

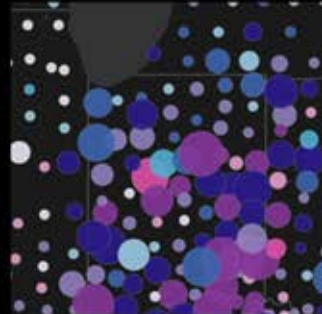
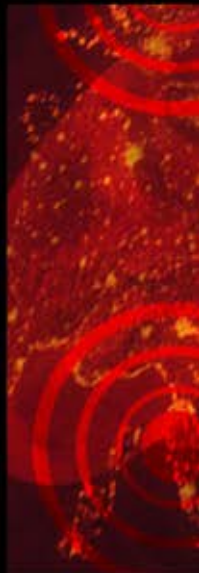
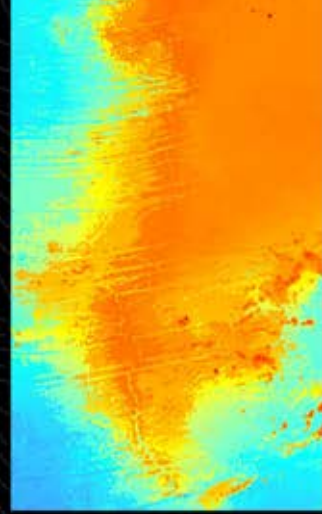


**esri** India  
THE SCIENCE OF WHERE™

Vol 14, Issue 2

# Arc India News

FOR PRIVATE CIRCULATION, NOT FOR SALE



## COVER STORY

# GIS - Building a Resilient Nation

## CUSTOMER SPEAK

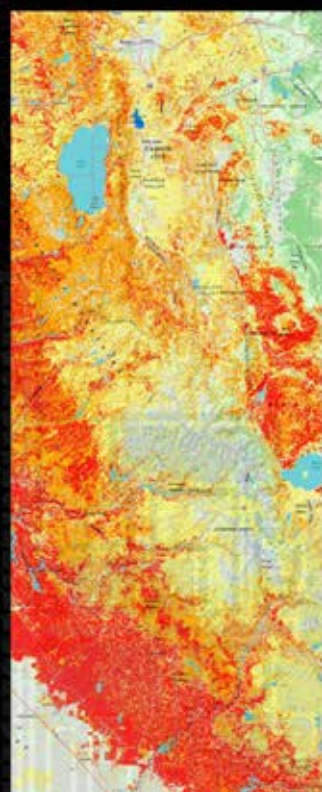
Greater Visakhapatnam  
Municipal Corporation

## PARTNER SHOWCASE

ULTS and Esri India team-up for  
Water Efficient Thrissur

## CASE STUDY

Varanasi Smart City





# Esri India Technical Services

Experience the best of Esri technology along with best of technical expertise.



## Email Support

[customercare@esri.in](mailto:customercare@esri.in)



## Support Helpdesk

Toll Free: 1800 - 102 - 1918  
(9:00 a.m. - 5:30 p.m. IST, Monday-Friday)



## Online Support

[esri.in/tech-support](http://esri.in/tech-support)



As the world is facing challenges of exploding population, increasing urban migration, ageing population, shifting agricultural patterns, changing climate and pandemic, it is transforming societal dynamics and impacting every facet of our lives. To overcome these challenges, we need to further innovate and invent, to collaborate across borders, and to not just rebuild systems and infrastructures after crisis strikes, but to build for a resilient and sustainable future for all. The new normal has re-established the relevance and need for the pervasiveness of technology and collaboration to prepare for, respond to and recover.

Geospatial thinking plays a critical role in building resilience and sustainability. Geographic Information System (GIS) provides unmatched capabilities to discover insights from within data and transform how organizations and nations see, think and act. GIS based resilience frameworks are incredibly powerful to communicate, analyze and share information for solving complex problems. GIS powers nation's resilience infrastructures with - risk information and analytics, hyperlocal hazard detection and early warning systems, scalable data analytics (national, state, district and community-level), tools for decision support and action on the ground which enable timely interventions towards strengthening resilience and adaptability.

As an intelligent nervous system with enhanced situational awareness, through its data driven insights, GIS aids in sensing health of ecosystems to plan and prepare and provides tools to respond and recover. Be it economic (Energy, Infrastructure, Agriculture), Social (Urban, Rural, Health, Transportation, Public Safety) or Environmental (Climate) components, GIS empowers all the stakeholders equally with data insights and tools. Most of these being dynamic in nature and intertwined with multiple factors, GIS plays a key role in facilitating planning, managing, and monitoring these subjects efficiently and effectively.

The Governments across the world are turning to GIS technology to create usable information

from the data they collect, then analyze that information to understand and develop better strategies to solve problems and subsequently become more resilient. The need of the hour is to create an

integrated geospatial infrastructure which can help integrating social, environmental, and economic information in a way that enables them to gain greater insight into complex situations, make data-driven decisions on where to act and apply resources, and collaborate across organizations and around the world. With its simplification and deployment on the web and in cloud computing as well as the integration with real-time information (the Internet of Things), GIS promises to be a robust platform for building nation's resilience framework.

You, our users, are already leveraging the power of location and spatial thinking in your work areas and GIS continues to optimize planning, analysis and increases preparedness against calamities such as floods, landslides, earthquakes, pandemic and so on. The GIS application across sectors and at all government levels is increasing every day to realize higher levels of service, promote transparency and to create a truly healthy, resilient community.

Moving into a new year we, as a community, need to apply all our GIS knowledge and learnings from the past to develop a better understanding of the risks and vulnerabilities that are specific to our nation and then, build solutions for a more resilient future.

Wishing you all a very happy new year. May this year bring lots of happiness and success.

Stay safe and healthy!!



**Agendra Kumar**

President, Esri India

Agendra Kumar



# CONTENTS

## 03 President's Desk

## 05 News

- Esri India shines at ETGovernment Global Smart Cities Forum 2020
- Esri announces launch of ArcGIS Field Maps
- Esri acquires Zibumi to enhance 3D visualization capabilities
- Esri named leader in Location Intelligence Platforms report by Forrester
- Inc.'s inaugural Best in Business Award names Esri gold medal winner in Government Services
- Esri Releases New Book Showcasing GIS in Scientific Research

## 08 Case Study

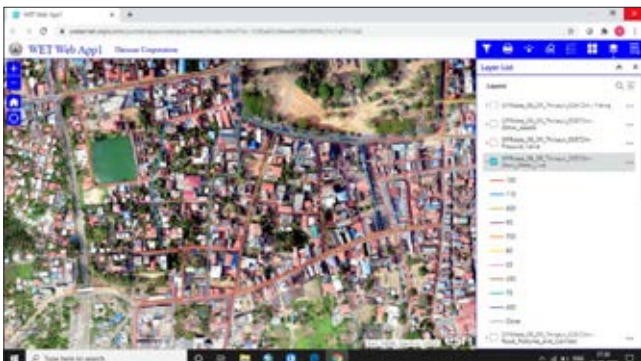
Varanasi Smart City moving towards Real-Time Operations Management using Esri ArcGIS



## 8 Case Study

## 12 Partner Showcase

ULTS and Esri India team-up for Water Efficient Thrissur (WET)



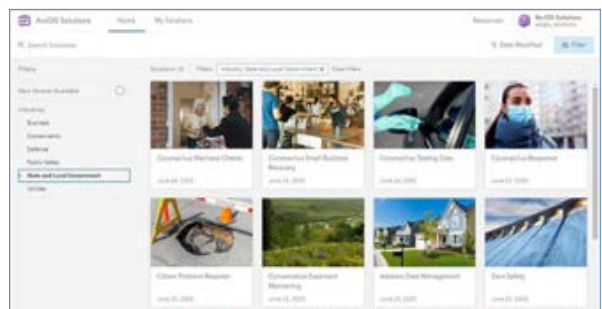
## 12 Partner Showcase

## 16 Cover Story

GIS- Building a Resilient Nation

## 24 Technology Update

What's new in ArcGIS Online?



## 24 Technology Update

## 27 Customer Speak

Achieving Resilience Smartly

## 29 Research Paper

Implementation of GIS-based master plans formulation under the sub-scheme of AMRUT- Jharkhand

## 34 Global View

AT&T Taps Advanced Analytics to Map Decades of Climate Risk



## 34 Global View

## 38 Tips & Tricks

Take your Map to the Next Level

## 40 Product Review

ArcGIS Collector (20.2)



## Esri India shines at ETGovernment Global Smart Cities Forum 2020

Esri India has been recognized with two Gold awards at the ETGovernment Global Smart Cities Forum 2020 for its work done at Varanasi Smart City and at Thrissur Municipal Corporation.

The Gold award in Best Smart City Project (India) was given to Esri India for its GIS implementation at the Varanasi Smart City. Varanasi Smart City SPV has been leveraging Esri ArcGIS platform to integrate city's locational data and IoT sensor data over GIS Base Maps and derive real-time analytics enforcing efficient decision-making on city management and its operations.

Best Water & Sanitation Initiative of the Year - Gold award has also been given to Esri India for enabling Thrissur Municipal Corporation's Water Efficient Thrissur (WET) project based on Esri technology. WET is an integrated solution based on ArcGIS platform with Internet of Things (IoT) to optimise the water utility management and to provide a data driven decision support system to reduce the non-revenue water. This solution affords Thrissur the luxury of becoming resilient to future water shocks. To enable better overview, less risk and more reliability in water management, Thrissur corporation used GIS technology as the spine for water management.

The awards were presented on the valedictory of the second edition of GSCF on 28th November'20. The two-day summit deliberated on distinct features of smart cities particularly integrated command and control centers, mobile governance, smart infrastructure, repurposing resources for the district administration, urban mobilization and designing resilient, futuristic smart cities.

## Esri announces launch of ArcGIS Field Maps

Esri, the global leader in location intelligence, announced the launch of the ArcGIS Field Maps mobile app. ArcGIS Field Maps is an all-in-one app that uses data-driven maps to help mobile workers collect and edit data, find information, plus report their real-time locations. ArcGIS Field Maps will solve many workflow challenges for organizations that have prioritized digital transformation from paper-based to digital field operations management.

"In the past, someone working in the field needed several individual apps on a device, each with its own focused purpose to view the organization's maps, to edit and collect data, and to record location tracks," said Scott Ball, Esri field operations apps principal product manager. "ArcGIS Field Maps does all this and more— in one place with only one login."

Organizations deploying mobile personnel will benefit from a single, powerful application that streamlines mobile operations and workflows by reducing the number of tools and optimizing field efficiencies with real-time location.

This new solution also solves a common problem—mobile crews using one set of maps while personnel at headquarters work from another. Additionally, it is a burden for an IT department to maintain and manage multiple apps across a large field workforce. With ArcGIS Field Maps, everyone involved can see and work from the same data simultaneously—saving time, reducing errors, supporting field workflows and boosting overall efficiency.

This new app also combines three of Esri's current mobile applications—ArcGIS Collector, ArcGIS Explorer and ArcGIS Tracker—into a single tool. ArcGIS Field Maps is now available to download on the Apple App Store and Google Play. To learn more, visit [esri.com/fieldmaps](https://esri.com/fieldmaps).

## Esri acquires Zibumi to enhance 3D visualization capabilities

**E**sri, the global leader in location intelligence, announced the acquisition of Zibumi Yazılım Bilişim Tasarım Arge Sanayi Ticaret S.A. ("Zibumi"), a Turkish software development company.

Known for unique and automated 3D models, Zibumi's products were delivered as the "CitiGenius" family of applications. The Zibumi software team, with strong connections to academia and GIS users, will be the hub of Esri's new R&D Center in Ankara, Turkey.

"We see the integration of our software team into Esri as the next logical step in our continued commitment to general mapping and GIS community worldwide," said Erdal Yilmaz, Director of Esri R&D Center, Ankara, Turkey.

Well known in and around Turkey, Zibumi develops innovative visualization, analysis, and simulation capabilities leveraging game engines. Acquiring Zibumi will advance Esri software in 3D visualization and simulation while expanding the integration of game engine technologies into ArcGIS.

"We are excited to have the Zibumi team join us at Esri's newest R&D Center," said Sud Menon, Esri Director (software development). "There is strong synergy between their work and our ongoing advancements for users in areas of 3D GIS, game engines, and photogrammetry for precision mapping and reality capture, and we look forward to their contributions."

"We highly respect the Ankara software development team and see this as a way to complement and extend our technology and services," said Jack Dangermond, Esri founder and president. "The acquisition of Zibumi will provide the Esri software development team new capabilities for integrating physical modeling into our advanced applications, while also extending our development team by creating a new lab in Ankara."

## Esri named leader in Location Intelligence Platforms report by Forrester

**E**sri, the global leader in GIS, location intelligence, and mapping technology, announced that Forrester has recognized the company in The Forrester Wave: Location Intelligence Platforms, Q2 2020 Evaluation. The report acknowledges Esri's leadership in location intelligence and long-term commitment to development of a shared global geospatial infrastructure.

The Forrester notes, "The key strength of Esri is its complete set of location intelligence capabilities. It has depth and strength in multiple areas, including data management, data products, spatial visualization and analytics, and location intelligence execution."

"We think Forrester's recognition demonstrates that Esri is providing a truly scalable GIS platform," said Jack Dangermond, Esri founder and president. "With the world becoming more interconnected each day, the ability to understand, organize, visualize, and utilize spatial data will be increasingly critical, and we are happy to contribute with our platform."

In this James McCormick report, Esri received the highest ranking in spatial visualization and location intelligence. Esri also received top scores in Current Offering and Market Presence.

"We are continually improving our location intelligence platform, ArcGIS, by innovating new tools and capabilities," said Dirk Gorter, Esri head of product management. "Esri provides a complete location intelligence platform that is used across many industries, supporting customers with a range of needs and applying geospatial analytics for market and customer analytics, suitability analysis, spatial data management, and logistics and supply chain management. Esri's platform is also used for emergency response efforts, most recently in the fight against COVID-19."

To learn more about Esri in The Forrester Wave: Location Intelligence Platforms, Q2 2020 Evaluation, visit [go.esri.com/ForresterWave2020](https://go.esri.com/ForresterWave2020).



## Inc.'s inaugural Best in Business Award names Esri gold medal winner in Government Services

Inc. Magazine's inaugural Best in Business list has awarded Esri the gold medal in the Government Services category. Inc. created the Best in Business Awards to honor companies that have gone above and beyond to make a positive difference.

The list, which can be found in the winter issue of Inc. (on newsstands December 29, 2020), recognizes small- and medium-size privately held American businesses that have had a superlative impact on their communities, their industries, the environment, or society as a whole.

"I am incredibly proud of the contributions our teams are making in response to COVID-19 and other natural disasters," says Jack Dangermond, Esri founder and president. "This year more than ever, our mission of helping our customers make an impact through the use of GIS is critical. We are humbled to have this important work recognized by a renowned publication such as Inc."

Instead of relying on quantitative criteria linked to sales or funding, Inc.'s editors reviewed the companies' achievements over the past year and noted how they made a positive difference in the world. They then selected honorees in more than 30 different industries—health, software, retail, business services, and more—and in age- and revenue-based categories. The applicant pool was very competitive, with around 2,700 entries and an acceptance rate in the low single digits—a huge success for these honors in their inaugural year.

Scott Omelianuk, editor-in-chief of Inc., says, "It's been an incredibly challenging year for companies. Across industries, businesses have had to make brutally tough decisions and face unprecedented uncertainty. That's why we knew 2020 called for a new recognition program, something to complement our annual Inc. 5000 list of the fastest-growing private companies in the country. For Best in Business, companies have prioritized tackling today's problems to lead us to a better future, even if they've struggled to stay in the black."

Honorees for gold, silver, bronze, and general excellence across industries and categories are featured online at [inc.com/best-in-business](https://inc.com/best-in-business).

## Esri Releases New Book Showcasing GIS in Scientific Research

Esri, the global leader in location intelligence, announced the publication of [GIS for Science: Applying Mapping and Spatial Analytics, Volume 2](#).

Most scientific study involves some spatial component, which is why professional scientists are increasingly applying geographic information system (GIS) technology to rigorous scientific study.

According to Pulitzer Prize-winning author, geographer, anthropologist, and historian Jared Diamond, "Just this year, millions of people—many for the first time—came to depend on maps and near real-time dashboards to stay abreast of a pandemic, not only to gain a sense of the global situation but to see how the new coronavirus affected their communities, even their neighborhoods."

In *GIS for Science: Applying Mapping and Spatial Analytics, Volume 2*, editors Dawn Wright and Christian Harder present examples of scientific research on the COVID-19 pandemic and other studies that address several of today's most pressing issues. What can people learn from oceans research, including the impact of plastics? How does the world continue to feed an ever-growing population? Why is it urgent to protect and preserve the earth's natural resources and biodiversity? This book examines these questions and more.

GIS for Science, Volume 2, pairs with the website [GISforScience.com](https://GISforScience.com), which provides collections of ArcGIS StoryMaps, apps, digital maps, and more. Links to learning pathways and blogs relate the practical use of GIS in each of the case studies.

Visit [esri.com/esripressorders](https://esri.com/esripressorders) for complete ordering options, or visit [esri.com/distributors](https://esri.com/distributors) to contact your local Esri distributor.

# Varanasi Smart City moving towards Real-Time Operations Management using Esri ArcGIS



**T**wenty-first century cities consume two-thirds of the world's energy, and emit 70% of global greenhouse gases. More than 800 million urban dwellers live in sprawling slums, in health-compromised conditions. Many live in cities that are yet to lose their reputation for being crowded, unsafe, and environmentally irresponsible.

Surprisingly, these inefficiencies have not deterred the demand for urban land. By 2050, two out of three people in the world will live in such cities. In a business-as-usual scenario, they will withstand the worst of climate change, even as they contribute upward of 80% to global GDP.

In the years to come, as their due, urban dwellers will demand intelligent urban planning that creates safe, affordable and resilient cities with green, and culturally inspiring, living conditions. Goal 11 of the UN Sustainable Development Goals has anticipated this demand by calling for sustainable cities and communities. India is attempting to deliver on this commitment through her ambitious Smart Cities Mission. The Mission promotes an area-based development strategy that focuses on city improvement (retrofitting), city renewal (redevelopment) and city extension (greenfield

development). In addition, a pan city initiative will attempt to integrate the city using smart technological solutions.

Identified smart cities will innovate replicable ICT solutions to resolve basic infrastructure issues, enhance the quality of life, and strive for a clean and sustainable environment. The goal is to learn from one another; among the identified 100 Smart Cities, a 20-20 concept pairs up the laggards with the front-runners. Thus, the Mission promotes and innovatively uses smart solutions that all Indian cities can learn from, replicate, and mold to their unique context.

## About Varanasi

Among several cities vying for the Smart spotlight, Uttar Pradesh's Varanasi has been making progress in leaps and bounds. The city's success story has important learning points for Indian urbanism. Multiple stakeholders, several layers of infrastructure, and a dense urban fabric (with a large proportion of floating population) make Varanasi a relatable case study for India's cities.

Varanasi boasts of international repute; it ranks among the oldest continuously inhabited cities of





the world, and has received UNESCO'S Creative City of Music tag. In India, the city's significance is both cultural and mystical. Every year, millions of domestic and international visitors flock to India's spiritual soul, eager to absorb the sights and sounds of Varanasi.

## The Challenges

Balancing the expectations of international audiences and domestic devotees against the needs of Varanasi's citizens has come with its own share of challenges. Virtually every part of India enjoys representation within the old Kashi area. This has generated challenges that affect identification, representation, coordination of city systems.

1. Balancing Varanasi's cultural and spiritual heritage with better administration, operations and holistic development
2. Mapping overlapping development that has congested the city over several centuries
3. Managing critical public service infrastructure, including assets related to water, sewage collection and treatment, street lighting, transportation, and parking services
4. Retaining and managing tourist footfall during the course of smart project implementation
5. Integrating Smart City projects with other ongoing development projects happening across the city

## The Approach

A Special Purpose Vehicle (SPV) mechanism designs and manages IT and non-IT projects under the Smart Cities Mission. Here, Varanasi Smart City Limited (VSCL) guards the idea of rejuvenating the city of Varanasi into a great place to live and visit.

VSCL targets projects that uplift Varanasi's denizens, upgrade city infrastructure and living standards, and add value to Varanasi's core culture. The SPV will fast-track projects that conserve the city's enriched heritage, spirituality, and traditions, while supporting inclusive social or financial solutions.

Varanasi's Pan-City Project follows an area-based development model with the following sub-missions:

1. The Suramya Kashi component capitalizes upon UNESCO's City of Music label. It is rejuvenating the experience of Varanasi's historic temples and riverfront ghats.
2. The Nirmal Kashi component deals with earth-friendly initiatives. It is rejuvenating sacred water bodies and parks, while inserting efficiency and accountability into water- and waste management solutions.
3. The Surakshit Kashi component focuses on improving the police-citizen interface. It is creating safer public spaces, and proactive emergency response, through analytics-based surveillance.
4. The Samunnat Kashi component aims to create a properly skilled workforce that is healthy, and works healthily. It uses smart technology to establish market linkages to promote local artefacts, provide better spaces for work, and enhance the life and health of local workers.
5. The Ekikrit Kashi component digitizes Varanasi's services to ensure transparent access to information, and quality services for all citizens. It employs smart cards and mobile apps to make grievance redressal effective.
6. The Sanyojit Kashi component focuses on generating a customized model of transit and

“ We have been using GIS for over 20+ years for diverse use cases. While GIS technology has become pervasive across sectors, Smart Cities are the one who have leveraged this technology to the maximum. Since our Kashi Integrated Command and Control Centre has GIS at its core, we could turn this into an effective Decision Support System with 360 degree view of all city services, smart components and disaster management. ”

### Dr. D. Vasudevan

General Manager (P&C), Varanasi Smart City Ltd.

transportation. It is easing congestion, improving last-mile connectivity, and diversifying modes of transport.

### The Solution

A customised solution for Varanasi depended on the mammoth task of mapping and overlapping multiple datasets of the city's development. Accordingly, the SPV used ArcGIS Platform Technology to create an enterprise-wide integrated City GIS. In the process, multiple data sources and data levels became available for analysis, including information on administrative boundaries, public services, religious places, education and health, tourism and recreation, transportation, water bodies, and locations of infrastructure related to water, sewerage and drainage systems in the city.

ArcGIS Platform is the digital mesh that superimposes all smart components of the city over

a common set of base maps. Some of the smart systems currently improving management and coordination of city services include:

#### 1. Kashi Integrated Command and Control Centre (ICCC):

It uses location-based technology to manage traffic safety and city security. The ICCC has also proved to be a versatile mechanism for rapid emergency response. Most recently, authorities converted the centre into a COVID War Room to survey public places using CCTV, map COVID-19 positive cases using GIS, and locate healthcare workers using GPS.

#### 2. Kashi Solid Waste Management System:

It optimizes waste pick-up facilities by using smart sensors on smart waste-bins. The sensors populate the City GIS by generating a real-time status of the bins, and statistical ward-wise overviews of waste dumps. This has helped coordinate waste management in the ward.



Smart Sensors on waste bins populate the City GIS with statistical ward-wise over views of waste dumps.

#### 3. Kashi Environmental Monitoring System:

It maps a real-time feed of air pollution in different parts of the city. Air Quality Monitoring sensors provide valuable information that warns citizens of health-threatening conditions. It also allows authorities to attune traffic and industry with dynamic regulations that keep pollution under control.





**4. Integration with traffic signals:** In most Indian cities, malfunctioning signals invite traffic police to manage traffic, diverting them from their actual policing duties. Devoid of a holistic overview, this manual approach is cumbersome, piecemeal and problematic. In Varanasi, the city's GIS system networks smart traffic signals; this helps to identify malfunctioning traffic signals and traffic affected on particular corridors.



Smart signals help identify malfunctioning traffic signals on particular corridors, and generates an overview of how many signals are functioning properly.

**5. Integration with smart streetlights:** Real-time mapping of smart streetlights provides civic authorities with live updates on dysfunctional lighting. This promotes citizen confidence by ensuring safer public places that deter wrongdoing.

## The Result

**1. Actionable insight:** Authorities use spatial analytics powered by GIS to harness real-time data, and design better decision support systems. In the process, authorities are gaining actionable insight for informed decision-making.

## 2. Improved business processes and workflows:

Smart integration of different features over a common GIS platform has standardised procedures across different departments. Inter-department collaboration has improved through geospatial mapping and geo-tagging of city assets.

**3. Improved asset management:** An Enterprise-integrated GIS provides insights into use patterns of civic assets to improve urban planning in Varanasi. For water and sewerage systems, geospatial utility asset management is helping authorities operate and manage utilities in a better way.

## The Benefits

The ArcGIS Platform Technology provides for customized solutions across different localities through IoT components. These integrated components generate thematic results in real time.

The system has also proven its flexibility for use in rapid response. In response to COVID-19, Varanasi generated GIS operation dashboards for health services, heat maps for containment zones, and CCTVs to monitor citizen movement and social distancing. The Platform also helped manage health response; it used drones to sanitize hotspots, established telemedicine facilities for remote health care and diagnosis, while also analysing infrastructure availability to address the health crisis.

Better and location-customized experiences await all citizens of Varanasi. Beyond improving the urban environment, GIS has now equipped the city with options to minimise air pollution, improve water management, create safer public areas, and respond intelligently to emergencies. The technology is steadily ensuring that city's culture maintains its rich heritage while assuring Varanasi's denizens the benefits of a new Indian urbanism.

# ULTS and Esri India team-up for Water Efficient Thrissur (WET)

The idea of a new India is closely intertwined with several flagship programs launched by the Indian government. Prominent among them is the Atal Mission for Rejuvenation and Urban Transformation (AMRUT), a central government initiative.

AMRUT undertakes a set of 11 reforms comprising 54 milestones; they aim to transform urban areas through urban revival projects. The Mission targets universal water supply, improves sewerage networks, develops green spaces, and supports non-motorised urban transport.

Technology has been a key enabler in such missions. Thrissur municipal corporation's Water Efficiency Thrissur (WET) is an example of how technologies like GIS, Internet of Things (IoT), have been leveraged to optimise the water utility management and to reduce the Non-Revenue Water.

ULTS is an offshoot inspired from the 95-year old veteran cooperative society ULCCS. The company creates exemplary solutions that synergize the power of location with IOT, Analytics and Machine Learning. By pushing the boundaries of data analytics to deliver actionable intelligence, the company has been changing the way that people utilize and value geospatial data.

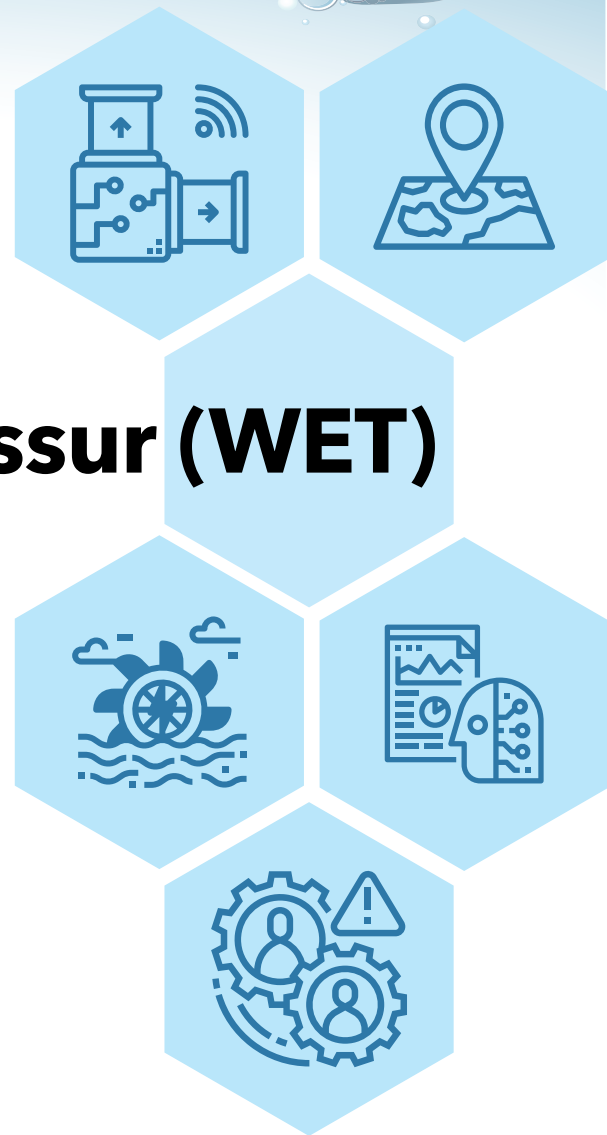
To enable better overview, less risk and more reliability in water management, ULTS created WET. The solution uses GIS as the spine of the water management solution for Thrissur corporation; after all, the technology is a proven solution to help retrofit and improve existing systems. WET is based on the capabilities of Esri's ArcGIS software - an

integrated GIS platform that lets users discover, create, use, and share location-based insights, on any device.

## The Challenges

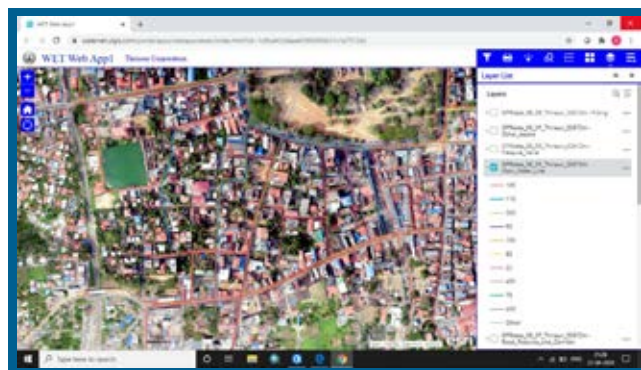
ULTS was tasked with managing and overcoming water distribution challenges faced by the Thrissur municipal corporation. Various studies have consistently revealed Non-Revenue Water (NRW) to be more than 50% in the city. City administrators have had difficulty grappling the problem because of the hidden and underground nature of water assets.

Other challenges compound the unavailability of authoritative data of under- and over-ground assets.





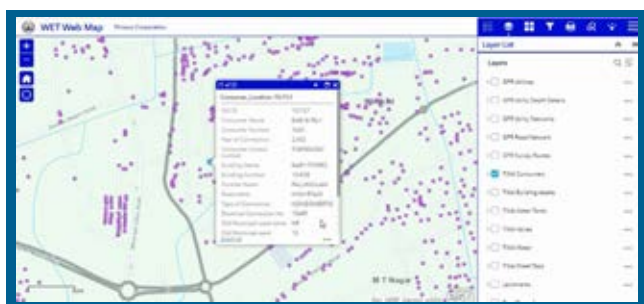
- Faulty meters & absence of smart metering devices
- Inefficient water outage identification and management
- Absence of updated customer and consumption data
- Pilferage, leakage and poor monitoring of water assets
- Nonexistent customer redressal mechanism
- Unavailability of an integrated platform connecting the distribution management with legacy systems like Customer Information, Outage Management, Meter Data Management & Workflow Management



Main Water Lines.

upgrades, or maintenance. Not only will citizens benefit from modernised water management, the solution affords Thrissur the luxury of becoming resilient to future water shocks.

ULTS framed WET Solution around four core considerations:



Consumer Details.

ULTS had to provide a solution which could retrofit public water supply, especially within the old municipal area of Thrissur, with the most modern systems. One of the main objectives of this project was to reduce public water loss by bringing Non-Revenue Water below 15%. To manage this project ULTS partnered with Esri India and developed the solution for WET.

### The Solution: Water Efficient Thrissur (WET)

WET is the authoritative repository for the assets and operational data of Thrissur's water supply network. It has mapped asset data such as pipes, valves, hydrants, meters, and other network features, as well as operational data such as pressure zones, work routes, main breaks, and inspection locations.

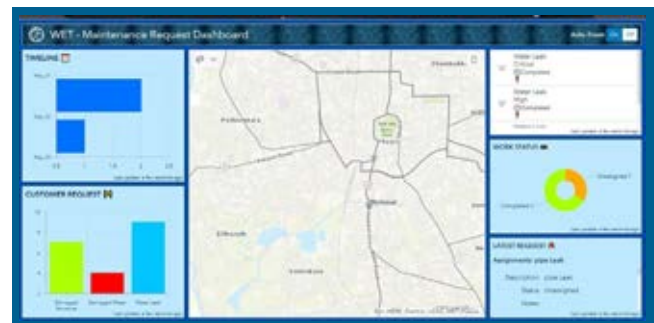
This GIS-based management model can simulate the existing system's behavior to ensure up-to-date

- Reducing Non-Revenue Water (NRW) by perceiving, tracing and rectifying leakage and pilferage
- Hydraulic modeling, analysis and forecast to proactively manage water infrastructure in Thrissur
- Better operational efficiency to reduce the response time to attend to any customer grievance, or disruption
- Descriptive and predictive analytics to help forecast future needs for water in Thrissur

### The Features

- **A central repository of water pipelines and consumer networks:** GPR, Drone, GPS, DGPS and ground-based asset surveys helped build an authoritative network of supply pipelines.
- **Water meters:** Smart water meters at critical network junctions access pipeline flow. The meters log any drop in water flow; smart utility applications use IoT and sensors to determine pipeline fractures quickly. Such deviations are live-updated into the central repository, alerting municipal authorities to the possibility of water loss.

- **Customer redressal and billing system:** Hand-held equipment like POS machines make on-the-spot billing and on-site logging of repairs a reality. GIS system integration with flow-meter reading, billing, and complaint redressal helps identify Non-Revenue Water at the neighbourhood scale. Last but not least, an online portal registers consumer complaints, and escalates pending complaints on a periodic basis to higher authorities.
- **Outage management system:** Dashboards provide a bird's-eye view of leaks (detection, reporting, and investigation) and outage management. They also help trace and isolate leaks so that they do not disrupt the network, or citizen routines.
- **Hydraulic modeling:** GIS predictive analytics power WET. This helps it estimate and ensure the feasibility of new user connections, based on existing consumption loads, water pressure, and other parameters.
- **Workforce management:** Mobile applications are helping notify maintenance crews of maintenance work. A Water Service Assignment platform connects supervisors to their crew, and enables them to communicate field assignments in a prompt and effective manner.
- Dashboards provide an interactive visual platform to analyse maintenance requests. Map views, timelines and pie charts communicate data to citizens in the simplest formats.
- GIS layers add richness to the data by improving queries through attributes.
- A geo-tagged digital database ensures that maintenance and future updates to the water network are proactive, and not piecemeal.
- Water network simulation enables authorities to ensure uninterrupted water supply to the consumers in Thrissur city.



Maintenance Request Dashboard.

Most importantly, the WET Project pushes for accountable governance.

It provides authorities with the tools to visualize and assess where they stand, in terms of water supply infrastructure. It gives citizens an interactive platform to air their grievances. Simple graphics and processes make the platform accessible to everyone, sans barriers of age or ability. It allows authorities to take charge of their assets and respond to how their city is growing.

In the future, solutions like WET can empower city governments to guide and direct urban growth. City governments will be able to decide whether they want their city to be compact, how their health, police and fire networks must connect, and how education, industry and amenities must be located.

And, through accountable governance, WET enables a Resilient India.

## The Benefits

ULTS's solution has used the ArcGIS platform to become a multi-utility, multi-device, multi-resource application. GIS system integration helped reduce Thrissur's water loss by striking at the root of the problem.

- Incorporation of various technologies like GIS, IoT Analytics and administrative applications like Billing Systems, Customer Feedback System helped in reducing the NRW by providing a Data-Driven Decision Support System
- An efficient outage management and workforce management system enhanced operational efficiency by reducing the response time in attending to disruptions or customer grievances.



# Learn the Esri Technology at the convenience of your home/office

Esri India Instructor Led Online (ILO) training platform is a great way to attend courses conveniently from any location. Similar to a physical classroom, the trainees get hands on experience in a virtual lab setup along with a live trainer. Be a part of a scheduled training or get a training pack customized as per your requirements.

Learn more at  
**esri.in/ilo** or write to us at **info@esri.in**





# GIS Building a Resilient Nation

The first two decades of the 21st century have redefined order of the world in many ways. Growing economies, exploding population, increasing urban migration, ageing population, shifting agricultural patterns, changing climate and pandemic have transformed societal dynamics and impacted every facet of our lives. What concerns is complexity, severity, and pace at which some of the disruptions and crisis have hit us and the negative impact they are causing on the economies and communities alike. These trends are expected to continue with most likelihood of acceleration of the pace.

With food, water, health, energy, and financial ecosystems getting impacted, no country has been spared. Urban and rural communities have been equally affected. Nations that invested in building resilience have fared better than others in dealing with these shocks and could ensure minimal impact on their citizens. Resilient nations "Prepare Strategically, Respond Rapidly and Recover Methodically" during the crisis times and return to normal as effortlessly as possible. Leaders embed resilience in their design for rapid response and recovery to stay ahead to ensure growth. Resilient communities respond, withstand, and recover at faster pace by utilizing the available resources to minimize the impact of disruptions. Undoubtedly, geospatial technologies are playing a critical role in helping these nations, leaders, and

communities to build a higher degree adaptability to bounce back.

India in particular has been highly vulnerable to these disruptions and shocks. With infrastructures and systems still evolving, lot needs to be done in terms of readiness and adaptive capacity to respond effectively and efficiently. It is important that the gaps are plugged and ability of the communities to deal with the disruptions and bounce back is strengthened. As a developing country, it is critical that nation's roadmap embraces resilience by design without compromising on the efforts to achieve cherished vision of "Atmanirbhar Bharat (Self-Reliant India)". "Atmanirbharta (Self-reliance) is about resilience, leveraging internal strengths to anticipate future trends, prepare, manage and mitigate the disruptions effectively and efficiently.

## What is Resilience?

Resilience is ability of the individuals, communities, organizations, and governments to adapt and recover from disruptions without compromising long-term prospects for the development. Resilience is about anticipating, planning, and reducing risk to effectively protect persons, communities and countries, their livelihoods, health, cultural heritage, socio-economic assets, and ecosystems (UN, 2015).



We live in a connected world where interdependence is historically high. Information and communication technologies have become backbone of economies and livelihoods. There is an increased flow of trade, capital, money, and people across the boundaries. Global businesses and supply chains are interrelated with organisations, resources, and processes to deliver goods and services to their consumers. While we are more connected and integrated today, the systems are also more fragile and vulnerable to external impacts. A disruption in one place can swiftly transcend across the borders and trigger breakdown across the ecosystems and chains. The Coronavirus disease (COVID-19) pandemic has revealed how these vulnerabilities can disrupt and cripple economies, and at the same time brings to fore the importance of being prepared to adapt and recover.

With increasing frequency and suddenness of disruptions, governments, businesses and communities are at increased risk of getting trapped into situations that are detrimental for nation's development and sustainable growth. By building resilience governments, businesses and communities, the nation can- a) Anticipate risk, b) Prepare to adjust, c) Share and Learn, d) Integrate, Coordinate and Collaborate and e) Ensure inclusiveness. And to be able to do so, it is important that all the responsible factors are brought together on a common framework which can integrate all types of data and knowledge, spatially and temporally. With its unique ability to integrate data about everything and, at the same time, ability to provide a platform for intuitively understanding data and knowledge as an integrated whole, GIS becomes an essential and irreplaceable tool for building resilience. GIS not only helps with a better understanding of the evolving situations, but also provides a platform for collective problem-solving, decision-making, and perhaps most critical of all for building resilience and collaboration.

### Why GIS Technologies hold the key?

In a connected world where ecosystems are intertwined and interdependent, production and supply chains are integrated and interlinked more than ever, protracted crisis's, uncertainties and surprises are the new reality. Some call it "new normal". Several disruptions can happen together, triggering simultaneous shocks and stresses across

the ecosystems. To strengthen resilience and adaptability of nation and its communities, there is a compelling need to explore and understand these interconnections, contextualize location, and analyse the interdependencies spatially and temporally.

"The Science of Where" becomes important more than ever for understanding and managing these interconnections. By harnessing geographic context, GIS provides unmatched capabilities to discover insights from within data and transform how organizations and communities see, think and act. With its simplification and deployment on the web and in cloud computing as well as the integration with real-time information (the Internet of Things), GIS promises to be a robust platform for building nation's resilience framework. As a unified digital environment that can provide a way to understand knowledge through data exploration, analytics, visualization and sharing and dissemination, GIS based resilience platforms:

**1. Embrace Complexity** - Bring together diverse data sets and systems, aid in identifying complex development challenges, and address within the political, economic, ecological, and social systems in which they exist. With advanced cloud capabilities and tools to leverage big data, Artificial Intelligence (AI), and Machine Learning (ML), an integrated GIS platform can bring together disparate systems and processes, along with multidisciplinary data on a unified platform for enhanced decision support. Using its situational awareness capabilities, GIS allows stakeholders to be more efficient and contain disruptions locally by limiting them and preventing widespread impact across the ecosystem. Modelling and simulations help building predictive scenarios for understanding the disruptions in a better way.

**2. Enable Inclusive Decision Making** - GIS fosters participatory problem-solving approach by facilitating seamless interactions between governments, institutions, businesses, NGO's, communities, and other stakeholders at different scales. By facilitating participation and multi-agency collaboration on a common platform, armed with contextual and actionable intelligence, stakeholders can take informed decisions. Mobile tools empower stakeholders to stay connected anywhere, anytime

on any device and take active part in the decision-making process to develop, adopt and implement equitable and sustainable solutions.

### 3. Promote Flexibility, Learning and Innovation-

With multidisciplinary factors, multiple stakeholders and evolving situations in the play, rigid solutions cannot build resilience for change. GIS platforms being versatile, scalable, adaptive, and responsive support dealing with complex situations as they evolve. They promote inclusiveness, allowing individuals and communities to be supported within social structures. Using big data and machine learning, historical data and knowledge can be put to best

use for learning, innovating, developing new approaches to deal with shocks and stresses.

With its extraordinary potential to touch every web-connected being through a common language of maps, GIS-based resilience frameworks are incredibly powerful to communicate, analyse and share information for solving complex problems. GIS powers nation's resilience infrastructures with - risk information and analytics, hyperlocal hazard detection and early warning systems, scalable data analytics (national, state, district and community-level), tools for decision support and action on the ground which enable timely interventions towards strengthening resilience and adaptability.

## ArcGIS-enabled geospatial infrastructure for a Resilience Framework

Esri inspires and enables people to positively impact their future through a deeper, geographic understanding of the changing world around them. By providing data-driven insights with location intelligence for decision support, ArcGIS platform enables a geospatial infrastructure that support nations and organizations in strengthening their resilience frameworks. This geospatial infrastructure helps governments and practitioners solve real-world problems and make critical decisions by analysing risks, evaluating potential impacts, planning resilience activities, and viewing status of resilience efforts.



Understanding geospatial infrastructure.

**The Geospatial Infrastructure:** helps governments and organizations with secure rapid enterprise deployment, mapping and visualization and analysis and discovery with automation tools for creating,

analyzing, and sharing geographic information which can be customized by adding ready-to-go capabilities and applications. By connecting existing data stores and ready-to-use storage, Esri's extensive collection of curated geospatial content can help decision makers with intelligent insights. Agencies can connect people, locations, and data across the risk management lifecycle holistically using interactive maps with smart, data-driven styles and intuitive analysis tools that deliver location intelligence. The analysis and actions can then be further communicated to other departments via compelling web pages and applications.

**Prevention & Mitigation:** ArcGIS platform provides powerful capabilities that aid in identifying, assessing, and understanding risks that cause disruptions and shocks. Locations of the shocks are not always predictable. With its advanced capabilities for mapping, imagery and remote sensing, ArcGIS enables users to visualize, analyse, and manage data in 2D, 3D, and 4D to gain new insights for prevention, mitigation and informed decisions. Using multidisciplinary factors and historical data, ArcGIS tools aid in improving predictions regarding subjects that will be impacted. Such localized evaluation helps in proactive measures to deal with the impact of the disruptions.

**Preparedness:** Spatial modelling and simulation of disruptions and shocks help agencies with strategic preparedness. By integrating real-time



## GIS for Strengthening Nation's Resilience

Rapid pace of changes, increasing vulnerabilities and associated complexities which nations face warrant transformative actions to address problems and strengthen resilience. It is time to shift the paradigm from siloed approach of addressing problems, which are becoming obsolete and ineffective, to an integrated inclusive approach. Geospatial technologies offer unique advantage in fostering an integrated-systems-based approach and intuitive understanding of what is going on at all scales – locally, regionally and globally, which are critical to nation's resilience.

As an intelligent nervous system with enhanced situational awareness, through its data driven insights, GIS aids in sensing health of ecosystems to plan and prepare and provides tools to respond and recover. Be it Economic (Energy, Infrastructure, Agriculture), Social (Urban, Rural, Health, Transportation, Public Safety) or Environmental (Climate) components, GIS empowers all the stakeholders equally with data insights and tools. Most of these being dynamic in nature and intertwined with multiple factors, GIS plays a key role in facilitating planning, managing, and monitoring these subjects efficiently and effectively.

data from sensors/IoT devices and social media on maps and big data capabilities, agencies can identify temporal patterns and extract actionable location intelligence. By analysing dependent factors, agencies can have a bird's eye-view as well as ability to drill down to details to assess accurate situations on the ground and plan remedial actions. Expected impact, estimated aerial spread and likely scenarios based on different characteristics help agencies identify areas that would be affected by disruptive events well in advance and prioritize resource mobilization.



Using GIS-based Data Analytics to effectively analyze and respond to risks.

**Response:** Situational awareness along with actionable intelligence being the key factor, it is important that all responders are armed with updated information as situations dynamically evolve and data-driven decisions are taken. Be it evacuation routes, rehabilitation shelters, or other services that are key to successful response operations, it is updated information presented in spatial

context that makes the difference and helps stay ahead. The GIS-enabled mobile apps support field operations, community and citizen engagement by bridging the gap between teams on the ground and command-control reducing response times and maximising resource utilization. With drones proving to be extremely useful in rapid response to disruptive events, data from Drones / UAVs can be seamlessly integrated into the geospatial infrastructure to generate images for visualization and analysis.

**Rehabilitation and Recovery:** The aftermath of disruptions is always painful and warrants a methodical recovery. While Post Disaster Needs Assessment (PDNA) is the first step towards a holistic recovery, it is important to recognize that the disaster recovery process goes beyond the PDNA and aids in identifying a criteria-based prioritization, planning and implementation of the recovery agenda. The geospatial infrastructure plays a critical role in ensuring that disaster recovery processes are prioritized and embrace inclusiveness, resilience, and sustainability. Situation analysis using dashboards, impact analysis tools, and workforce management tools help in providing prioritized relief to affected citizens and their needs in the shortest time. This enables the affected communities to build back in a more adaptive way. The information and knowledge shared during the process supports in building actionable agendas for strategic planning, disaster risk reduction, and policy decisions to strengthen resilience.



## Economic Resilience

Risks and uncertainties impact the ability of nations and communities to build capacities, and infrastructure (physical and digital) for developmental efforts and economic growth. Building economic resilience calls for comprehensive policies and strategies, institutional and participatory interventions for strengthening energy and food security supported by robust infrastructure that can promote economic activity. By using GIS governments gain a better understanding of the economic landscape and conditions, identify risks and vulnerabilities, analyze causes, and impacts of the shocks, their likely impacts in social and environmental context. This complements their efforts in developing - policies, strategies, human resources, institutional and financial resources for strengthening economic resilience.



## Energy Resilience

With increase in population and urbanization, demand for energy has been increasing rapidly. Water and coal, the two dominant resources for energy generation are already under pressure. Nuclear energy, solar energy and wind energy too are dependent on natural resources. Climate-related impacts on these resources add further stress on the energy security. Governments and energy producers use GIS to manage the energy balance, gain visibility into regions natural resources, planning and designing energy projects, optimize the generation, distribution, and transmission activities along with judicious use of the natural resources.

**Application Areas** - Energy Infrastructure Management, Natural Resource Management, Distribution and Transmission Management, Outage Management, Mobile Workforce Management, Distribution Integrity Management, Critical Infrastructure Protection, Emergency Response / Disaster Management



## Agriculture and Food Resilience

Even without climate change, world food prices are expected to increase due to growing populations and rising incomes, as well as a greater demand for biofuels. The effects of a changing climate will have a significant impact on the world's food supply. Seasonal water scarcity, rising temperatures, changing rainfall patterns, and intrusion of sea water threaten crop yields, jeopardizing the country's food

security. Food producers and agriculturists need GIS to understand dynamics of agro-climatic features, evaluate risks and work towards adopting sustainable agricultural practices and strengthen resilience.

**Application Areas** - Land Management, Crop Life Cycle Management, Water Resource / Irrigation Management, Precision Agriculture, Fertilizer Management, Pests and Disease Management, Farm Produce Management, Disaster Management



## Infrastructure Resilience

By presenting data on a common platform, GIS provides powerful capabilities to design, build, manage and operate physical and utility infrastructures. Digital spatial models and networks help agencies to visualize, identify risks and vulnerabilities and build capabilities to respond to shocks. Mobile solutions augment field teams for inspections, maintenance, and operations. GIS also aids in managing long-term transactions typical of the planning, analysis, design, while preserving data integrity and overall system performance.

**Application Areas** - Land Information Management, Building Information Management, Public Services Management, Energy Management, Public Safety & Physical Infrastructure Security Management, Utility Infrastructure Management (Electric, Communications, Water and Gas), Outage And Distribution Management, Mobile Workforce Management, Emergency Response / Disaster Management





## Social Resilience

Along with the nation's structural components, it is critical that the social components – people, communities and associated subjects are also strengthened to deal with disruptions and shocks. Using GIS, nations can build social resilience by empowering its citizens and communities with information and tools using which they can prepare, respond, and recover from threats and quickly adapt to the changes.



## Urban Resilience

Increasing urbanization and migration is constantly adding pressure on the urban infrastructure. In the absence of a resilient framework, disruptive events can unfold rapidly and cripple economic and social activity. GIS assists urban administration and its stakeholders by presenting data from multiple sources for an efficient decision support, sharing and collaboration of data and services, better coordination among stakeholders, efficient citizen services and optimized usage of resources. GIS GIS-based city operations centres have proved to be very effective in enhancing urban resilience by bringing together utility networks, assets and infrastructure on a common platform and aiding in prevention, preparedness, response and recovery during disruptions while at the same time supporting financial self-sufficiency.

**Application Areas** - Urban Sprawl & Growth Management, Cultural Heritage & Tourism Management, Capital Improvement Program Management, Healthcare Management, Social Infrastructure Management, Institutional Infrastructure Management, Economic Infrastructure Management, Healthcare Management, Public Safety & Physical Infrastructure Security Management and Emergency Response & Disaster Management



## Rural Resilience

Rural communities face unique challenges. Poverty, social inequalities, and lack of education makes them disproportionately vulnerable to disruptions including natural disasters and health related hazards. By bringing together all the rural subjects together on a GIS platform, governments can build rural resilience

at a block/village level and empower the rural communities to mitigate, respond, and recover from the disruptions and shocks. Spatial tools for decision support promote self-sufficiency by arming rural communities to take sound decisions on livelihoods, sustainable agriculture, and natural resource management.

**Application Areas** - Rural Infrastructure Management, Land Management, Sustainable Agriculture Management, Natural Resource Management, Livelihood Management, Economic Opportunity Management, Cultural heritage & Tourism Management, Healthcare Management, Climate Change Management, Ecology and Biodiversity Management, Conservation Management, Disaster Management



## Transportation Resilience

Disruptions to transportation networks have cascading effect on the societies and economies. GIS assists transportation personnel across the transportation life cycle. Presenting data from multiple sources for planning & monitoring, build and maintain digital network models for transportation systems, including roads, signage, signals, pavement, markings, transit, and traffic control, provide public access to traffic and road conditions, weather, and other traffic data for accurate and timely information which is critical to respond to disruptions and emergencies.

**Application Areas** - Road & Rail Infrastructure Management, Airport/Seaport Infrastructure Management, Land Information Management, Outdoor Advertising Management, Public Information Services, Transportation Infra Security, Emergency Response/Disaster Management



## Public Safety and Disaster Resilience

With human lives and property at stake, public safety and disaster resilience calls for meticulous planning and response management. GIS plays a vital role in prevention, mitigation & preparedness, response, and recovery including planning and analysis, risk assessment, public evacuation planning and damage assessment. By fostering multi-agency interoperability GIS provides common operational picture to all stakeholders along with actionable intelligence. It aids in streamlining organizational processes, workflows, and best practices.

**Application Areas** - Surveillance Management, Incident Management, Disaster Management, Emergency Operations Management, Critical Infrastructure Protection, Transportation Security Management, Emergency Response / Disaster Management



## Health Resilience

With declining fertility, increase in life expectancy adding stress to the health infrastructure, climate change is compounding the health challenges. Communities, especially poor and vulnerable are faced with increasing threat due to malnutrition, pollution, vector-borne diseases, heat waves, etc. GIS is a highly effective tool for healthcare decision support including research, epidemiological studies, surveillance, management of diseases and healthcare infrastructure. Social services organizations rely on GIS to analyze transportation networks, demographics, and other layers of essential information for assessing, delivering, and integrating their programs.

**Application Areas** - Healthcare Planning and Management, Healthcare Research, Healthcare Infrastructure Management, Healthcare Supplies and Services Management, Health Transportation Management, Emergency Response and Disaster Management



## Environmental Resilience

Environment and its resources have significant impact on sustenance of nation's growth. With directly impacting energy and food security, there is a compelling need for conservation and sustainable management of these resources. Impact of human exploitation of natural resources, climate change and resultant disaster risk can pose risk to human survival on the planet. By bringing together multidisciplinary factors and actors GIS, can play a vital role in strengthening environmental resilience of the nations.



## Climate Resilience

Climate change is a global environmental problem transcending boundaries. Geospatial technologies are vital to governments, nonprofits, and businesses to respond to climate-driven events, such as floods, earthquakes, and droughts. GIS aids in locating areas where temperatures are particularly high or erratic, discovering how natural atmospheric processes might affect global warming, create models to show how a warming climate might impact the ecology

of various regions, examine the relevance of shifts in land cover, deforestation, urban activity, and visualize multiple factors with the potential to affect crop growth, industry, wildlife and much more.

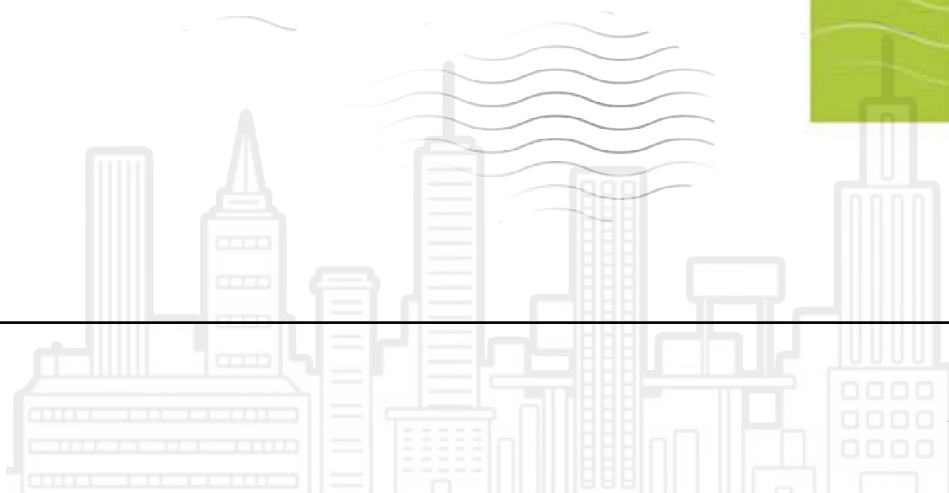
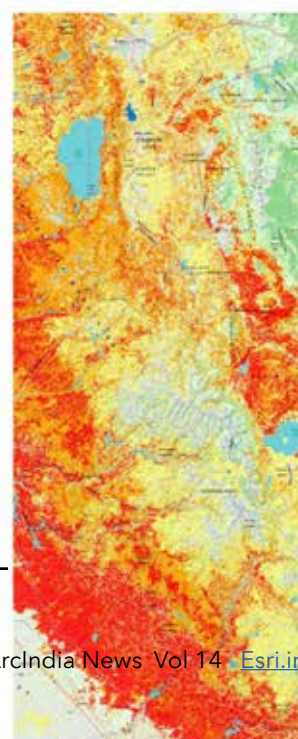
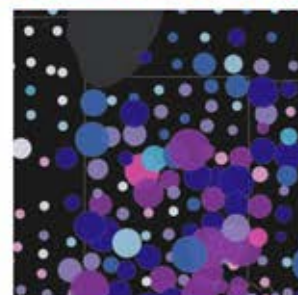
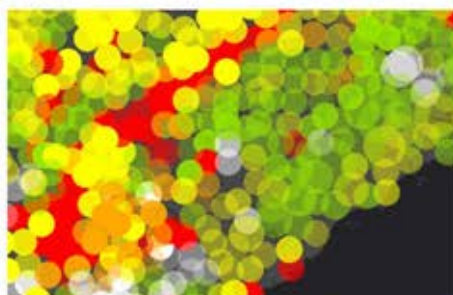
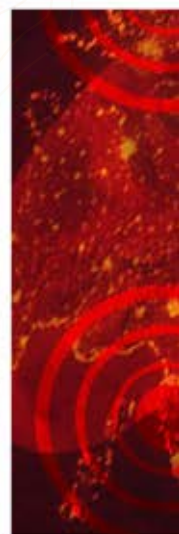
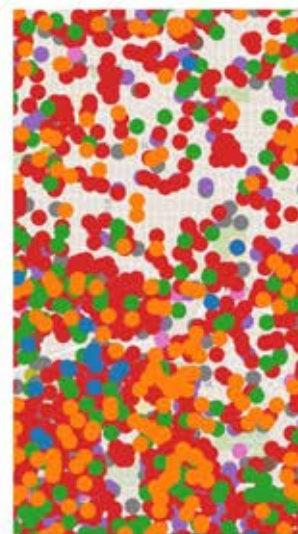
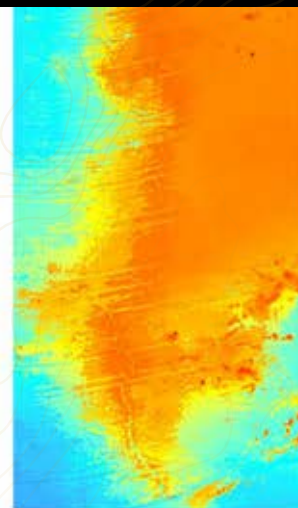
**Application Areas** - Environmental Management, Weather Information Management, Climate Change Management, Biodiversity Management, Natural Resource Management, Pollution management, Conservation Management, Disaster Management



## In closing

Disruptions and shocks are here to stay and are new-normal. Nations and communities all over the globe continue to make concerted efforts to address these challenges. While it is not humanly possible to stop the disruption from occurring, but through building resiliency the nations prepare ahead of time, operate effectively during a crisis, and recover quickly. They stay ahead of others by Preparing Strategically, Responding Rapidly and Recovering Methodically.

While governments have been embracing GIS technology to address the situations, the need of the hour is to have an integrated-geospatial infrastructure that has sustainability at its core, fosters inclusiveness, participation, and collaboration of stakeholders by embracing all linkages and interdependencies. It is time for capitalizing on the geospatial intelligence and unleashing the power of Big Data, Artificial Intelligence (AI) and Machine Learning (ML) spatially to build resilience through knowledge-based geo-enabled decision support frameworks for Aatmanirbharta and safeguarding our future.







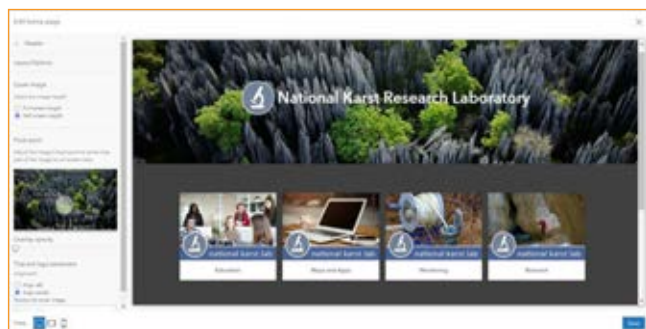
## What's new in ArcGIS Online?

**A**rcGIS Online is a complete cloud-based solution used to complement, or extend, the capabilities of ArcGIS Pro or ArcGIS Enterprise.

Keeping pace with new realities, ArcGIS Online is frequently updated and equipped for new challenges. The latest release of ArcGIS Online contains several enhancements such as a customisable homepage and a redesigned Organization Profile experience.

### Revamp your Organization's Home Page

An organization's homepage can make or break customer interaction. Communicate your organization's essence through a modern and professionally designed homepage using ArcGIS Online.



Communicate your organization's ethos using a superior homepage with immersive cover images and item thumbnails.

Enjoy a multi-device experience using customization options with our new editing capabilities offer.

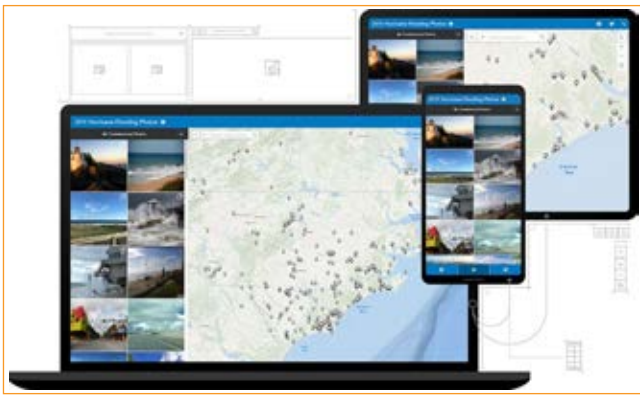
The organizations new to the ArcGIS Online family enjoy these new capabilities by default. When ready, existing users can also transition from their current homepage configurations to the new experience.

### Express Setup for Configurable Apps

Improved configuration options are now available for some ArcGIS Configurable Apps, including Nearby, Minimalist, Zone Lookup, and Attachment Viewer.

### What's New?

- Streamline your journey from map to app using Express Setup.
- Enjoy the flexibility of detailed user configurations with Full Setup options.
- Category Gallery now allows URL access; the gallery opens directly to a specific category or sub-category.



An easily adaptive multi-device experience now awaits you on ArcGIS Configurable Apps.

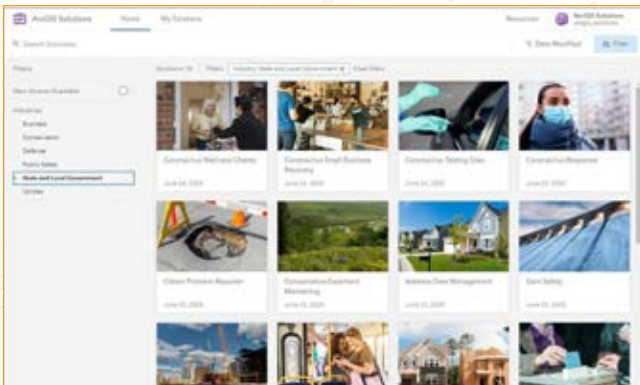
## ArcGIS Notebooks

Easily create, share, and run administrative, data management, and spatial data science workflows using Notebooks.

ArcGIS Notebooks offers:

- **Advanced Analytics:** Generate statistically significant results with spatial algorithms and open-source Python libraries.
- **Data Preparation:** Harness spatial and open-source libraries to isolate areas of interest and identify anomalies within them.
- **Inference training:** Perform inference on models using Notebooks's built-in tools that employ machine learning and deep learning frameworks.
- **Better communication:** Get your story across effectively by combining Python with interactive visuals and descriptions.

ArcGIS Notebooks provides for a Jupyter Notebook experience within ArcGIS Online. ArcGIS Notebooks is available in Standard, Advanced and Advanced (with GPU) versions.



Use filtered searches to identify the solution best for your organization.

## ArcGIS Solutions

Deploying solutions within your organisation has never been easier than with the ArcGIS Solutions app. With latest release, the app includes more than twenty-five solutions for state and local governments, and Business ArcGIS users.

## ArcGIS Business Analyst Web and Mobile Apps

Planning, site selection, and customer segmentation for your organization is in safe hands with the Business Analyst, available through a host of desktop, web, and mobile apps.



An example of how the US is using side-by-side comparisons to understand inter-generational and interracial equity.

## What's New?

- View a single infographic for up to ten areas using side-by-side comparisons.
- Experience improved Void Analysis workflows through newly added Normalization variables.
- Set up layers as standard geographic boundaries using the new Standard geographies in custom data setup.
- Highlight variables in your interest using the fully customizable My Facts tab, now available in addition to the Standard Facts tab in Business Analyst Mobile.
- New infographic report templates, including COVID-19 Impact Planning Report and Race and Age Overview

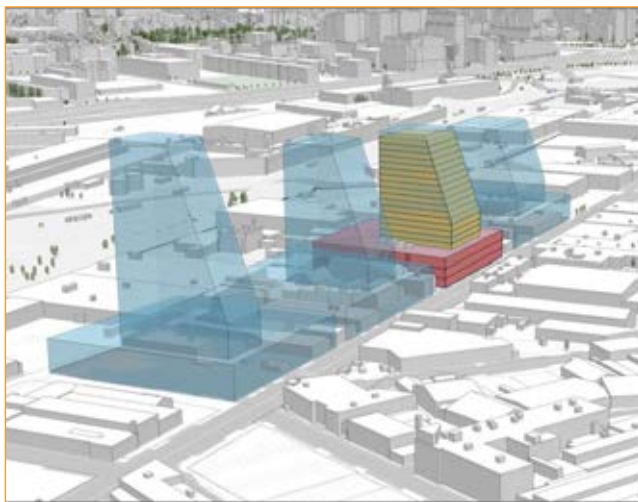
- Communicate with visually improved exported PDF map reports.

## ArcGIS Urban

Inform urban planning and decision-making using ArcGIS Urban's immersive 3D experience. The June release of ArcGIS Urban adds support for land use planning.

### What's New?

- Collaborate better with all stakeholders using an improved Public feedback feature.
- Quickly sketch buildings and visualise ground conditions using the new Project Editing feature.



Visualize and communicate ground conditions quickly using ArcGIS Urban.

## ArcGIS Analytics for IoT

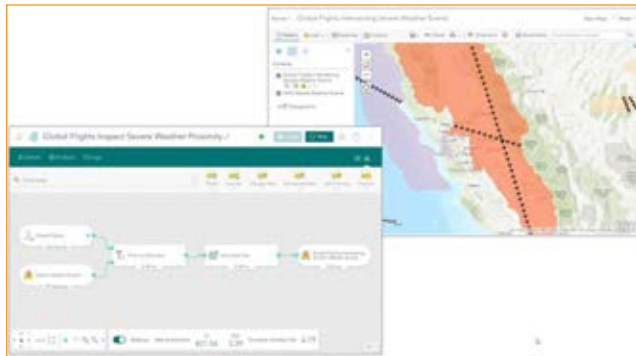
ArcGIS Analytics for IoT helps you easily access and analyze sensor data and take actions and send notifications.

### What's New?

- Notify users with text messages by configuring analytics within the new Text Message output.
- In queries, to utilise the current polling timestamp from feeds that poll websites for data, enter URL parameters with new inline variables
- Identify features that are most, or least, similar

to a set of reference features using the new Find Similar Locations analytic.

- Metrics for running analytics
- Go international with the Analytics for IoT application that now supports features like translation.



Pattern and incident analysis using Analytics for IoT could help improve safety of global flight paths intersecting severe weather events.

## Other enhancements

The latest release of Map Viewer boasts two new renderers that display superior imagery dynamically.

The Shaded Relief renderer colourizes terrain representation. It applies colour ramps to hillshaded elevation layers using a traditional, or multidirectional, hillshade.

Colormap applies a predefined colour map to a single-band image to display a colourized red, green, and blue image.

## 3D Visualization

Realistic water body visualizations, that reflect 3D objects, are now possible with the Quality Mode in Scene Viewer settings.

Waves are now more visible in top-down views; wave animations can be adjusted with Wave Size and Direction options in the Water Style.

Modifications published from ArcGIS Pro are now displayed in integrated mesh scene layers. Developers also can access these new functionalities using the ArcGIS API for JavaScript.





# Achieving Resilience SMARTly

In conversation with **Mr. G. Anand Rao**, Manager (Urban Development), Greater Visakhapatnam Smart City Corporation Limited

India's ambitious Smart City Mission aims to develop 100 citizen-friendly and self-sustainable urban settlements meeting the aspirations of citizens. It hopes to develop the institutional, physical, social, and economic infrastructure for a resilient India.

Visakhapatnam is one among 100 Smart Cities selected by Gol under Phase-I. The city's Special Purpose Vehicle (SPV) carries out Smart City Project proposals, on a PAN City and Area-Based Development (ABD) basis.

## What all comes under the purview of the SPV - Greater Visakhapatnam Smart City Corporation Limited (GVSCCL)?

We created Greater Visakhapatnam Smart City Corporation Limited (GVSCCL) to implement projects related to clean environment, basic infrastructure, and the application of smart technology. We want Visakhapatnam to become a role model for the region, and catalyze the creation of similar Smart Cities.

GVSCCL is operationalizing fifty-two city projects, with Smart City grants amounting to nearly Rs.1000.00 Crore. We have earmarked 1600 acres for projects related to various sectors, including heritage conservation, water supply and sewerage, parks and open spaces, solar, smart systems integration, roads and parking, schools, and citizen service centres. They will follow Area-Based Development strategies.

We hope to replicate these projects in city areas

outside the ABD limits, along the Smart City Mission guidelines.

## What are the initiatives/steps Greater Vishakapatnam Municipal Corporation (GVMC) is taking in building a resilient New India?

GVMC believes in a bottom-up model of resilience; we try to involve citizens in all our resilience-building initiatives.

Our City Operations Centre brings all citizen complaints on a single platform. From here, it is tracked, analysed, and escalated to different departments. Similarly, GVMC uses platforms like Facebook, Twitter, and Whatsapp to log complaints. Our grievance platform Spandana and toll free number put citizens at a fingertip's distance from authorities. We address grievances on a day-to-day basis, and ensure that solutions fall within Service-Level Agreements. This takes care of daily maintenance to ensure systems work when they have to.

GVMC tracks disastrous incidents within the city, and responds promptly. The city is equipped with Smart Poles, containing smart sensors and a Public Address (PA) system. Smart sensors track weather conditions and pollution levels across the city, while PA systems disseminate precautionary information during a disaster. Smart Poles are also equipped with emergency response systems; the City Operations Centre attends to emergencies.

## **Esri India is a staunch believer in New and Resilient India. How do you feel GIS technology and Esri India are helping further this vision?**

GIS is transforming visual interpretation. Providing us with centralized control over our assets, GIS helps track our infrastructure. Better decision-making using geo-tagged assets prevent cascading failures. GIS helps us nip problems in the bud.

GIS is helping us effectively communicate ideas and solutions to non-professionals, technical teams, and scientists alike. This speeds up and streamlines our crises responsiveness. We can now manage emergency response centrally, while retaining the capacity to work inter-departmentally and intra-departmentally.

## **Developing a Smart City is an ongoing journey, and not an ultimate destination. What role Esri India has played in this journey?**

GIS has been indispensable in completing the multiple government schemes that are currently active in Vishakapatnam. Esri's GIS solutions help GVSCCL track the progress of 52 Smart City projects progressing across Vishakapatnam. Undeterred by the large spatial spread, city-level GIS maps simplify our tasks by delivering thematic maps for situation analysis. Esri's Collector and Survey 123 applications collect data quickly to build maps instantaneously.

Even interventions have become easier. GIS maps are bettering Vishakapatnam's various urban proposals, simply because we have data readily available.

## **Currently what are the areas in which this platform is helping?**

We have created multiple dashboards through the city-level GIS Basemap, using data acquired by the City Operations Centre. Under Smart City and Amrut schemes, our water supply and sewerage networks were mapped, and the House Service Connections (HSCs) geo-tagged. We have geo-tagged nearly all municipal assets. Tracking asset functionality is a crucial requirement in city resilience.

India was hit by the COVID-19 outbreak in March this year; since then, governments are attempting to work

around the pandemic. Vishakapatnam was always ahead of the game in tackling COVID. Maps of hotspots and affected patients allowed us to quarantine various zones, and halt spread of the disease.

## **Integrated Control & Command Centers (ICCCs) were a bulwark during the COVID-19 pandemic response. Going forward, all cities will see the need to become smart cities. On the GIS front, what is your suggestive approach to non-smart cities in preparing for better responsiveness?**

Going ahead, responses adopted by the Smart Cities have much to teach the so-called 'non-smart' cities. GVMC's strategy, in particular, hinged on creating a baseline from available data, coordinating among departments, and informing citizens. All three stages of this response required that we use GIS.

We first prepared GIS-based maps to identify risky areas around COVID - 19 positive case locations. To improve data granularity, we developed an app to collect household data, and track international travellers. We believe that something as small as avoiding the use of paper forms could help control COVID-19 transmission.

Once the baseline was in place, we worked on coordination. Intra- and inter-department coordination, with the Chief Medical Officer - Health (CMOH) as nodal officer, was the first step. Then, coordinating mechanisms were extended to cover international travellers and their family members. In the process, we could track their health, and analyse risks of COVID -19 transmission.

Finally, we communicated with citizens on a daily basis. The citizens app developed under the Smart City Project was equipped with a tab for COVID - 19 awareness. We made sure that citizens were made aware of transmission risks by enabling Public Address (PA) announcements at 76 locations. Of these 76 spots, 50 locations used Smart Poles for communications. Elsewhere, 10 spots displayed 24x7 video messages through Variable Message Display Screens (VMD).

This tells us that, for better responsiveness, all three pillars are important: a baseline of information, inter- and intra-department coordination, and public confidence and participation. This makes GIS an indispensable tool for future resilience.

# "Implementation of GIS-based master plans formulation under the sub-scheme of AMRUT- Jharkhand"

**Ar. Pallavi Prakash Jha**

2 Urban Planner/ Designer,  
UD&HD, Govt. of Jharkhand

Room No. 403, Urban  
Development & Housing  
Department(UD&HD), Project  
Bhawan, Dhurwa Ranchi 834004,  
Jharkhand

Thus, census data integrated with GIS data forms the basis of inclusivity here. Existing public toilets, water networks, , power networks, slum points, landfill dumps, building footprints, etc. are mapped on GIS. This helps Urban Local Bodies (ULBs) prioritise infrastructure projects that contribute to citizen well-being.

Road lines and polygons are richly attributed to help plan integrated transport networks. The urban land-use layer incorporates AMRUT's design standards; it also accommodates building codes from Jharkhand's online Building Plan Approval Management System, and relates it to the land use allocated in the various master plans.

## Introduction:

City resilience has four key dimensions: Health and well-being, economy and society, infrastructure and environment, and leadership and strategy (The Rockefeller Foundation | ARUP). Jharkhand's data-rich GIS-based master plans offer a robust platform to investigate each of these dimensions. They build resilience through realistic insights that induce a conscious and participatory planning process.

GIS-based master plans in Jharkhand document data based on Government of India AMRUT standards. They integrate various city systems through information exchange; this promotes consistency in decision-making. In Jharkhand, GIS-based master plans have enabled officials visualise geographical and statistical information effectively. It allows them to model and foresee future scenarios, based on a data-driven and evidence-based planning approach; this helps plan resource use effectively, and firms the base for a resilience.

Nearly 26% of Jharkhand's population is tribal. Tribals also own the most land in the state; thus, prevailing land tenancy acts restrict land transfer.

Formulation of GIS-based master plans for 500 AMRUT cities is an important component of the Atal Mission for Rejuvenation and Urban Transformation (AMRUT). Forty-two Urban Local Bodies (ULBs) in Jharkhand have cabinet-approved sanctioned GIS-based master plans. Of these, seven notified ULBs are selected AMRUT cities, namely Hazaribag, Giridih, Adityapur, Deoghar, Chas, Dhanbad and Ranchi. The sub-scheme enjoys 100% central funding, with a budget of Rs. 515 crore. The Sub-scheme aims to:

1. Develop geo-referenced GIS-based maps, and land use maps;
2. GIS-based master plan formulation for 500 selected AMRUT Cities at a scale of 1:4000.

'Least cost' is a major evaluation criterion for project managers and procurement specialists with limited budgetary plans; the same held true for master plan formulation in Jharkhand. Affordable, future-proof choices at all levels of planning and decision-making, including software purchases, are important. Master plan formulation in Jharkhand has strengthened immensely through data-driven techniques on the ArcGIS platform.



This article highlights strategies employed during capacity building, procurement, plan formulation, data review, and GIS-based analysis that contributed to the success of GIS-based master plans. GIS tools and data need to be affordable, interoperable, and easily accessible. A robust web-based GIS Data Repository, user-friendly web mapping interface, analytics, and application development are crucial to expand participatory planning outreach.

“As we look towards 2017 and beyond, GIS is evolving with Spatial Analytics, Big Data and Deep Learning” (Empire Training, 2017). Geospatial technology could be the foundation of the Fourth Industrial Revolution. Deep Learning and Artificial Intelligence is our coming future (Geospatial Strategy Forum, 2017).

GIS-based maps are becoming imperative in every domain of planning and strategy. In India, government organizations are realizing the necessity of GIS-based information systems. Through various initiatives, Town and Country Planning Organization (TCPO), Ministry of Housing and Urban Affairs (MoHUA), and Government of India (GoI) along with NRSC (National Remote Sensing Centre) is building GIS capacities. Jharkhand formulated all ULB master plans using ArcGIS software.

Jharkhand's State Water Policy intends to prepare a computerized database of all cultivable plots and irrigation sources, within the state. This database will include land capacity, land use, rainfall and cropping patterns, and topography. The State Data Sharing and Accessibility Policy supports Jharkhand's State Spatial Data Infrastructure (JSSDI). Jharkhand's Urban Development & Housing Department has made GIS-based master plans for 42 ULBs; the plans comply with AMRUT's design standards for GIS data creation.

## 1. Capacity Building Stage:

Under AMRUT's sub-scheme, MoHUA and NRSC have trained decision makers, mid-level officers, and computer operators in GIS. While GIS experts are equipped to operate software and applications, it is the decision makers who envision city planning. GIS training must cater to the decision maker's perspective also.

Thus, capacity building must bridge the gap between GIS experts and decision makers, allowing them to work in tandem. Only then can valuable city-related information can be visualized, analyzed and interpreted for decision-making. Training must also update officials involved in early stages of framing RFPs; they must be aware of GIS technology, competitive GIS applications, and advancements.

## 2. Procurement Stage:

A mature RFP is one that communicates expected deliverables clearly; this mitigates quality gaps caused by the Least Cost Approach.

Officials must use the RFP to specify expected GIS technology, applications that match department skills and infrastructure, image resolution, and data-driven techniques and survey methods. Upfront, this helps to establish deliverable standards; then, even on Least Cost basis, bidders can quote with deliverables in mind.

MoHUA's TCPO has formulated a Model RFP that calls for a periodic review process. After every stage of submission, map attributes and metadata submitted by consultants are checked using ArcGIS 10.5. However, such reviews are hampered by missing links, errors, or poorly updated and reviewed data. Therefore, the RFP must limit consultant opportunities to incorporate departmental comments; this will avoid uncurtailed reviews.

Conditions for land use codes: The RFP must specify the utilization of land use codes. Layer styles and properties for AMRUT's land use categorization, and the state's land use code as per municipal acts, must be fixed upfront.

AMRUT's design standards sub-classify nearly 475 layer categories for 21 layers. The polygon layer for land use alone has about 220 categories based on sub-class classification. Additionally, these layers contain 69 class-wise classifications. At the same time, thematic GIS maps for analysis have their own layers of data categorization. The Department has also created land use codes using ArcGIS 10.5 software.

Layer and style formats: Various GIS applications have their own layer and style formats for data

classification; GIS maps save classification and symbology in the Styled Layer Descriptor (SLD) format. It describes both raster and vector data, including colours, labels, fonts, legend specifications, and so on. However, SLD files use a protocol called Web Map Service (WMS), which is incompatible with ArcGIS 10.6; often, the RFP does not mention such discrepancies. This issue requires correction.

Layer Symbol Formats using image source: AMRUT's design standards classify certain vector point features using custom symbols. ArcGIS supports symbol creation in GIF, JPG, PNG, Bitmaps, and enhanced bitmap formats through the Picture Marker Symbol. However, it is incompatible with the Scalable Vector Graphic (SVG) file format. Thus, the RFP must compel consultants to use department-specified GIS software to preserve data classification. This saves time.

Therefore, the RFP must guide quality controls effectively; for this to happen, officials must know of technical advancements. For example, they must be able to judge whether multi-angle imagery technology is an adequate replacement for stereo pair imagery. This, in turn, will allow latest technology to enter department workflows.

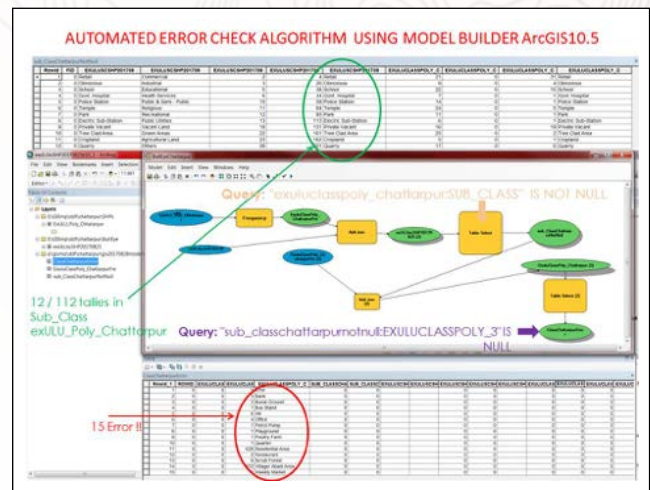
Officials must know of benefits that GIS technology, open-source, and commercial software offers, and be able to estimate their potential. They must also be able to estimate the technical specifications that their project will require. For instance, DEMs can extract features, model environments, analyse geography, or prepare meaningful thematic maps.

### 3. Review of GIS Data:

Data review has remained a challenge in departments that compile GIS data delivered by consultants.

Model Builder within Arc GIS 10.5 has simplified this review process; it allows accuracy checks for urban land use categories, across multiple cities. The input file usually consists of layers of existing urban land use submitted by multiple consultants. ArcToolbox's Frequency tool tallies data categories incorporated in these land use layers, and compares them against AMRUT's land use categories. This

creates a master file of land use categories adhering to AMRUT's design standards. Then, the two data sets are joined using land use category fields. Query Builder then selects data with null values, and segregates untallied land use category errors, for consultants to rectify.



Data delivered by consultants is tallied against AMRUT's landuse categories using ArcGIS Toolbox. Query Builder then selects data with null values, and segregates untallied land use category errors, for consultants to rectify.

For example, Model Builder could estimate the Mean Relative Error in DSM to check accuracies of DSM,DTMandGroundControlPoints(GCP)delivered by consultants. This check pushed consultants to improve data quality; they incorporated advanced raster interpolation methods to improve the accuracy of DSM and DTM.

ArcCatalog within ArcGIS 10.5 allows users to preview main .mxd files, against layers and raster data; this eases review. ArcGIS 10.5 also simplifies feature extraction by allowing changes in the bandwidths of raster files.

### 4. Base Maps and Master Plan Formulation Stage:

AMRUT design standards outline the process of master plan formulation under two major components: (a) Base map preparation; and, (b) Master plan formulation.

Base maps detail roads, building layouts, open spaces, green areas, water bodies, spatial extent of development, land parcels, etc. They are developed from Very High Resolution Satellite images (VHRS) procured through NRSC.



Consultants used DEM and DSM to estimate heights of built forms for Deoghar and Chas using raster interpolation methods. Multi-criteria decisions are possible with such information; it reflects existing infrastructure conditions, road widths, tree canopy, traffic data, state's TOD policy, etc. Raster interpolation improves Building Density Analysis; it is an important criteria for Floor Area Ratio (FAR) allocation in the city. Infrastructure planning also benefits, since this method optimises the use of city infrastructure and utilities by properly allocating FAR at master plan level.



DSM of Deoghar Town at 465,728.320 2,710,089.498 Meters, view in ArcScene 10.6; Source: Superview Stereo Data: Satellite-SV1B, SV1B; Sensor id-PMS; Task time-2017/11/28; Cloud cover-0; procured from NRSC by UD&HD, Government of Jharkhand.

Next, individual ULBs vetted their respective draft base maps. UD&HD (GoJ), through SUDA and TCPO, trained ULB officers to vet GIS and land use maps. To this end, ULB officials mapped random reference points from known local areas. They used Google Maps and Google Earth, on mobile, to create Keyhole Markup Language (.kml) points. Using ArcGIS, they overlaid these points on base maps created by consultants.

Following cross-verification and multiple stakeholder meetings, ULBs validated the base maps. Processes designed in ArcGIS 10.5 Model Builder verified data submitted at state-level Consultancy Evaluation Review Committee (CERC) meetings. After this, base maps were overlaid on digitized cadastral maps, village maps, and ward boundaries for master plan formulation.

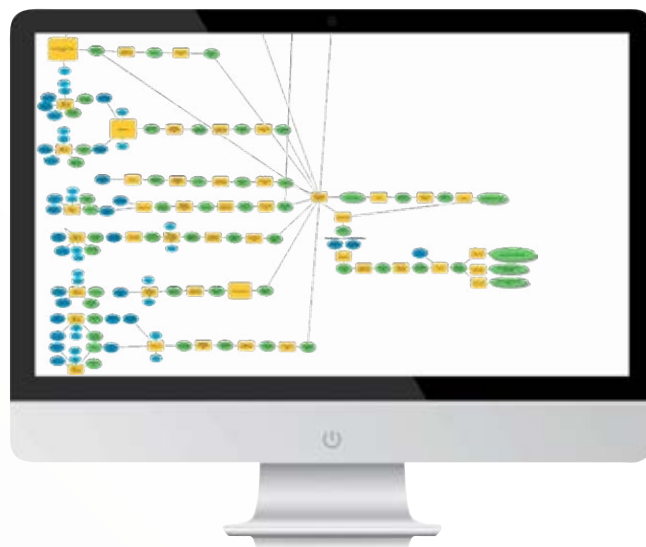
The master plan guides urban land use management towards sustainability. The final base maps for master plan formulation contain spatial attributes extracted from primary and secondary

surveys of social, demographic, historical, and other information. This is used to create thematic maps that accurately reflect ground realities. These thematic maps can help extend Multi-criteria Site Suitability Analysis in land use planning towards a participatory planning approach. For example, Map Algebra methods in Model Builder helped decide the best possible routes for Public Bicycle Sharing (PBS).

Finally, decisions-makers make the Draft Master Plans available on public domains for citizen participation. Consensus-based suggestions are then incorporated in the final Master Plans, prior to the Cabinet approval procedure.

## 5. Using Master Plan's GIS Data:

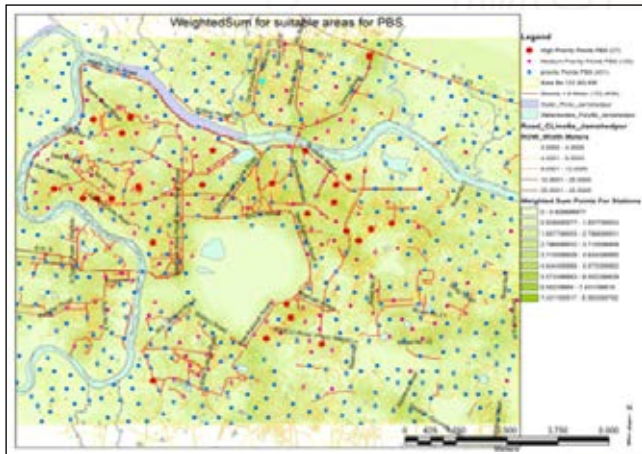
ArcGIS 10.5 simplified complex modeling for spatial tasks, and complex raster and vector analysis. Algorithms developed in Model Builder helped users create algorithms, even when knowledge of programming languages was limited.



Algorithm for weighted sum output for Suitable PBS Stations using Model Builder in ArcGIS 10.5.

Most importantly, GIS data in Sanctioned Master Plans is now available to various line departments, for project planning and decision-making. In future, the state can integrate this data with the existing Building Plan Approval Management System (BPAMS) to simplify land use verification and speed up permits for construction.





Output for Suitable PBS Stations for Jamshedpur; Data Source- UD&HD, Government of Jharkhand.

## 6. Need for Common GIS Application Platform:

A common GIS platform is mandatory when creating multiple city master plans within a state. It improves coordination, preserves data categories in layers, and standardises symbols and styles. Therefore, RFPs must specify preferred versions and brands of GIS software to ensure that consistent data products are created within efficient timeframes.

## 7. Need for Web-Based GIS Portal for Data Repository, Applications & Mapping:

Increased GIS literacy and user-friendly web-based GIS software is empowering data-driven decision making.

To cover the still-existent gap between decision makers and GIS experts, GIS outreach is mandatory. It saves time by eradicating duplicate work in different divisions of state and central departments.

Data-at-source requires continuous updates based on new development schemes, or projects. Near real-time data updates become possible when data is shared across departments; by extension, this makes master plan updates cost- and time-effective. Broader participatory planning approaches become a reality when social media data (scrapped for sentiment analysis) is integrated with real-time spatial data.

Domain knowledge within the department is intrinsic to using spatial and non-spatial data effectively. Therefore, State Town & Country Planning

Departments must frame data sharing policies in favour of the department. This allows departments to control their data better, granting them ownership and accountability.

Town planning departments at state level must consider maintaining individual GIS cells with IT-enabled facilities for GIS data storage, web publishing, and sharing. Individual departments could also decide the extent of data sharing, in line with the state's data sharing and accessibility policy. Data access levels given to line departments, and state and national repositories could be decided.

Town planning departments must directly engage with consultants to ensure good practices while standardizing spatial data, metadata, and other interoperable data formats pertaining to master plans. Better quality controls, adhering to open standards and interoperable formats, minimise administrative processes and manual intervention.

## 8. Conclusion:

GIS-based systems must incorporate flexibility for data sharing and data interoperability. An evolved State Data Sharing and accessibility policy can ensure GIS data quality, standardize and limit data sharing, safeguard data from duplication, and prevent data misuse.

Departments must use policy-level discussions to mandate OGC compliances; this will smooth data sharing, access, and interoperability. In this regard, advanced investigations can help create geodetic control standards that standardize data products up to state-level.. This is especially true for projects with multiple consultants who use their own survey equipment, at varying level of accuracies.

The future demands real-time information and Big Data analytics. It is important that we equip our independent researchers, students, academicians, professionals, and experts with knowledge on trending software, and freely available shared data. GIS software can equip planners to integrate their domain knowledge in planning with data-driven pragmatic and rational methodologies. This is the way to creating resilient cities with a conscious participatory planning approach. This is the way to futuristic planning.





# AT&T Taps Advanced Analytics to Map Decades of Climate Risk

**W**hen one of the world's biggest companies uses big data and location intelligence to predict how climate change will affect its business for the next 30 years, the signal is clear: climate risk is real, and businesses must adapt.

Every year, the World Economic Forum asks leaders in government, business, and academia to identify the most consequential risks facing the world over the next decade. This year, for the first time in its 14-year history, the Global Risks Report revealed a striking consensus: the top five biggest risks were all climate related, from extreme weather events to collapsing ecosystems.

The fallout is already apparent. For example, real estate that is likely to face climate change-fuelled flooding is already selling for 15 percent less than properties free of that risk.

For industry leaders that take the long view,

it's a reality they can't afford to ignore. In a recent open letter to corporate executives, BlackRock CEO and chairman Laurence Fink emphasized that climate risk would be a major guiding force in how the firm invests its \$7.4 trillion in assets going forward.

In part, insurers and influential investors are driving the trend, demanding new levels of transparency from businesses on the climate risks their assets face. That's because the costs of climate change are becoming more apparent as its impacts accelerate. In 2017, when Hurricanes Maria and Harvey pummeled the US and nearby island nations, and storms battered Northern and Central Europe, insurers paid out a record \$135 billion around the world. In the US alone, total damages skyrocketed to \$307 billion.

Climate change is already reshaping the world economy. The degree to which business leaders



accept this fact—and the speed at which they adopt the right actions in the right locations—may reset the roster of industry leaders in the coming years.

## Assessing and Mapping Climate Risk

Leaders at AT&T—the world’s largest telecom company by market cap—are focused on doing their part to mitigate climate damage. The company serves as an essential utility to millions, providing connections to home computers, mobile devices, IoT sensors, and more. Those services are digital, but the infrastructure that powers them – from cell towers to base stations – is very much part of the physical world, and vulnerable to climate impacts.

A pioneering public-private collaboration between the telecom giant and the US Department of Energy’s Argonne National Laboratory points out how data and location intelligence can shed light on both climate risk and business adaptation. Combining the data-gathering and supercomputing powers of the leading national lab with the visual and analytic capabilities of geographic information systems (GIS), AT&T developed a climate analysis tool capable of identifying the areas of its network most at risk in the US Southeast.

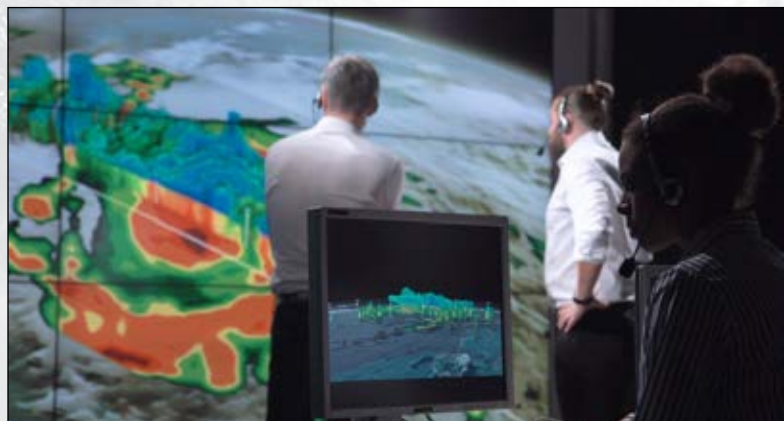
With an unprecedented degree of detail, they forecasted how building and cell tower infrastructure in four states – Georgia, North Carolina, South Carolina, and Florida – could be affected by impacts from, for example, a 50-year storm event in the coming decades.

“It’s not just AT&T – I’m seeing this more and more in all kinds of industries where companies are saying, ‘If this is the reality, then let’s prepare for it, let’s deal with it,’ ” says Antoine Diffloth, director of data insights in the Chief Data Office at AT&T.

## Bolstering Climate Resiliency through Data

AT&T had been formalizing its climate adaptation efforts since 2015, but the cascade of severe weather events that struck the US between 2016 and 2018 made it clear how alarming climate risk was becoming. During that time, repair and recovery from major storms cost AT&T over \$800 million.

As one of the world’s largest companies, with revenues of \$181.2 billion and over 247,000 employees, AT&T has a vast infrastructure network and thousands of pieces of equipment exposed to the worst that Mother Nature can deliver. With the blessing of the company’s executives, data and sustainability teams began developing a tool that would predict impacts on areas of the network most at risk from climate change, all the way out to 2050.



Climate damage assessments are significant to bolster infrastructure utilities, and ensure that they continue functioning in a crises.

“One of the things we quickly realized was that if we’re going to talk about climate change, probably the best thing we could do is give folks a visual representation of that,” says Shannon Carroll, director of global environmental sustainability at AT&T. “You have to think about the end user. You could give them a bunch of datasets, but how useful is that really?”

To capture climate data in a visually engaging way, AT&T turned to the GIS technology it was already using to map locations of its infrastructure assets. The smart map was a natural fit both to communicate with stakeholders and to shape decisions around



We’re helping an organization understand something about their own internal risk due to climate impacts, but we’re doing so by conducting additional modeling that hasn’t been done before. There is scientific discovery with each of these projects. ”

**Tom Wall**, Argonne National Laboratory



adaptation and resilience. “People just gravitate to seeing it this way,” Diffloth says.

AT&T has had plenty of experience dealing with big data, as the company processes huge streams of information generated by its network users. But while AT&T relies on its own meteorological operation center to forecast short-term weather events, it lacked the expertise to manage and build predictive models for climate change. They needed new data to match a new reality. For that, they reached out to one of the nation’s top research institutions, Argonne National Laboratory.

### Groundbreaking New Climate Modeling

Many companies conducting climate risk and adaptation analysis end up relying on generalized data that’s often dated by several years or even decades. By working with Argonne, AT&T had the advantage of accessing timely data tailored to their locations of interest and climate risk priorities.

“AT&T’s problem was very complex and very, very specific,” says Thomas Wall, program lead for engineering and applied resilience at Argonne. “It was also at a systems-level scale that is much larger and more detailed than most of what I’ve seen for these types of projects.”

The telecom giant was particularly interested in flood risk and high-intensity winds – the two threats deemed most significant to electrical and battery-powered equipment aboveground and underground. Company leaders particularly wanted to know the depth of inundation in scenarios of varying severity in the four southeastern states of focus, both inland and along the coast.

“We’ve had a lot experience dealing with big data. What we did not have a lot of experience with is climate change and how to create models around climate change. That’s where Argonne came in.”

**Antoine Diffloth**, AT&T

To carry out the task, Argonne built on its physics-based regional climate modeling system, taking global climate predictions and applying them to a local level. While most climate modeling of this kind works on 12-kilometer blocks, Argonne was able to enhance the focus down to hyperlocal, 200-meter blocks – the most detailed level of climate modeling available that covers the four southeastern states of focus.



Climate modeling is as necessary for resilience, as it is to take advantage of new and renewable energy sources such as wind and solar power. AT&T was particularly interested in flood risk and high-intensity winds – the two threats deemed most significant to electrical and battery-powered equipment aboveground and underground.

### Adaptation Today for Resiliency Tomorrow

To address flood risks, researchers used advanced hydrologic and hydraulic models to simulate how water would flow and pool around terrain. The analysis was broken into 200-meter by 200-meter cells – roughly the size of seven football fields – and applied throughout the entire Southeast region, covering more than 35 million grid cells. Using world-class supercomputers, Argonne was then able to reduce the project data, equivalent to about 500 billion pages of text, to an output that could be formatted into AT&T’s GIS. AT&T then layered the climate forecasts and information on maps of the company’s network assets.

“What’s really important here is the quality of the data,” Carroll says. “It’s never perfect, but if we know with a 95 percent confidence interval that between now and the next 30 years, a specific grid cell will



have a maximum flooding of 15 feet, that's really good information to have." Utilizing the smart maps, AT&T can determine which assets they have in each cell and how susceptible they are to flooding.

The precision of the climate data and the visualization power of the smart maps enabled a sharper level of predictive analysis, helping AT&T plan today for resiliency tomorrow. Even within a mile or two, local topography, such as hills and valleys, affects coastal flooding and presents different levels of risk. With knowledge of those risks, a planning team might decide to move the construction of a cell tower 200 meters south to an area less prone to floods or wind, or to the other side of a highway. The team can shore up existing facilities, knowing that one building may only need to be reinforced by sandbags, while at another location, batteries need to be elevated to avoid maximum flooding levels. "The more granular you can get, the better decisions you can make," Diffloth says.



Construction of resilient cell towers and networking infrastructure depends on the quality of data. It grants a confidence interval that is crucial in understanding susceptibility to damage.

With this climate-prediction tool in hand, AT&T is able to take a proactive approach to growing risks from extreme weather events, ensuring the safety and integrity of its facilities, and the continuity of its service to customers.

"What this tool does is complete the adaptation side of climate change," Carroll says. "How are you going to adapt to the parts of climate change that are already baked in? How are you prepared for the future? That's how this tool helps."

## Strengthening Communities in the Face of Climate Threats

From the beginning, the AT&T teams working on the climate risk analysis tool decided they were going to make the data available to everyone. They even publicized access to the climate data through press releases and social media channels, encouraging people and groups to download it.

Launching a climate resiliency community challenge, AT&T and Argonne invited local municipalities and universities in the four-state region to submit applications to work with the data in ways that would address local problems. Five universities were selected and each given \$50,000 to assist communities with climate resiliency and adaptation.

Argonne's motivation to map climate risk in collaboration with companies like AT&T keeps a larger perspective in mind - the insights they uncover often benefit not just the individual company but also the larger region.

"It's not just helping their business do better, it's broader than that," says Argonne's Wall. "It's helping the community they serve be more resilient in the future."

Businesses are increasingly stepping into the role of neighborhood watch, alerting communities to the impacts of climate change as part of their corporate social responsibility missions. For instance, the design firm Atkins used GIS technology to develop a simulator that shows residents of a given municipality how the impacts of climate change will affect their lives on a daily basis.

It speaks to the larger reality that no single company's efforts will turn the tide of climate change. But, by adapting to risks, a company can create—data, processes, maps – that business leaders can share, encouraging orchestrated action in the most vulnerable places.

"I've got two young kids," Diffloth says. "It might sound trite, but I want to do what I can to leave a better place for them. I can't set policy, I'm not a climatologist. But I can do stuff with data. So, this is my contribution to leaving the world a better place."



# Take your Map to the Next Level: Tips & Tricks

**W**hat if few extra minutes could make a world of difference to your mapping?

Generate accurate datasets. Ease analysis, and improve visualisation. Communicate better data stories with lessons for everyone.

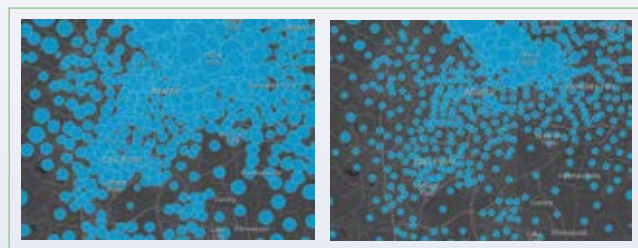
Here are our nifty tricks on how to project content-rich cartography that delivers compelling stories.

## Find the Pattern in your Data

Be deliberate when assigning data with colours, or symbol size. Choose values that clarify the patterns within data.

### How do you ensure this?

- Vary sizes to represent your data.
- Use the handles within Histogram to readjust your map quickly.

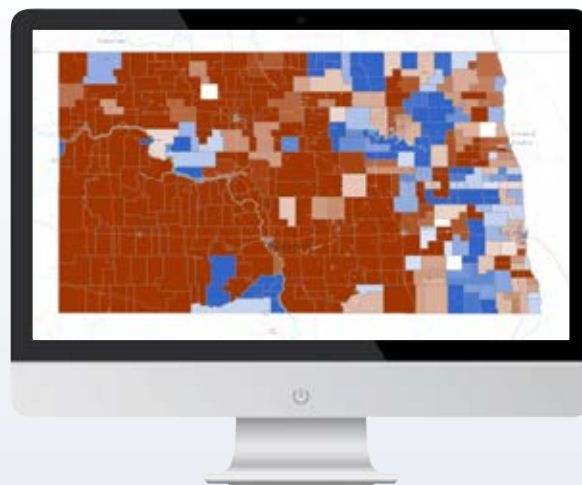


LEFT: Continuous ramp through all values of the data.  
RIGHT: Map starts showing larger circles once a value is above average.

- Emphasize deviations from the mean: Adjusting the average value of the histogram can direct attention to data points that lie above or below average. Specify the average by hovering over the x-bar value to the right of the histogram, or type an exact value into it.

## Find the Largest Value

How can you avoid calculations within datasets, but visualize predominant values just as effectively? Use Smart Mapping's built-in interface to pinpoint the largest value between multiple attributes. Do away with calculations in data fields!



An example for a predominance map.

- The interface allows you to choose (up to) five numeric attributes that share a common subject of measurement.



## Choose Basemap-Specific Colour Ramps

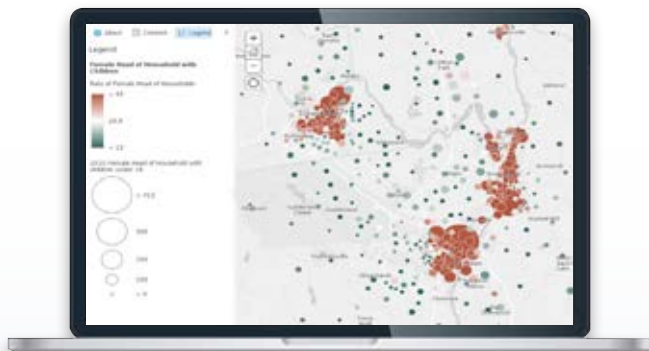
ArcGIS contains many basemap-specific colour ramps. When switching between basemaps, Smart Mapping automatically suggests colour ramps that could display selected data better. For example, Light and Dark Gray Canvas basemaps are designed to enhance stories, while colour blind- friendly template options improve upon ArcGIS accessibility.



Alternative color ramp that matches the context of data.

## Use Size and Colour

Smart Mapping in ArcGIS utilizes Colour and Size to enhance data patterns.

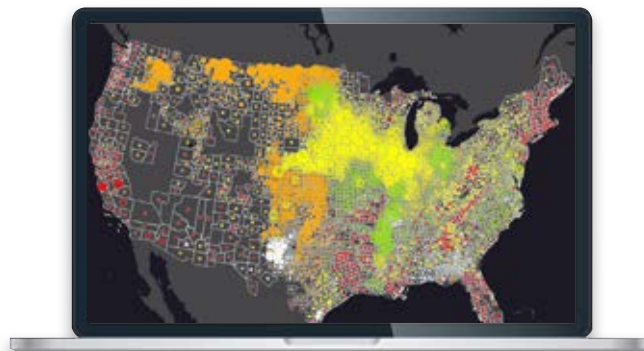


Multivariate map display using smart mapping.

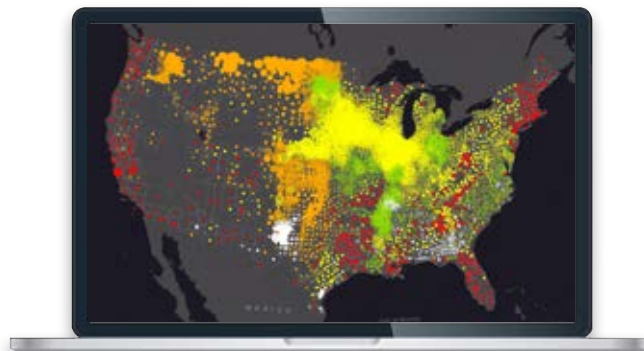
- Smart Mapping suggests colour and Size options that can help draw attention to areas with higher variable counts.
- To better analyse underlying patterns in multivariate maps, use count attributes for size, and a normalized attribute for color.

## Adjust Outlines

Point and Polygon outlines can divert attention from your map's message. Easily sidestep this issue by toggling Colour and Transparency on boundaries/outlines.



Overbearing boundaries and outlines in a map.



Transparent circle outlines and boundaries with a color similar to the basemap.

## Decide the focus of your map by:

- Changing point and polygon outlines to slightly transparent values
- Attributing colours similar to the basemap
- Applying fully transparent boundaries to variables not intrinsic to your story

## Utilize Transparency

Enhance the readability of your map by highlighting a pattern, or a statistically significant value. Contrast and emphasize the core variables that tell your story using Transparency attributes on supporting variables.

To toggle transparency, select the required attribute field from data, and then adjust the Transparency Range.



Setting transparency based on attribute values.

# ArcGIS Collector (20.2)

Part of the Esri Geospatial Cloud, ArcGIS Collector, a mobile data collection app, makes it easy to capture accurate data. Fieldworkers use web maps on mobile devices to capture and edit data. ArcGIS Collector works even without Internet and integrates seamlessly into ArcGIS. You can do the following with it:

- Data captured with Collector feeds directly into ArcGIS, so everyone works from the same accurate data.
- Collector uses smart devices to capture field data and seamlessly return it to the office reducing manual processes.
- Add new assets and update existing GIS data in any environment, remote to urban, on your authoritative maps. In connected environments, data feeds directly into ArcGIS. Otherwise, it will reside on your device then sync as soon as connected. Create, deploy, and manage apps in a single place.

## Updates from the latest release

The 20.2 release is a major update that includes better-looking and more performant maps, modern user experience, improved form editing, better offline experience, new tools and support for 3D data-collection.

### 1. Better Looking

An upgraded engine powers Collector and now supports map rotation capability. Use vector base maps and view crisp, high-quality cartography that takes advantage of the pixel density of high-end mobile devices.

### 2. Modern User Experience

When editing forms, a user has faster access to the camera and a preview is provided inline for quick access to all the photos that are to be captured.

Common tasks are now available on a quick access toolbar at the bottom of the panel.

### 3. Form Improvements

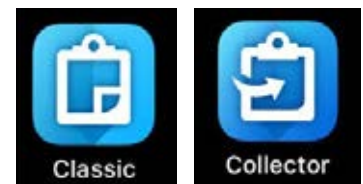
Forms include support for attribute expressions

authored using Arcade and included within the user-created popups.

This version supports photo and video capturing. Scan a QR code or barcode and automatically populate a text field.

### 4. Improved Offline Experience

Collector still supports taking maps offline to work in areas with unreliable connectivity. In the app, mobile workers can still define and download multiple map areas to take offline. Map authors can now create map areas as part of the map so that mobile workers in Collector can download them by name, without having to configure the areas themselves.



Collector for ArcGIS - logo update

### 5. 3D Data Collection

Collector now supports the capture of elevation within the z-value of a geometry when using GPS. If using a high accuracy GPS receiver, we will apply an MSL to the Z value in the geometry as well.

### 6. New Tools

Compass: Working in the field, the user might be near the asset or observation and can use the Compass (available in the asset or observation's Overflow menu) to get to where one needs to be. The map orients itself in the facing direction, and a guideline shows the direction to the asset or observation point.

Direction: If the user needs to navigate streets to get to the observation area, use Direction before using the compass. Navigation can be done using either Google Maps or Navigator for ArcGIS.

To ensure a smooth transition, both the Classic version and the new Collector app can be installed and run parallelly on Android devices. One can migrate to the new app when ready to do so. Regular updates will allow for a hassle-free experience.

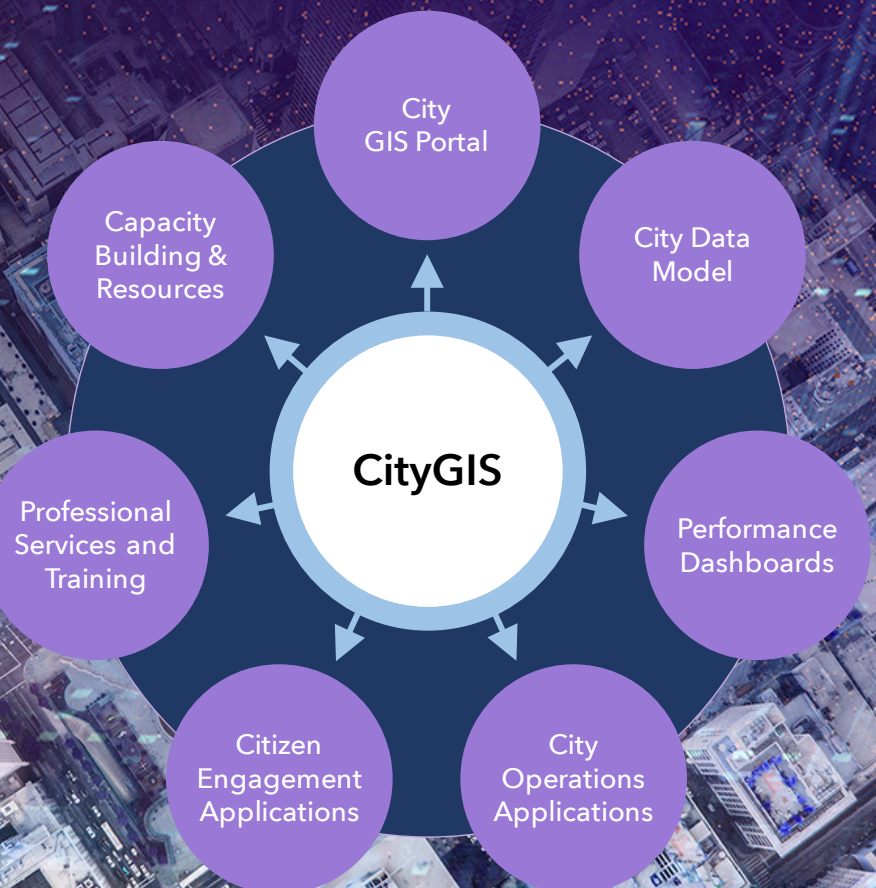


# CityGIS

## Geo-enabled city management solution

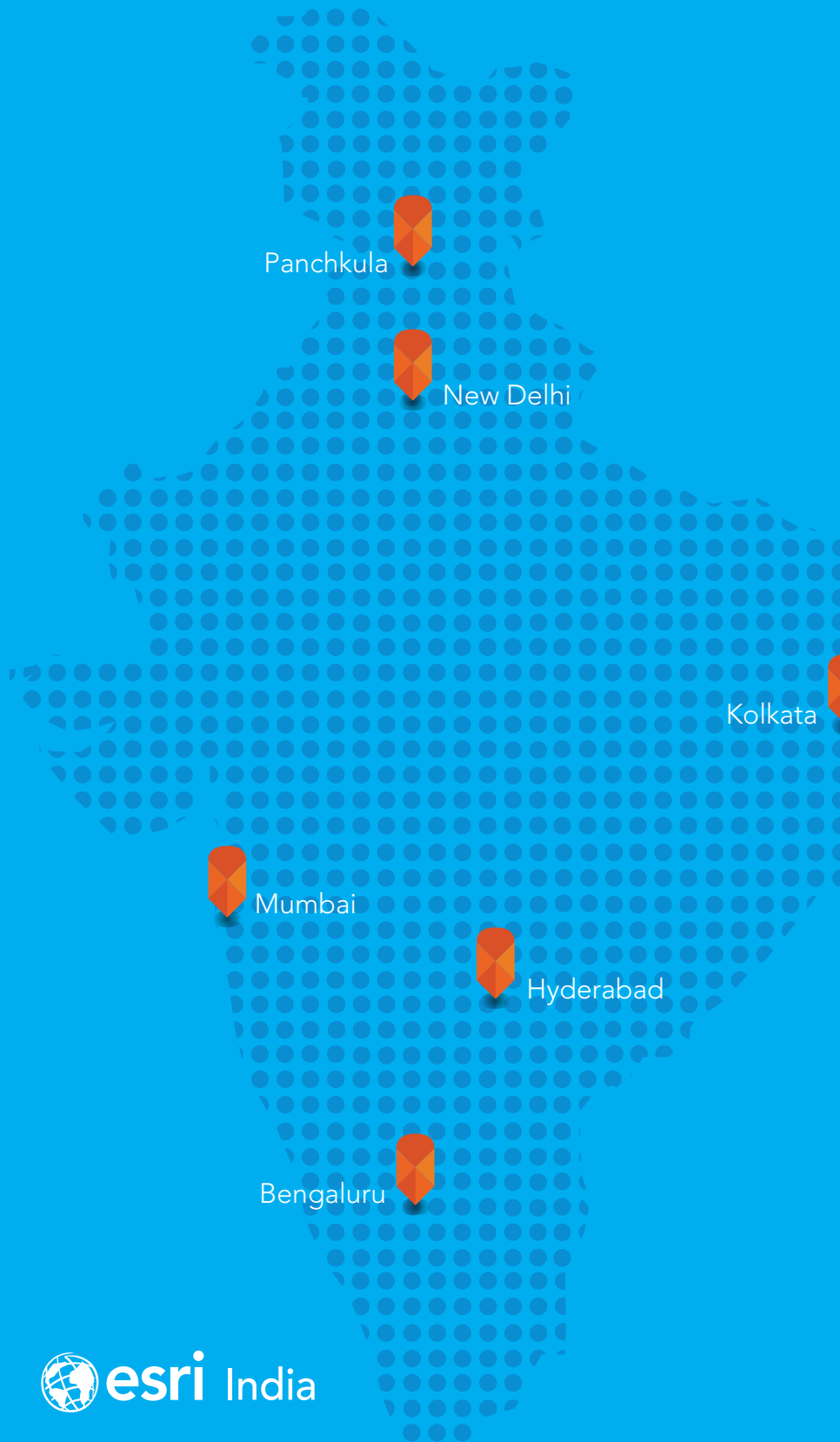
CityGIS solution supports your city management projects through a detailed process of planning and implementation that involves citizens, government, and municipal corporation. While citizens get better services, city stakeholders gain better inter-department collaboration, improved operational efficiency, visibility of day-to-day operations, and visibility of on-going projects.

For details visit [esri.in/citygis](https://esri.in/citygis) or email us [info@esri.in](mailto:info@esri.in)





# Esri India Locations



## Bengaluru

# 70, 1st Floor,  
Above ICICI Bank,  
45th Cross, 8th Block, Jayanagar  
Bengaluru - 560082, Karnataka

## Hyderabad

Apeejay Business Center, Tresorie,  
1st Floor, The PARK, 22, Raj bhavan Road,  
Hyderabad - 500 082, Telangana

## Kolkata

Block DN - 62, Sector - V, 12th Floor, Tower II,  
Millennium City Information Technology Park,  
Bidhan Nagar, Salt Lake  
Kolkata - 700 091, West Bengal

## Mumbai

EFC Business Center,  
D wing, 14th floor, Empire Tower Reliable Cloudcity  
GUT No.31 Airoli  
Navi Mumbai - 400708, Maharashtra

## Noida

10<sup>th</sup> Floor, Max Tower,  
Delhi One C-001/A/1, Sector - 16B  
Noida - 201301, Uttar Pradesh

## Panchkula

Plot no - 16, Sec - 22, 3rd Floor, Panchkula IT Park,  
Panchkula - 134114, Haryana



Esri India Technologies Private Ltd.

(erstwhile Esri India Technologies Ltd.)

10<sup>th</sup> Floor, Max Tower, Delhi One C-001/A/1,  
Sector - 16B Noida - 201301, Uttar Pradesh (India)  
Toll Free No. 1800-102-1918 | Email : [info@esri.in](mailto:info@esri.in) | Web : [esri.in](http://esri.in)