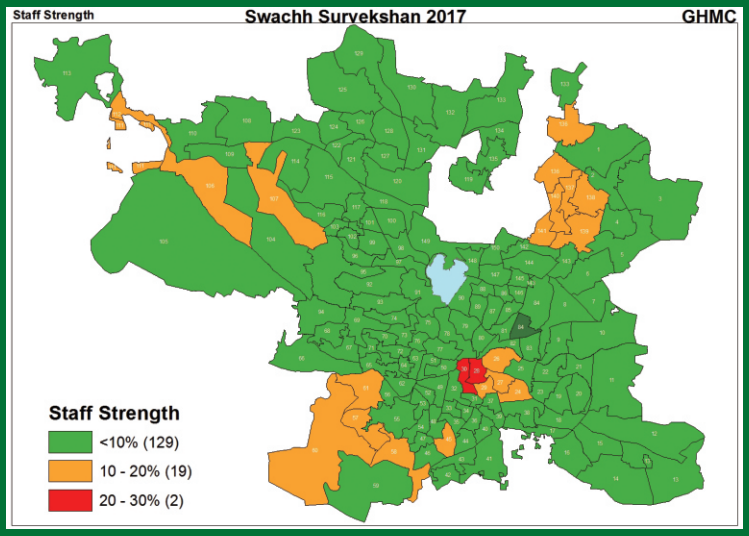

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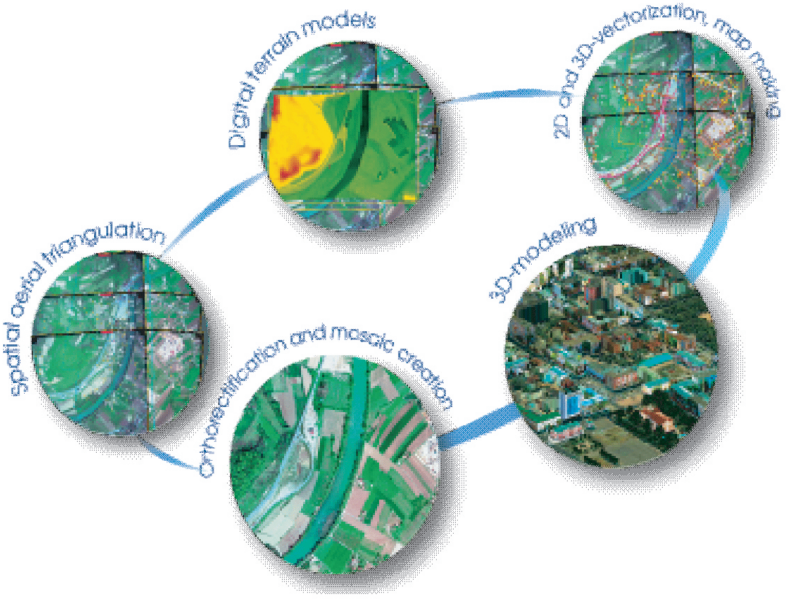
Students Forum

Department of Geography at Osmania University, Hyderabad offers post-graduate courses in MSc Geography, MSc Geoinformatics and PG-Diploma in Geographical Cartography. The department has GIS lab, Cartography lab & Remote Sensing lab. Faculty, scholars and students of the Department celebrated ‚World Environment Day' on 05th, June 2019. The theme was, 'Save trees - Save water - Save earth'. On the occasion a group photo was released

(Prof A Bala Kishan, Head, Department of Geography,
email :prof.balakishan9909@gmail.com / https://www.osmania.ac.in)

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

MAPS TODAY

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Editorial

Direct Georeferencing under Mohan's Musings in May 2019 issue of Maps Today generated some interest. More informative articles on this topic are covered on this topic in this issue.

3D printing is catching up. Read about how NASA is experimenting with this. One case study of 2015 and information on Open source 3D printing SWs available now is given in this issue.

The world's tallest, Statue of Unity in Gujarat commissioned in May 2019 used a range of geospatial technologies. Read in this issue, case studies pertaining to applications of GIS/GST in various sectors.

The informative article on Google My Maps an online mapping tool, shows how students can create and share their own maps.

Article on lakes is thought provoking. It is a case of implementing policies.

Abstracts of three articles related to water management (Today's hot topic) are included as GIS can deal with issues like water distribution, water conservation , reducing leakages, water utility, ground water, etc.

Note on GIS for waste management for Hyderabad city is yet another example of GIS application.

Feedback

Mail dt 21st June 2019

To

Dr V Raghavaswamy, Maps Today

First of all let me thank you on behalf of our dept for publishing our Earth Day Celebration news in Maps Today, May 2019 Issue. Enjoyed reading the Issue which has a different outlook; like the article on maps and art. It gives new insights to studies like US census data analysis . But I have realized & must admit that I have to update myself on new technology as most of the studies are based on GIS applications.

Minakshi P Hazarika

JB College, Jorhat

Assam

To

Dr V Raghavaswamy, Maps Today

Mail dt 24th,June 2019

Our Principal Dr Bimal Barah has written this after going through the Journal.

"The efforts of Team of Maps Today to popularize and rejuvenate the subject geography is highly commendable. I specially liked the efforts to promote open source software which is the need of the hour to take geography to a new level of understanding"

with best wishes

Dr Bimal Barah

Principal, JB College (Autonomous)

Jorhat

Assam - 785001

Yours sincerely

Minakshi P Hazarika

Declaration:

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

3D Printing

3D Printing a Space Vehicle NASA'S HUMAN-SUPPORTING ROVER HAS FDM PARTS

STRATASYS - THE 3D PRINTING SOLUTIONS COMPANY

CASE STUDY

An agile white vehicle roams the Arizona desert, maneuvering the unforgiving terrain as the wind and sun beat down and temperatures swing from one extreme to another. NASA astronauts and engineers are test-driving a rover over rocks and sand, up and down hills in an environment that simulates the brutal conditions of Mars.

This is Desert RATS (Research and Technology Studies), and the rover — about the size of a Hummer and boasting a pressurized cabin to support humans in space — is being put to the test. It could ultimately serve one of NASA's loftiest goals: human exploration of Mars. In the nearer future, similar vehicles might help humans investigate near-earth asteroids.

The rover is integral to NASA's mission to extend human reach farther into space. Its cabin can accommodate a pair of astronauts for days as they study extraterrestrial surfaces. Its twelve rugged wheels on six axles grapple over irregular, unsure terrain. And its forward-jutting cockpit can tilt down to place its observation bubble low to the ground.

3D Printed Rover Parts

To design such a tenacious and specialized vehicle, NASA engineers drew on ingenuity and advanced technology. For example, about 70 of the parts that make up the rover were built digitally, directly from computer designs, in the heated chamber of a production-grade Stratasys 3D Printer. The process, called Fused Deposition Modeling (FDM) Technology or additive manufacturing, creates complex shapes durable enough for Martian terrain.

When you're building a handful of highly customized vehicles and subjecting them to otherworldly punishment, stock parts and traditional manufacturing methods aren't enough. 3D-printed parts on NASA's rover include flame-retardant vents and housings, camera mounts, large pod doors, a large part that functions as a front bumper, and many custom fixtures. FDM offers the design flexibility and quick turnaround to build tailored housings for complex electronic assemblies. For example, one ear-shaped exterior housing is deep and contorted, and would be impossible — or at least prohibitively expensive — to machine.

For its 3D-printed parts, NASA uses ABS, PCABS and polycarbonate materials. FDM, patented by Stratasys, is the only 3D-printing method that supports production-grade thermoplastics, which are lightweight but durable enough for rugged end-use parts.

Failure is Not an Option "You always want it to be as light as possible, but you also want it to be strong enough that it's got your safety factors, that nobody's going to get hurt," NASA test engineer Chris Chapman says. NASA's mantra regarding human space travel is: Failure is not an option. The journey to space subjects a vehicle to intense stresses, starting with the launch from Earth. "You're going at several thousand miles per hour just to escape the Earth's atmosphere. So you've got to be able to handle all these vibrations just to get out into space, and the vehicle can't be damaged," Chapman says.

NASA engineers also 3D print prototypes to test form, fit and function of parts they'll eventually build in other materials. This ensures machined parts are based on the best possible design by solving challenges before committing to expensive tooling. "Everyone's got a budget to deal with, and we're no different," says Chapman.

Every day, NASA engineers and their devices bridge the gap between practical concerns such as budget and manufacturability, and the human drive to discover the secrets of unfamiliar worlds — in the workshop, in the desert, and eventually on another planet.

Watch a video of the rover's story online at Stratasys.com/Rover

3-D uncertainty-based topographic change detection with structure-from-motion photogrammetry: precision maps for ground control and directly georeferenced surveys.

White Rose Research Online URL for this paper: http://eprints.whiterose.ac.uk/112711/

James, M. R.a, Robson, S.b and Smith, M. W.c

Lancaster Environment Centre, Lancaster University, Lancaster,

(corresponding author: m.james@lancs.ac.uk,)

Short title: 3-D uncertainty-based change detection for SfM surveys

Abstract

Structure-from-motion (SfM) photogrammetry is revolutionising the collection of detailed topographic data, but insight into geomorphological processes is currently restricted by our limited understanding of SfM survey uncertainties. Here, we present an approach that, for the first time, specifically accounts for the spatially variable precision inherent to photo-based surveys, and enables confidence-bounded quantification of 3-D topographic change. The method uses novel 3-D precision maps that describe the 3-D photogrammetric and georeferencing uncertainty, and determines change through an adapted state-of-the-art fully 3-D point-cloud comparison (M3C2; Lague, et al., 2013), which is particularly valuable for complex topography. We introduce this method by: (1) using simulated UAV surveys, processed in photogrammetric software, to illustrate the spatial variability of precision and the relative influences of photogrammetric (e.g. image network geometry, tie point quality) and georeferencing (e.g. control measurement) considerations; we then present a new Monte Carlo procedure for deriving this information using standard SfM software and integrate it into confidence-bounded change detection; before demonstrating geomorphological application in which we use benchmark TLS data for validation and then estimate sediment budgets through differencing annual SfM surveys of an eroding badland. We show how 3-D precision maps enable more probable erosion patterns to be identified than existing analyses, and how a similar overall survey precision could have been achieved with direct survey georeferencing for camera position data with precision half as good as the GCPs'. Where precision is limited by weak georeferencing (e.g. camera positions with multi-metre precision, such as from a consumer UAV), then overall survey precision can scale as n-½ of the control precision (n = number of images). Our method also provides variance-covariance information for all parameters. Thus, we now open the door for SfM practitioners to use the comprehensive analyses that have underpinned rigorous photogrammetric approaches over the last half-century.

Book Review

Title : Where will Man Take Us.

Author : Atul Jalan : Publisher : Penguin, Year 2019

(Review by Dr.V.Raghav Swamy)

The book has 26 chapters divided into 5 sections. It describes about the future of humans in the advancement of new technologies. The chapters cover topics from nanotechnology to artificial intelligence, quantum computing to genetics. The sections cover creation of technology, data science, blockchain & cryptocurrency, artificial intelligence and the new humans the technology will create. The author looks at how science, technology & new inventions might help to solve human society's greatest mysteries. It is a good read for students and for all those believers in technology. It is available in paperback in 272 pages and costs Rs 399/- *(email : vraghavswamy@yahoo.com)*

Mohan's Musings

Bundle- Block-Adjustment Demystified

If you are not swayed away by this time with the title of this musing, then stay with me for a couple of more minutes – lest you continue to be confused with this very important and primary photogrammetric process.

We by now know that the camera's exterior orientation (EO) is defined by its position XYZ and attitudinal angles -omega phi kappa. These 6 parameters are to be determined accurately so that the measurements we make from the photographs are reliable.

How do we get or deduce these six parameters? In the previous musing, we discussed direct georeferencing technique whereby EO is directly determined by various onboard sensors such as GPS and IMU. This technique came into vogue since last 2 decades. Prior to that the EO used to be computed analytically using only ground control points (GCPs).

For determining EO of a **single photograph**, we need to have 3 distributed GCPs – to be precise 2 horizontal controls for scaling and 3 vertical points for leveling. We write collinearity condition equation – connecting the ground coordinates of GCPs, camera centre and the corresponding image locations – and solve for EO iteratively. Initial XY of the camera is the mean XY of the GCPs while flying altitude the initial Z.

For determining EO of **2 overlapping photographs**, we can still manage with only 3 GCPs – provided they lie in the common area (or the model area) of the photographs.

Let us stretch it further where you are to handle **100s of photos** – as seldom, or never, the project area to be mapped is covered by one or two photographs. To give you an idea, a small district of India will have to be covered by about 4000 photos of medium scale. Now to compute EO of these 1000s of photos, how many GCPs are needed? Frighteningly enormous – isn't it?

And GCP acquisition is time consuming and a pretty expensive exercise. Hence, a smart technique was evolved in 1950s to minimize the requirement. It is now being called Bundle Block Adjustment (BBA). Let us interpret each of these words from mapping perspective: Bundle, Block and Adjustment. A *block* is the set of overlapping photographs covering the project area. A *bundle* is a bundle of photogrammetric rays (or collinearity constraints) mathematically developed for each point – GCPs, tie points and pass points as well.

We know that pass and tie points are present in multiple models- thanks to the usual 60% overlap and 20% sidelap. Each model computes the ground-space coordinates of tie and pass points. Hence, you have multiple XYZs for the same point – albeit the difference in coordinates is small or negligible. So, the statistical average of these coordinates is the *adjusted* XYZ that we list and use as derived control/check points.

Remember, least squares theory is widely used in photogrammetric analytics involving huge redundancy; processes are highly iterative; and the computed coordinates go through *adjustment*.

Let us understand how BBA is done for a large block with optimal control. Visualize you have taken a series of overlapping photos of a beautiful landscape. And you printed them. To reconstruct the scene, you carefully place one over the other so that common area is cut out. You may glue them together to provide a seamless view. Such a mosaic, mathematically, is possible to be made with pass and tie points. Stereo models thus made are parallax free, contiguous and seamless-but the 3D measurements are still in arbitrary space. So let's bring in GCPs to transform the coordinates from arbitrary space to ground space. Moot point is how many GCPs are needed?

Having appreciated that the block of photos is one entity- with strong internal relationship established through glue points of common areas- can we support this entity with 3 control points like we did in single model case? Theoretically yes. However, to contain the sag of the

Contd...8

Predictive Machine Learning Algorithm Forecasts Potential Water Main Breaks

https://nobelsystemsblog.com/predictive-machine-learning-algorithm-forecasts-water-main-breaks/

Nobel Systems has developed a new Predictive Machine Learning algorithm that enables water utilities to forecast the likelihood of pipe leaks and system failures. The breakthrough algorithm allows services to create a preventative pipe replacement plan that will reduce costly ruptures.

Nobel IoT Engineer Tanmay Thakur created the new algorithm, which uses artificial intelligence (AI) or Machine Learning. The model gives a Prediction of Leak (POF) rating based on historical and present GIS/IoT data collected via GeoViewer. The data is exported into the model and analyzed. The results are pushed back to GeoViewer as a geospatial rating, indicating the POF for each analyzed pipe segment.

The POF enables water companies to create a preventative maintenance plan to avoid unforeseen water main breaks and costly disruption of water service.

The type of data collected includes pipe age, length, diameter material, install date, the pressure of pipe static, and elevation of installation. Other factors include soil type, weather, and road ratings, which differentiates Nobel's method from other systems.

Nobel's Predictive Machine Learning algorithm analyzes the correlation between historical leak data with infrastructure, environmental, and geographical parameters gathered by GeoVIewer. The model produces a highly accurate POF for a utility's entire water distribution system.

A utility can use the POF to budget a pipe replacement plan where necessary.

New Model Utilizes Neural Network Algorithm

Nobel's Predictive Machine Learning model uses a neural network algorithm. Neural networks are loosely modeled on the human brain and designed to recognize patterns.

The neural network translates real-world data into numerical patterns, which helps cluster and classify data. Deep learning via classification enables the correlation of data. The more data available, the more likelihood of establishing relationships between past and future events.

Unique factors that Nobel's Predictive Machine Learning algorithm uses is the use of detailed weather, soil, and road conditions.

Harsh or extreme weather conditions, such as it being sunny one day and cold the next, can cause pipes to expand and contract at higher rates, reducing the lifespan of pipes. High soil salinity can cause rapid pipe erosion. If pipes are located near a railroad, ground vibrations can cause higher probabilities of failures.

The predictive model takes into account all these factors, in addition to other data, to produce an accurate POF, or prediction of failure.

Utilities can develop a preventative maintenance program using the POF data to replace pipes that are more likely to leak. The predictive maintenance ensures uninterrupted water supply and distribution and reduces costly pipe system repairs.

(For details visit the website)

Mohan's Musings

Contd...8

block; to reduce the tensions in the block and to limit the propagation of errors, we introduce a few more points. And of course, a few check points to independently verify the adjustment process.

The output of BBA include EO of all camera stations, XYZ of tie and pass points, camera calibration parameters, error log, check point analysis – besides input data such as GCP data, image coordinates.

Can we reduce the GCP requirement to bare minimum? The EO obtained through direct georeferencing is so good that it just requires one control point at each corner of the block to adjust the whole block however large it may be. Great savings in money and no time overruns.

BBA is a challenging and yet interesting process. In every new block, be ready to expect known unknowns, and of course unknown unknowns besides known knowns. It is a common practice to dichotomise the large blocks into manageable sub-blocks. Adjust the sub-blocks individually and merge the sub-blocks in the final stage. It helps if one gets a bit of hang on the least squares theory, geometry of camera, error analysis and knack of interpreting the long reports and graphs that roll out of every adjustment. Another essential ingredient one should display is patience. A spoonful of it makes the process delicious- I mean- reimbursing and repaying!

Urban Lakes in Hyderabad Reasons and Measures to Save Kapra Lake from Dissipation

Dr.KavitaToran
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A lake is an area of variable size filled with water, localized in a watershed that is surrounded by land, stream or any other outlet to feed or drain the lake waters [1]. Lakes exist on land, larger and deeper than ponds and are distinct from lagoons [2]. Though, most of the lakes are fed and drained by streams, they are distinct from rivers /streams which have flowing waters. Natural lakes are generally found in glacial terrain, lowlands of hilly terrain, as oxbow lakes along the paleo-courses of rivers and so on. All lakes are temporary over geologic time scales, as they will slowly fill in with sediments or spill out of the basin containing them.

Hyderabad is the capital city of Telangana and is located along the banks of the river Musi. The city with a spread over of 650 sq.km has a population of more than 6.9 million (GHMC, 2016). At an average altitude of 542 metres (1,778 ft), much of Hyderabad is situated on Deccan terrain of rocky and undulating landscape, dotted with many lakes of small and big size. The most popular is lake Hussain Sagar located in the middle of city. It is built by Ibrahim Quli Qutub Shah in the year 1563 over an area of 5.7 sq. km. The lake is part of Musi river catchment and was the source of water supply to Hyderabad, before Himayat Sagar and Osman Sagar were built on upstream of river Musi. It also separates Hyderabad from its twin city Secunderabad. Few other important lakes in Hyderabad are Mir Alam lake (named after Mir Alam Bahadur) in south, built in 1806 during the reign of third of Nizam of Hyderabad; Shamirpet lake (Nizam reign), in north, and Saroornagar lake (1626) in east, to mention few important lakes in the city.

Fig 1 Satellite view of Kapra lake and its surroundings.(Google Image, 2017)

Kapra Lake, Sainikpuri, Kapra Municipality,

Kapra lake or Oora Cheruvu is located in the Kapra municipality, near Sainikpuri, in the north-east part of Hyderabad city. (Fig 1). The length of its bund as observed is around 1254 m.

The lake has two feeder channels and two sluice gates. The lake being part of a chain of water bodies, wherein, the surplus course of water from water body in upstream flows down into the lower water body. It is said, a decade ago the lake was the main source of fresh water to the residents residing in Sainikpuri (Anonymous).

Table 1 Attributes of Kapra Lake

Surface Area	113 Acres (Presently 70 Acres)
Average Depth	547.87 m
Maximum. Depth	551.61 m
Surface Elevation	536 m

(Source: GHMC, 2016)

A one time deemed pristine and pollution free but it is now marked as polluted[2] and susceptible to encroachment and dumping of waste. As the details in Table -1 the area of the lake which was 113 acres (46 ha) is reduced to 70 acres (28 ha), largely due to construction and dumping of waste.[3] A part of the Kapra Lake stands

encroached for the past few years[4]

Reasons for Kapra Lake Dissipation

Many freshwater lakes, streams and ponds are polluted. The causes of pollution could be many. One major cause is due to construction of houses and industrial sheds close to lakes and ponds. The untreated water is let out by homes and industries directly into lakes. The contaminated water, thus gets mixed with the fresh water and damages the aquatic system and make water unfit for drinking . Reasons for dissipation are discussed below.

- **Rapid Urban Development**

Challenges of a growing city would be many. Rapid and unplanned urbanisation block the feeder channels of lakes, which eventually lead to drying of lake beds. The dry exposed lake bed land became lucrative for un-authorised construction. Several residential and commercial establishments get sprouted on such lands and the sewage from them find their way into whatever left over part of lakes. Intermittent regularization drives by local government eventually these buildings gets a legal tag. It has been seen, migration of villagers to cities in search of economic opportunities and jobs, settle down close to lakes due to availability of free land and source of water. People living in such slums around the lakes use water for washing clothes, cattle and bathing. Lakes are a single source of drinking water for domestic animals. Contaminating of lake waters affect the health and hygiene of local population.

- **Encroachmentand Un-Authorised Construction**

Encroachment and un-authorised construction is big menace for all lakes. Over a period of time, many un-authorised houses have also been noticed to have been constructed in the lake bed, turning it into a polluted water body. One has to digress as to how right decisions are avoided in municipalities from preventing such developments in lake beds. Death of many such beautiful urban lakes is often due to negligence by human decision making. In early 2014, a network of activists called *'Save Our Urban Lakes'* (SOUL) filed a *'Public Interest Litigation'* (PIL) petition in the High Court against the constructions within the *'Full Tank Level'* (FTL) of Kapra lake and alleged the complicity of State officials. A status report filed by the Telangana government reveal, rampant encroachment in lake beds located in Hyderabad and adjoining Ranga Reddy districts. The report identified twenty five encroachments within the FTL of Kapra lake, including a temple, badminton courts and concrete houses, but does not mention a tennis academy that is named in the petition.

- **Improper Waste Disposal**

Garbage is regularly disposed into the lake. Plastic bags and industrial waste from butcher shops litter the lake front. At times, people perform religious puja and death rituals right here. The stink becomes unbearable sometimes and mosquitoes have become a menace due to presence dirty waters. The lake surface is covered with floating weeds and plastic material. Garbage heaps can be seen all over the banks, once clean where, children use to play and families sit to relax. New apartments and houses around the lake dump the untreated sewage directly into the lake and people from nearby households, markets also dump vegetable waste and plastic, choking the lake for ever.

Measures to save Kapra lake from Dissipation;

As Kapra lake is a landmark water body in Kapra municipality and a very important source of ground water recharge, potential recreation spot and an open urban space it is imperative to protect and save the lake from slow extinction .A few measures are hereby suggested to conserve and preserve Kapra lake.

- Declare the lake and its lake front a *'No Development Zone'*.
- Stop releasing Raw sewage directly into the lake. Build, *'Sewage Treatment Plant'*(STP) to release treated water into the lake.
- Desilt the two feeder channels and outflow channels in order to maintain a clear depth and width for uninterrupted water flow.
- Strengthen sluice gates for ease of operation of water flow during monsoon in flows into the lake
- As a measure of protection, Construct fence around lake to avoid dumping of garbage and litter into the lake.
- Restoration efforts like building bunds to increase storage capacity of lake
- Removal of weeds is important. Clean water would increase aquatic biodiversity of lake, improve water quality and rejuvenation of lake ecology
- Local residents should volunteer to adopt and maintain the lake to prevent encroachment ; Like Mr K L Vyas (Save Lake Campaigner) in 1995 has adopted Saroornagar lake for restoration
- Develop the lake front as an important spot for recreation, plant trees to increase the greenery, place for *'walkers and joggers'* etc
- Sensitize residents, conduct awareness programs about the importance of clean environment, health and hygiene
- Enforce strict measures to prevent encroachments and destruction of lake & lake front; dumping of waste ; discharge of untreated water etc
- Apply Geospatial technology to expedite cadastral survey of (lake) lands, digitisation of land records,

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Excerpts
Groundwater Studies

Rush Springs

https://www.owrb.ok.gov/studies/groundwater/rushsprings.php

The study area includes 4,692 square miles in west-central Oklahoma, underlying portions of Blaine, Caddo, Canadian, Comanche, Custer, Grady, Stephens, and Washita counties. The study area for this investigation was expanded from a 1998 study by the US Geological Survey to include two additional areas where well yields are indicative of a "major groundwater basin" as defined by the OWRB.

xxxxxxxxxxxxxxxxxxxxxxxx.

The study area received an annual average of 28.20 inches of precipitation from 1905–2015. Recharge occurred through diffuse precipitation and discharges through groundwater withdrawals and streams, including Barnitz, Cobb, Deer, and Lake Creeks. Groundwater also supplies baseflow to the Canadian and Washita rivers. Recharge was estimated using the SWB code and the RORA method. Estimates using SWB for the period 1950–2015 ranged from 0.03 inches in 1963 to 4.63 inches in 2007 and an average annual recharge of 1.4 inches. RORA, which utilizes a base-flow separation technique from streamflow gauging stations, ranged from 0.46 inches in 2006 on the Little Washita River streamflow gauge near Ninnekah to 5.76 inches in 2007 on Cobb Creek streamflow gauge near Eakly. From 1946–2015, at least one station from the study area had streamflow data to estimate recharge using RORA.

Reported groundwater use from the Rush Springs aquifer for 1967–2015 averaged 69,900 acre-feet per year with a median of 62,154 acre-feet per year. During this period, 91.0 percent of reported groundwater use in the study area was for irrigation, 7.8 percent was for public water supply, and 1.2 percent was for other purposes. The highest total reported annual groundwater use was about 115,016 acre-feet in 2014 and 133,113 acre-feet in 2015, which corresponded to drought conditions during these years. In 1992, only 37,210 acre-feet was reported, which was the lowest reported use for a single year; however, the data for that year may be incomplete. The second lowest reported total use for a single year occurred in 2007 at 40,418 acre-feet. Water use trends for the period of record correspond with changing precipitation patterns, with the highest groundwater use occurring during the 2010-2015 drought period and the lowest groundwater use during the wet period in the late 1980s and early 1990s.

Annual water-level measurements collected by the OWRB since the 1950s were analyzed for long-term trends. Water-level data from 95 wells with a period of record of greater than 12 years provided enough data to assess long-term trends. Water-level trends from 54 wells were determined to primarily fluctuate with climate trends, showing declining water levels during drought periods and increasing water levels during wet periods. Data from 15 sites showed overall increasing water levels and 17 sites showed decreasing water levels; nine sites had indiscernible water levels during the period of record. Measurements at the USGS well 351308098341601 had the longest period of record in the study area and showed a decline of 37.52 feet from September 1948 to April 2015.

Lithologic descriptions from groundwater wells were used to determine the base of the aquifer. Generally most of the descriptions indicated a "red bed," "dark red bed," or "red shale" at the bottom of the borehole, which was interpreted to be the base of the aquifer. The contact between the Rush Springs and Marlow formations on geologic maps was used to refine the edges of the aquifer where lithologic logs were sparse; however, this caused the edges of the base of the aquifer to be at higher elevations than what was observed on the lithologic logs independently. Rock cores collected in the study area also show the Marlow Formation consisting of some coarser-grained layers capable of transmitting water that can be considered part of the aquifer system. Therefore, for this study, the Marlow Formation was included as part of the aquifer. Average saturated thickness using the 2013 potentiometric map and base of aquifer is 181 feet with a maximum thickness of 432 feet. The area of greatest saturated thickness occurs along the axis of the Anadarko Basin where the Cloud Chief Formation confines the Rush Springs aquifer.

Hydraulic conductivity was estimated from drawdown analysis, slug tests, aquifer tests, and a percent-coarse

analysis from lithologic logs. The minimum hydraulic conductivity for the Rush Springs aquifer estimated from drawdown data was less than 0.01 feet per day, and the maximum was 90.90 feet per day with a median of 1.63 feet per day and a mean of 3.27 feet per day. Hydraulic conductivity estimated from slug tests ranged from 0.13 feet per day to 7.60 feet per day, with a mean of 1.70 feet per day and median of 1.40 feet per day. Hydraulic conductivity estimates from three multi-well aquifer tests were 1.60, 6.40, and 44.9 feet per day. Using lithologic logs and assigning hydraulic conductivity to lithologic descriptions, mean and median hydraulic conductivity were estimated to be 6.3 and 4.0 feet per day, respectively. Transmissivity estimates for the three multi-well aquifer tests were 219, 956, and 4,129 feet squared per day.

Specific yield was estimated from regional methods and aquifer tests. Using base flow discharge and monthly groundwater-level measurements, specific yield was estimated in the Cobb Creek, Deer Creek, and Lake Creek subsurface watersheds. For this method, the ratio of the volume of groundwater discharged to the volume of the aquifer drained is the specific yield for the aquifer drained. The specific yield estimated for Cobb Creek, Deer Creek, and Lake Creek subsurface watersheds was 0.05, 0.07, and 0.07, respectively. Specific yield estimated from three multi-well aquifer tests was 0.04, 0.07, and 0.09, which correlates with the regional method.

The mean total dissolved solids concentration from 79 samples collected from the study area was 1,106 milligrams per liter. Concentrations ranged from 178 to 4,680 milligrams per liter with a median of 485 milligrams per liter. The dominant cation of the samples is calcium and the dominant anion is carbonate/bicarbonate with a secondary bimodal population of sulfates, which were predominantly collected in areas where the Cloud Chief Formation overlies the Rush Springs Formation. Four samples exceeded the maximum contaminant level for arsenic of 10 micrograms per liter; the highest concentration of arsenic sampled was 16.5 micrograms per liter. Thirteen samples reported concentrations exceeding the maximum contaminant level for nitrates of 10 milligrams per liter; the highest concentration of nitrate sampled was 59.2 milligrams per liter.

(For details visit website)

Urban Lakes in Hyderabad

contd...10

fix, 'FTL boundary, delineate catchment areas of upstream and down stream of lakes, conduct hydrological studies to understand ground water recharge , water quality and water flows etc

- Develop a strong *'Decision Support System'*(DSS) to develop, monitor and manage Kapra lake as ,*'People Friendly Lake'*.
- Private players to contribute to save the lake under,*'Corporate Social Responsibility'* (CSR) voluntary scheme.

Conclusion

Water in a city is not only about pipes and taps [5]. Lake water is an important natural resource. It is very essential for survival of all humanity, flora and fauna. It is also important from the perspective of environment, livelihood , health and hygiene.

Hyderabad is well known as, *'City of Lakes'*.Many lakes dot the urban landscape of Hyderabad. Therefore, conservation and protection of all water bodies such as lakes, ponds, and streams is essential. Along with many lakes ,the Kapra lake is also one of the important lakes in Sainikpuri, Kapra municipality, Hyderabad. The same lake which once provided a source of clean drinking water to the residents of Sainikpuri and adjoining localities is now lying under the shadow of extinction. The efforts by GHMC, Kapra (local) municipality to protect the lake has to increase further to save the lake. They may even engage private players to contribute to save the lake under,*'Corporate Social Responsibility'* (CSR) voluntary scheme.

Finally, local residents too, have to own responsibility to initiate awareness campaigns, sensitize people on benefits of presence of lakes, discourage dumping of garbage into the lake, develop composite pits, carry tree plantation on lake front and so save Kapra lake in particular, and in general all lakes in city of Hyderabad.

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Google My Maps

Caleb Allen
Middle School Social Studies and
Language Arts Teacher
Cincinnati, OH
Twitter: @CalebCAllen

Mapping is a necessary skill in any social studies classroom. As a teacher, I've found that when it comes to mapping, collaboration is tough. Giving a map to a group for collaboration usually means one-two students doing the work of mapping, while the remaining two-three students sit idly and have side conversations.

Google My Maps is an online mapping tool, that allows students to create and share their own maps

This problem makes collaborative mapping difficult to do as a learning activity. Try Google My Maps

Google My Maps, what is it?

Google My Maps is an online mapping tool, that allows students to create and share their own maps. This tool allows students to drop pins at certain locations throughout a map and provide a description of that pin. Students can add different layers for different regions or topics. Other features available to use in My Maps are drawing a line between multiple locations, adding directions to get to a location, and measuring the distance between locations. Students can all be on the same map simultaneously, collaborating on locating different locations to drop pins on or measure.

Using MyMaps in the Classroom

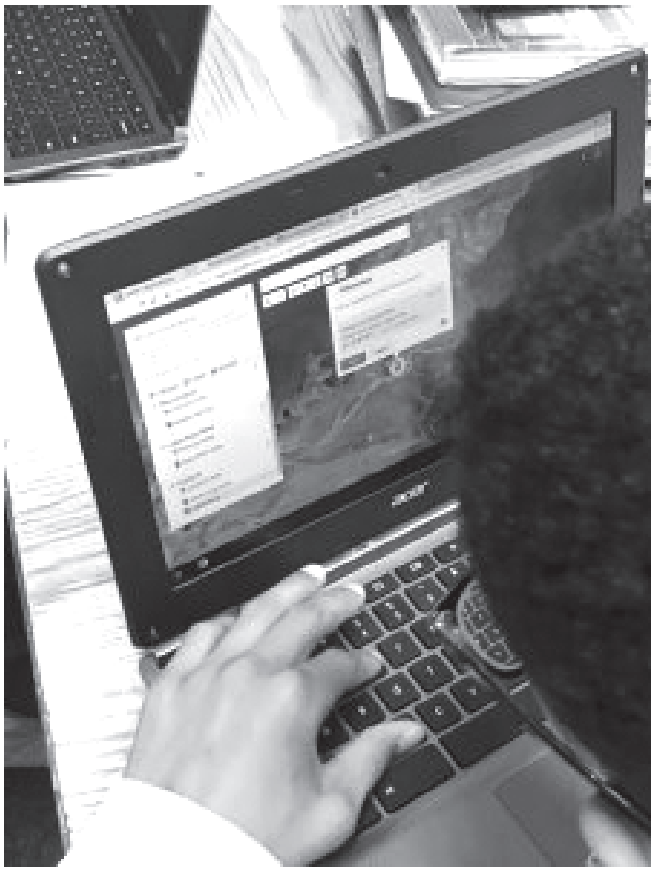
My Maps is best for having students share and work on the same maps together. The map on the left is an example of a My Map that students collaborated together on as a part of station rotation group in my blended learning classroom. Students collaborated together to map out the significant regions of the Middle Ages to Europe and areas that had an influence on Europe. I've also used My Maps in the classroom to map out areas of cultural significance in Ancient Civilizations. Students in my sixth-grade class collaborated on different layers of a My Map to map areas around the world today that show the cultural impact of Ancient Civilizations. My goal is to use My Maps in a collaborative setting more often to plot out significant historical regions of the past but to also connect areas of historical significance in our modern world.

Lessons learned using MyMaps in the classroom?

My Maps is a relatively new feature to my classroom, but I have already learned a lot in my first few attempts.

First thing, in order to have student collaborate more effectively, I should have had students define their roles in the group explicitly. I didn't do this, and the result was many students dropping pins in locations that were already previously pinned.

Second, my groupings were too large for effective collaboration. Great collaborative groups are between 4-5 students, I had 7-9 students in a group. This was not effective in getting students to meet the desired results. Keeping the collaborative groups smaller will allow for more defined roles throughout the task and a better

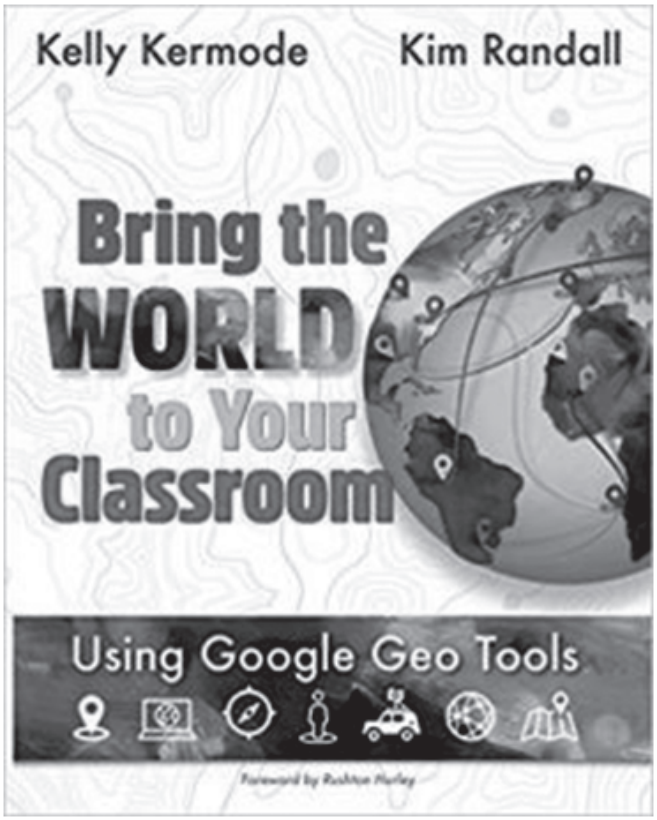


learning experience for the students.

Lastly, Google My Maps can be posted to your Google Classroom stream from your Google Drive, just make sure your directions are very clear. Give students very clear directions when posting this to your Classroom stream to allow students a clear vision of what the purpose of this learning activity is.

Using My Maps isn't only for a social studies classroom either. Teachers can use My Maps for measuring out distances between multiple points in math class. Use My Maps in science to plot points of different climates or trends in weather. Reading an interesting novel in class? Have students map out places in the novel and describe the significance of those regions. This tool allows students to connect learning across multiple subjects.

In conclusion, Google My Maps is a great way to have students collaborate during the mapping process. Not only does this application have use in the social studies classroom, but across multiple subjects as well. Google My Maps is an excellent way for students to connect regions on a map to real-world learning and application. I hope that you give this application a try! Drop your thoughts on My Maps here in this Padlet, or share how you've used this tool best in your classroom.



Want to learn more about how to integrate Geo Tools in your classroom? Check this book out!

Kinesthetic Lessons in Empathy and Digital Citizenship

TED-Ed Clubs: Student Voice and Presentation Skills

Improving Student Learning by Turning on the Light: Technology Enhanced Learning

Comments

Beth Block April 11, 2018

I'm a Latin teacher and I've used the MyMaps feature to have my students create personalized tours of Rome for themselves. Each student has researched a particular attraction in Rome and created a short presentation, which I combined into a large class presentation. Students viewed the presentation and then picked 10 places in the city they would like to visit. I had students trace their itineraries using MyMaps. I like the idea of having them collaborate together to make their itineraries- perhaps I'll try that next year!

RESPONSE

- **Caleb Allen** May 19, 2018
- That's awesome to hear Beth! I feel I can differentiate the map better when I allow students to collaborate. I can set different layers for what I want students to plot based upon their needs. Also having students collaborate is something I'm trying to do more in all of my work with my class, I want students to learn from not only myself but the others in the room as well. Let me know how I can help you if you have questions!!

GIS in Mapping: Mapping is a central function of Geographic Information System, which provides a visual interpretation of data. GIS store data in database and then represent it visually in a mapped format. People from different professions use map to communicate. It is not necessary to be a skilled cartographer to create maps. Google map, Bing map, Yahoo map are the best example for web based GIS mapping solution.

GIS Applications

Case Studies in Geographic Information Systems
For Internet Portals
June 2012

Prepared for:
Office of Planning
Federal Highway Administration
U.S. Department of Transportation

Some excerpts *(Some pictures are shown on cover page 3. For full details please visit h*ttps://scholar.google.co.in/scholar?q=CASE+STUDIES+ IN+ GEOGRAPHIC+ INFORMATION+SYSTEMS+ FOR+I NTERNET+ PORTALS

The following report investigates the experiences of transportation agencies in the deployment of Internet-based mapping portals based on geographic information systems (GIS). The report presents background information, a series of case studies, and a summary of conclusions.

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For today's transportation agencies and organizations, Geographic Information Systems (GIS) is an everyday tool used in many different capacities. Among its myriad applications, agencies use GIS to manage assets such as roads and bridges, map routes for trucks and buses, track safety incidents, plan for new facilities, and monitor traffic activity. As more transportation agencies collect, store, and manipulate spatial data, it has become increasingly important to ensure that these data are accessible to all feasible users.

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With the emergence of the GIS portal, transportation agencies are investing in streamlined spatial solutions, fast performance, and intuitive capabilities. GIS portals are quick, easily readable, online geospatial data viewers. The concept is not unlike a vehicle dashboard, allowing viewers to swiftly get the pulse of the situation without much effort.

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Case studies

The five agencies profiled in case studies are:

- **Kentucky Transportation Cabinet (KYTC) —** An assortment of individual GIS portals tailored toward specific subject matters. Strong outreach efforts and a reduced mingling of unrelated data within each portal allows for a highly customized and valuable tool for many users throughout KYTC. (See screen shot on cover page 3)
- **New York State DOT (NYSDOT) —** The Oversize/Overweight Vehicle Pre-Screening Tool produces information on height and weight restrictions for roadways, as well as diversions caused by construction activity, to support permitting for oversize and overweight freight movements.
- **Georgia DOT (GDOT) —** GeoTRAQS is a new interactive mapping tool developed by GDOT which enables a wide range of users with one-stop access to much of GDOT's publicly available data. The tool is particularly robust in allowing users to specify their data needs by both subject matter and geographic location.
- **Iowa DOT —** An evolving application with an intricate data collection scheme, the Iowa DOT Snow Plow Portal provides decision-makers with real-time and historical materials usage data to influence maintenance activity during winter weather events. It strives to achieve cost savings by modulating the amount of materials used to treat roadways.
- **Kansas DOT (KDOT) —** KGATE is a collection of 70 feature datasets from a variety of different sources through KDOT and others

Xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

Conclusions

GIS portals built by transportation agencies can serve a wide variety of needs, both internal to an agency and external to the general public. Some transportation agencies use GIS portals as a way to manage and query

data pertaining to an agency's transportation assets, or for a specific subset of assets (such as those by a type of mode). A centralized, data-rich GIS application can assist agency employees in querying relevant information related to user-defined characteristics of a transportation system, such as the year of construction for all railroad bridges in a county. This type of tool can help track the conditions of organizational assets, manage maintenance needs, prioritize investment decisions, and address questions from the public or lawmakers. In practice, GIS portals can be complex and resource-intensive to maintain, requiring powerful databases and knowledgeable staff for support. However, a high-quality system can greatly improve an agency's internal operations.

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Asset management systems, such as those for bridges, highways, and pavement, can also be integrated with GIS portals to assist with analysis

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A more data-intensive example of a GIS portal for public consumption is the use of interactive base maps, which allow users to query information relating to the transportation system

Essential Portal Components: *Database; GIS Server; GIS Server*

Lessons Learned : *Focus on the User, Institutional Support, Data Stewardship*

Xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

Performance Metrics

None of the DOTs interviewed for this series of case studies have robust systems in place for measuring the performance of its GIS portal. While most agencies do track web statistics and distribute surveys to solicit feedback from users on the successes and needed improvements of the tool, there are little quantitative data to suggest that GIS portals are generating a return on the investment. Potential opportunities for quantitative measures include cost savings incurred from the release of a certain portal functionality or feature, calculated time savings related to data collection processes for federal documentation requirements, and fuel savings resulting from a reduced number of trips into the field

Landscape and Urban Planning

Volume 89, Issues 1–2, 30 January 2009, Pages 7-16

The impact of detention basin design on residential property value: Case studies using GIS in the hedonic price modeling

https://doi.org/10.1016/j.landurbplan.2008.09.002Get rights and content

Abstract

This study examined the impact of two different detention basin designs on residential property value. The hedonic price model was applied to analyze two College Station, TX, subdivisions. One subdivision had only uniuse flood control detention basins (UDBs) and the other included a multi-use detention basin (MDB) integrating a detention pond with a recreational neighborhood park. Geographic information system (GIS) was used for analysis. Spatial autocorrelation and spatial regression were analyzed. The results indicate that the network distance from the UDBs did not have a significant effect on residential property value. Yet, the properties with a view of the UDBs were significantly lowered in property value. In contrast, the network distance from the MDB where a neighborhood park was merged had a significant impact on residential property value within the 274-m (900-ft) impact area, consistent with expectations. The study also found that environmental amenities such as recreational facilities improved the hedonic price model for the impact area of the MDB, whereas the effect of spatial and locational features was not significant due to its spatial location. The findings of this study imply that thoughtful integration between recreation facilities and detention basins could significantly alter public's perception of detention basins from stormwater collection eyesores to neighborhood parks. The challenge is whether municipal governments are willing to adopt a policy that encourages developments with MDBs as these municipalities will

typically become responsible for maintaining them after construction.

Management of urban green space

Source:Urban land resources and urban planting — case studies from Denmark; https://www.sciencedirect.com/science/article/pii/S0169204600001298

Author links open overlay panelKarenAttwell

https://doi.org/10.1016/S0169-2046(00)00129-8Get rights and content

Abstract

Trees benefit urban communities environmentally, esthetically and recreationally. This raises the question of whether Denmark's towns have enough space for more trees. A research project investigated this by examining in detail the potential for more sustainable planning and management of urban green space in towns with 10,000–40,000 inhabitants and was completed in 1999. The paper describes the vegetation cover in selected urban areas, including the cover of woody vegetation (trees and shrubs) and discusses the land area potentially available for supplementary planting in urban zones. The method used to map urban vegetation is discussed and related to Denmark's administrative practice and planning system. Case studies are presented for various categories of urban land use to highlight the variation in vegetation coverand to identify the land area available for increasing tree cover. Apart from undeveloped urban land, the largest areas potentially available for planting included industrial zones, institutional zones and apartment complexes. Other types of residential district lacked the coherent space normally required for sustainable planting. The cover of trees and shrubs in the case study towns is very limited, but large areas of non-functional lawn could be available for planting. Lawn comprised the largest proportion of the urban surfacecover in the case studies. The findings of the case studies were assembled into data sets relating to each type of urban zone and summed up in green structure maps based on geographical information systems. This approach can provide an overview of best practices to allow areas lacking vegetation cover to be identified. This assessment method can usefully be applied to incorporate issues related to the urban natural environment and urban greening potential into conventional planning practice in Denmark's municipalities.

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Digital Technologies in Surveying & Mapping

15 – 16 October 2019, Hyderabad

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GIS principles and practices

By GS Kumar, former Director, Survey of India and Managing Editor, GIS India.

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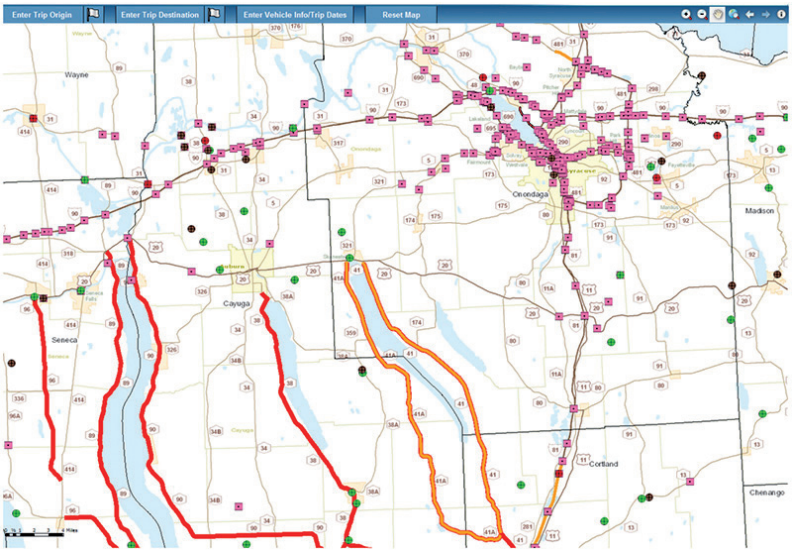
GIS Application – Transportation



Bridge and Road Restrictions

The Pre-Screening Tool shows bridge and roadway restrictions in the area southwest of Syracuse, NY.

Orange roadways signify construction or maintenance activity and red roadways are restricted for large trucks.

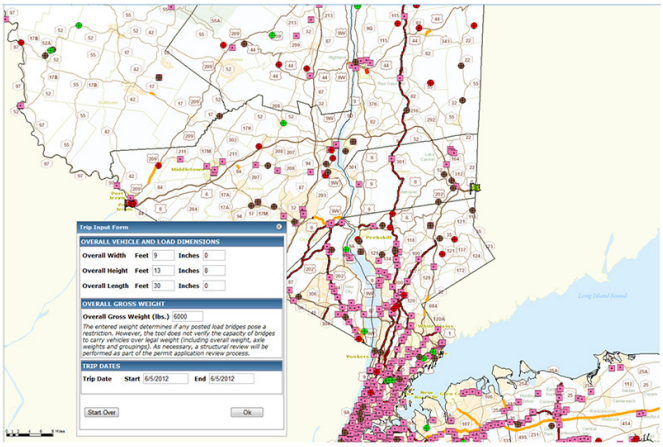
Source: https://www.dot.ny.gov/gisapps/osowscreen/

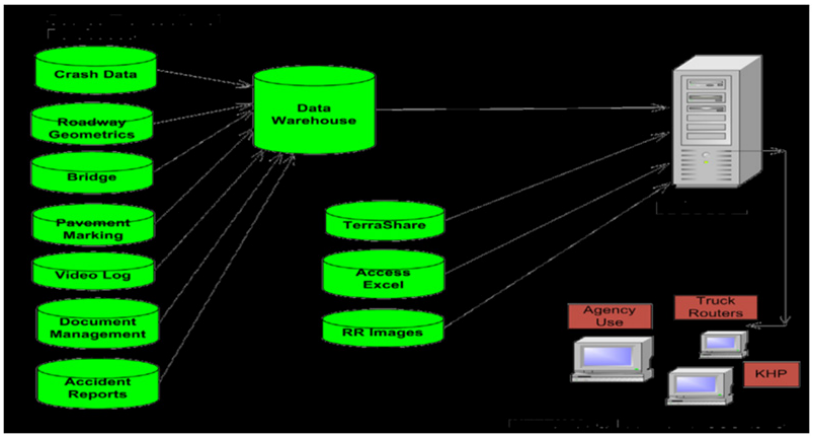
Vehicle dimension entry form

Users can input entry and exit points, as well as the dimensions of the vehicle.

The application shows potential restrictions for a vehicle 9 feet wide, 13 feet high, and 30 feet long.

Source: https://www.dot.ny.gov/gisapps/osowscree





KGATE Data Flow Diagram

Much of KGATE's data is housed in the data warehouse, but a few items have yet to be incorporated or come from other sources outside KDOT.

Source: www.gis-t.org/files/fjCZ2.pdf

Statue of Unity enters 2019 World Architecture News Awards

28 May 2019

- Constructed in a record 33 months, the world's tallest statue stands at 182 metre
- The statue is a memorial to the contributions of Sardar Vallabhbhai Patel in the country's freedom struggle

We were operating in an extremely tough terrain and hence used a range of geospatial technologies like DGNSS, terrestrial LiDAR, drone-based photogrammetry for our geological surveys and sonar for the hydrographic survey. Every one of the 6,500-odd bronze panels were RFID-tagged that rendered assembly and erection much easier

The world's tallest, Statue of Unity in Gujarat built by Larsen & Toubro (L&T), has entered the globally-acclaimed 2019 World Architecture News (WAN) Awards, an official said

The WAN Awards showcase the best international design in current and future projects, and the award ceremony is likely to be held in July.

"This is a significant and deserving recognition of India's engineering skill and project management," S.N. Subrahmanyan, CEO and MD of L&T, said on the recognition for the Indian-made engineering marvel

"The Statue of Unity was by far one of the most complex and challenging assignments we have executed and being featured along with several other global engineering marvels is a truly remarkable achievement, not only for L&T but for the entire nation," he added.

Constructed in a record 33 months, the world's tallest statue stands at 182 metre (597 feet) as a memorial to the contributions of Sardar Vallabhbhai Patel in the country's freedom struggle and the stellar role he played in unifying the country into a nation.

A staggering 6,500 tonnes of structural steel, 18,500 tonnes of reinforced steel, 210,000 tonnes of concrete and 1,700 tonnes of bronze cladding went into the making of the statue by an army of over 4,500 designers, architects, global consultants, engineers and workmen.

L&T's Whole Time Director and Senior Executive Vice-President M.V. Satish said the Statue of Unity is not only a triumph of teamwork but also of digitalization.

"We were operating in an extremely tough terrain and hence used a range of geospatial technologies like DGNSS, terrestrial LiDAR, drone-based photogrammetry for our geological surveys and sonar for the hydrographic survey. Every one of the 6,500-odd bronze panels were RFID-tagged that rendered assembly and erection much easier," Satish added.

The Statue of Unity — one of the few man-made objects visible from space — is situated on Sadhu Bet, 3.2 kms downstream from the Narmada Dam, comprising a complex with a museum, a memorial garden, a designer bridge connecting Sadhu Island with the mainland along the Narmada River, an internal five km-long roadway, an administrative complex, a conference centre and a star-rated hotel.

The statue, designed by Maharashtra's legendary architect Ram V. Sutar, was conceived as a naturalistic depiction of Sardar Patel in his characteristic style in a walking pose, rising out of a star-shaped geometric base that covers the entire Sadhu Hill.

It has a unique, slender width-to-height ratio, far more exacting than existing technical norms that called for special engineering considerations.

Two vertical cores that house high-speed passenger elevators support the steel frames to which around 6,500 bronze panels are clad.

A viewing gallery has been constructed at 135 metres, at the chest level, from where 200 visitors can take in the breathtaking views of the Narmada Dam and other landmarks.

At its height of 182 metres, it is twice as tall as the Statue of Liberty in New York, 100 times larger than a normal human being, and at 70 feet, Sardar Patel's face is bigger than the faces of the US Presidents cut out on Mount Rushmore in the US.

The Statue of Unity is built to withstand winds of up to 290 kmph and earthquakes of up to 6.5-magnitude on the Richter scale.

This story has been published from a wire agency feed without modifications to the text.

Abstract

SAVE WATER, ENERGY AND COSTS USING PRESSURE MANAGEMENT

GRUNDFOS DEMAND DRIVEN DISTRIBUTION REDUCES LEAKAGE LOSSES, INCREASES ENERGY EFFICIENCY AND SAVES OPERATION AND MAINTENANCE COSTS.

Prepared by Marco Fantozzi (Studio Marco Fantozzi, Italy).

Contributors: Allan Lambert (Water Loss Research & Analysis, UK),

Carsten Skovmose Kallesøe, Abdul-Sattar Hassan, Danny Stærk, Sune Lieknins Neve, Morten Riis (Grundfos Holding A/S, Denmark).

https://in.grundfos.com/content/dam/gin/Campaigns/isolutions%202018/WD-Whitepaper

Pressure management has proven to be an effective tool for reducing the leakage part of Non-Revenue Water (NRW), improving energy efficiency and reducing operation and maintenance costs.

This article looks at the benefits of tackling these three issues using pressure management, especially as the predicative models for burst frequency are now more precise. Extended asset life, based on latest research results, is expected to be the largest benefit with pressure management.

A major challenge facing many municipalities is how to deal with high levels of NRW. Although not all NRW is leakage, inefficient management of distribution system pressures is known to cause substantial excess leakage and bursts and other adverse consequences such as reduced infrastructure life.

Meanwhile, water scarcity and water quality are emerging as key issues of public concern and, more pressingly, as inhibitors of growth in cities and countries around the world. In addition, energy is the highest operating cost item after manpower for most water companies. As a result, the water market that treats and transports water is expected to continue to grow rapidly as stakeholders look for new and efficient water solutions, technologies and approaches for improving water resource and distribution management. However, many water utilities continue to struggle with forming a convincing business case to replace and upgrade aging and inefficient distribution networks, while many regulatory policies still fail to reward cost-conscious efforts to upgrade or improve the management of networks.

Pressure management has a great potential to help improve efficiency and alleviate water scarcity concerns. In fact, pressure management is now recognised as the foundation for optimal management of water supply and distribution systems. The proven benefits of pressure management in distribution systems now include not only the water conservation benefits of reducing leak flow rates, but also water utility and customer benefits arising from reduced numbers of bursts and leaks. These are, for example, reduced repair and reinstatement costs, reduced public liability and adverse publicity, reduced costs of active leakage control, deferred infrastructure renewals and extended asset life of mains and service connections. Benefits also include fewer problems on customer service connections and plumbing systems, all leading to fewer customer complaints. The general purpose of this article is to explain and demonstrate the benefits related to pressure management implementation based on the latest research, best practice methods developed by the Pressure Management Team of the IWA Water Loss Specialist Group, and the advanced tools and technologies available. Three main areas of benefits related to pressure management implementation will be specifically addressed: Non-Revenue Water, energy efficiency and operation and maintenance costs. In addition, the latest research advances in assessing pressure management benefits and how water utilities can benefit from large scale pressure management implementation will be explained.

WHAT DO WE MEAN BY PRESSURE MANAGEMENT? Pressure management can be defined as "the practice of managing system pressures to the optimum levels of service ensuring sufficient and efficient supply to legitimate uses and consumers, while reducing unnecessary or excess pressures, eliminating transients and faulty level controls, all of which cause the distribution system to leak unnecessarily" Definition by the Pressure Management Team of the Water Loss Specialist Group of the International Water Association (IWA)

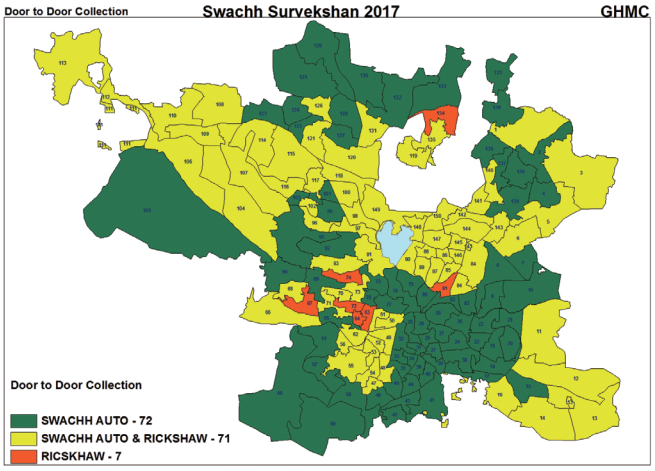
For full paper please visit website

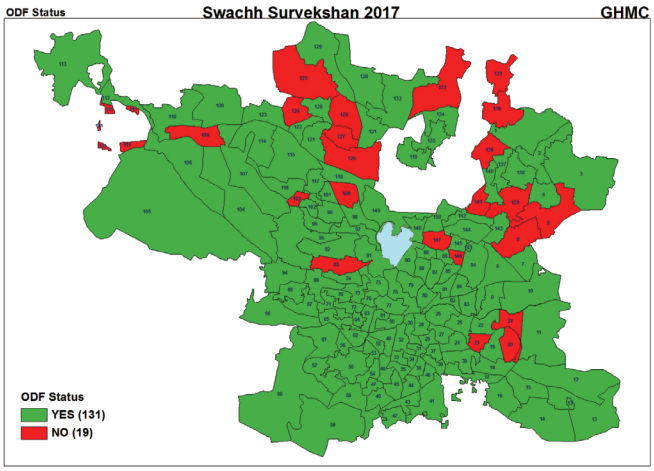
Note on GIS / Map Outputs Hyderabad City Level

GIS for Waste management

Maj Dr. G.Shiva Kiran

- The analysis covers all circles of GHMC area of about 625 Sq Kms.
- Staff Strength map
  - 129 wards in Green have staff shortage < 10%
  - 19 Wards in Orange have staff shortage between 10 - 20% mostly in South and East Zone
  - 2 Wards (29 & 30) in Red have staff shortage between 20-30% in South Zone.
- Door to Door collection
  - 72 wards have door to door collection system with Swachh Autos mainly in South Zone.
  - 71 Wards have door to door collection systems using Swachh Autos and Tricycles.
  - 7 Wards use only Tricycles for door to door collection owing to narrow lanes and slum population.
- Solid Waste Transported
  - 121 Wards transport 100% of the Waste Generated.
  - 29 Wards mostly in the South West and Northern areas transport 80% of the waste generated.
- ODF Status
  - 131 wards are open defecation free (ODF)
  - 19 wards are still effected by open defecation.

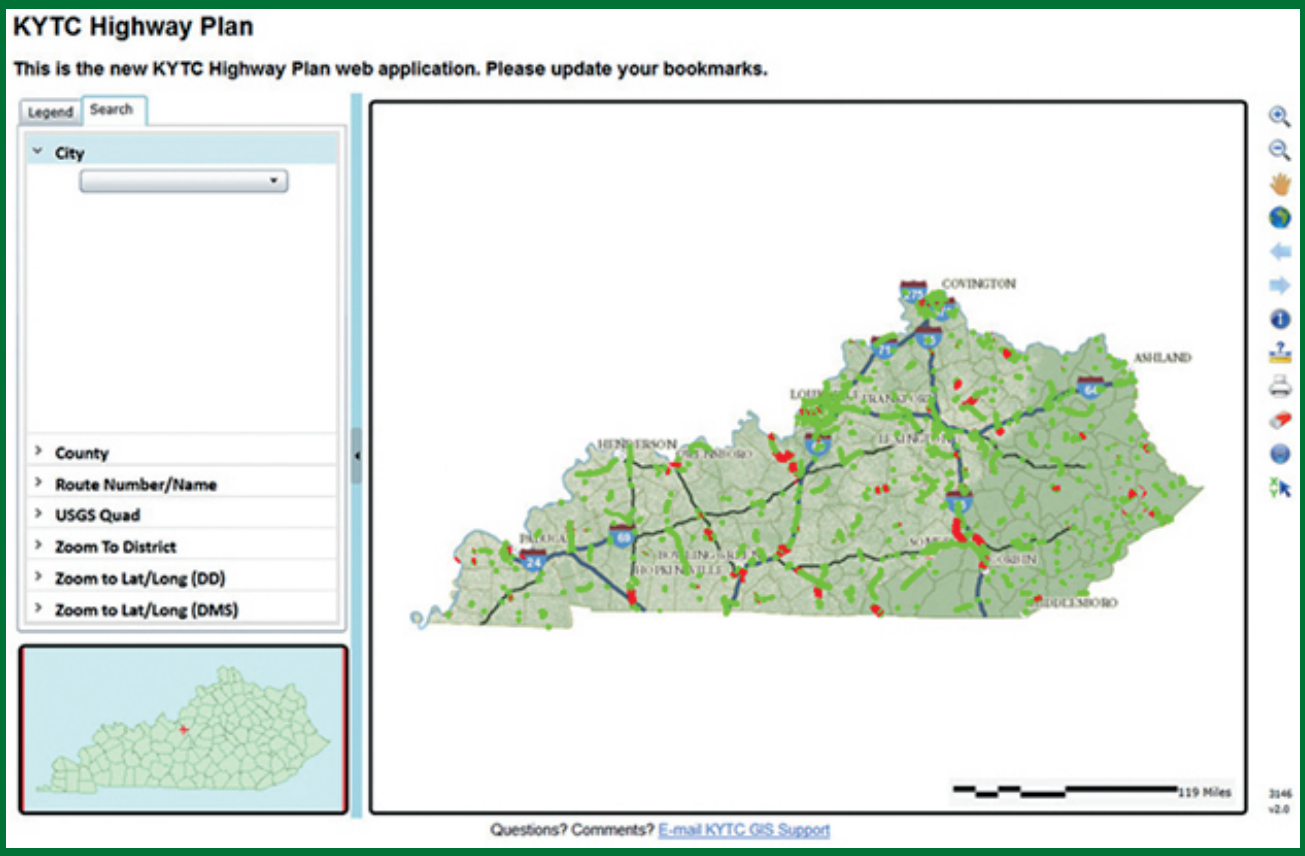




EVENTS

Recent Advances in Civil Engineering	July 02, 2019	JNTU Hyderabad	*www. jntuh.ac.in*
GI_Forum 2019 - Symposium and Exhibit of GIS	July 2-5 2019	Salzburg, Austria	www.gi-forum.org
Esri User Conference	July 8 – 12, 2019	San Diego,	https://www.esri.
WGDC 2019	July 9-10 2019	Beijing, China	http://wgdc.taibo.cn
Society for Conservation GIS 22nd Annual Conference	July 15 – 17, 2019	CA, USA	scgis.org/conference/30
19-23 August 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/
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
AGSE 2019	Sep 11 - 14, 2019	Stuttgart, Germany	http://applied-geoinformatics.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 SDSC2019 - Conference on Smart Data and Smart Cities GGT2019 - Geomatics Geospatial Technology	Oct 1-3 2019	Kuala Lumpur, Malaysia	isoladm.org/LADM2019Workshop; 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



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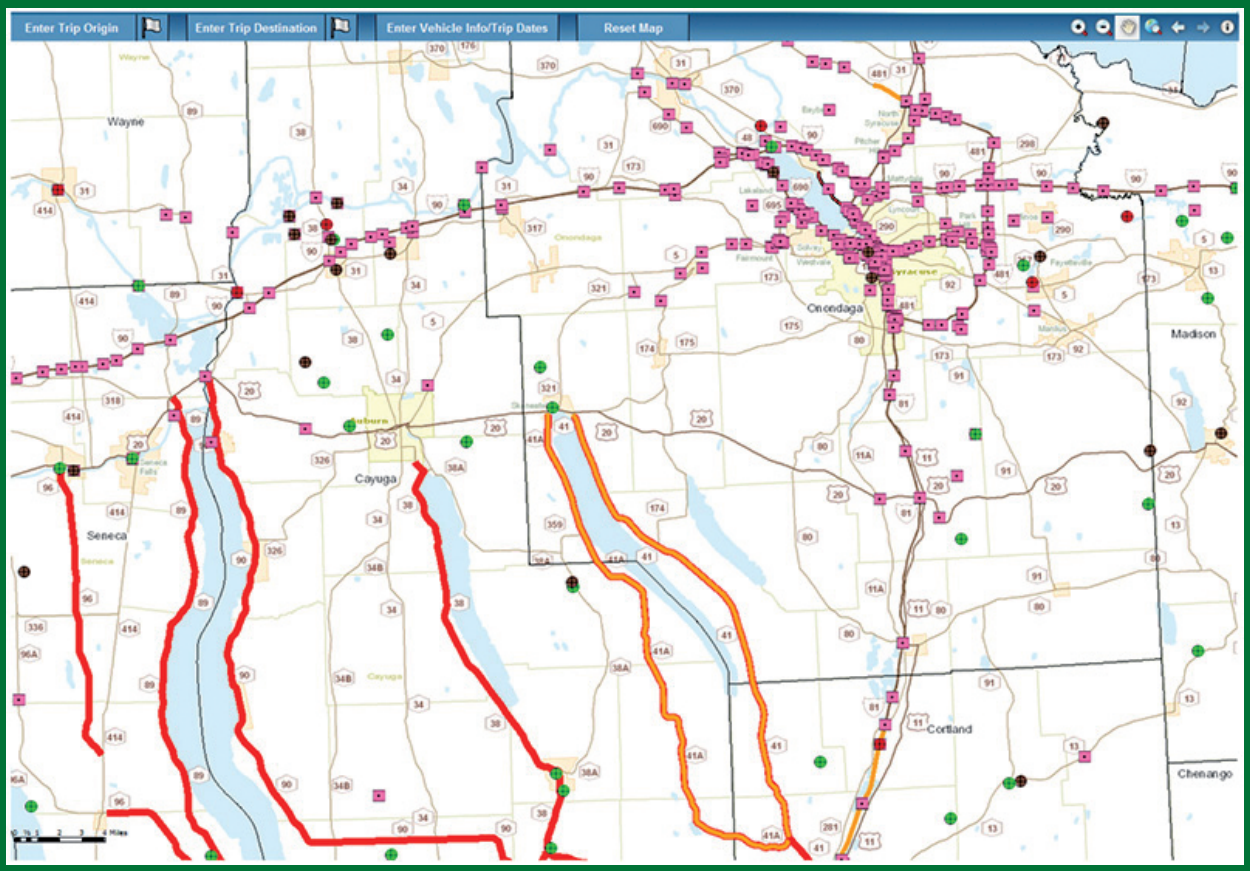

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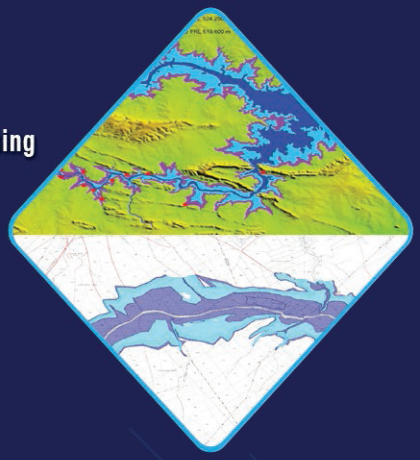
- Town Planning, Electrical, Telecom & Utilities
- Right of Way Acquisition & Permitting and Clearance
- Software & Web Enabled Geoportal Development Services



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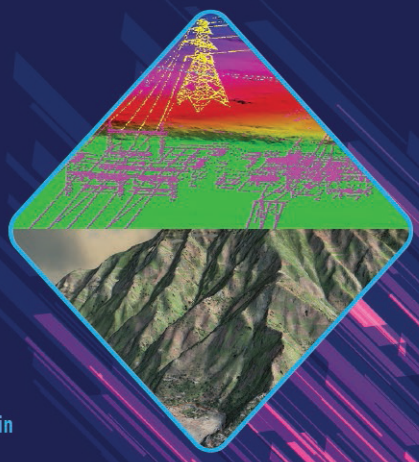
- Photogrammetry, LiDAR & Remote Sensing
- Aerial LiDAR & Imagery, Mobile LiDAR data Acquisition and Processing
- Geotech Engineering and Geophysical Surveys
- Underground Utility Detection (GPR)
- Underwater Leak Detection and Turnkey Solution
- Airborne and Ground Geophysical Surveys
- Route Planning & 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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