



Arc India News

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COVER STORY

GIS Making Cities More Livable

CASE STUDY

Adani Electricity Mumbai Limited
Optimizes Outage Management
with ArcGIS

ARTICLE

2025: Usher a new
Vision with GIS

PRODUCT REVIEW

ArcGIS CityEngine



ESRI INDIA LOCATIONS



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Agendra Kumar

Managing Director, Esri India

As urbanization accelerates, creating more livable cities is no longer a choice—it's a vital necessity to ensure a high quality of life for all citizens. With rapid population growth and increasing migration to cities, many urban areas are struggling with overcrowding, pollution, inadequate infrastructure, and insufficient public services. These challenges often lead to poor living conditions, safety and security issues, limited access to essential services like healthcare and education, and a general decline in residents' well-being.

Livable cities prioritize sustainability, accessibility, and resilience, ensuring that people can thrive in environments with clean air, efficient public transport, better roads and utility infrastructure, green spaces, easy access to healthcare and education. By designing urban spaces that are both functional and aesthetically appealing, we can reduce stress, promote better health, and create environments where economic opportunities are accessible to all.

To build smarter, more livable cities, data-driven solutions are essential. Geographic Information Systems (GIS) can play a vital role in urban planning by integrating diverse data sources—such as satellite images, ground surveys, and Internet of Things (IoT) sensors—into a unified platform. GIS helps cities make informed decisions by providing insights and enabling scenario-based analysis. A critical feature of GIS is 'Geodesign,' a methodology that enables efficient urban design by considering geographical and functional attributes. It allows planners to evaluate different design scenarios interactively, optimizing urban areas based on a variety of factors. Imagine planning a new suburban area covering 500 square kilometers to accommodate a population density of 500 people per square kilometer. GIS can help assess topographical attributes such as contours, water bodies, and existing infrastructure. Using this data, planners can design housing, workplaces, schools, hospitals, parks, and recreational areas in a way that maximizes space and resources.

Additionally, GIS can be used for detailed planning of utilities, drainage systems, roads, and parking facilities. With tools like ArcGIS Urban, ArcGIS CityEngine, ArcGIS Reality, urban planners can simulate various scenarios, such as increasing the height of buildings from 18 to 25

floors, and understanding the impact of such changes on infrastructure, traffic, and the environment. It also facilitates sustainable planning by incorporating factors like carbon neutrality and weather patterns.

One successful example of GIS in urban planning is the GIFT City in Gandhinagar, which showcases how GIS can be used for effective planning, development, and management of a modern urban area. The city's design is a testament to the potential of integrating technology into urban transformation.

While several government programs are working towards making urban spaces more livable, upgrading transport systems, ensuring 24/7 water supply, addressing concerns such as urban flooding, and enhancing safety and security should all be part of the broader strategy for transforming cities into smarter, more sustainable living environments. Let's prioritize creating smarter, livable cities for all, with GIS serving as the key enabler of this transformation.



Esri India and IITTNiF

Inaugurate Center of Competence at IIT Tirupati



A Center of Competence was officially inaugurated by **Chief Guest Prof. Abhay Karandikar, DST Secretary** at IIT Tirupati on 17th March 2025. Esri India and IIT Tirupati Navavishkar I-Hub Foundation (IITTNiF) had earlier signed a Memorandum of Understanding (MoU) to establish the Center of Competence (CoC) to drive geospatial education, research, and industry applications, reinforcing India's position as a global leader in GIS innovation.

The CoC will provide students, researchers, and startups access to advanced GIS tools, training modules, and real-world applications. This collaboration is expected to foster breakthrough developments in land management, urban planning, transportation, and drone-based geospatial analytics.



Prof. Abhay Karandikar, DST Secretary, said at the occasion, "Strengthening the collaboration between academia and industry is essential for building a skilled geospatial workforce

in the country. Initiatives like the Center of Competence at IIT Tirupati can not only equip the students with the right skillsets for better job opportunities but also help them gain spatial intelligence and develop solutions that can solve the challenges of the country."

Prof. K. N. Satyanarayana, Director, IIT Tirupati, said, "We are excited to collaborate with Esri India to establish a Center of Competence at IIT Tirupati. This collaboration will empower students, startups, and professionals with access to state-of-the-art geospatial technologies, fostering innovation and addressing real-world challenges. Through tailored training and strong industry-academia connections, we aim to cultivate a skilled generation of geospatial experts ready to drive technological and economic progress."



Agendra Kumar, Managing Director, Esri India, said, "Our partnership with IIT Tirupati through the Center of Competence is a key step in developing the next generation of geospatial professionals. With the rise of geospatial technologies, including satellite and drone data, AI/ML integration, and advanced analytics, this initiative will equip students and professionals with cutting-edge GIS skills. These capabilities will drive innovation across industries, offering vast career opportunities. This collaboration reflects our commitment to building a skilled geospatial workforce for the future."

The event further highlighted key industry partnerships, startup advancements, and cutting-edge research. It also featured a showcase of startups in the area of geospatial technologies.

Young Scholar Program 2025 Results Announced

Esri India's Young Scholar Program provides students with a platform to showcase their GIS projects and gain recognition for their innovative work. By participating, they stand a chance to win exciting prizes, gain access to exclusive learning resources, and expand their professional network within the GIS community.

Over **125 colleges** actively participated in this year's program. After following a rigorous evaluation, the following students were selected as the winners of the Young Scholar Program 2025.



Birla Institute of Technology, Mesra (M.Sc. Geo-Informatics)
Project: **Archer: An open-source GIS AI assistant for ArcGIS Pro**



IIT Bombay (M.Tech Geo-Informatics)
Project: **IoT-based lake monitoring system**



Shivaji University Kolhapur, Maharashtra
(M.Tech Geo-Informatics)
Project: **Integrated Dam Breach Analysis, Real-Time Evacuation and Early Alert System: A Mobile Application for Koyna Dam**

GIS: Building More Livable Cities

Cities are the hubs where culture, commerce, innovation, and human interaction thrive. With the massive shift toward city living, the concept of “livability” has become central to discussions around urban planning, public policy, and sustainable development. **But what exactly makes a city livable?**

At its core, livability refers to the quality of life in a city, encompassing aspects like safety, affordability, accessibility, and overall well-being of its residents. It's not just about what a city has, but how these elements are combined in a way that fosters a high standard of living.

Urban Planning and Land Use

Urban planning and land use are fundamental in making cities more livable by strategically organizing spaces to enhance functionality, sustainability, and quality of life. Effective land use ensures that residential, commercial, and recreational areas are appropriately zoned, reducing overcrowding and congestion while providing easy access to essential services such as healthcare, education, and transportation. Proper urban planning incorporates green spaces, pedestrian-friendly designs, and mixed-use developments, which promote social interaction, physical well-being, and environmental health. Thoughtful land use can also help minimize environmental impacts, reduce traffic, and lower pollution levels, making cities more sustainable and healthier places to live. By balancing development with green areas and public infrastructure, urban planning fosters vibrant communities that are accessible, equitable, and resilient, ultimately improving the overall experience of urban life.

How GIS Transforms Urban Planning

Effective urban planning is crucial for creating livable cities, and GIS is at the heart of this process. By providing spatial data and tools to analyze land use patterns, population densities, and growth trends, GIS helps planners make informed decisions about where to place new developments, infrastructure, and public services.

GIS allows planners to analyze land-use patterns, helping to ensure that cities grow in an organized and sustainable manner. By examining how land is currently being used (residential, commercial, industrial, recreational, etc.), GIS helps optimize land distribution and avoid issues like congestion. This helps ensure that people have access to necessary services (e.g., schools, hospitals) without the long travel times typically seen in poorly planned cities.

GIS supports the concept of smart growth by identifying areas where dense development is appropriate and areas where open space should be preserved. This can help prevent urban sprawl, preserve natural resources, and encourage mixed-use developments, which are essential for creating walkable, vibrant communities.

GIS is used to map and assess infrastructure such as roads, water supply systems, sewage networks, and power grids. Urban planners can use this data to identify areas in need of improvement, ensuring that infrastructure investments are efficiently allocated and enhancing the overall functionality of a city.

Esri's ArcGIS is helping cities to become more sustainable, resilient, and livable. By allowing urban planners, city officials, and stakeholders to collect, manage, analyze, and visualize spatial data, ArcGIS empowers data-driven decision-making. It offers valuable insights into urban environments, enabling better planning across various aspects of city development. By utilizing ArcGIS, cities can enhance their planning efforts, making them more data-driven, sustainable, and responsive to the needs of their citizens.

ArcGIS offers a suite of tools vital for urban planning, including ArcGIS Urban for 3D planning and impact analysis, ArcGIS Pro for spatial analysis and data management, and ArcGIS CityEngine for creating detailed 3D city models.

ArcGIS Urban provides an immersive 3D experience designed to improve urban planning and decision-making. Using the software, urban planners can quickly visualise their projects in the local context and leverage location intelligence to drive better decisions. ArcGIS CityEngine is a procedural 3D city generator that aids in creating and iterating on urban environments and scenarios.

GIS-Enabled Collaborative Platform boosting GMDA's Intelligent Decision Support

The main function of Gurugram Metropolitan Development Authority (GMDA) is to prepare plans, policies and proposals for guiding the city's planned development. To accomplish the mission of GMDA, to be a major support in governance by embedding GIS in all aspects of decision making, planning & management, OneMap Gurugram was developed on Esri platform by the GIS division of GMDA.

OneMap Gurugram provides vivid details of various infrastructure in the city through its webGIS portal named "Onemapggm". The site provides details of dry infrastructure like Rail, Road, Telecom Towers and Metrolines. It also provides wet infrastructure details like Water Distribution Network, Sewage Network, Drainage network and recycled network with Network Asset details and Power infrastructure, Public transportation facilities, Land Governance Layers, health facilities, homeland security, image services and similar other information. OneMap Gurugram is a detailed and accurate geo-enabled intelligent Decision Support System, aligned with objectives of development of the state that increases effectiveness of land acquisition, planning, compensation and providing urban services, etc. The GMDA has adopted a hub type framework for the collaboration of different departments under the Smart City. The platform clusters GIS layers of information into different applications as per the departmental requirements. The same platform is also being leveraged for integrated Command & Control Centre under mission through various interactive dashboards.

Transportation Systems

Sustainable transportation systems are vital for making cities more livable as they help reduce congestion, improve air quality, and promote better overall health for residents. By prioritizing public transit, cycling, and walking infrastructure, cities can create more accessible and efficient mobility options, making it easier for people to travel without relying on private cars. This not only reduces traffic and pollution but also helps lower greenhouse gas emissions, contributing to a healthier environment. Sustainable transportation systems encourage more equitable access to jobs, education, and essential services, especially for those who cannot afford private vehicles. Furthermore, they help create vibrant, people-centered urban spaces by reducing the need for vast parking lots and making room for parks, green spaces, and community areas. Overall, sustainable transportation fosters a more connected, cleaner, and healthier urban environment, enhancing the quality of life for all residents.

How GIS aids in Building Sustainable Transportation Systems

GIS helps create sustainable, efficient transportation networks by providing real-time data and supporting long-term planning efforts. It allows cities to monitor and analyze traffic flow patterns in real-time. This data helps city officials identify traffic congestion hotspots and determine where new infrastructure (e.g., roads, public transport routes, or cycling lanes) is needed to alleviate bottlenecks. By identifying areas of inefficiency, GIS can help optimize the movement of vehicles, reduce delays, and lower air pollution.

GIS is widely used to map public transportation routes, stops, and stations. It can help identify underserved areas or areas where public transport services are inefficient. Using GIS, cities can better plan transport systems to improve accessibility and reduce the dependence on private vehicles. For example, planners can ensure that high-density residential areas are well-connected to business districts, schools, and hospitals.

GIS helps in determining capacity enhancements, improving operations, and identifying the most strategic investments for keeping the transportation system in any country running optimally. The use of GIS in transportation is widespread. The major areas of applications include **road and highway maintenance, traffic modeling, accident analysis, and route planning.**

Roads and Highways

GIS in road and highway planning helps in visualizing and understanding the condition of the existing assets and the performance of the transportation network. It also helps in analyzing needed safety improvements to determine the best mix of new projects and required maintenance activities. With location intelligence, the stakeholders can strategically prioritize their investments.

Esri's mobile GIS technology allows transportation maintenance and inspection crews to save time when collecting and updating information from remote locations. By using GPS and GIS-enabled devices, field crews accurately collect information from the field, and officials can track resources and assets in real time. This allows for a quick response to any event that requires immediate attention. They can also more effectively manage mobile resources by instantly seeing the location of any work or inspection crew on a map, then redeploy resources as needed. The integration of work order management systems, routing, and scheduling software allows managers to more efficiently direct their mobile workforces and ensure that resources are most effectively utilized.

Traffic Modelling

GIS data can also be transformed into functional road models for large-scale traffic simulation. 3D models of large-scale road networks can be readily used in a real-time traffic simulation, interactive visualization of the virtual world, and autonomous vehicle navigation. The resulting model representation can also provide important road features for traffic simulations, including smoothly connected highways, overpasses, merge zones, and intersections.

The ArcGIS Network Analyst extension for ArcGIS Pro and ArcGIS Enterprise enables the effective movement of goods, efficient organization and coordination of vehicles, and intelligent transport network analysis. Users can make smarter decisions by developing strategic routing plans and save time and money by creating and implementing daily route plans to solve vehicle routing problems and perform post-route spatial network analysis for greater insight.

Esri India helps Tamil Nadu Highway Department to take the high road to success

The Transportation network is the backbone of all developmental activities in the state of Tamil Nadu. With exponentially increasing motorized vehicles, there is a need for supporting road and related infrastructure and continuously monitoring and managing this vast network to make quick, reliable, and rational decisions on upgrades and maintenance. The Tamil Nadu Highways Department (TNHD) is primarily responsible for the construction and maintenance of about 60,000 kilometres of road network. The Department was facing problems in dealing with an exponential increase in data related to the road system and required a GIS solution to manage the same.

TNHD deployed a solution centered around Esri's ArcGIS Server technology. TNHD envisioned a web-based GIS road and bridge information system under the e-Pathai (Electronic Project, Administration, Traffic, Highway Assets and Information Management System) program by integrating the GIS solution with the TNRMMS and the Project & Finance Management System (P&FMS).

This led to the integration of spatial and non-spatial data into the e-Pathai GIS from several sources such as the Survey of India (SOI), Open Series Maps (OSM), the Census of India, and the Indian Meteorological Department. Customized query and analysis tools were also developed specifically for the TNHD.

Multi-lingual support allowing users to switch between English and the Tamil language was offered, and the solution encompassed video integration with the web GIS interface.

Accident Analysis

Traffic accidents are one of the most important national and international issues, and their consequences are important for the political, economic, and social levels in a country. Management of traffic accident information requires information systems with analytical and accessibility capabilities for spatial and descriptive data. GIS delivers

powerful spatial analytics, allowing the authorities to discover patterns and gain intelligence to better understand travel behavior and perform accident analysis.

GIS significantly helps in accident analysis and leads to a reduction in the number of accidents on roads as well. GIS allows a more careful and accurate data selection, screening, and reduction. Also, it allows a spatial analysis of the results in pre and post-processing. It allows the development of spatial statistics that rely on geographically referenced data. For instance, through the analysis of accident history, a transportation firm is able to identify significant safety issues and determine areas where measures can be taken to reduce the number of incidents. GIS can also allow the user to choose two months of accidents for comparison. The statistics can be useful in displaying a decrease in accidents over a period of time.

Route Planning

Route planning is an important application within transportation. Hurdles on routes can lead to unnecessary delays and losses. It is in favor of all businesses and people to know in advance which route is the best to follow. This knowledge can help in saving time and essentially gaining the best cost/benefit ratio. GIS-based systems quickly provide and analyze essential economic, demographic, and cost estimates for planning new routes. It helps in analyzing existing routes, collecting data, and informing the riders of changes to routes.

Managing modern roadways is a complex affair. From computerized traffic control systems and incident and safety management systems to effective capital improvement planning and maintenance activities, transportation planners must draw on a wide array of technologies to effectively manage today's roadways. GIS can help transportation planners to integrate agency-wide information to achieve better operational efficiencies and results. By bringing GIS in transportation, higher efficiency can be achieved in the entire infrastructure lifecycle - from planning and design through survey and construction management to operations and maintenance. GIS helps in mitigating woes, both for the travelers and the planners. As the travelers get to know about the best routes for their destinations, transportation professionals get equipped with enhanced ability to manage their infrastructure.

Utilities Management

Enhanced utilities management plays a crucial role in making cities more livable, especially as urban populations continue to grow. Efficient management of essential services such as water supply, electricity, waste disposal, and public transportation directly impacts the quality of life for residents. By adopting smart technologies, data-driven planning, and sustainable infrastructure, cities can ensure the reliable delivery of these services while minimizing environmental impact. Improved utilities management not only reduces resource waste and operational costs but also fosters healthier, cleaner, and more resilient urban environments. Ultimately, it forms the backbone of any initiative aimed at building cities that are not just functional, but truly livable for current and future generations.

How Geo-enabling Utilities Infrastructure & Operations Helps

With Esri's ArcGIS platform at the center-stage, Indian utilities have been increasingly harnessing the geographic potential in the last few decades. By geo-enabling their infrastructures, utilities capture, store, manipulate, analyze, manage, and present, data from disparate sources across networks on a unified platform. Thrissur Municipality, Orange City Water (Nagpur) and Municipal Corporation of Greater Mumbai (MCGM) have taken lead in geo-enabling automation of their water / wastewater utility operations.

Facilitating planning, design, monitoring and maintenance of networks, GIS is becoming invaluable to utilities for strategic and operational decision support in the management of - land information, distribution, transmission, outages, workforce, revenue, compliance, network integrity, surveillance and infrastructure protection and emergency response. In the power utility sector - Sterlite Power, Tata Power, BSES Yamuna and many state owned discoms are leveraging ArcGIS to improve their operational efficiencies, reduce AT&C losses while providing enhanced services to their consumers.

In the telecom sector, Airtel and Reliance Jio rely on ArcGIS platform for their network operations, asset management, workforce management, marketing, and customer service improvement. And in the oil and gas sector IOCL, Mahanagar Gas Limited, Gujarat Gas Limited, and many others have been leveraging ArcGIS for their operations and asset

management.

Geo-enabled network mapping and asset mapping are enabling quicker detection of faults for faster response while at the same time achieving better management of assets and resources. It is noteworthy that only a small part of the available geographic potential is being currently tapped. With still a lot of potential available that can be leveraged, utilities are gearing up for advancing their geo-enablement efforts for a sustainable digital future. By leveraging machine learning and artificial intelligence, utilities are now aiming to exploit the advanced capabilities for predictive modelling and simulation.

ArcGIS Utility solutions are making access to contextualized information easier than ever, helping utility CXOs to address their priorities better than before. They are helping organizations to stay agile in the changing times and drive innovation. By augmenting existing frameworks with **ArcGIS Utility Network**, utility CXOs can enhance their business value delivery while optimizing operations for improved efficiencies and increased customer satisfaction, paramount for creating more livable cities.

Public Health and Well-being

Focusing on public health and well-being is essential for making cities more livable, as it directly impacts the quality of life for all residents. Urban environments that prioritize health and well-being integrate access to clean air, safe drinking water, and green spaces, which contribute to both physical and mental health. Designing cities with pedestrian-friendly streets, bike lanes, and recreational areas encourages active lifestyles, reducing the risk of chronic diseases like obesity and heart conditions. Furthermore, cities that invest in healthcare infrastructure, affordable housing, and sanitation services ensure that all residents have access to basic needs, improving overall life expectancy and well-being.

The Role of GIS in Public Health and Well-being

GIS plays a key role in improving the health outcomes of urban populations. By analyzing spatial patterns of disease, environmental hazards, and access to healthcare services, GIS can inform policies that promote health and well-being in cities.

GIS allows public health officials to map the spread of diseases

or identify patterns of health issues across neighborhoods. For example, GIS can be used to track the prevalence of diseases like asthma, which are often related to air pollution, or to monitor the spread of infectious diseases. By understanding the geographic spread of health issues, cities can allocate healthcare resources more effectively and design targeted interventions.

RSAC-UP Optimizes Green Organ Corridor Route using ArcGIS

Green organ corridors are demarcated, cleared-out special road routes created so that the organs arrive at their specified destination within the shortest possible time. Traffic congestion can defeat the cause. With the help of ArcGIS, RSAC-UP discovered the best route for developing a green organ corridor between CDRI, Jankipuram, and Amausi Airport in the city of Lucknow.

The Road Network Analysis helped in finding the best route to healthcare facilities among the four possible routes. Network connectivity can explain significant variance in the spatial pattern of the network structure. Analysis reveals that transport network services are directly varying with respect to connectivity indices and coverage of the study area. The use of the ArcGIS Network Analysis tool in the route optimization study provided the following benefits to RSAC-UP:

Identifying the best new route among healthcare facilities: Utilizing network analysis methods, the optimal new route between CDRI, Jankipuram, and Amausi Airport, Lucknow was developed from a list of four possible routes. This route is more effective in terms of the minimal distance required for hospital connectivity.

Defining service areas based on distance and time for healthcare facilities: By this analysis, the actual

service area of different facilities can be analyzed, and it can be determined whether these facilities are enough for that area, if not, then how much is required. This is also called service allocation analysis.

Connectivity of road segments: The most basic characteristics of a transport network are measured by the Alpha Index, Beta Index, and Gamma Index. The network (line) and junction (node) are required to obtain the connectivity index. These indices are useful for system and traffic analyses to detect changes in network structure. The Beta index (β) is used to determine the level of road connectivity. The Alpha index (α) is the ratio of the actual number of circuits in a network to the maximum possible number of circuits in that network. The Gamma index (γ) is a measure of the ratio of the number of edges in a network to the maximum number possible in a planar network.

β

382 edges and 252 nodes were found in the buffer zone of 1 km in Route 1, 772 edges and 497 nodes were found in the buffer zone of 1 km in Route 2, 949 edges and 567 nodes were found in Route 3, and 1335 edges and 847 nodes were revealed in route 4 through the road network analysis using ArcGIS.

Following a thorough analysis of all four routes, it was noticed that Route 3 has the highest network connectivity, resulting in a low rate of accidents involving pedestrians and bicyclists. It was also observed that higher connectivity levels are associated with fewer accidents involving non-motorized users. Nodes around Route 3 also displayed a good level of accessibility.

GIS is used to map healthcare facilities and the accessibility of medical services for urban populations. It helps identify areas with inadequate access to healthcare services, allowing for the strategic placement of new clinics, hospitals, or emergency services. Additionally, GIS can help determine the optimal locations for mobile health clinics or vaccination campaigns to ensure that underserved populations receive the care they need.

Poor air quality is a significant concern in many urban areas. GIS allows for the monitoring of air pollution levels in real-time, helping authorities to identify areas with high pollution levels and take corrective actions. This could include rerouting traffic, reducing emissions from industrial sites, or creating policies to improve air quality in highly polluted areas.

Environmental Sustainability and Green Spaces

Environmental sustainability and green spaces are crucial for making cities more livable, as they directly impact the health, well-being, and quality of life of urban residents. Green spaces such as parks, urban forests, and green roofs help improve air quality by absorbing pollutants and carbon dioxide, while also reducing the urban heat island effect by cooling the environment. These spaces promote mental and physical health by offering areas for relaxation, recreation, and exercise, which help reduce stress and encourage community interaction. Additionally, they play a vital role in preserving biodiversity by providing habitats for wildlife in otherwise concrete-dominated environments. Green spaces also enhance resilience to climate change, helping manage stormwater, mitigate flooding, and improve energy efficiency by providing natural shade to buildings. By promoting social cohesion, reducing environmental stressors, and supporting economic growth through tourism and property value increases, green spaces are essential for creating cities that are sustainable, resilient, and more enjoyable for their inhabitants.

Addressing Environmental Concerns with GIS

GIS is invaluable in the creation and maintenance of green spaces, natural habitats, and sustainable urban environments. By providing data on environmental conditions and monitoring urban development's impact on the ecosystem, GIS helps cities mitigate environmental issues.



AGiSAC Achieves Excellence in Solar Power Plant Installation with ArcGIS

In collaboration with Himachal Pradesh Electricity Regulatory Commission, AGiSAC has carried out a study to identify suitable sites of land for Solar Power plant installation. Disparate datasets such as imagery, DEM, land use, settlement clusters, and locations of existing infrastructure such as roads and electricity sub stations were used in ArcGIS Pro spatial overlay analysis to find suitable sites along with solar power potential calculated in MW. Following the GIS study, field visits were undertaken to verify the optimum locations.

AGiSAC has used ArcGIS spatial analysis tools to streamline the complex process of running suitability analysis. The ArcGIS Desktop platform provides an interface where raster, vector, and tabular data can be ingested and analyzed. The Suitability Modeler tool allows disparate datasets such as DEM, satellite imagery, LULC maps, as well as vector datasets such as roads and human settlement, to be overlaid to delineate suitable areas according to user-defined thresholds. ArcGIS has proved invaluable in the analysis of both raster and vector datasets. The user was able to carry out advanced proximity analysis to measure the accessibility of potential Solar Power Plants to existing roads and electric substations. High-resolution land use maps were also created using image classification tools on CARTOSAT-1 imagery. Tracts of barren land extracted from this classification were identified as the most suitable land use type for Solar Power plant installation. The suitability modeler tool then overlaid all the resultant layers and applied a uniform user-defined index to assess the suitability of each class for the construction of a PV plant. Several zones that best matched each user-defined threshold were then extracted from each district, which was further verified via field survey.

GIS helps cities analyze the risks posed by climate change, such as rising sea levels, extreme heat, or flooding. By mapping ve. GIS tools also aid in disaster response by providing real-time data on infrastructure damage, helping emergency responders prioritize resources.

Conclusion

Geographic Information Systems (GIS) are essential tools in creating cities that are more livable, sustainable, and resilient. From improving urban planning and transportation to promoting social equity and public health, GIS enables cities to optimize resources, enhance decision-making, and engage communities in the urban development process. As urbanization continues to rise, the role of GIS in shaping the cities of tomorrow will only become more significant, helping to create urban environments that are not only functional but also inclusive, sustainable, and truly livable for all.

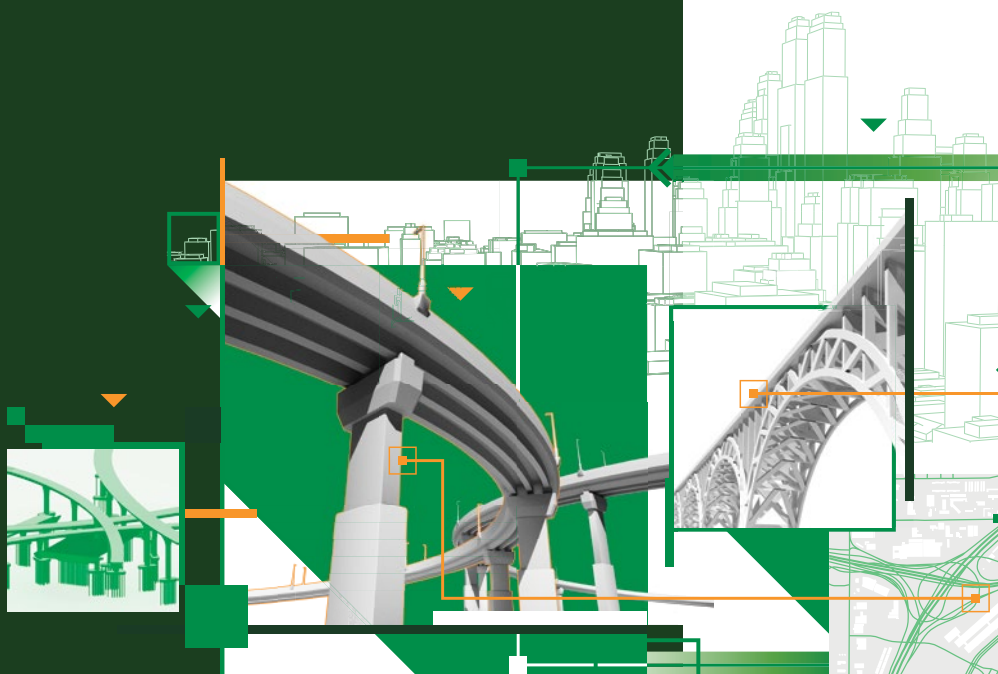




ArcGIS GeoBIM

Collaboration in the Cloud

for Architecture, Engineering,
and Construction



ArcGIS GeoBIM delivers an innovative, easy-to-use web-based experience for teams to explore and collaborate on BIM projects and issues, using data from multiple systems in a geospatial context. AEC and operations teams can easily work with linked data and documentation in configurable web apps to simplify communication and collaboration.



See all your project activity on one map



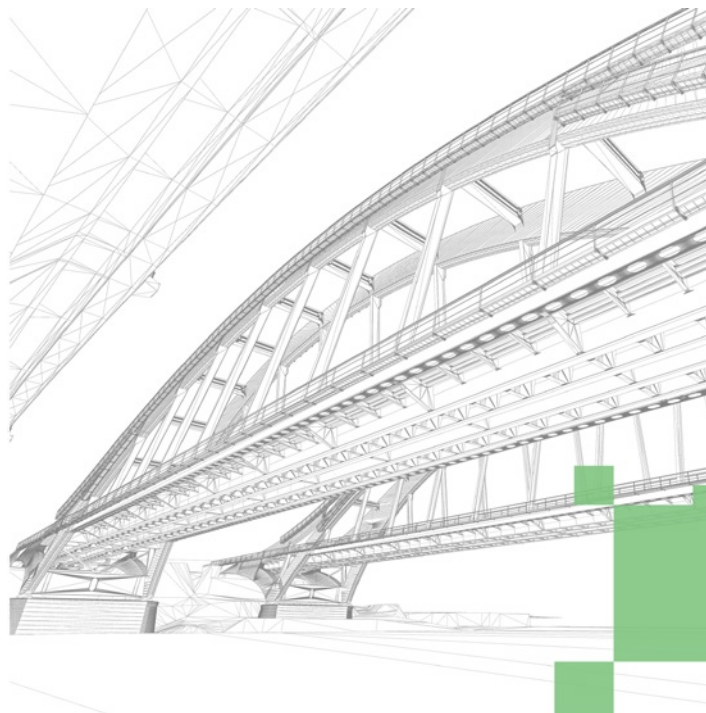
Keep your project and asset data organized



Minimize costly model conversions by
connecting to the source



Communicate project information easily
and securely



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Adani Electricity Mumbai Limited Optimizes Outage Management with ArcGIS

Client

Adani Electricity Mumbai Limited

Industry

Utilities

Organization Profile

Adani Electricity is India's largest private sector power distribution utility, distributing electricity for over nine decades in Mumbai, the commercial capital of India. It is the distribution arm of the Adani Transmission Limited (ATL), formed after the acquisition of Reliance Infrastructure Limited's integrated Generation, Transmission, and Distribution utilities powering the city of Mumbai. A huge customer base and the spread of electricity distribution have made Adani Electricity, a business powerhouse of Mumbai. The Company owns the largest, advanced, and efficient power distribution network which helps in meeting the power demand of 2,000 MW in Mumbai. Additionally, the company offers world-class customer care service through various customer convenience offerings spanning issuing bills in multiple languages, more than 2,000 payment avenues, 24X7 multi-lingual toll-free number, contemporary customer care centers, and a bouquet of other technology-driven and value-added services.

Website

www.adanielectricity.com

Project

GIS-based Outage Management System (OMS)

Highlights

- Quicker & effective response to power outages.
- Minimized average complaint management time.
- No delays and errors in site data capture; having accurate and reliable data.

Project Summary

Quicker & effective response to the customer's power outages in today's ever-changing environment is key to achieving AEML's primary goal of enhanced customer satisfaction. To enable this AEML's Mumbai Distribution Business has implemented an Enterprise GIS solution developed by Esri India. The GIS-based Outage Management System (OMS) has replaced its legacy application, a call-based Complaint Management System (CMS).

The Enterprise GIS solution is aimed to minimize average complaint management time by focusing on network abnormalities rather than customer calls thus improving the overall reliability of the electric system. The system determines the "most probable" location of fault that has taken place in the field on receipt of power outage complaints. With the accurate knowledge of outages & associated up-to-date distribution networks, dispatching outage crew & carrying out the field operations is improved.

Challenges

The Enterprise GIS solution has helped AEML to overcome the following challenges that existed with the previous system.

- Managing assets spread geographically
- Reaching asset locations on-time for timely isolation and restoration
- Work-hour loss due to work duplication & subsequent data entry
- Unnecessary efforts spent on tracking jobs
- Delay in site data capture and knowing real-time progress and variance
- Errors in site data capture and having accurate and reliable data
- Non-availability of network data on demand for analysis and value engineering

Solution & Benefits

The GIS-based OMS provides a number of advantages over the legacy CMS, some of them are:

- With the introduction of OMS, there is a paradigm shift in the overall approach of managing outages. Now, the focus has

been shifted to the root cause of the outages (Network Device level fault, in OMS terminology: Incidents) rather than concentrating on the symptoms (individual customer complaints, in CMS terminology: Calls). This will improve the overall outage management efficiency, fewer outages, and better customer satisfaction.

- As a lot of changes are being carried out in the vastly dispersed distribution network, it is vital for the utility personnel in the control centre /outage management centre to know what exactly is happening in the field. The CMS has limitations in providing this critical information since it does not maintain field network snapshots. On the other hand, GIS based OMS provides a common window through which one can visualize & understand network changes & field operations being carried out on near-real time basis without any overhead to operation & maintenance personnel.
- The home-grown legacy CMS provides functionality to attend & handle Customer Outage Calls whereas OMS technology has progressed into determining “where” the actual outage has taken place.
- The dispatcher (Shift Engineers/System Controllers) can quickly view consumer/outage locations within OMS. This has improved the dispatching of crews, provided the utility's customer service representatives with up-to-date outage knowledge, and increased the overall effectiveness of outage restoration personnel.
- Now dispatcher overhead of performing analytical processing to understand all the outages received from a particular area in case of bulk outages is minimized.
- Even in case of bulk area outages, the dispatcher working on CMS has to manage every complaint. But in the case of OMS all complaints received from a particular area, which forms a considerable part of the common feeder/distribution network automatically get attached to a common upstream device (i.e. most probable location identified by in-built heuristic engine). This has immensely benefited in saving outage management time.
- Sometimes during the course of outage management, it is necessary to reassign outage complaints to other crews. This was time-consuming in the earlier system whereas OMS provides an effective way of crew re-assignment.
- Instead of the crew providing the affected area information, now Dispatcher is in the position to guide the crew who are not familiar with the feeder network.
- Considering the geographic nature of Mumbai City, a considerable part of the network is laid through the hutment area. Locating outage consumers & their supply delivery points (Service points) that belong to the slum area has been a herculean task earlier. With the help of the new system now locating outage consumers & their related feeding points is going to be less laborious & efficient.
- Overall reliability of the electric system is going to be improved due to the shorter outages and hence will increase overall customer satisfaction level.
- OMS enforces better adherence to the rules (e.g. defining faults in terms of network equipment). This has brought improvement in overall consumer tagging & network updation errors.
- Since OMS keeps a record of all the outages in terms of network abnormalities; it is crucial information for short-term as well as long-term network planning and improvement.
- The underlying application architecture provides numerous advantages for integration. COM and XML (extensible Markup Language), and other existing standards enable the solution to be deployed along with work management systems, customer information system (CIS), and other technical/business systems without the need for proprietary programming tools or closed interfaces. By using open standards, both deployment and maintenance costs of integrated systems are minimized.

“With the Implementation of GIS, we could achieve a single window concept for viewing assets spread across geographical extents. With the help of COTS functionalities available through the product like Electrical Network Tracing, we could derive Consumers connected to DT/Feeder and vice versa. The software is easy to learn and comes with a whole range of plug-ins for specific needs. Esri India's GIS solution has given us a platform to view all the utility assets in a single screen which is available to all stakeholders. ArcFM gives the user “the power to trace the electrical network” and identify the assets/consumers related to a feeder. Tracing functionality is one of the backbone tools for the utility industry. With this tool, the user can easily visualize, get instant information and make effective decisions. Esri's GIS system has helped us to achieve higher productivity and deeper insights with many such tools.

- Mr. Anand Kumar S V, Addl. VP - IT DevSecOps,
Adani Electricity Mumbai Limited

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Building a Robust Healthcare Infrastructure for City Dwellers using GIS

Geographic Information Systems (GIS) have proven to be a powerful tool when combined with field survey techniques for enhancing health services management in various states. GIS facilitates the improvement of accessibility, resource allocation, and decision-making processes within healthcare systems. By spatially mapping health facilities, population distribution, transportation infrastructure, and health-related resources, GIS enables the visualization of existing health infrastructure in terms of manpower, services, infrastructure, and equipment. The spatial display of data on a dashboard assists decision-makers in balancing existing resources through reshuffling and adding further support where needed.

GIS offers valuable insights for policymakers, healthcare administrators, and public health professionals, enabling them to identify areas lacking sufficient healthcare facilities and services. This information aids in prioritizing the establishment of new health centers without any biased interventions, thus enhancing the effectiveness of healthcare services in the state.

Collaborating to Strengthen the State's Health Infrastructure

Esri India and NeoGeoInfo joined hands to enable the **Haryana Health Department** to assess the geographical accessibility of existing health centers, determine catchment areas of the current network, identify underserved regions, and propose new facilities to improve service coverage.

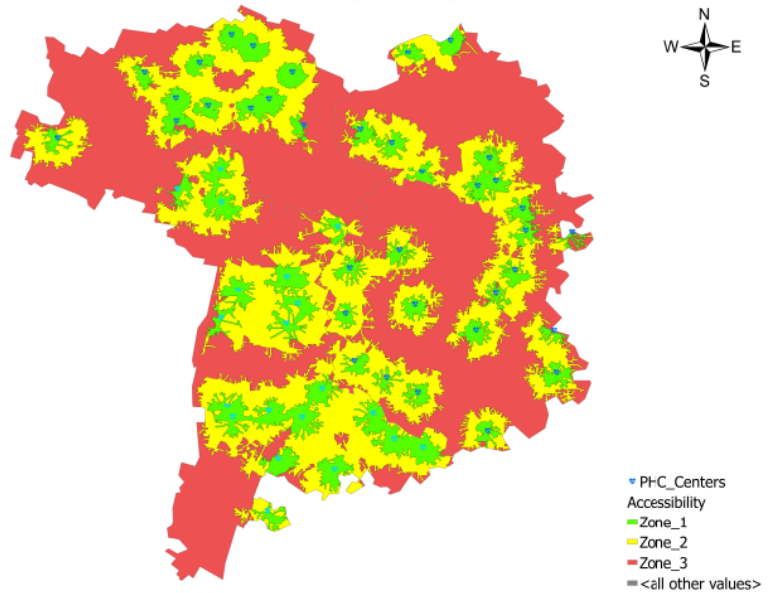
The survey involved collecting precise spatial location data (X, Y) of existing centers using DGPS instruments and capturing photographs to assess the condition of the buildings and the current situation of each center. Data was collected on various attributes, such as manpower, services, infrastructure, and equipment availability.

This information was then attributed to the respective center locations on Land Use & Land Cover Base Maps and Street networks with different categories. The hierarchy of health centers and the services they provided were also mapped. Health facilities at district and sub-district levels, Community Health Centers, Primary Health Centers, Ayush Facilities, Wellness Centers, and Medical Colleges were mapped.





Accessibility Analysis



Health Centers Accessibility Analysis without Road Network

The following attributes were mapped:

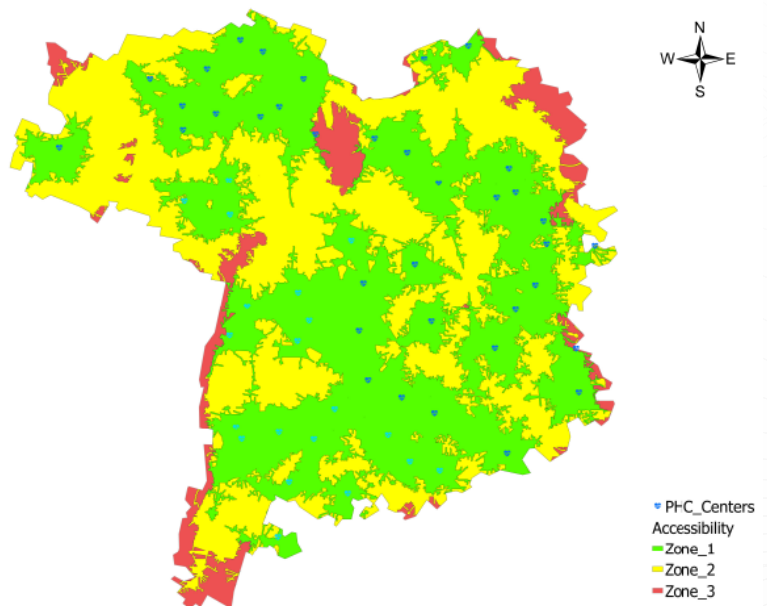
- Infrastructure
- Services
- Workforce
- Equipment

A comparison with IPHS guidelines was conducted to evaluate the existing resources and restructure the infrastructure for maximum catchment in the area.

GIS Network analysis was performed to set threshold cutoffs for distance and travel time, indicating the physical accessibility of health centers. The street infrastructure in the area played a crucial role in augmenting the reach of health services, making medical support easily accessible to patients.

Additionally, GIS was utilized to propose priority centers or areas (PPA) based on spatial population distribution, distances, existing center locations, and transport facilities in the area. This allowed for reliable analysis of the existing health infrastructure's capacity to provide physical access to specific health services.

Accessibility Analysis with Roads

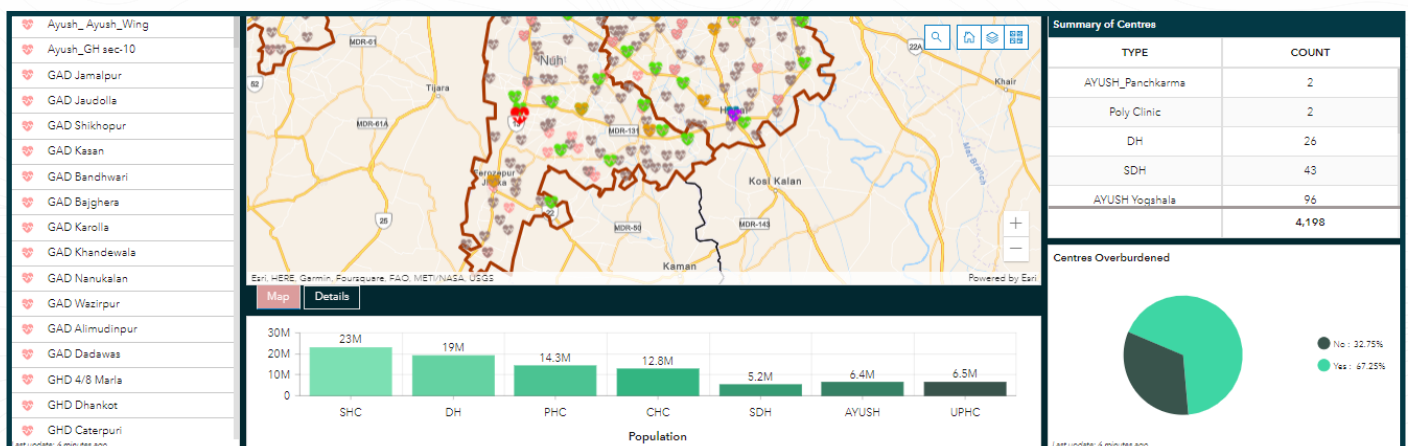
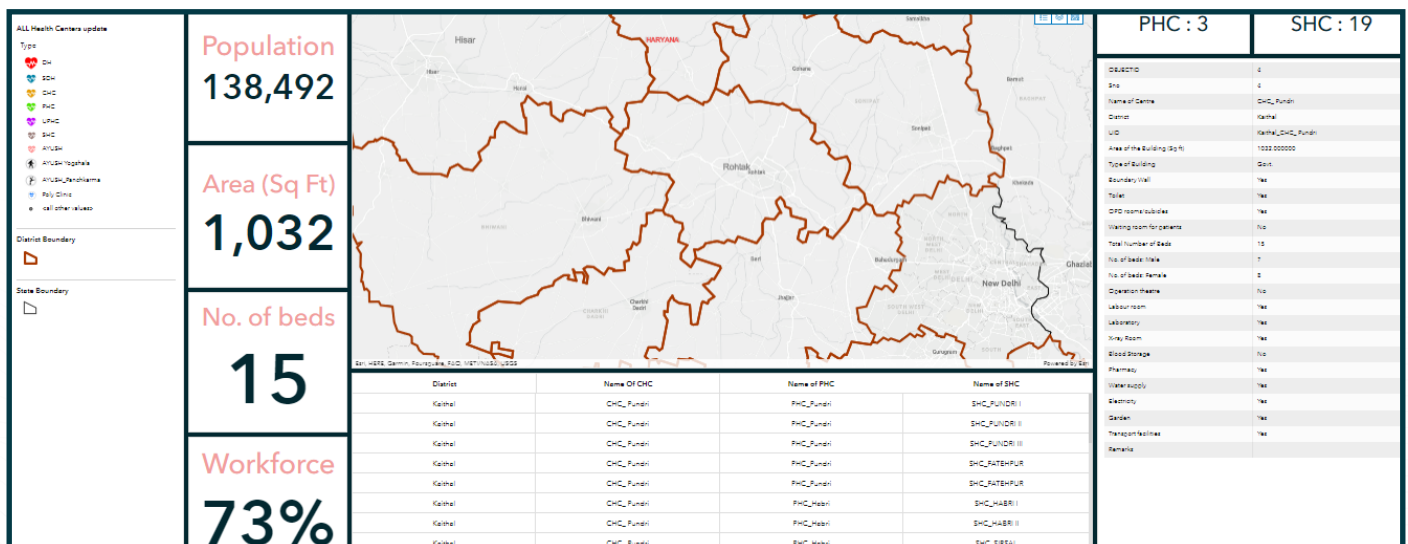
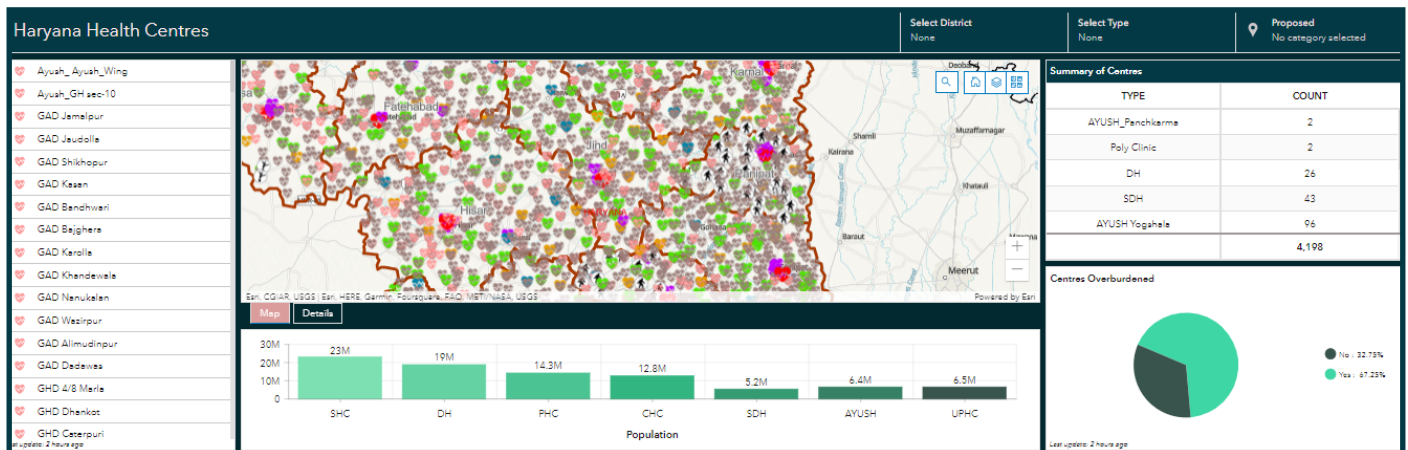


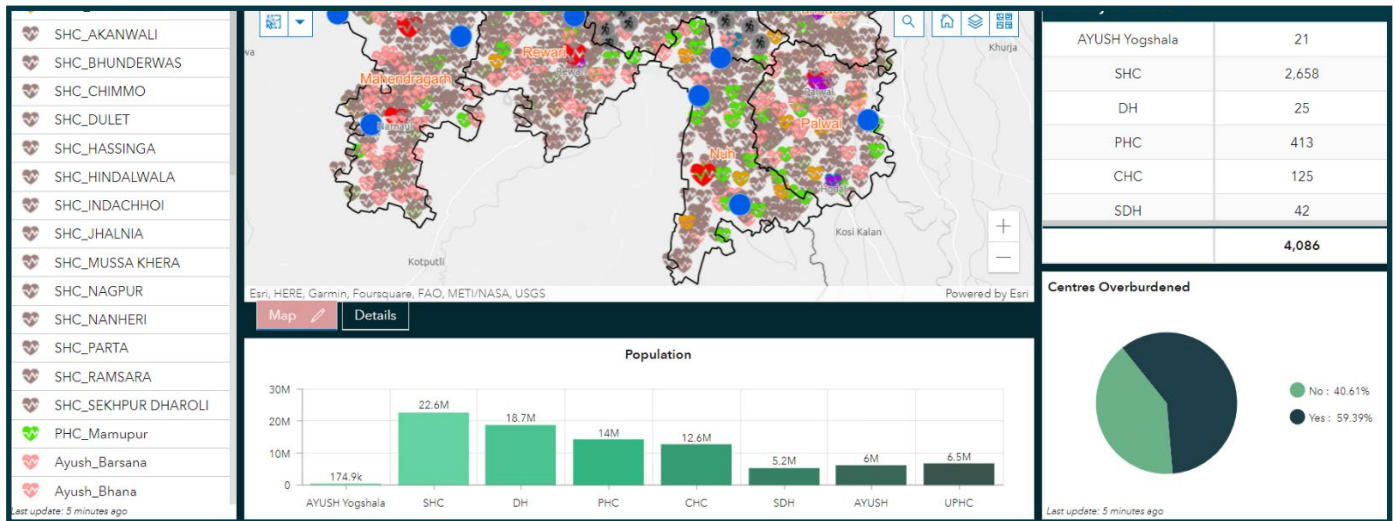
Health Centers Accessibility Analysis with Road Network

PARTNER SHOWCASE

Esri India's Web Application, developed using ArcGIS highlighted:

- The map distribution of centers
- Facilities available at each center and overburden status (in Pie Chart)
- Population catered by each type of center in Bar Chart





GIS Gap Analysis also provided recommendations about centers to be opened or elevated. The blue dots are proposed health centers.

“

The GIS-based system enabled the Haryana Health Department to adopt a data-driven approach for managing healthcare systems, improving accessibility, equity, and efficiency. It also allowed them to forecast future healthcare needs and respond proactively to emerging health challenges. The application enhanced decision-making, resource distribution, and service delivery at the state level.”

- Mr. G.V. Sreeramam, CEO, NeoGeoInfo Technologies Pvt. Ltd.

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GIFT City: Fostering a Data-driven Approach to Urban Development



Dr. Nilesh Kumar Purey, CTO, GIFT City, let's explore how the use of GIS has helped them build a highly liveable and citizen-friendly city.

How have you harnessed the capabilities of GIS to create the GIFT city?

GIFT City (Gujarat International Finance Tec-City) is a prime example of how Geographic Information Systems (GIS) can be utilized to create a modern, efficient, and sustainable urban environment. In its planning, execution, and management, GIFT City has integrated GIS to streamline urban development. The city's comprehensive urban planning relies on GIS to integrate various data sources, including geographical, demographic, and environmental information, enabling informed decisions about land use, infrastructure, and resource allocation. GIS also supports the creation of 3D city models that help visualize urban development with precision, aiding in the design of buildings, infrastructure, and public spaces.

Efficient infrastructure management at GIFT City is facilitated through the City Command and Control Centre (C4), which monitors and manages utilities like power, water, wastewater, and solid waste. This centralized system ensures efficient resource management and quick responses to issues. Additionally, GIS supports the development of smart infrastructure such as smart grids, district cooling systems, and

GIS-based urban planning can immensely contribute to the vision of Viksit Bharat. GIFT City is a shining example of the use of GIS in the planning, execution, and management of an urban body. In an interaction with

automated meter reading (AMR), enhancing the sustainability and efficiency of urban services. GIS is also integral in safety and security, where it is used for incident tracking and management, enabling swift responses to emergencies. The platform integrates over 70,000 input/output points, allowing comprehensive monitoring and control. GIS further assists in disaster preparedness by providing detailed mapping of vulnerable areas and supporting emergency response plans.

In terms of sustainable development, GIS aids in planning and maintaining green spaces and parks, promoting environmental sustainability while enhancing residents' quality of life. Environmental monitoring through GIS ensures that urban development aligns with sustainability goals. Additionally, GIS fosters transparent communication between city administrators and residents, encouraging better community involvement in planning and decision-making processes. This transparency, combined with efficient urban planning, helps attract investment, driving economic growth and job creation. Overall, GIFT City's integration of GIS has transformed it into a smart, sustainable, and citizen-friendly urban model, setting a benchmark for modern urban development.

Benefits Realized in GIFT City:

- **Centralized Monitoring:** The City Command and Control Centre (C-4) integrates multiple platforms, providing a centralized view of the city's infrastructure.
- **Predictive Maintenance:** By monitoring critical parameters and predicting potential issues, GIFT City can address problems before they affect residents.
- **Smart Living and Working:** The Intelligent Building Management System (IBMS) enhances user satisfaction, safety, and security, contributing to the overall livability of the city.

What are the prominent features that make cities like GIFT city more liveable and citizen-friendly?

Cities that leverage GIS-based urban planning, like GIFT City, possess several prominent features that make them more livable and citizen-friendly. One of the key aspects is the integration of smart infrastructure, where IoT devices and sensors are used for real-time monitoring and management of utilities, traffic, and public services, along with efficient waste management systems and smart grids for energy distribution. Sustainable development is another hallmark, with the strategic planning of green spaces and parks to enhance quality of life and promote environmental sustainability, alongside the use of renewable energy sources and eco-friendly building practices.

Enhanced mobility is a key feature, as these cities have well-planned transportation networks that optimize traffic flow and reduce congestion. Public transportation options, including buses, trams, and bike-sharing programs, are readily available to residents. Safety and security are also prioritized, with advanced surveillance systems and emergency response mechanisms in place to ensure the safety of citizens, as well as disaster management plans and risk assessment tools to mitigate potential hazards.

Community engagement is a central element, with platforms that allow residents to participate in urban planning and decision-making processes, fostering transparent communication between city administrators and citizens. GIS-based cities also focus on high-quality public services, ensuring the efficient delivery of services such as healthcare, education, and sanitation, and providing digital platforms for accessing government services and information.

Economic opportunities are abundant, with modern infrastructure that attracts businesses and investors, creating a conducive environment for economic growth, job creation, and support for startups and innovation hubs. Inclusive urban design is also emphasized, with accessibility features for people with disabilities and elderly residents, alongside affordable housing options and mixed-use developments that cater to diverse populations. By incorporating these features, GIS-based cities like GIFT City create a more livable, sustainable, and citizen-friendly environment that enhances the overall quality of life for their residents.

What's the road ahead for GIFT city?

The future of GIFT City is marked by ambitious plans and innovative initiatives aimed at transforming it into a global financial and technology hub. The Gujarat government has announced a Rs 6,200 crore expansion plan to be implemented over the next 15 years, which will triple the city's area to 3,430 acres in three phases. This expansion will be accompanied by significant infrastructure development, including improvements in streets, water supply, sewerage, stormwater drainage, solid waste management, landscaping, and water channel development. Sustainability remains a core focus, with GIFT City committed to eco-friendly urban development through LEED-certified buildings and the increased use of renewable energy sources. Additionally, the city plans to enhance water conservation efforts and implement efficient waste management systems to minimize its environmental footprint.

Technologically, GIFT City will continue to evolve, developing its smart infrastructure, including the City Command and Control Centre (C4), district cooling systems, and automated waste management. The city also aims to leverage cutting-edge technologies such as IoT, AI, and big data to improve urban management and service delivery. Community and liveability are key priorities, with plans to create more green spaces and recreational areas to improve the quality of life for residents. The development of improved public transportation options will ensure seamless connectivity within the city and with neighboring regions. In summary, GIFT City's future is centered on sustainable growth, technological innovation, and creating a vibrant, liveable urban environment, positioning it as a leading global financial and technology hub.



2025: Usher a new Vision with GIS

Make our cities more livable



As per the Global Livability Index of 2024, five Indian cities figured on the list comprising 173 across the world. Indian megacities Delhi and Mumbai tied for 141st place with a score of 60.2 out of 100. They were followed by Chennai (59.9), Ahmedabad (58.9), and Bengaluru (58.7). Factors like traffic congestion, pollution, and infrastructure issues have made our cities 'barely livable'.

The Smart Cities Mission, with a goal of 100 smart cities was conceived to address these issues but was only partially successful. The Smart Cities Mission had two main aspects:

area-based development consisting of three components – redevelopment (city renewal), retrofitting (city improvement), and green field projects (city extension); and pan-city solutions base lakh crore was kept aside for the mission, with public-private partnerships (PPP) an important driver of the same. A total of 6454 projects worth Rs 86,063 crore were sanctioned, but a viable PPP model could not be evolved.

Though no clear definition of a Smart City was articulated, the expectation was to improve the living conditions for inhabitants in our cities. Most cities selected very small areas

for improvements like street lighting, wi-fi, and solid waste management. The area being small, the impact wasn't felt, and probably '100' was a very ambitious number. Learnings from this program can guide future initiatives for making our cities more livable.

Data-driven decisions play a crucial role in the success of such mission-mode programs. GIS brings different types of data, whether from satellites or aerial surveys or data from ground surveys, or data from IOT devices, together on a single platform, provides actionable insights, and enables scenario-based analysis. GIS assists in activities like:

- Master Planning
- Land Use Management
- Sustainability and ecological protection
- 3D Visualization of proposed habitat
- Infrastructure planning, including mobility
- Esthetics and functionality of proposed infrastructure
- Construction monitoring
- Infrastructure management

GIS enables 'Geodesign' to achieve optimum design based on geographic attributes and functional requirements of the urban area. Geodesign provides a methodology to efficiently evaluate alternative design scenarios, providing the ability to interactively create, alter, visualize, and make trade-offs to arrive at the most optimal designs.

Let us consider a scenario where city management decides to build a new suburb to cater to the growth of the city and identify an area of 500 Sq Kms. for development for 500 people per square kilometer.

A survey of the land will give a good idea of its topographical attributes - contours, water bodies, trees or forests, pre-existing infrastructure, etc. This data is brought into a GIS system.

Considering the geographic features of the land, planning for housing, industry, or other workspaces, facilities like schools, hospitals, and open spaces like parks, shopping, recreation, etc. are done and brought to the same GIS system. Next comes the planning for buildings, utilities, drainage, roads, parking facilities, etc. Geodesign comes in, assumptions

are made, and 3D building models are created in the GIS. If a residential area is designed with 8 buildings, each with 18 floors and 8 apartments per floor, GIS assists in the planning of open space, parking, utilities and drainage requirements, and road designs for optimum movement of traffic, following regulations and building by-laws. In this digital canvas, different scenarios like understanding the impact if the height of all buildings is increased to 25 floors instead of 18, are easily simulated. Simulations based on population growth over a long period of time, changes in weather patterns, etc., can also be carried out. Multi-modal transport systems can be planned. Factors like carbon neutrality can be studied and factored into the planning of the new urban area.

Geodesign also facilitates designing urban areas with better aesthetics, views from different points, shadows on buildings, and the solar potential of the city. The same concepts are applicable if it is about the redevelopment of an existing township.

GIS-based urban planning can immensely contribute to the vision of Viksit Bharat. GIFT City near Gandhinagar is a shining example of the use of GIS in the planning, execution, and management of an urban body. GIFT City is a good example of a Smart City.

To conclude, our recommendations are - pick a smaller number of cities, maybe 3, for transformation into smart cities. Make the transformation impactful by incorporating - aesthetically and functionally better design, uninterrupted water and electricity, an efficient drainage system to avoid flooding, a multi-modal transport system, planning of roads and parking with future growth in mind, and modern architecture to support the need for sustainable and resilient infrastructure.

Let the new year 2025 be the beginning of making our cities more livable, smart cities are one of the ways; others could be interventions like Swachh Bharat Mission 2.0 to address the waste management in cities and building new toilet facilities, efforts on pollution control, addressing the issue of urban flooding, improvement in transport systems, 24x7 water, safety and security and improvements in aesthetics.



ArcGIS CityEngine

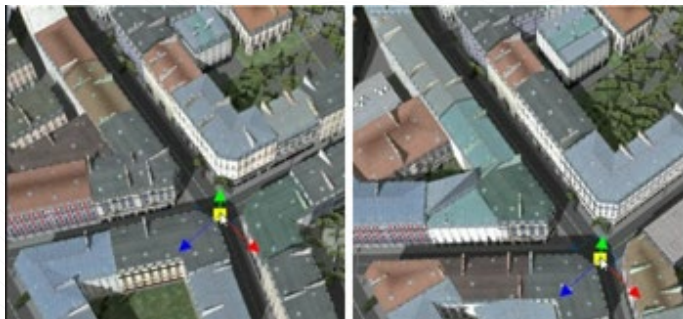
ArcGIS CityEngine is a valuable tool for urban planning and design, enabling stakeholders to create more liveable cities by integrating spatial data, 3D modelling, and simulation capabilities to support sustainable and efficient urban development initiatives.

The main concept of CityEngine is the procedural approach toward modeling efficiently. The computer is given a code-based procedure that represents a series of commands—in this context, geometric modeling commands—which then will be executed. Instead of the classical intervention of the user, who manually interacts with the model and models 3D geometries, the task is described abstractly, in a rule file.

CityEngine Features:

A. Procedural modeling core

The commands provided in the CityEngine CGA shape grammar, such as extrude, split or texture, are widely known commands in most 3D applications, and you can adapt them to create complex architectural forms.



B. Dynamic city layouts

The dynamic city layouts allow you to create interactive street networks that automatically update in real time. Streets, sidewalks, and whole blocks, which form the specific urban context, adapt efficiently to your input and allow you to design the layout of complete cities.

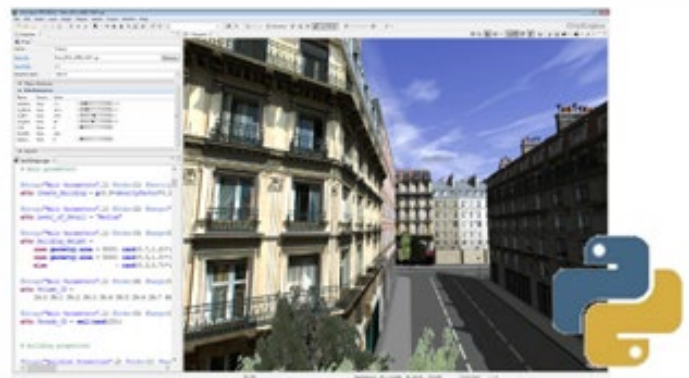
All the geometries that depend on the layout of the underlying dynamic city layout are also updated on the

fly. Your buildings are rebuilt while you edit the width of the surrounding streets.

C. Customizable UI

The user interface (UI) in CityEngine can be adapted to tasks, including rule creation, working on the street network, editing attributes with real-time feedback, or studying the statistical reports of your current city's development.

To have control over repetitive tasks, create formatted reports in file format, or automate other specific actions. Use Python scripting to further streamline the workflow in CityEngine.

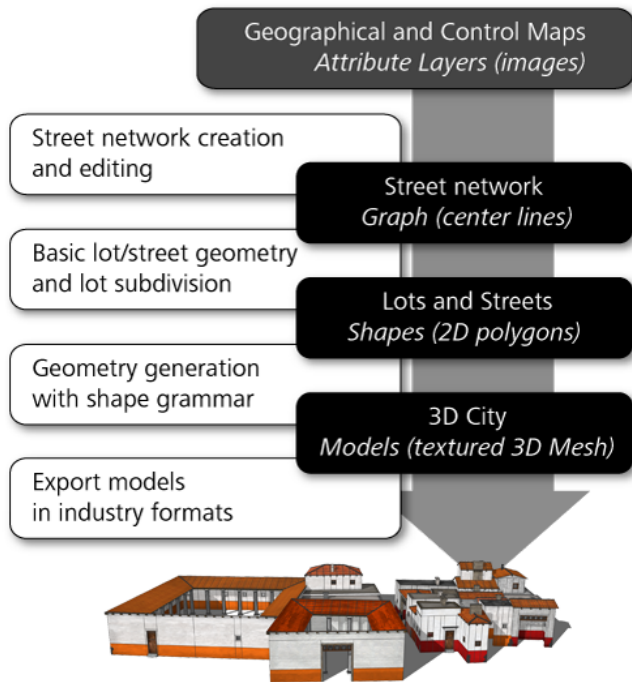


D. Data interoperability

CityEngine supports the industry's most common formats for both import and export. You can transport line data, shape data (footprints), and 3D geometry to and from CityEngine. Whether you work in urban planning, architecture, entertainment or simulation, CityEngine provides a way to transport your data.

E. CityEngine modeling pipeline

Modeling an urban environment with CityEngine usually implies the individual stages of the pipeline given in the image below. The pipeline consists of several procedural modeling tools for generating large-scale urban layouts, as well as applying CGA rules for the creation of detailed building models.



A CityEngine scene is stored as layers of data types representing the different stages. The pipeline is flexible and can be entered at various stages. For example, street blocks or building masses can be imported and further processed.

F. Generate large-scale urban layouts

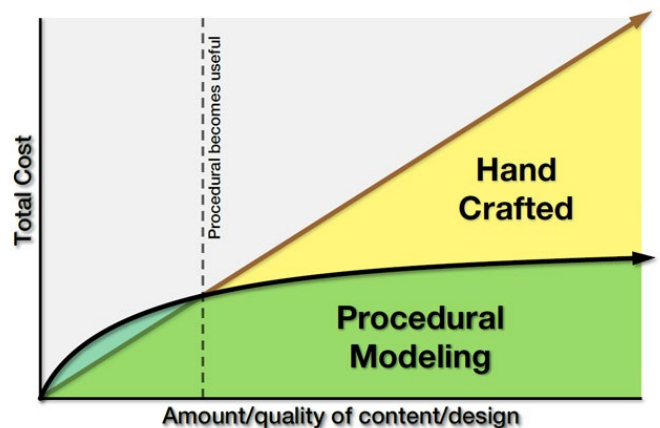
CityEngine consists of several procedural and interactive tools to lay out street networks and align and subdivide shapes. Streets can be grown according to patterns and edited interactively. For example, street-crossings can be moved, streets can be deleted or selected, and the street growth wizard can be applied again on the selection. Also editing tools for lot shapes are available, such as aligning building lots to a terrain. The tools usually work on the selection in the 3D view window or the viewport or operate on the whole layer.

The layered organization of CityEngine scenes provides a practical and organized handling of the massive datasets. For example, it is recommended that you duplicate layers before editing and therefore create variations in each layer. You can switch on or off the visibility of each layer.

G. Grammar-based modeling

Grammar-based modeling, or procedural modeling, has a widespread range of applications, but mostly it is applied when large numbers of iterations of a design or large numbers of objects must be created that obey certain standardized rules. Automation of the modeling is the goal, and the overall quality of the grammar-based description is reflected in the quality and number of details of the generated models. Unique objects (such as landmark buildings) are best modeled by hand and usually do not need the procedural approach since often none of the modeling tasks on that object can be automated.

Of course, the preparation of the rule set creates a certain overhead at the beginning, but on the other side, the model generation itself is done in a small fraction of the time compared to classic manual modeling. The following chart compares both techniques, showing that the application of grammar-based modeling becomes useful with a certain number of models to do.



H. Computer Generated Architecture

The Computer-Generated Architecture (CGA) shape grammar of CityEngine is a unique programming language specified to generate architectural 3D content. The idea of grammar-based modeling is to define rules, or CGA rules within CityEngine, that iteratively refine a design by creating more and more detail. The rules operate on shapes that consist of a geometry in a locally oriented bounding box (the scope). The following rule derivation illustrates the process: on the left side, the start shape is shown, and on the right side, the resulting generated model is displayed.



ArcGIS Urban

ArcGIS Urban is a web-based solution that applies GIS technology to urban planning to streamline plan creation, analyze the impact of plans, visualize current projects, and facilitate public engagement. In addition to helping you design, manage, and measure urban developments, ArcGIS Urban allows you to visualize citywide plans and projects in one place for collaboration among stakeholders.

With ArcGIS Urban, you can do the following:

- View a digital representation of your city in which all urban developments are visualized in one place for collaboration among stakeholder groups.
- Upload 3D models to projects and store them in a 3D system of record.
- Create and compare design scenarios.
- Visualize zoning rules in 3D. Convert legal text into a visual representation that you can use for detailed scenario planning down to the parcel level.
- Generate plausible buildings according to zoning regulations and draw custom buildings.
- Analyze the impact of plans with predefined or custom metrics.
- Open plans and projects to discuss scenarios within user groups.
- Gather feedback on plans and projects that are shared with everyone.

ArcGIS Urban has three user interfaces (UIs): the overview, the experience to view plans and projects, and the experience to edit plans and projects.



Overview

The overview is visible when you open the app. It contains a 3D representation of your city along with its indicators as well as plans and projects you have access to. These three key elements comprise the overview and can be explored and searched using the left panel. Additionally, if you have the appropriate permissions, you can use functions in the overview that allow you to add plans, projects, and indicators. A user without a login can access the overview, open selected plans and projects, and provide feedback on them.

Consider the following when preparing data and uploading it to the data manager:

- Ensure that there are no duplicate or overlapping features in the zoning, land-use, and parcel layers.
- Ensure that the Zoning Type or Land Use Type field in the zoning or land-use boundaries layer refers to the Custom ID value of the zoning types or land-use types data.
- Some attributes require a JSON string as an input (for example, Allowed Space Use Types in Zoning Types).

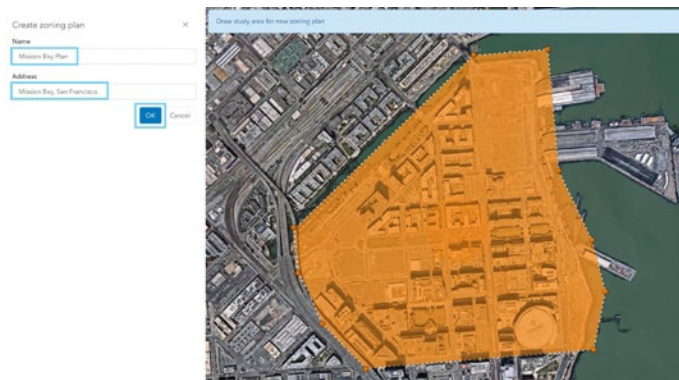
Ensure that this JSON string has the correct format. The schema is explained in detail in the corresponding spreadsheet templates. You can download them in the data manager.

- When you use spreadsheet templates to upload data, the string values are case sensitive. The schema is explained in detail in the template.
- For the parcels layer, ensure that the number of edges in the EdgeInfos field matches the number of edges of the parcel's geometry.
- On import, geometries are converted to the coordinate system of the urban model if the coordinate systems don't match.
- Urban has two UI appearance modes: light and dark. Click the user button at the upper right of the app to change the mode.



The overview is a complete view of all plans, projects, and indicators in a city. The overview UI contains the following key elements:

- The view - A 3D model of a city with plans and projects represented by multicolored buildings, study areas, and pins. Hover over a pin to get more details about the plan or project.
- The search panel - An interactive side panel with search and filter functionality with a list of plans, projects, and indicators.



The overview is the first thing you see after starting ArcGIS Urban. Depending on your permissions, the overview can be either read-only or the starting point for creating and editing plans, projects, and indicators. As an administrator, you can configure Urban using the data manager in the overview.

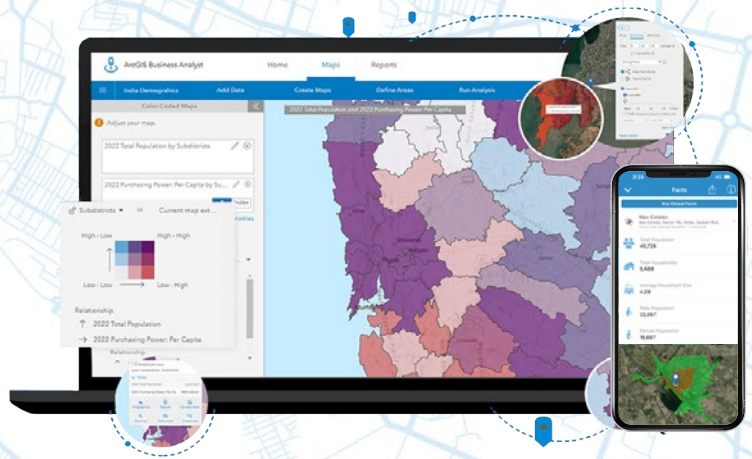
The data manager is only accessible to users with an Urban license and the required permissions. The manager allows you to import data into your urban model and configure the settings.

The project editor is only accessible to users with an Urban license and to users with an ArcGIS Hub premium community user account. The editor allows you to sketch various design scenarios. Users can draw buildings and enrich the 3D scene, for example, with greenery and street furniture. Once designs are finalized, users with the required privileges can share the project with relevant stakeholders or everyone.

The plan editor can only be accessed by those with an Urban license. There are two types of plans: land-use plans and zoning plans. The editor allows you to create multiple alternative scenarios to a plan. As you edit land use, zoning, overlays, and parcels or design buildings, metrics allow you to analyze the probable impacts by comparing your current scenario designs to the existing condition or to other scenarios. Use metrics to understand how your designs interact with a parcel or site. Once designs are finalized, you can share the plan with relevant stakeholders or everyone.

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**Demographic Data
& Map Content**

+



Smart Maps

+



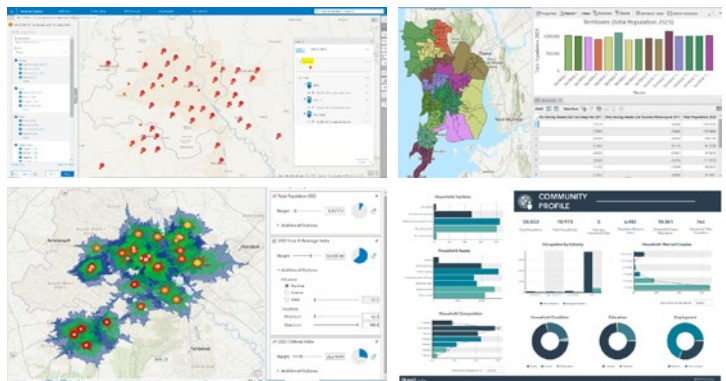
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Let's discuss the possibilities!



ArcGIS Reality Studio

ArcGIS Reality Studio is an advanced photogrammetry product optimized for precision, speed, and simplicity. This scalable solution for city and countrywide aerial mapping is an important component of 3D digital twins. Align large collections of images captured by multicamera sensors across multiple flights to create highly accurate true orthos, 3D meshes, and point clouds. An intuitive map centric 3D interface provides automated processing workflows for the efficient creation of survey-grade products.

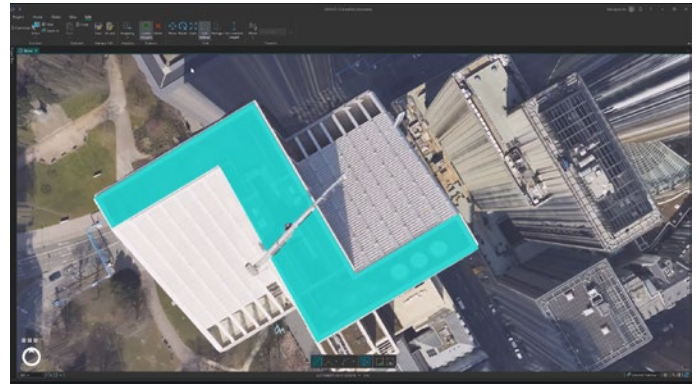
What's new in ArcGIS Reality Studio 2024.3?

Geometries

1. **Create and Edit Geometries:** Create and edit a Region of Interest, Water Body, or Correction geometry within the application without the need for additional software.

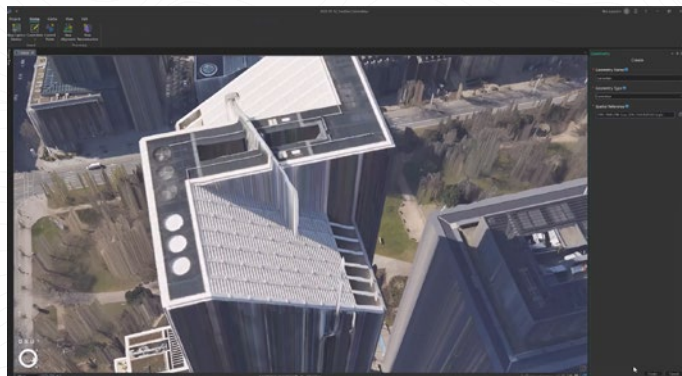
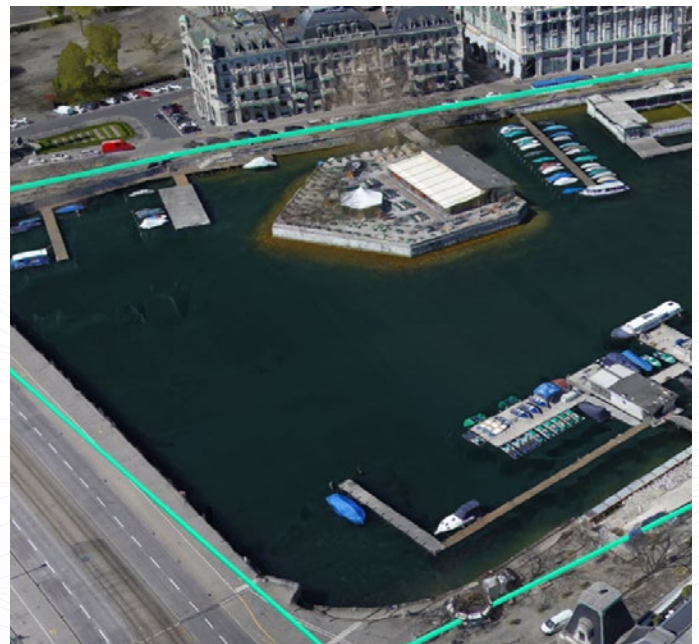
Define the elevation in two ways for new and existing geometries:

- Get heights from an elevation source layer with the world elevation terrain or a computed DSM within the same project.
- Set a constant height with a user specified elevation value.



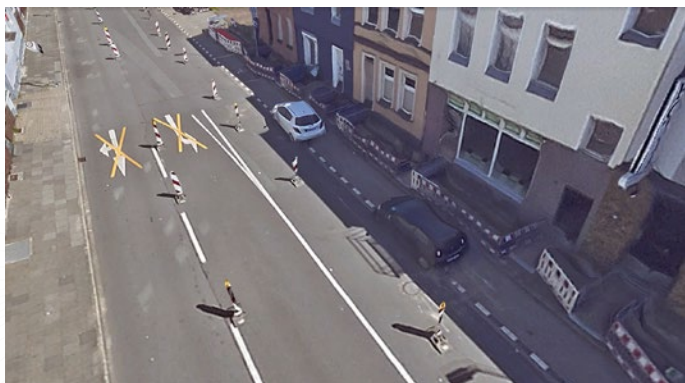
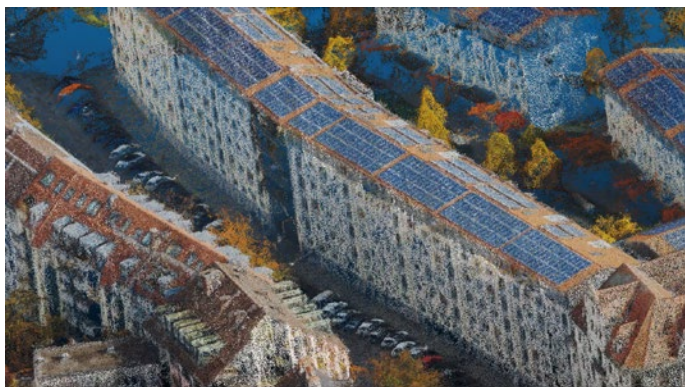
2. **New Water Body Handling:** Water body geometries previously had to be pixel-accurate, which can require considerable manual effort and time. Pixel-accurate Water Bodies can still be used in a reconstruction.

An additional new method for handling water body geometries allows the user to provide coarse geometries that fully encompass the water surfaces. Water surfaces are automatically detected in the reconstruction.



Reconstructions

1. **Quality Improvements :** Improvements have been made in the 3D mesh generation algorithm to retain more detail. More thin structures are now visible in the full resolution mesh. Streaming and visualization of 3D meshes have been improved when viewing them at different zoom levels. Point clouds retain more details and are sampled at a higher and more uniform density pattern.



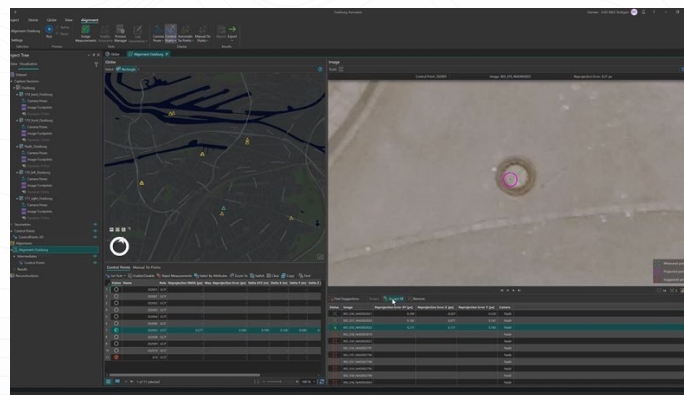
2. **Efficiently re-process results:** After an initial reconstruction has been completed, Correction or Water Body geometries can be applied to areas that need improvements, and only the affected areas of the project are automatically re-processed to incorporate the changes into the reconstruction results.



3. **Colour Balancing:** When processing a reconstruction with the Aerial Oblique scenario, the DSM and True Ortho products can be added to the same reconstruction. The DSM and True Ortho are consistent with the generated mesh. True Ortho, DSM Mesh, and Mesh benefit from more consistent colour balancing across the dataset. Radiometric differences caused by variable lighting or atmospheric conditions in capture sessions are minimized.

Alignments

1. **Memory Optimization:** When processing an Alignment - This is improved to guarantee a responsive user interface and quick processing of further refinement steps.
2. **General:**
 - When creating a new capture session from an ASCII text file, the unit used for angular values can be specified as degrees, radians, or gradians.
 - Select specific control points directly from the globe view in the image measurement tool and change their role or toggle their use for the alignment process.





Evolving Architecture Education to Tackle Modern Urban Challenges: NIT, Raipur



GIS helps architects and urban designers by providing detailed geographic and spatial data, crucial for large-scale projects. It aids in identifying spaces with specific attributes, enabling informed decision-making and efficient resource use.

Keeping this in mind, the National Institute of Technology, Raipur offers Remote Sensing and GIS courses to senior undergraduates and postgraduates. We unfold the details through a discussion with **Dr. Vivek Agnihotri, Assistant Professor, Department of Architecture and Planning, NIT, Raipur.**

Why is it important to integrate GIS into architecture education?

As technological advancements continue to permeate the architectural landscape, the utilization of tools like Building Information Modelling (BIM) and Geographic Information Systems (GIS) has become indispensable, particularly for larger projects. By analyzing spatial relationships and patterns, GIS aids in the optimization of urban design, contributing to sustainable and resilient urban environments. One of the most significant advantages of GIS is its ability to overlay various data layers, such as zoning information, demographic data, transportation networks, and environmental factors. This multi-layered analysis enables architects to develop comprehensive design solutions that address diverse aspects of urban planning. For instance, GIS can highlight areas prone to flooding, ensuring that infrastructure is designed to mitigate potential risks. It can also identify underutilized spaces that can be transformed into vibrant public areas,

enhancing the overall quality of urban life. As urbanization continues to surge, the demand for architects who possess a robust understanding of GIS is growing. **Emerging architects must equip themselves with GIS skills to remain competitive in the industry.** Embracing this technology will empower them to create innovative, data-driven solutions that shape the future of our cities.

How is your institute inculcating GIS knowledge and skills in the students?

At the National Institute of Technology Raipur, the Department of Architecture and Planning offers Remote Sensing and GIS courses for both senior undergraduate and postgraduate students. These courses combine theoretical knowledge with practical, hands-on tutorials, providing a comprehensive learning experience.

Are you witnessing a change in the way architecture students approach urban problems today? If yes, how? Would you like to highlight any project?

Yes, there has been a noticeable change in the way architecture students approach urban problems today. This shift can be attributed to several factors, including advancements in technology, increased awareness of sustainability, and a greater emphasis on interdisciplinary collaboration. Students today are more conscious of the environmental impact of their designs and strive to create buildings and spaces that promote ecological balance. This includes incorporating green building practices, such as using renewable materials, optimizing energy efficiency, and enhancing water conservation.

Additionally, students are increasingly considering the social and economic aspects of sustainability, ensuring that their designs contribute to the well-being of communities. Interdisciplinary collaboration is another significant change in the way architecture students approach urban problems. Modern urban issues are complex and multifaceted, requiring input from various disciplines such as engineering, urban planning, sociology, and environmental science. Students are now more open to collaborating with professionals from these fields, leading to more holistic and integrated design solutions. This collaborative approach not only broadens their perspective but also fosters innovation and creativity. Moreover, architecture education is evolving to address contemporary urban challenges. Curricula are being updated to include topics such as disaster resilience, climate adaptation, and smart city planning. These changes ensure that students are well-prepared to tackle the pressing issues facing our cities today. In summary, architecture students are adopting a more innovative, sustainable, and collaborative approach to urban problems. This transformation is driven by technological advancements, heightened awareness of sustainability, and interdisciplinary collaboration, enabling them to develop solutions that are responsive to the complexities of modern urban environments.

How crucial is it to equip the students with the knowledge of advanced technologies like AI, ML, etc. so that they create better architectural marvels in the days to come?

Equipping architecture students with knowledge of advanced technologies like Artificial Intelligence (AI) and Machine Learning (ML) is crucial for shaping the future of architectural design. As the world becomes increasingly interconnected and technology-driven, the architecture profession must evolve to meet the demands of contemporary society. AI and ML are transformative technologies that offer significant advantages in architectural design and planning. AI can automate repetitive tasks, such as drafting and data analysis, allowing architects to focus on more creative and strategic aspects of their work. For example, AI-powered tools can generate multiple design options based on specific parameters, enabling architects to explore a wider range of

possibilities and make more informed decisions. Machine Learning, a subset of AI, excels at identifying patterns and making predictions based on large datasets. In architecture, ML can analyze historical data, environmental factors, and user preferences to optimize building performance and sustainability. For instance, ML algorithms can predict energy consumption patterns, helping architects design energy-efficient buildings that reduce environmental impact. Furthermore, AI and ML can enhance the accuracy and efficiency of urban planning. By analyzing vast amounts of spatial data, these technologies can identify optimal locations for new developments, assess the impact of proposed projects on traffic and infrastructure, and suggest sustainable solutions for urban growth. This data-driven approach ensures that architectural designs are not only aesthetically pleasing but also functional and contextually appropriate. Integrating AI and ML into architectural education prepares students to navigate the complexities of the modern built environment. By mastering these technologies, future architects will be better equipped to tackle pressing challenges such as climate change, urbanization, and resource management. Additionally, proficiency in AI and ML will enable architects to stay competitive in an increasingly technology-driven industry.

In summary, imparting knowledge of advanced technologies like AI and ML to architecture students is essential for fostering innovation and creating better architectural marvels. These technologies empower architects to design smarter, more sustainable, and resilient structures that meet the needs of the future.



Flood Mapping and Change Detection of Delhi 2023 Floods

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Abstract

Floods are a natural occurrence in water bodies, essential for maintaining balance in nature. However, the increasing frequency of floods has raised concerns due to climate change, shifts in rainfall patterns, soil erosion leading to siltation, and the impacts of unplanned development in river areas. In July 2023, heavy rainfall caused severe flooding in Delhi NCR, resulting in the Yamuna River reaching a 45-year high water level. Accurate flood inundation maps, generated using remote sensing techniques, are crucial for mitigating the impact of flood disasters. The utilization of publicly available Sentinel-1A SAR data, well-known for its all-weather imaging capabilities, holds promise for mapping flood inundation. This study leveraged temporal dual-polarization Sentinel-1

SAR for inundation mapping and change detection. This research employs open-source datasets for inundation mapping and damage assessment, and the methodology can be easily adapted to different study areas, depending on data availability. The findings revealed a clear progression in flood extent, with initial flooding observed on 12th July, peak flooding on 16th July, and recession by 24th July. The assessment indicated flooding occurring in three stages, covering 170.326 sq. km, 365.929 sq. km, and 92.514 sq. km on 12th, 16th, and 24th July, respectively. Such research is valuable for policymakers and local authorities, enabling efficient resource allocation and damage assessment in flood-affected areas. The methodology adopted for this study is cost-effective, time-efficient, and easily replicable.

Introduction

Floods are complex natural disasters that cause significant loss of life and property globally while also helping to restore balance in rivers and other water bodies (Janizadeh et al., 2024). The increasing frequency of floods in recent years is a major cause for concern and can be attributed to various factors such as climate change, shifts in rainfall patterns, heightened soil erosion, which leads to excessive siltation, and the significant impact and loss of life resulting from haphazard development and unregulated settlements in river catchment zones (Di Baldassarre et al., 2010; Jha et al., 2012).

This study proposes an approach to promptly assess flood extent and detect changes using SAR earth observation data (Vanama, Musthafa, et al., 2021; Vanama, Rao, et al., 2021). Assessing the impact of damage and losses is crucial for flood management but can be challenging due to the complexity of dealing with extensive data, various types of damage, and different spatial and temporal scales. Evaluating damage involves making assumptions about factors such as spatial and temporal boundaries, financial considerations like depreciated values or alternative costs, categorizing at-risk assets, determining the value of uncovered assets, and formulating strategies to assess vulnerability (Shen et al., 2015; Tavus et al., 2022).

(Landuyt et al., 2018) provides an in-depth assessment of various SAR-based flood mapping algorithms, including global and enhanced thresholding, active contour modeling, and change detection. These methods were tested on medium-resolution SAR images of different flood events and lakes across the U.K. and Ireland. The findings indicated that the most suitable method depends on the area of interest and its specific characteristics. The tiled thresholding approach was found to be robust and well-suited for automated, near-real-time flood detection and monitoring, while active contour models offered higher accuracy but required longer computation times. This comprehensive evaluation of different algorithms provides valuable insights into selecting appropriate methodologies for specific flood mapping scenarios.

Study Area

The city of Delhi, located in the northern part of India and

also known as the National Capital Territory (NCT) of Delhi, covers an area of approximately 1,484 square kilometers. Among its total area, around 470 square kilometers are designated as urban. With a length of 51.90 kilometers and a width of 48.48 kilometers, Delhi is one of the world's seven largest cities and has been experiencing a steady increase in population. The city's population rose from 14 million residents in the 2001 census to 16 million in the 2011 census, solidifying its status as one of the most densely populated regions in India. The extent of the Study Area is 29.037830°N to the north, 28.142567°N to the south, 76.918008°E to the west, and 77.763766°E.

In July 2023, extensive rainfall led to severe flooding in Delhi NCR, resulting in the Yamuna River reaching its highest water level of 208.46 meters in 45 years after 207.49 meters in 1978. Floods present significant risks to urban areas like Delhi, and remote sensing technologies, such as Synthetic Aperture Radar (SAR) data from satellites like Sentinel-1, offer valuable tools for monitoring and assessing flood events (Delhi Floods, 2023).

Methodology

The preprocessing of Sentinel-1 SAR data involves essential steps within the "Synthetic Aperture RADAR" toolbox in ArcGIS Pro software provided by Esri. This includes radiometric calibration, multi-looking, speckle filtering, and geometric calibration applied to GRDH products. Operators like "Download Orbit File", "Apply Orbit Correction", "Apply Radiometric Calibration", "Despeckle" with "Refined Lee" filter, and "Apply Geometric Terrain Correction" resulting in terrain-corrected images with a pixel size of 10 m × 10 m are used for scientific analysis and "Convert SAR Units" with conversion type "Linear to dB".

After preprocessing the images, we used the flood binary masking technique to categorize them as either flood or non-flood, as per (Liang & Liu, 2020). The "Raster Calculator" feature under the "Image Analyst Toolbox" in ArcGIS Pro was utilized to create a classification equation based on the pixel values from the "Sigma0_VV_db" band. Histogram statistics for flood events on various dates were produced, using different values for each, ensuring an accurate distinction between flooded and non-flooded areas in the images.

Date	Threshold Value	Equation
4th July 2023	-11.5	$\text{Sigma0}_{VV_{db}} < -11.5$
12 th July 2023	-9.87	$\text{Sigma0}_{VV_{db}} < -9.87$
16 th July 2023	-10.58	$\text{Sigma0}_{VV_{db}} < -10.58$
24 th July 2023	-9.26	$\text{Sigma0}_{VV_{db}} < -9.26$

Table 1: Threshold Values for different flood dates

To assess the impact of flooding on backscatter values, the Normalized Change Index (NCI) was computed for each flood date (12th, 16th, and 24th of July). The NCI serves as a quantitative measure to evaluate the changes in backscatter values between the flood and pre-flood conditions. By utilizing the equation specified, the NCI was calculated using the

“Raster Calculator” feature under “Image Analyst Toolbox” in ArcGIS Pro based on the difference and sum of Sigma0_VV values for the flood and pre-flood images, providing insights into the variations in backscatter intensity resulting from the flooding event.

$$\text{NCI} = \left\{ \frac{(\text{Sigma0}_{VV_{\text{Flood}}} - \text{Sigma0}_{VV_{\text{PreFlood}}})}{(\text{Sigma0}_{VV_{\text{Flood}}} + \text{Sigma0}_{VV_{\text{PreFlood}}})} \right\} + 1$$

Equation 1: Normalised change index

A value greater than 1 in the NCI indicates an increase in backscatter values following the flood, suggesting a potential change in surface properties or conditions due to inundation. Conversely, a value less than 1 signifies a decrease in backscatter intensity, and 1 signifies that there has been no change in the Pixel Values.

Results and Discussion

Flood Extent:

Delhi NCR region experienced significant flooding in July 2023, systematically monitored using Sentinel-1 SAR datasets. The flood extent was quantified on three specific dates: 12th July, 16th July, and 24th July 2023. The observed flood extents on these dates were 170.326 km², 365.929 km², and 92.5154 km², respectively. The findings revealed a clear progression in flood extent, with initial flooding observed on 12th July, peak flooding on 16th July, and recession by 24th July. The assessment indicated flooding occurring in three stages, covering 170.326 sq. km, 365.929 sq. km, and

92.514 sq. km on 12th, 16th, and 24th July, respectively. The flood event in Delhi NCR during July 2023, as quantified by the Sentinel-1 SAR datasets, revealed a significant temporal variation in flood extent. The initial, peak, and recession phases of flooding presented unique challenges and implications for flood management and mitigation. This analysis underscores the critical role of timely and accurate flood monitoring in enhancing the resilience of communities to such natural disasters.

This analysis of flood extent provides critical insights into the flood management practices required for the Delhi NCR region. The data underscores the importance of integrating remote sensing technologies, such as Sentinel-1 SAR datasets, into flood monitoring and response frameworks. By leveraging such technologies, authorities can enhance their capacity to predict, respond to, and recover from flood events, thereby reducing the adverse effects on human life and infrastructure (Thakur et al., 2020).

Inundation Dates	Flooded Area (Sq. Kms)
12th July 2023	170.326
16th July 2023	365.929
24th July 2023	92.5154

Table 2: Flooded Area on Different dates

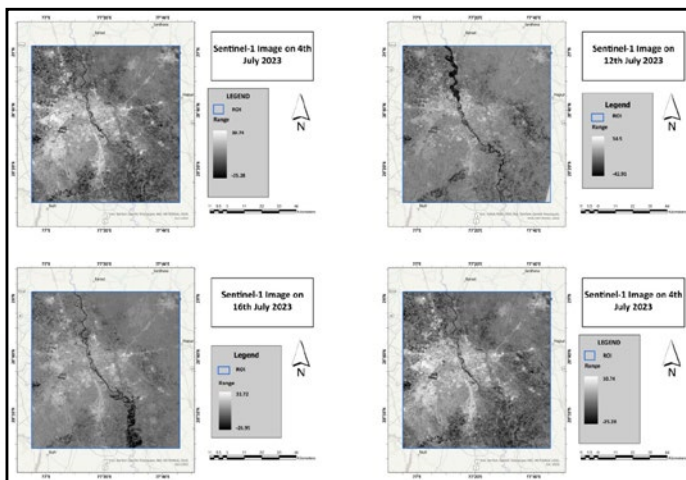


Figure 1: Sentinel-1 Images on different dates

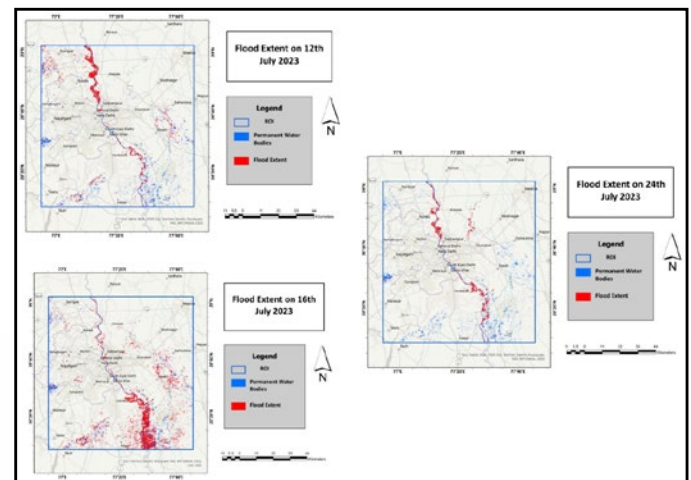
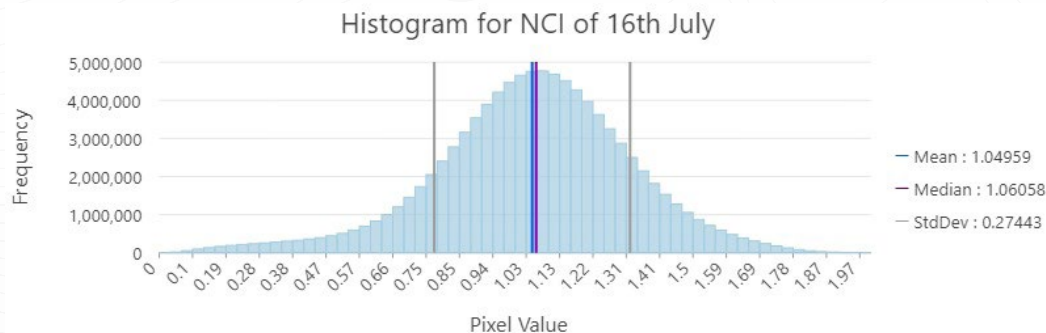


Figure 2: Flood Extent on different dates

Normalized Change Index:

The Normalized Change Index (NCI) is calculated by normalizing the absolute difference between the flood and pre-flood σ values according to a specific equation. NCI values range from 0 to 2, with a value of 1 indicating no change in the images. Positive changes in NCI values signify flood areas. The 4th July 2023 image is utilized as the pre-flood reference for generating all temporal NCI indices using the specified equation. The histogram observed in

the NCI image was derived from the pre-flood and peak flood images (4th July and 16th July 2023, respectively). The histogram distribution is attributed to the presence of permanent water bodies and flood areas in the images. The flood normalized change index image's histogram ranges from 0 to 1.97. The statistical analysis reveals a mean of 1.04959, a median of 1.06058, and a standard deviation of 0.27443. This suggests that most values are concentrated around the mean and median, with a moderate level of variability indicated by the standard deviation.

Figure 3: NCI Histogram for 16th July

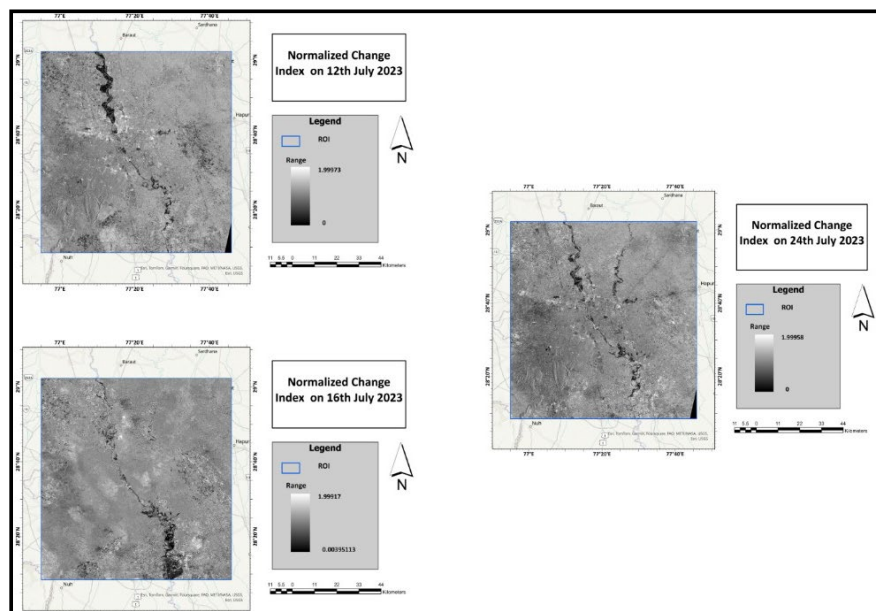


Figure 4: NCI on different dates

Conclusion

The launch of the Sentinel-1 SAR satellite has expanded the potential benefits of freely available SAR data for different applications, particularly due to the access to extensive time-series SAR data. Mapping large areas affected by natural disasters like floods is crucial for targeted relief efforts. This research investigates the effectiveness of C-band SAR data in accurately mapping flood inundation using straightforward

methods. It showcases the capabilities of flood mapping with datasets collected on multiple dates and emphasizes the use of the Binary classification method and Change detection through Spatial Indices.

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How a Texas Town Is Building the City of the Future by Going Vertical

By Keith Cooke



Dickinson, Texas, has nowhere to go but up.

The city, 30 miles south of Houston, covers a mere 10 square miles. Surrounded by other cities, it has no room to expand. "I always say we're 'landlocked,'" said Theo Melancon, Dickinson's city manager.

Greater Houston is exploding. Only one other US metro area—Dallas-Fort Worth, Houston's neighbor to the north—is adding more new residents. Much of that growth has rippled south, to cities like Dickinson along the I-45 freeway.

When Houston grows, it sprawls. Over a recent 19-year period, the metro area added enough concrete and asphalt to fill 187,000 football fields.

Sprawl is not an option for landlocked Dickinson. While the populations of the surrounding cities expand at a rate of around 17 percent, Dickinson holds steady at 22,000 people.

"We can't have the suburban sprawl growth," Melancon said. "But we can have something with much more impact per square foot on the property that we do have."

With the help of a geographic information system (GIS), Dickinson is about to grow up—literally.

Dickinson, Texas is embracing vertical growth and mixed-use development to revitalize its downtown, using GIS technology for strategic urban planning.

Key Takeaways

- Planners use a GIS 3D model and an immersive experience to communicate an urban ideal not typical in Texas.
- The model for growing without sprawl is flexible, allowing officials and developers to experiment.
- GIS tools enable stakeholders to analyze the economic impact of the project.

‘Going Vertical, Not Horizontal’

When Melancon and his team of urban planners pondered the situation, they saw only one option.

"We needed to look at going vertical, not horizontal," he said. "Especially if we want a viable city center, we had to talk about increasing density."

Other landlocked cities around the world have reached the same conclusion. Vienna, which regularly tops lists of Europe's most livable cities, is surrounded by Austria's federated states. With no room to grow, Austria's capital is managing population pressures by transforming a disused airfield into one of the continent's most ambitious planned communities.



Planners in Dickinson, Texas, are working to establish a viable city center. (Photo courtesy of the City of Dickinson)

However, in a place like the Lone Star State, where single-family homes on the range are highly prized, it can be a tough sell.

The team developed a tentative plan to transform 12 square blocks of Dickinson's downtown into a new kind of neighborhood—with mixed-use buildings that are home to both residents and retail.

Planners anticipated a skeptical city council and dubious developers. So they decided to build the city first, in the form of a 3D geospatial model.

An Urban Identity Crisis

Historically, Dickinson has been seen more as a pit stop than a destination, with travelers bound for Houston or Galveston pausing briefly to refuel along I-45.

Dickinson's rep as a waystation precedes the freeway. In the early 20th century, the city was the midway stop on the

Houston/Galveston interurban rail. The main attraction was a picnic grounds that hosted harrowing horse-and-buggy races on a figure-8 track.

"You'd get off the train with your packed lunch, watch the races, maybe bet on them, and then you get back on and continue to Galveston or Houston," Melancon said.

Reinventing Dickinson meant overcoming this deeply engrained idea that the city is neither here nor there.

"How do we differentiate ourselves from our sister cities?" Melancon said, summarizing the problem. "Why would someone go to Dickinson, rather than League City, Texas City, or Webster?"

Reinvention and History

For a Texas city, Dickinson is attempting a radically different approach to urban growth.

League City, where the amount of undeveloped land could fit two Dickinsons, may soon build 4,000 acres of new homes on the edge of town, west of I-45.

Meanwhile, Dickinson's plan to go vertical involves building structures that have retail at the base, topped by a few stories of apartments. Overall, the new downtown will hold between 200 and 400 new apartments, along with some semi-detached single-family townhomes.

The neighborhood will de-emphasize car use, with one parking space per 2,000 square-feet of built space. (For single-family rentals in Texas cities, the typical allotment is two spaces per dwelling unit.)

With so many amenities available in the neighborhood, the Dickinson planners expect cars to be less of a necessity. In place of spaces that might otherwise be dedicated to driving, downtown will feature more pedestrian and cycling paths. The team hopes the convenience of downtown will also give those who live in the old neighborhoods near the city center more car-free options.

The team envisions the new downtown as not merely a place to live, but also a place to be, knit together by public

spaces. So far, two anchor spaces have emerged.

ELS Construction has purchased a long-vacant former First Baptist church, which it hopes to turn into a brewpub, along with outdoor pickleball courts.

A few blocks away, the city is developing a park near the old interurban tracks, now used by freight trains to haul chemicals to and from the Texas Gulf Coast. Winking at Dickinson's way station past, the park will be called the Picnic Grounds. An on-site figure-eight path will pay homage to the old racetrack.

Show, Don't Tell

This is a lot to convey in writing.

"Historically, planners and city councils have had ideas that they communicate with words," Melancon said. "But it's hard to explain what we're going for with these high-density figures. Everybody knows how Texas cities develop. They're horizontal and they sprawl."

Using GIS, the planners first built a 3D model of the new downtown. Working with ViewPro, an urban planning consulting agency, they used the planning software ArcGIS Urban and the design solution ArcGIS CityEngine. Then they moved the model into the Twinmotion game engine to create a 3D immersive experience.

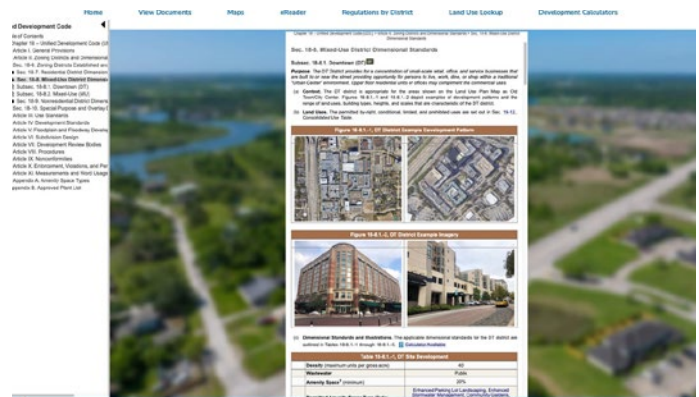
When explaining the model, the planners emphasized that it was a vision of the city, but not the vision. As with many new urban projects, the zoning applies a system called form-based coding. (The church development came about after ELS Construction saw the video, then understood the total context of the project.)

Instead of designating zones based on use, such as residential or commercial, a form-based code establishes some physical parameters to provide a unified look. For Dickinson's downtown, if developers follow those rules and adhere to density-related requirements, they have a large leeway for their projects.

The planners fed these rules into the GIS model. People can explore different ways to structure the downtown by dragging and dropping to create streetscapes. What if we

added a floor to this building? Or put more parking there? If a change violates the rules, it turns red on the model.

In this way, the model provides contextual knowledge and shows how every building is part of a larger unified project.



The City of Dickinson has recently revamped its unified development code. Here, the readily available document details the requirements for mixed-use development. (Screenshot courtesy of the City of Dickinson)

The Whole Picture

Along with physical context, the model provides economic context. A city manager can plug in figures to determine, for example, how much tax revenue a space is likely to generate, now and in the future.

This will help downtown projects obtain financing. Potential investors in Texas "have no experience with this kind of development," Melancon said. "But when you can show a broader picture of what downtown could be, what we're committed to doing over several city blocks, they realize every parcel is part of a bigger picture."

So far, the plan is working. Dickinson's city council and the city's Economic Development Corporation (EDC) have become enthusiastic converts. ELS Construction has demonstrated its long-term commitment in a major way. The company is transforming the gym in the renovated church downtown into its new corporate headquarters.

The difficult conversation about a Texas town going vertical has gotten easier. "It's changed the mindset of the council and the EDC," Melancon said. "Instead of seeing Dickinson as landlocked, now it's 'we have very limited space, but we're exclusive.'"

Reborn on the Bayou

With its downtown development project, the city of Dickinson hopes to attract residents who value a new approach to urban living in a location that offers non-urban recreational possibilities. One possible demographic is remote workers who won't mind the distance from Houston and may value the proximity to the outdoor attractions of the Texas Gulf Coast.

Dickinson planners are emphasizing the city's connection with the outdoors. The region lies underneath one of North America's largest bird migration routes. Bird-watchers seek out Dickinson Bayou, which winds through town on its way to Galveston Bay. Statues depicting the great blue heron are displayed in front of several local businesses.

Near the bayou on the far east side of Dickinson, the city is redeveloping a 34-acre piece of property. It will become a mixed-use district and a 20-acre bayou-front park. To prepare for environmental reviews, planners use GIS to map pipelines that cross the property.

"We have an opportunity to bring in people who only have to commute to Houston once or twice a week, not five," Melancon said. "They might like being so close to the bayou, and love being closer to Galveston than Houston."



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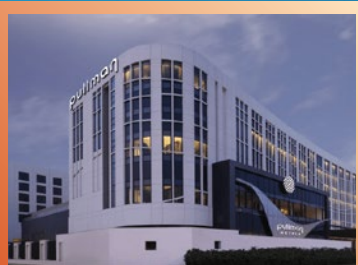
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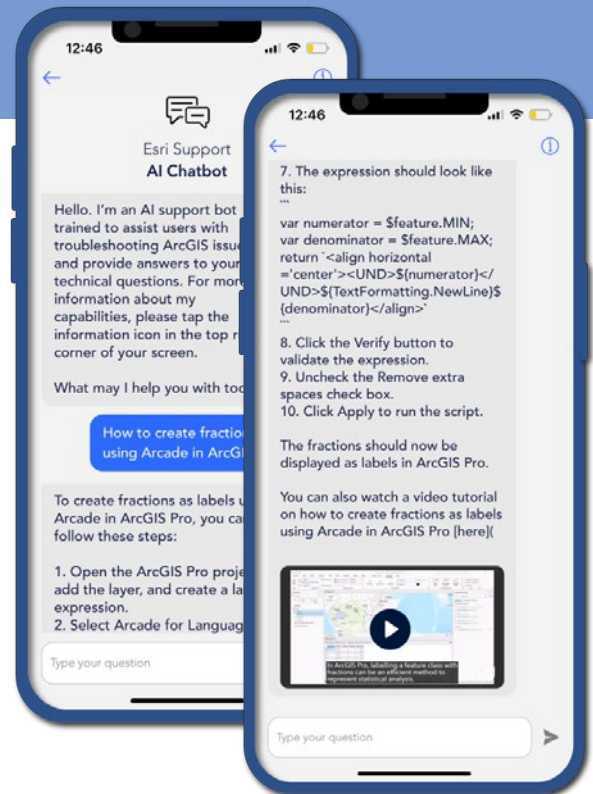
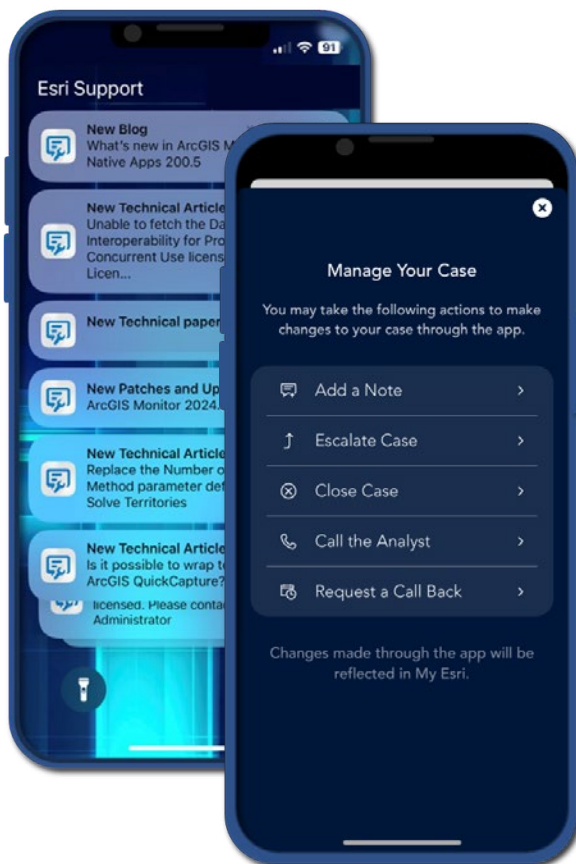
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