AUTODESK®

BIM & GIS Integration

Transforming infrastructure planning, design, construction and operation.

GET STARTED >

The Fusion of BIM & GIS

The power of location intelligence and design process, combined.

Context is King

Combine the power of location intelligence with design processes and a more holistic view of infrastructure emerges.
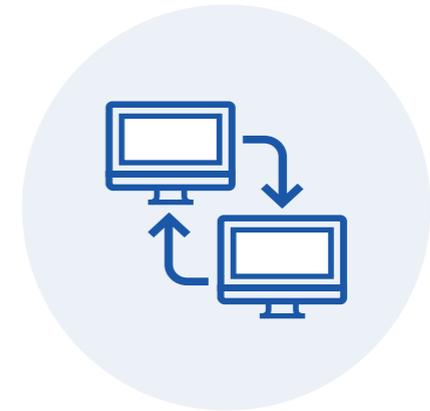
GIS Informs BIM. BIM Fuels GIS.

By providing a real-world context of an asset's existing environment within which designers and engineers can explore and evaluate design and construction – **GIS informs BIM.** Then, rich, more accurate models can be utilized to improve the overall operations and maintenance of assets within a larger area – in this way, **BIM fuels GIS.**
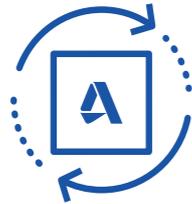
Real World Understanding

The fusion of BIM and GIS provides the power to build a robust context model where geographic information and infrastructure design data are brought together, helping to better understand how assets interact within the context of a real place and geography.

More, Better, with Less

To meet today's macro-economic challenges and build more sustainable and resilient infrastructure, we need more seamless sharing of data and information between BIM design processes and GIS technologies. Breaking down barriers will improve urban planning and management, and help us make investments in infrastructure with less negative social, economic and environmental impacts.
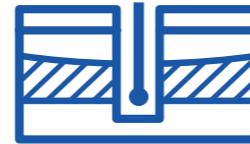
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Key Benefits

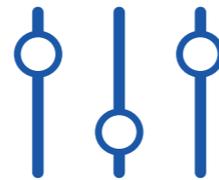**Transforming the Project Lifecycle**
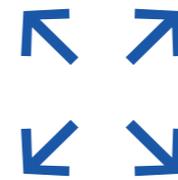
Building Site Context with the Environment

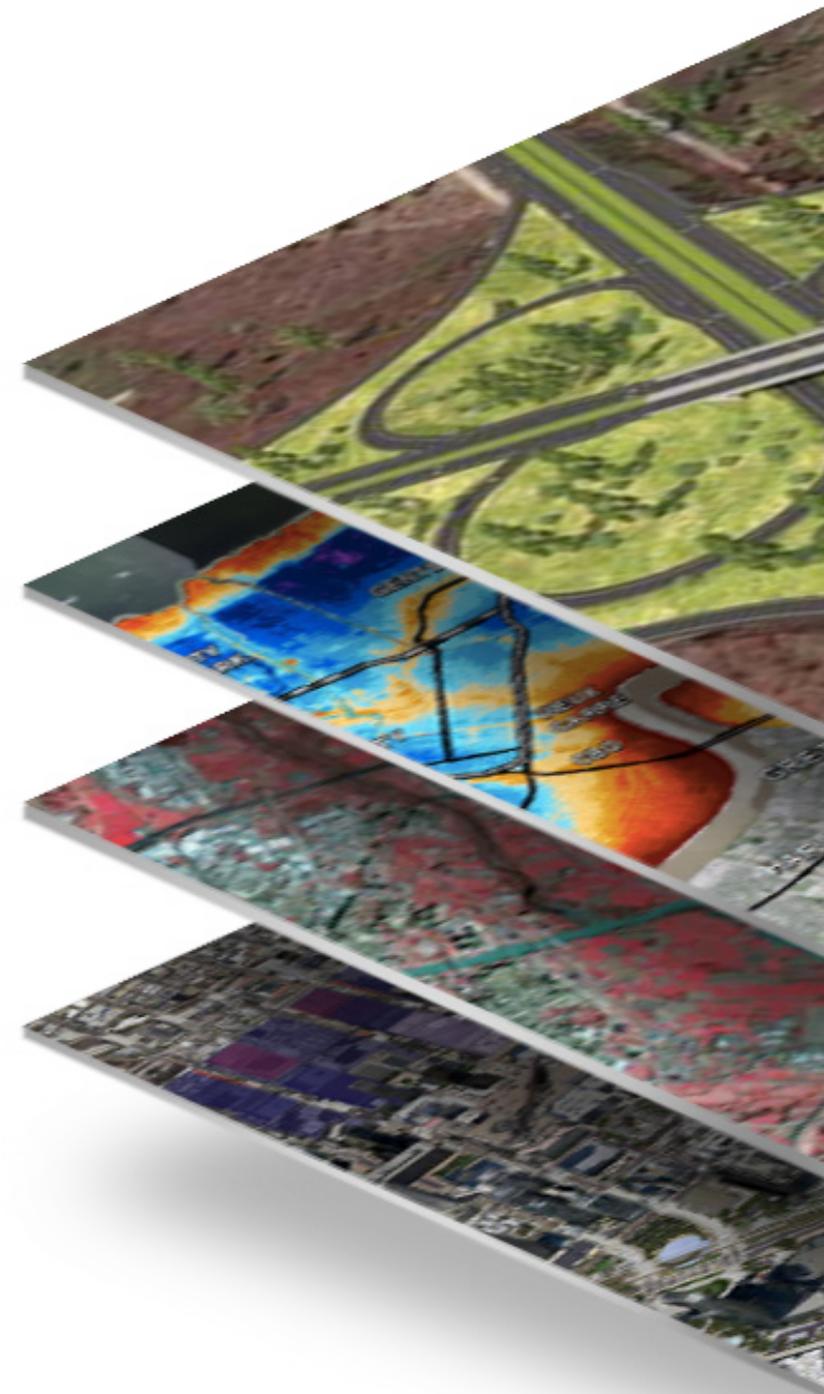**Sensing Site Change**

Designing and Visualizing the Real World in 3D

Optimizing Infrastructure Operation Intelligence

Open and Extensible Systems

Let's get started!

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Table of Contents

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Global Challenges & Opportunities

The world is changing fast, look at these key trends:

200K
people move to cities every day
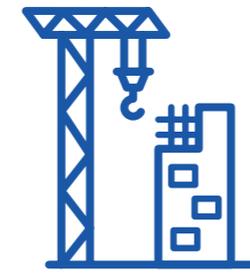
6.3B
by 2050, the urban population will increase by 75% to 6.3 billion, from 3.6 billion in 2010*

$15T
global construction output expected to double by 2025

13K
buildings built daily and still not on pace with demand

$3.7T
infrastructure spend needed to keep pace with demand

The ability to keep pace and have the vision to anticipate and prepare for these trends is critical to success moving forward – we need new approaches to planning, design, and asset management.

*Source: United Nations, Department of Economic and Social Affairs, Population Division (2012).
World Urbanization Prospects: The 2011 Revision
https://www.pwc.com/sg/en/real-estate/assets/pwc-real-estate-2020-building-the-future.pdf

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Disconnected & Fragmented

Current ways of working between BIM and GIS teams hamper our ability to meet global trends. Here are three examples:

1 Project Handover Process

The GIS specialist receives raw BIM or CAD data. Then, they must update manually so that it can be imported into a GIS database. The flow of information usually goes in one direction, which is not taking advantage of project data across workflows.

2 Outdated Data
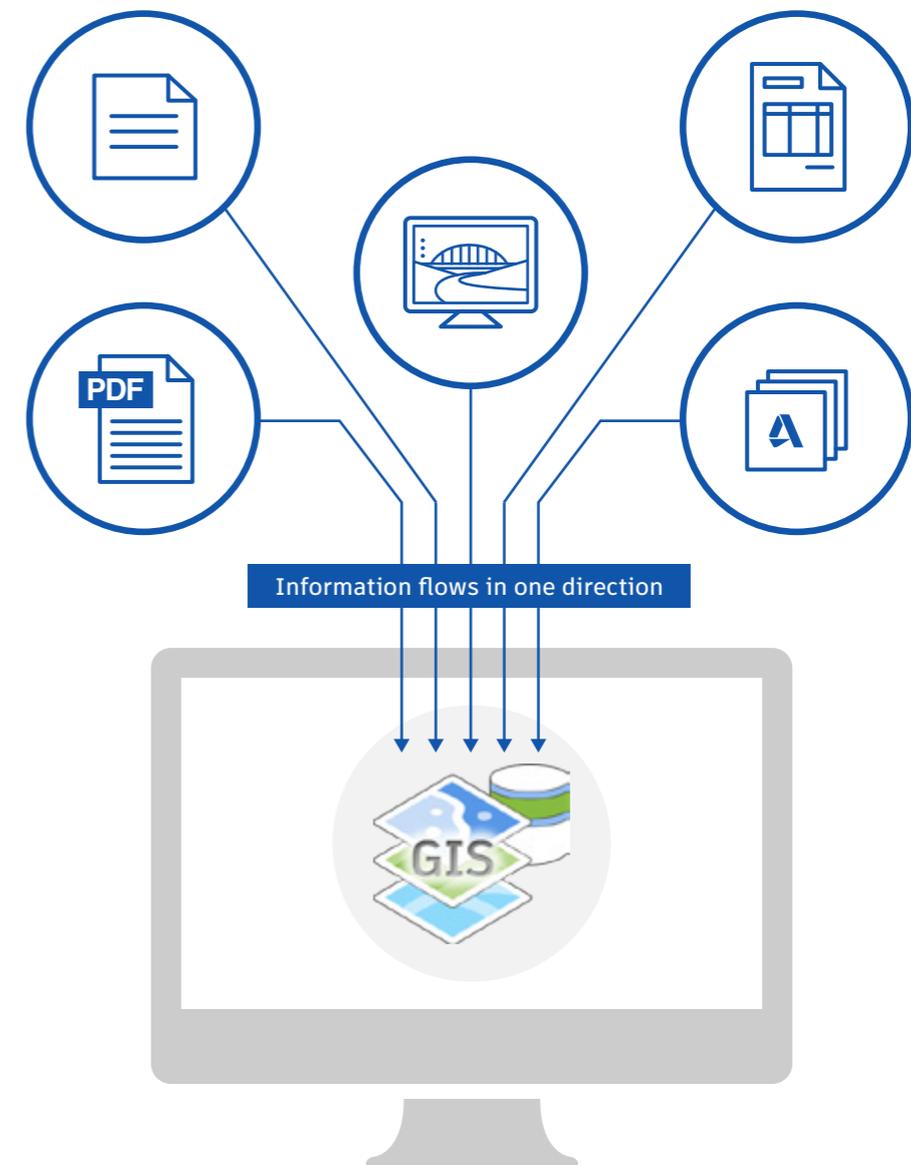
The likelihood of human error in the manual data input process can result in the loss of critical information. Exporting data manually also makes it "outdated" in a sense, since it can no longer be accessed directly by the BIM or CAD program from which it came.

3 Nonauthoritative System of Records

Projects teams might incorporate GIS data that is not connected to an authoritative system of record, and so designs may be based on inaccurate and out of date information.

These processes are prone to not just inefficiencies, but critical data loss leading to increased risk. These inefficient ways of working are key drivers to help integrate BIM and GIS.

The Current Way of Working

Information flows in one direction

GIS

1 2

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A New Approach: Data at the Center

To deliver more, better, with less, the industry needs to think about things differently. Integrating BIM and GIS can result in workflows that move data seamlessly from one system to another. Let's take a look.

Seamless Collaboration

Esri and Autodesk are working together to provide an environment where GIS professionals and designers and engineers can **collaborate** across the project life cycle by integrating GIS and BIM.
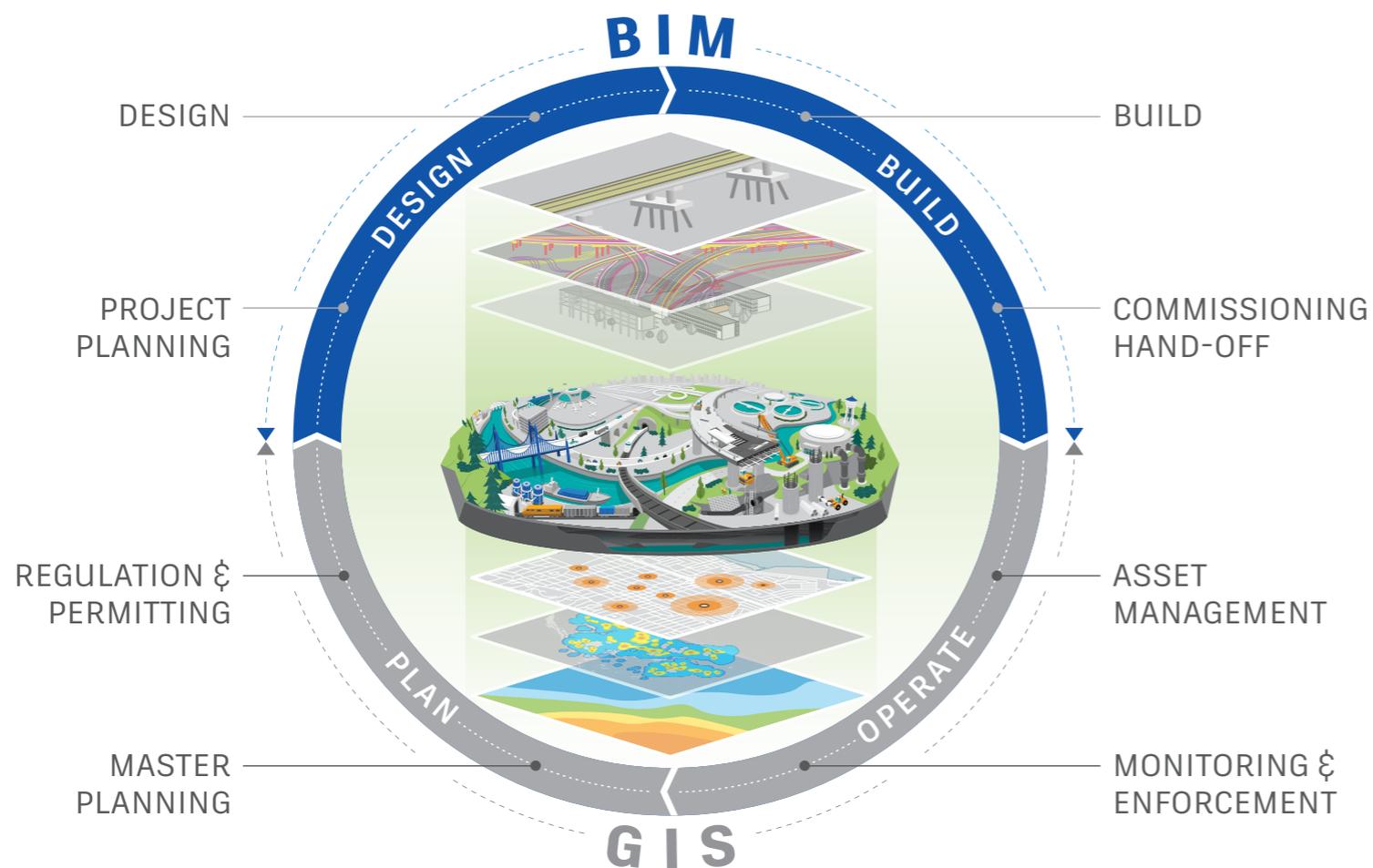
Deeper Understanding

"Data at the Center" creates a broader and deeper understanding of infrastructure in the **larger context** of our built and natural environments – enabling earlier and better-informed decision-making, improved stakeholder engagement, and accelerated approval processes.

Better Decision-Making

Stakeholders throughout project life cycles can **leverage digital information** that includes the built and natural environment, allowing everyone on a project to look at alternatives, see what the impacts are, and make better decisions.

Driving Smarter Decisions

In this new approach, GIS informs BIM and BIM in turn fuels GIS. Using integrated GIS and BIM optimizes the performance of assets within systems, which feeds back into the ongoing planning of new and more sustainable projects, helping to:

Enable Better-Informed and Smarter Decision-Making

Improve Stakeholder Engagement

Accelerated Project Timelines

Reduce Costs

Deliver More Resilient Infrastructure and Smarter Cities

Image courtesy of Hyder Consulting

What if you could? With Autodesk You Can.
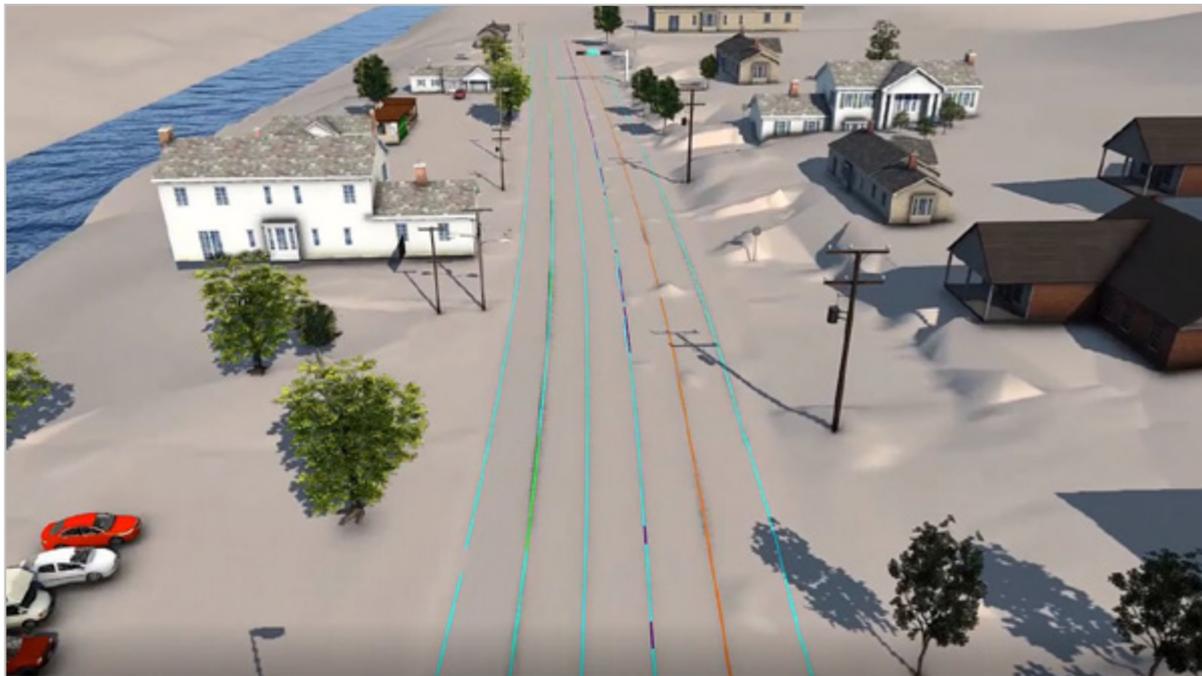
What if you could bring different types of information together, including geospatial data, to create an information model that forms the basis for planning, analysis & simulation, sustainability, visualization and more?

Project Information Model

- **GIS**

  ArcGIS®
  Map3D

- **Reality Capture**

  Digital Programming
  LIDAR
  Infrared

- **BIM**

  Civil 3D®
  Revit®

- **IoT**

  Traffic
  Parking
  Climate
  Lighting
  Utilities

PLANNING · ANALYSIS & SIMULATION · SUSTAINABILITY · VISUALIZATION · OTHER

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INPUTS

Reality Capture

When laser scan information is added to a model in InfraWorks, it becomes a valuable source of 3D data. By extracting terrain, point, and linear features, you can create a more comprehensive existing conditions model. InfraWorks features automated intelligence extraction which makes it easier to access and use your reality capture data.

Laser Scans as 3D Data Sources

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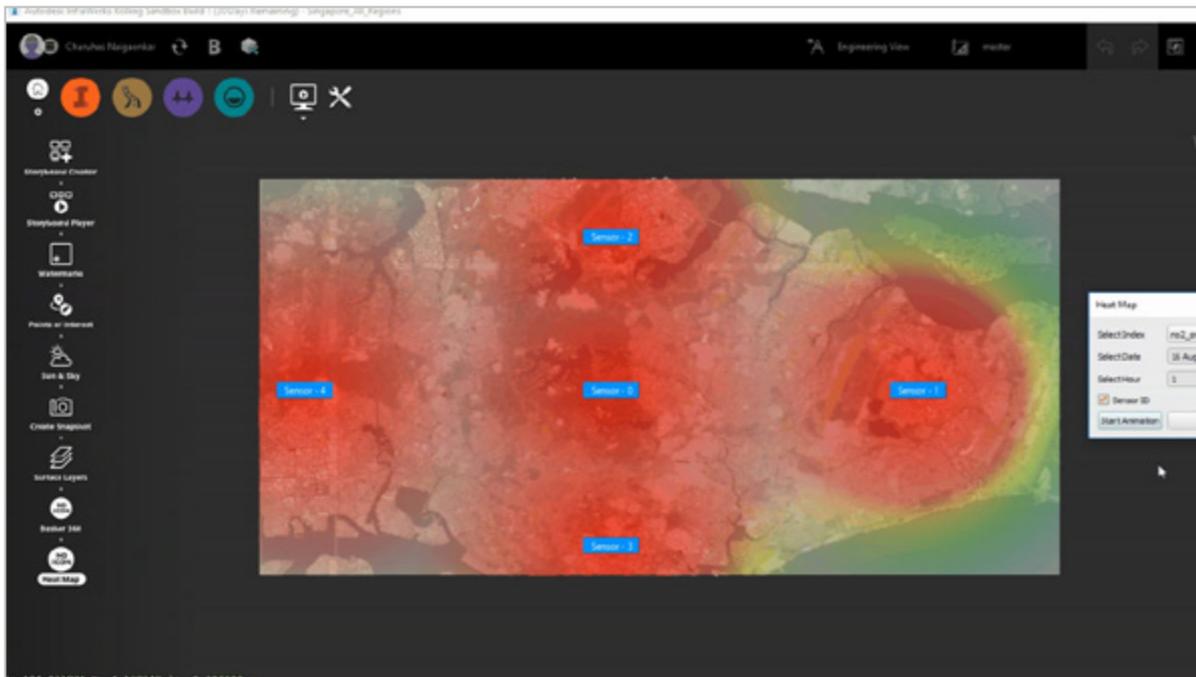
INPUTS

IoT

IoT deployments consisting of sensors collecting data doesn't make something 'Smart'. Analyzing and using IoT data to make real-time decisions is important, but this information can also be used to provide inputs and context when new assets are being designed and built. Access to this data type means new insights can be derived to improve the efficiency of individual assets (one intersection) and systems of assets (road network in a city).
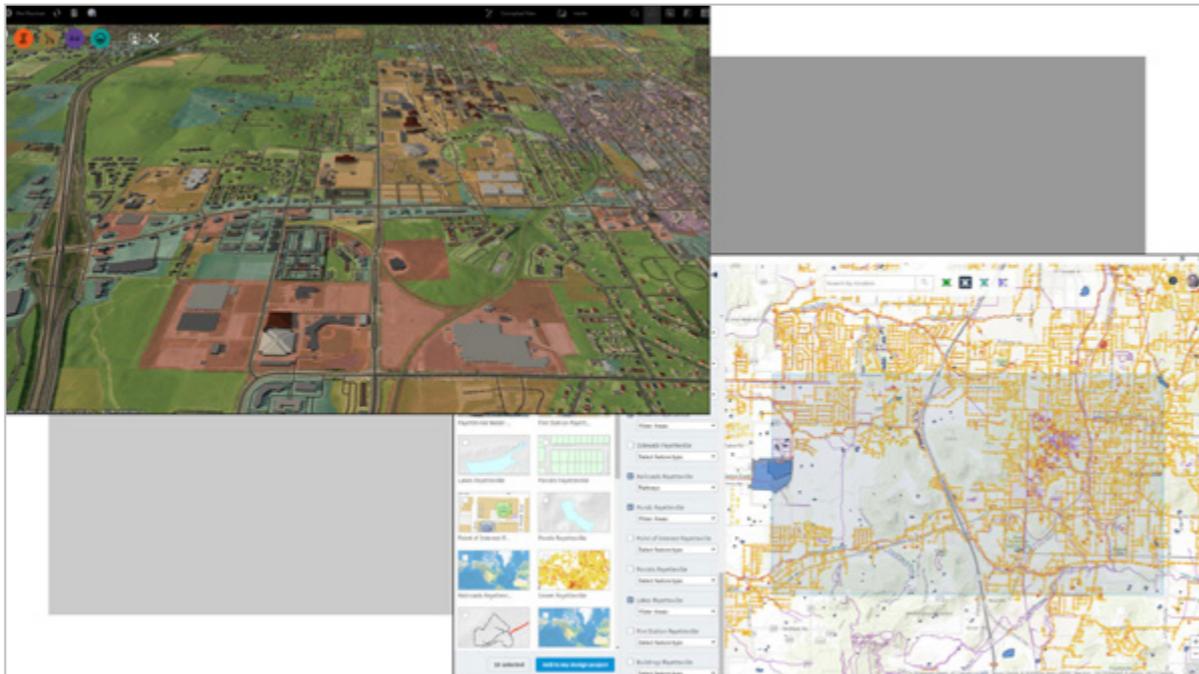
Singapore Heat Map Example

VIEW THE VIDEO >

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INPUTS
GIS/BIM Process Integration
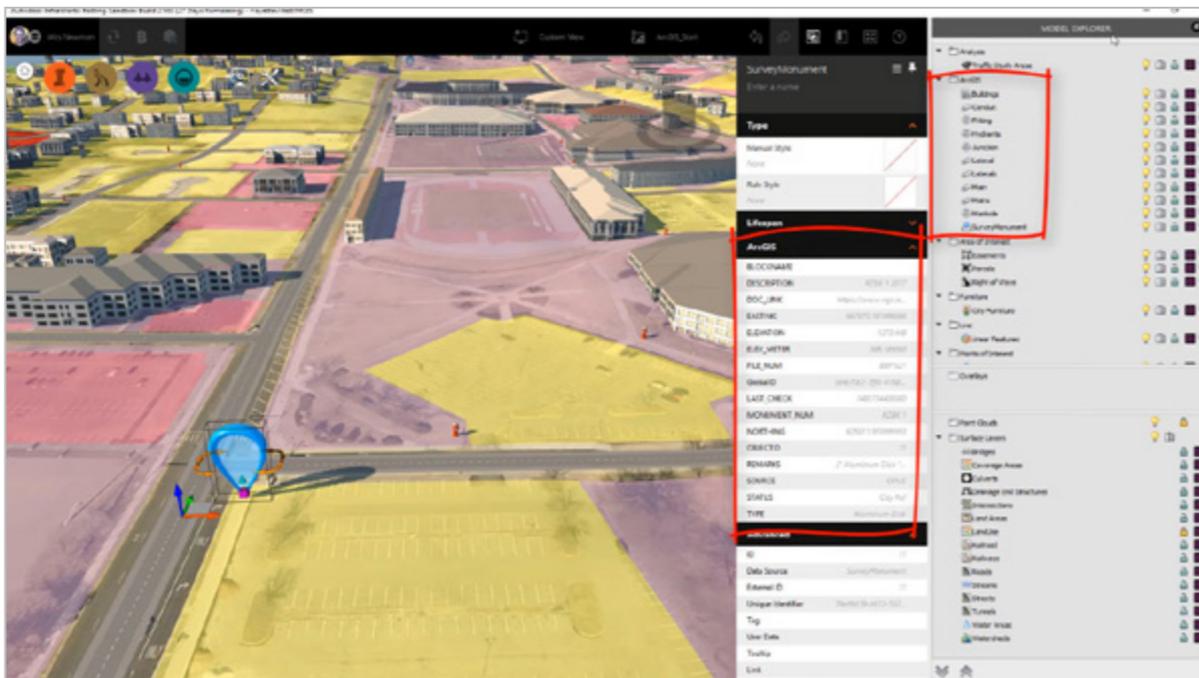
GIS and BIM are the two data sources most infrastructure owners are looking to bring together, because processes that could take advantage of BIM and GIS technologies are already in place in many cases. The next step is to integrate the processes.

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INPUTS

Autodesk® Connector for ArcGIS®

When laser scan information is added to a model in InfraWorks, it becomes a valuable source of 3D data. By extracting terrain, point, and linear features, you can create a more comprehensive existing conditions model. InfraWorks features automated intelligence extraction which makes it easier to access and use your reality capture data.

Autodesk Connector for ArcGIS

VIEW THE VIDEO >

1 2 3 **4** 5 6 7 8 9 10 11 12 13 14

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PLANNING

Norwegian Railway: High Speed Rail

Utilizing GIS information in InfraWorks, this Ramboll-Sweco Team was able to fast-track this Norwegian railway high speed rail extension project. Utilizing extensive overlays of project critical constraints and proposed design models, the team was able to effectively communicate design intent and issues with over 120 stakeholders to drive design approvals.

They used InfraWorks as the common data environment for the entire project team, enabling a rigorous schedule of project reviews every 14 days – a process the team called Integrated Concurrent Engineering, or ICE. The project was able to recognize a 20% time savings by implementing the Connected BIM process in the planning and approval phase of the project.

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ANALYSIS AND SIMULATION

Flooding

This flood model of the City of Paris, created with various data sources, including GIS, BIM and reality capture, was built to perform critical analysis that could be used to inform design decisions.

One such analysis helps identify areas most likely to be impacted by flooding. In a collaborative effort between Autodesk and Hydronia, the InfraWorks user gets the ability to simulate, visualize and animate flood events directly in a 3D contextual model. Performing practical riverline and coastal flood simulations helps to determine preliminary flood risk assessments in urban floodplains and coastal areas.

City of Paris Flooding Model

VIEW THE VIDEO >

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ANALYSIS AND SIMULATION
Traffic Simulation

Another type of analysis that can be performed using the same model addresses the movement of people and cars. Red areas are showing where there is likely to be delay – blue areas show where traffic is running smoothly.

We can make better decisions when we can see in real-time the impacts of design decisions, not only of the road or intersection we are changing, but also its potential impact on other parts of the system. What happens when you eliminate access to a road? What happens when you confine movement in one-direction? What happens when you add an intersection? Analysis results shown in a 3D design model helps with the communication aspects that are required to get stakeholder buy-in when changes are being considered.

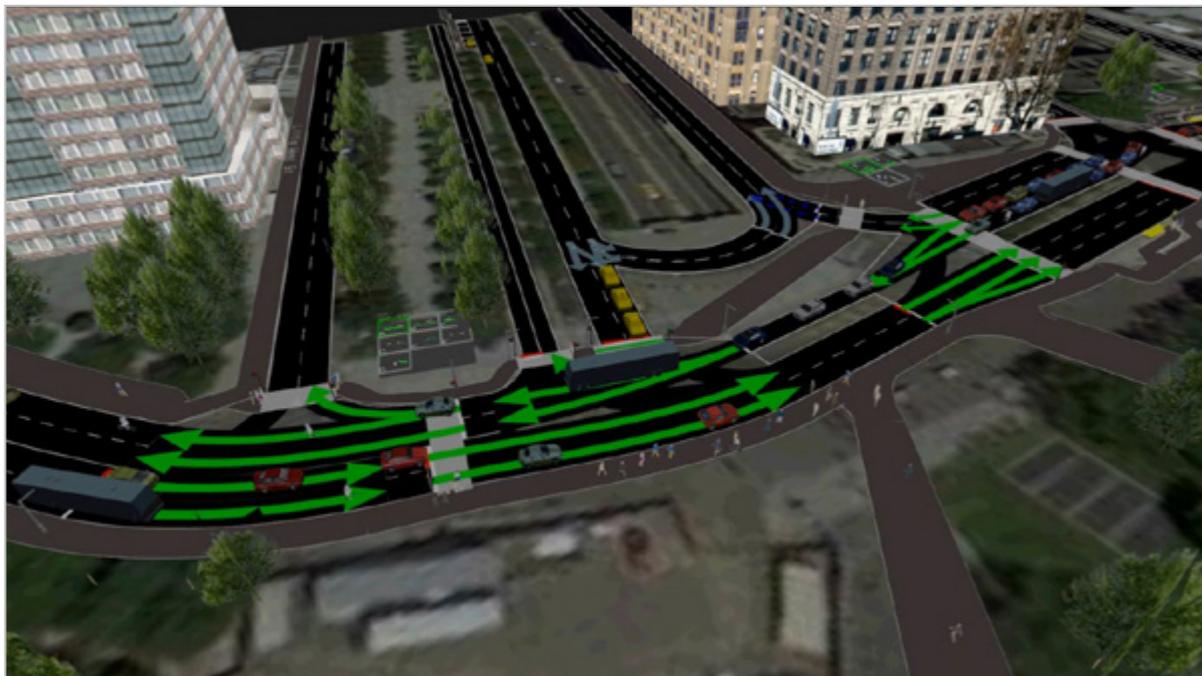**City of Paris Traffic Simulation**

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ANALYSIS AND SIMULATION

Microsimulation

With InfraWorks and mobility simulation, available as part of InfraWorks, you can evaluate pedestrian traffic around a large park. Different entry points can be evaluated for safety and ease of accessibility. While this is an example of mobility simulation with a focus on pedestrians, this same type of simulation could be run to evaluate locations of parking structures, bus stop locations, and other items.

Infraworks Mobility Simulation

VIEW THE VIDEO >

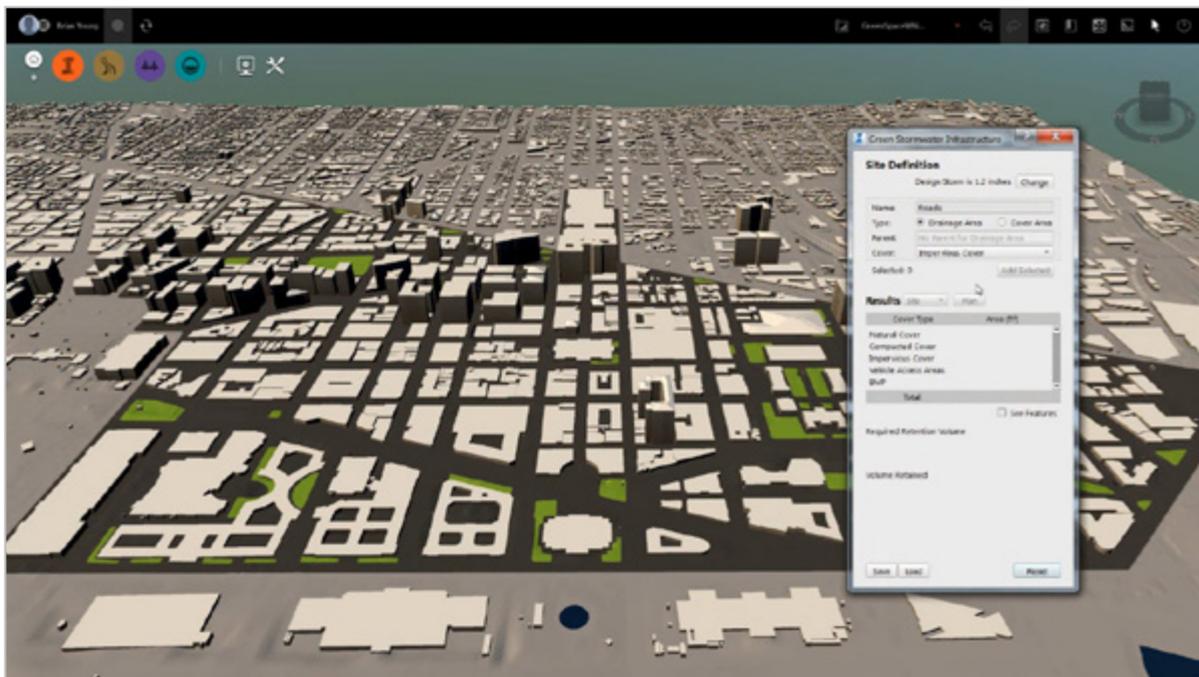1   2   3   4   5   6   7   **8**   9   10   11   12   13   14

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SUSTAINABILITY

Green Stormwater Infrastructure

3D contextual models can be used to help determine the best way to implement green infrastructure on a neighborhood or district scale.

The Green Stormwater Infrastructure Extension for InfraWorks combines rapid design and real-time analysis of stormwater management projects with BIM. Civil engineers and landscape architects can sketch and model green infrastructure in 3D to meet local performance requirements or sustainability standards.

In this video, we see an example of how planning for green stormwater infrastructure elements can minimize or even eliminate runoff.
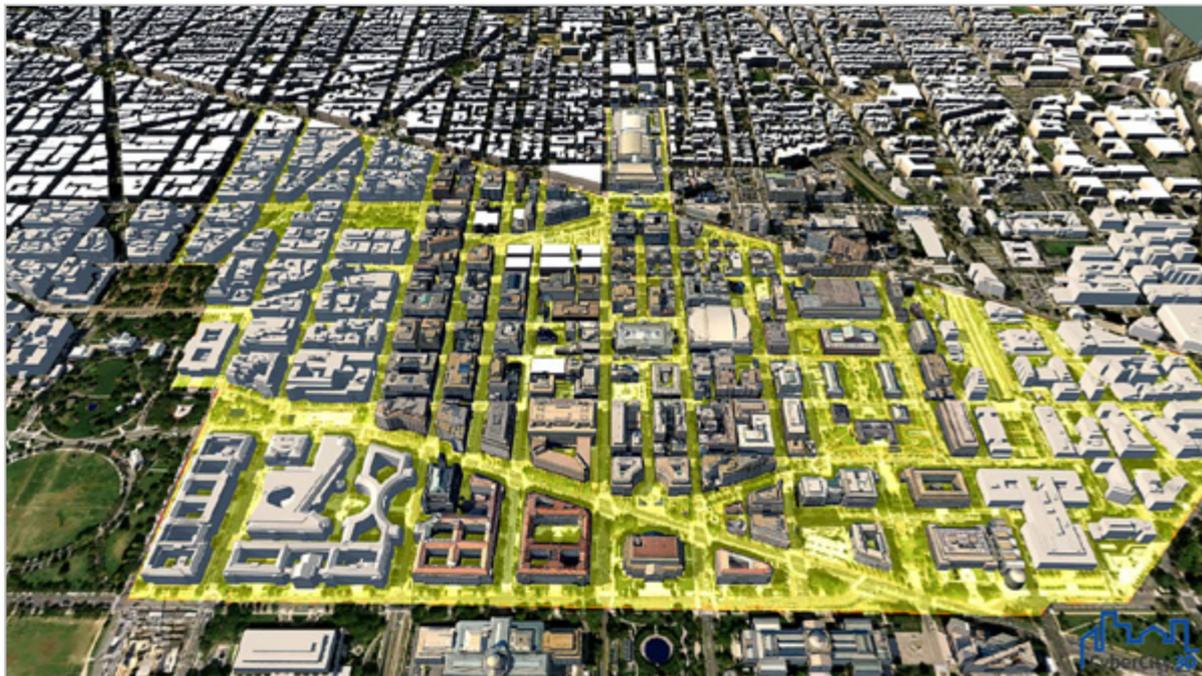

Green Stormwater Infrastructure

VIEW THE VIDEO >

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SUSTAINABILITY

GIS Information

Information from GIS can be leveraged in a BIM process to improve energy savings. By making use of data like building heights and footprints, it is possible to identify areas with high energy use costs or to identify high priority retrofit candidates.

This video depicts a district in Washington DC with overlays to show information like energy usage intensity, annual energy cost, and locations that would be good candidates for retrofit.

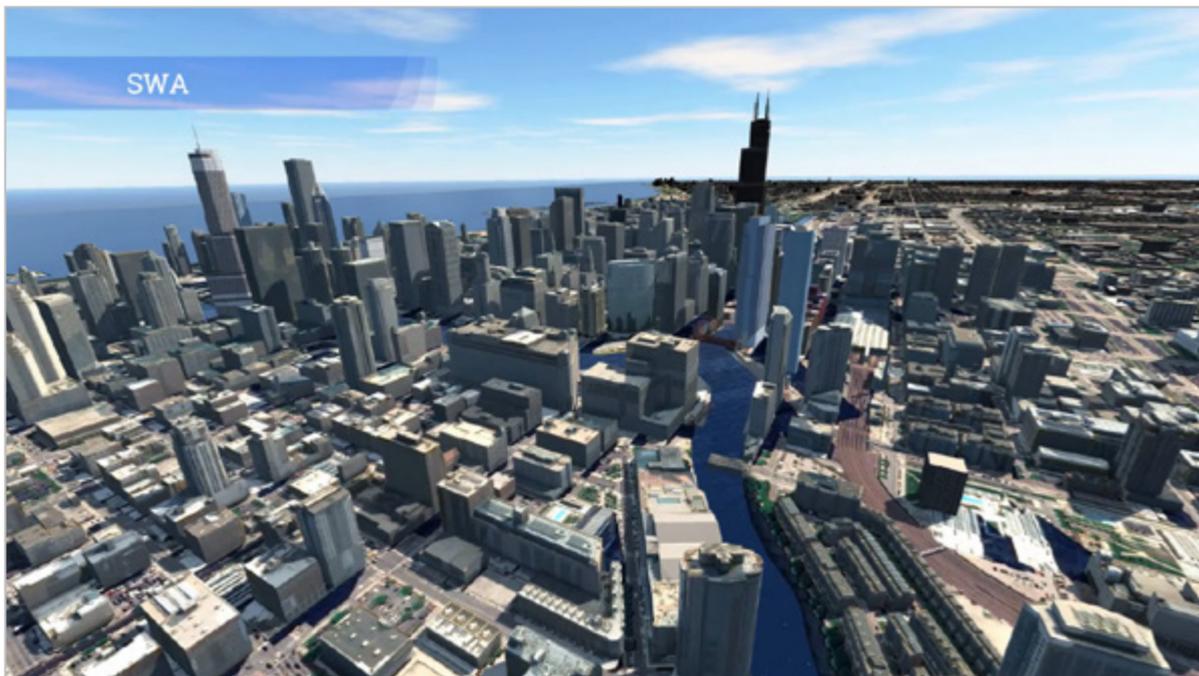### Linking GIS to Energy Use

VIEW THE VIDEO >

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VISUALIZATION

SWA – City of Chicago

You can communicate and conduct early stage infrastructure project reviews within a 3D contextual model that has been enhanced with GIS Information.

This video shows an example project within the city of Chicago. You can navigate through a 3D version of the city (created by WSP) while showing how different design alternatives would look at various locations along the Chicago River.

SWA – City of Chicago

VIEW THE VIDEO >

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VISUALIZATION

AR & VR – Austin

Value can be added to contextual models by building VR and AR experiences around them. In the video, you see a VR user navigating through a number of different contextual models. In the first, the user navigates around Austin, Texas and is able to move from point to point throughout the city and have a 360-degree view of his surroundings. In the second example, the user flies over a virtual representation of the Glen Canyon Dam in Arizona. Once again the user can navigate to any point on the model and look at the landscape from a bird's eye view.

Virtual Reality Experience Examples

VIEW THE VIDEO >

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OTHER CATEGORIES

Location-Intelligence Linked to BIM

Think about the value that could be gained by using BIM models and their respective location/condition in all phases of lifecycle. In essence, location-intelligence can provide a map to BIM data.
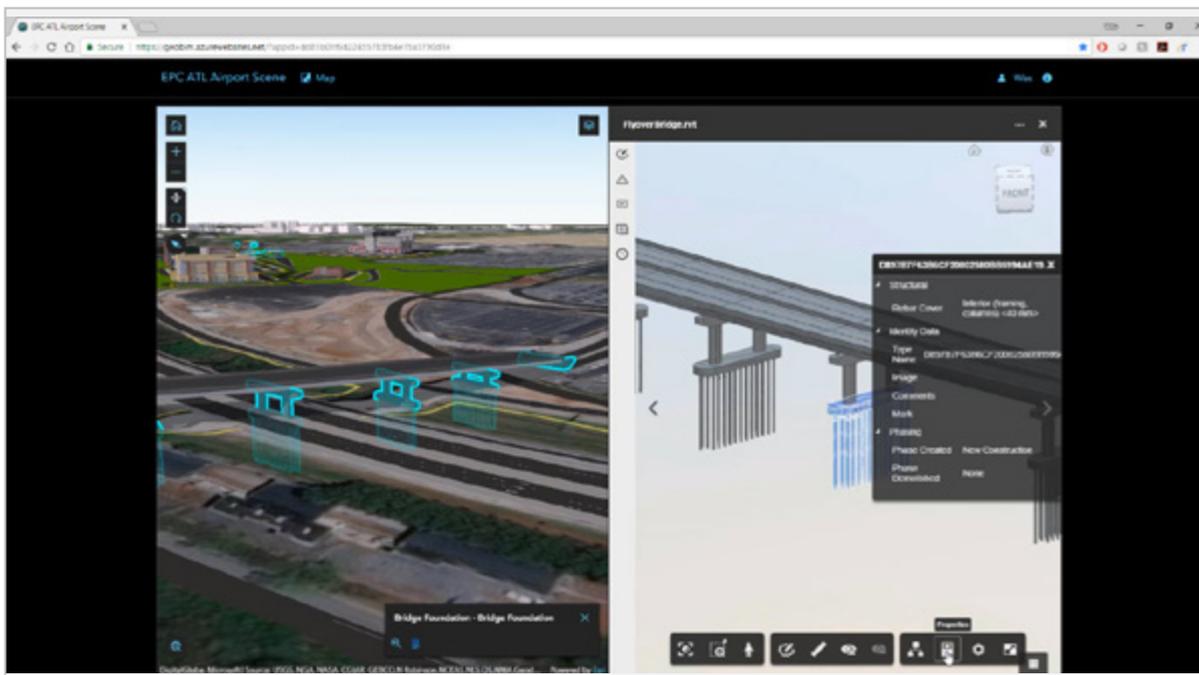

Image courtesy of CSoft-Terra

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OTHER CATEGORIES

Linking to BIM 360® from ArcGIS

One of the largest problems facing the AEC industry today is having to work with massive amounts of data that is only needed by certain people at certain times. In this video, we see how it is possible to provide live access to BIM models within an easily navigable spatial environment, thereby connecting project delivery to O&M. This video features an Autodesk developed proof of concept showcasing the powerful solutions that can be built using Esri web apps and BIM 360 APIs.

Proof of Concept: Linking to BIM 360 from ArcGIS

VIEW THE VIDEO >

1   2   3   4   5   6   7   8   9   10   11   12   13   **14**

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Bringing It All Together

New workflows are enabled with the integration of BIM and GIS – allowing you to deliver increasingly complex projects more quickly, better communicate intent to shareholders, and reduce risk.

Deliver Complex Projects in Less Time

Remove "old way" technology restraints and silos

Improve team collaboration

Accelerate design decisions

Effectively Communicate Project Intent

Build context models enriched with GIS data

Deliver enhanced project insights

Accelerate regulatory approvals

Reduce Risk

Minimize data loss and leverage data across entire project lifecycle

Provide for more efficient and less error-prone project handover

Improve operational efficiency

1 **2** **3** **4**

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Six Keys to Success

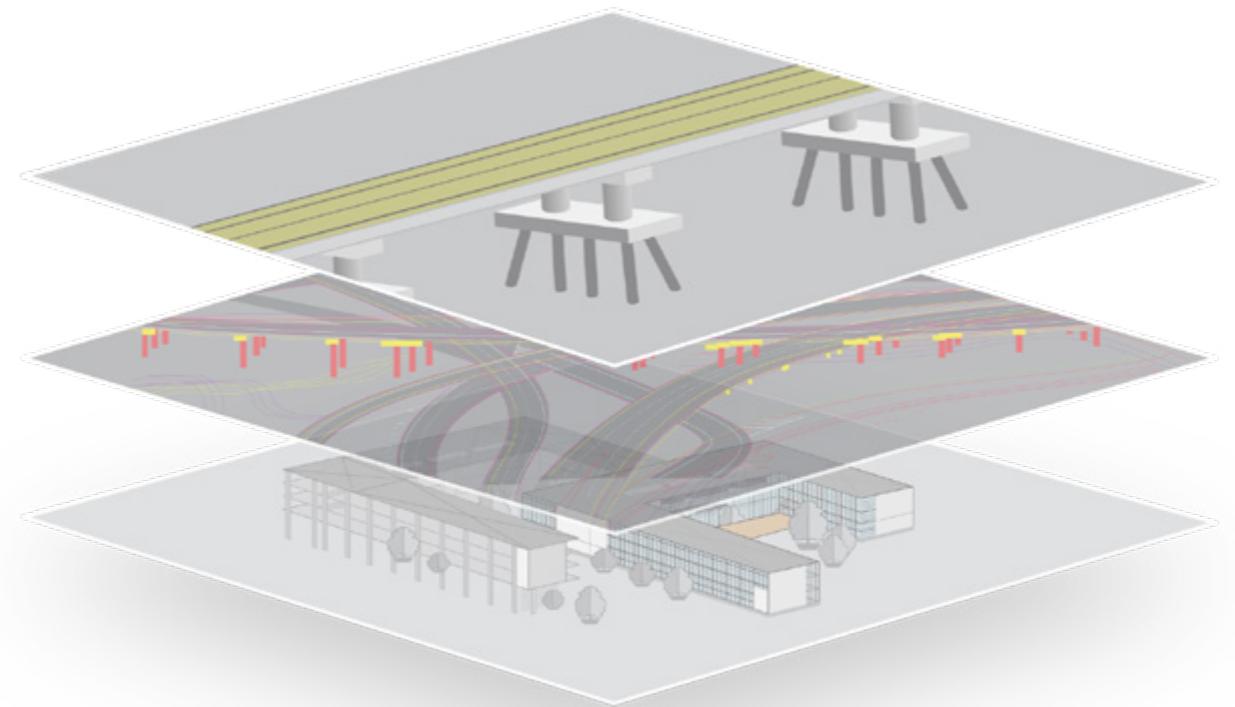## 01 Transforming the Project Lifecycle

Improving data integration workflows will bring immediate value to both the GIS and BIM communities, researching opportunities to bring context to the design and build workflows that lead to improved construction and renovation of facilities and infrastructure.

02 Designing and Building In-Context

By integrating GIS and BIM, planners and designers will better understand projects in relative context: how the natural and existing built environment will be impacted by and interact with new projects. By pulling these insights up the project lifecycle, project owners will be able to predict potential issues, streamline the lifecycle, and reduce costly delays.

03 Sensing Site Change

With the many technological innovations of drones, sensor input, and data processing, we can rapidly scan, photograph, and sense the three-dimensional world around us. Every project can start with a realistic and accurate 'picture' of the original site that can be updated with regular scans to record how the site changes with every phase of development. We are focused on delivering and improving site context and visualization for all project stakeholders.

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Six Keys to Success

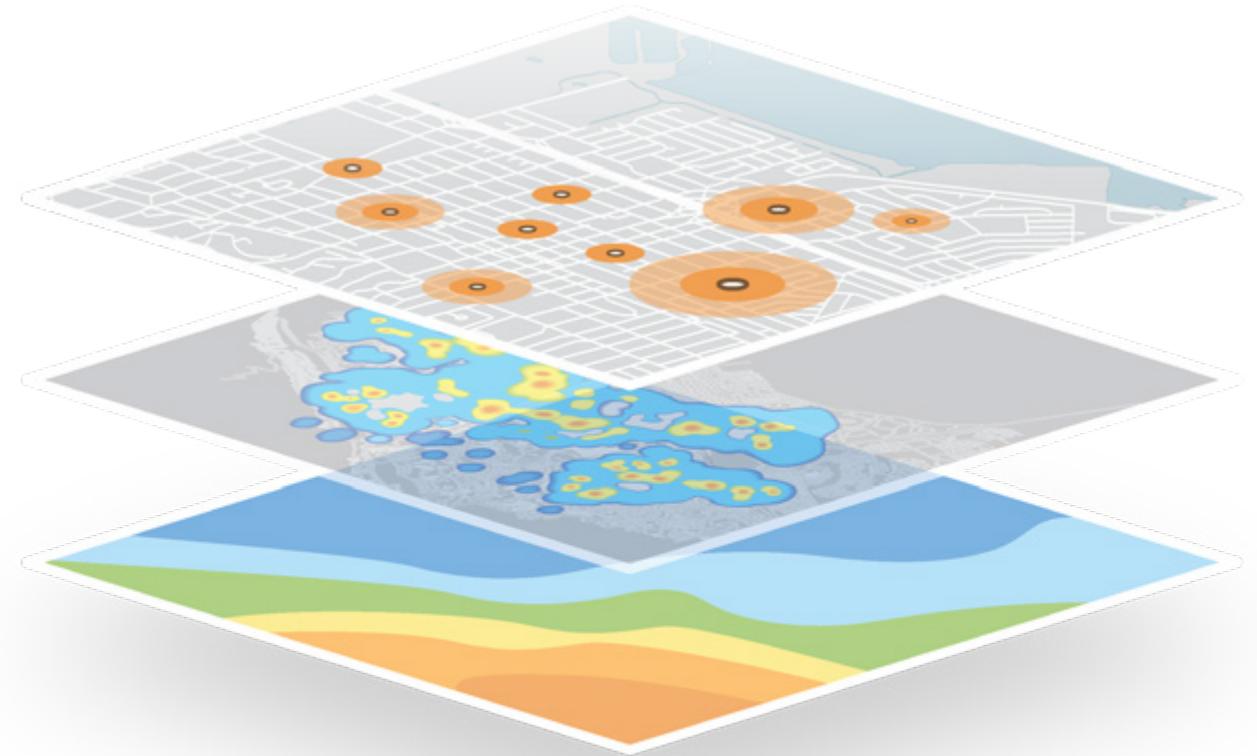## 04 Designing and Visualizing the Real World in 3D

With advancements in technology and hardware, 3D is quickly becoming the standard people want to use for design, visualization, and analysis of assets throughout their lifecycle. Our focus will be on tools and apps that utilize 3D to facilitate better use of spatial information to inform and guide the design process so that projects can achieve economic, sustainability, and performance goals.

05 Optimizing Infrastructure Operation Intelligence

The Internet of Things (IoT) makes it possible to monitor every tremor and temperature change of an infrastructure asset such as a building or bridge using embedded sensors. The world is going to be tracked with billions of sensors all around us, many of which will be designed into the assets we use and then tracked and analyzed in 3D experiences. This data will fuel machine learning that will generate new insights when they are most relevant. We look to discover new opportunities for enabling customers to plan, deploy, and consume sensor information to improve operational performance of large systems of assets.

06 Open and Extensible

Recognizing that 'Data is at the Center' of our customers' businesses and organizations, we are committed to creating extensible platforms that enable our users to innovate. We understand that the future of our platforms depends on users extending our capabilities, creating new tools from our software building blocks, and inventing new workflows to become more productive.
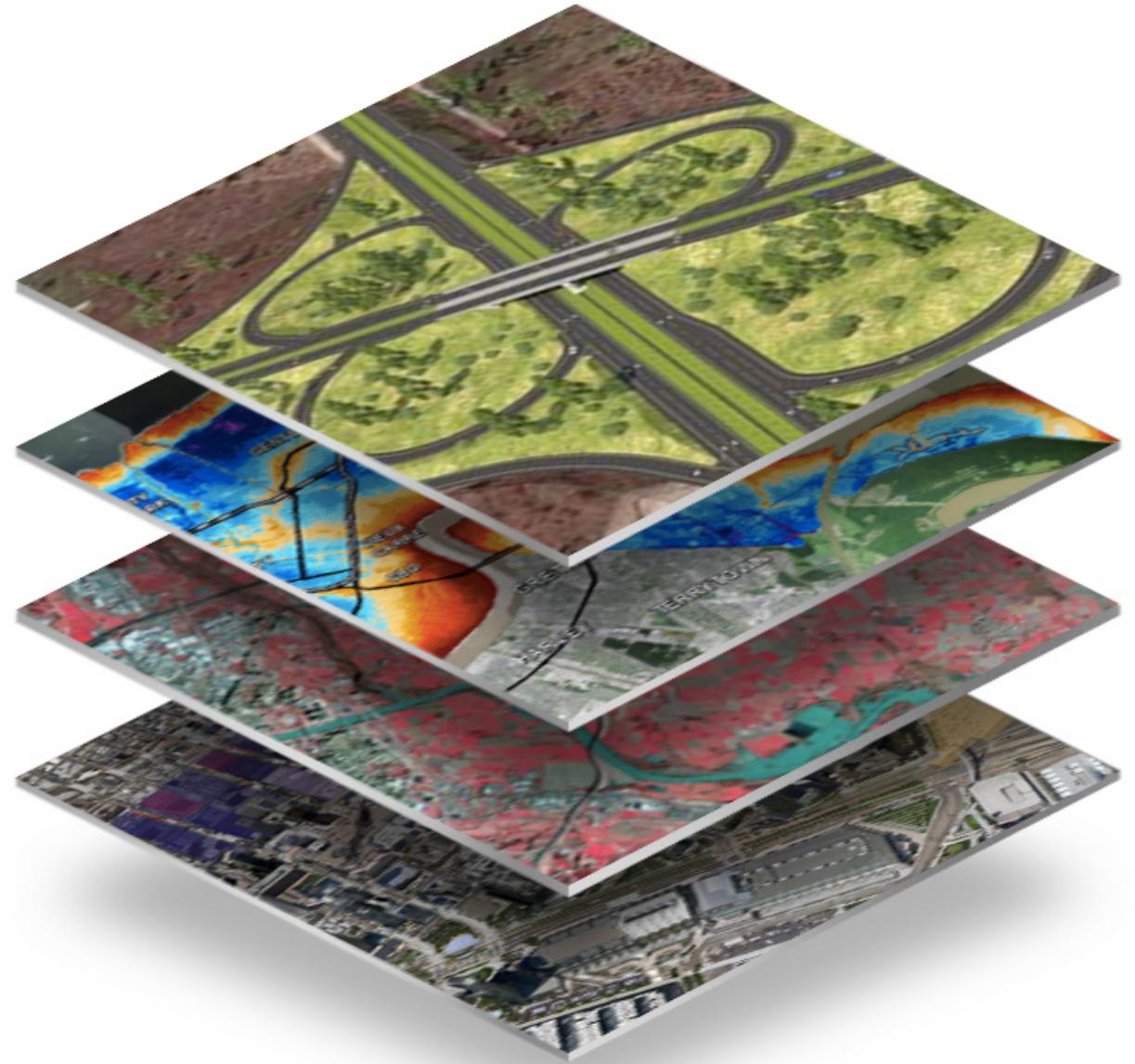
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Next Steps

Focus on What, Where, & Why

The infrastructure we create today will be around for a very long time. The vision of tighter GIS and BIM integration is to empower AEC firms, projects owners and operators, and public agencies to focus not just on the what of infrastructure, but also the where and why. It is to create a future of more resilient and sustainable infrastructure, responsible use of our planet's resources, and thriving environments for our growing cities and populations. Ultimately, using GIS and BIM can mean improved workflows that can help give you a competitive edge.

The move towards frictionless interoperability will not only help the two technologies work seamlessly together, it will also enable a more connected workflow, helping to deliver increasingly complex projects in less time.

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Contact us to learn more.

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