DT applications for management of construction sites: environmental monitoring and interaction with surroundings

Matteo De Minicis

High Level Training on Digital Twin applications in Port ecosystems, Venice 28th Jan 2025

www.italy-croatia.eu

Location Intelligence and DT lead to Safe, Efficient and Sustainable Projects

When we are building new infrastructure and buildings, there needs to be a better understanding of how it will be used and maintained in the future.

Also, how it can be better built to make the process faster and more profitable for everyone involved.

30% of materials are wasted

40% of projects are over budget

30% of construction is rework

90% of projects are late

40% of buildings are under-utilized

40% of jobsite work is unproductive

Location Intelligence and DT lead to Safe, Efficient and Sustainable Projects

Historically Owners \ Operators, and AECs have worked in silos, building up systems, data, and processes to support the one piece of work they are responsible for.

These silos rarely communicate or collaborate as a project moves through the typical process.

In many cases, this results in constant project rework from one phase to another.

Location Intelligence and DT lead to Safe, Efficient and Sustainable Projects
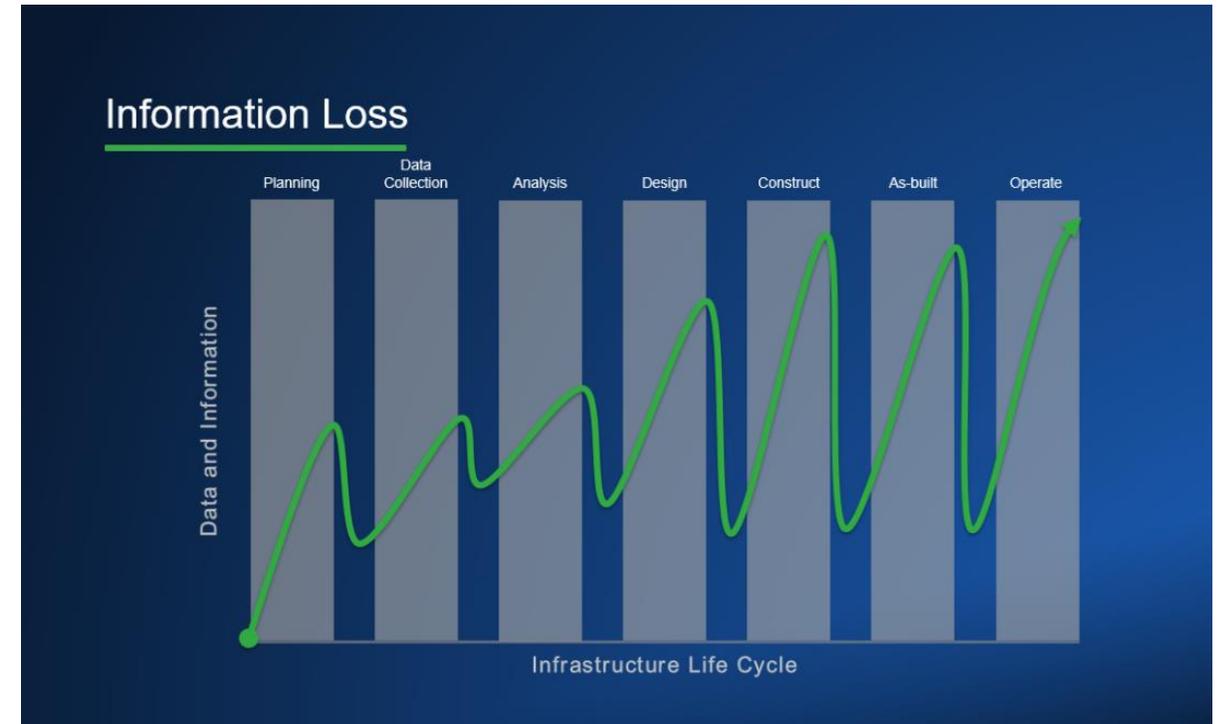
Connecting and integrating project data through GIS

- reduces information loss between phases

- adds value to information already generated by the project

- and serves as the foundation for a digital twin

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This is because ...

... Location Matters

AEC Projects are SPATIAL

AEC professionals integrate massive amounts of data and data types

Location Integrates AEC Data

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Real world benefits of Location Intelligence and DT

GIS technology is an invaluable resource for large construction projects, optimizing the following:

Safety: a shared awareness of a project site and the specific areas where workers are located enables more efficient and careful construction practices. Syncing with feeds from sensors and drones, **GIS shows hard-to-reach data inputs and imagery without putting crews at risk**.

Efficiency: The convergence of BIM and GIS captures work processes and construction operations and provides a greater site-wide perspective. GIS technology **helps in visualizing project data and communicating complex information for better collaboration**.

Sustainability: **GIS maps show a project's relationship to protected areas**, wildlife habitats, water bodies, and more to ensure compliance and minimize impacts.
GIS technology also **powers circular construction** practices, tracking waste generation and disposal locations and identifying options for recycling and reusing materials

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Integration of GIS with other digital tools optimize environmental sustainability, time and efforts.

Drones—Provides aerial imagery for **monitoring construction**, **measuring earthwork volumes**, and observing hard-to-reach or dangerous areas of a project site.

GIS and BIM Integration—Gives stakeholders a seamless picture of construction and a common platform for collaboration and communication.

IOT—Sensors return real-time located data that help for security, environmental sustanaibility, both on construction phase and on maintenance phase
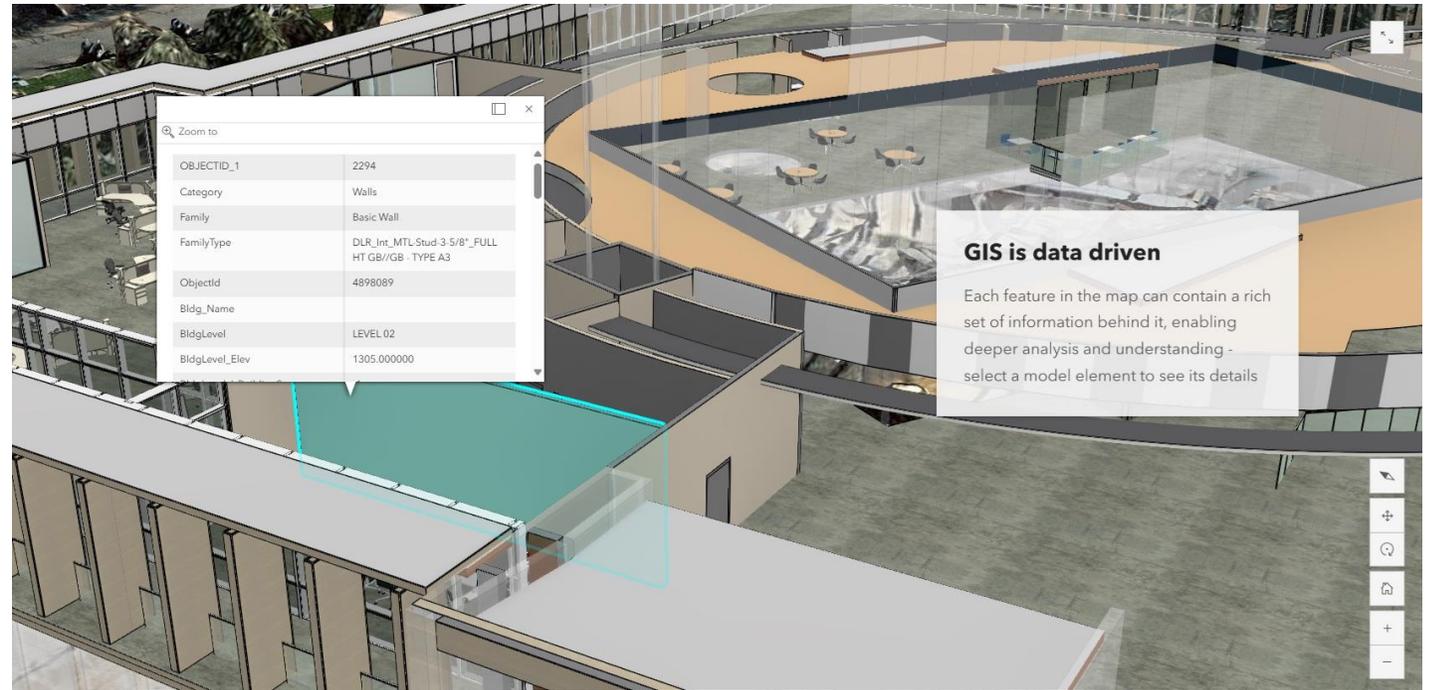
Digital Twin—Simulates the on-site experience with the ability to rewind and fast-forward progress or observe a project from any angle to see how it functions within the natural world

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Digital twin

Virtual 3D models of construction areas and surroundings provide a means of proposing, understanding, and analyzing development and other changes to the landscape.

Construction firms can create their own digital twins, to gain an exact replica of a project or asset—which is valuable for **design, planning, building, and operations**.

GIS is data driven

Each feature in the map can contain a rich set of information behind it, enabling deeper analysis and understanding - select a model element to see its details

Building construction site + GIS 2D data
Basic Building model + CAD model
IoT sensors and real-time monitoring

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GIS and BIM integration

Any structure can be viewed in a real-world context for deeper analysis throughout the project life cycle.

Together, GIS and BIM support **scenario planning** such as
- Environmental constrains for site selection
- line-of-sight analysis for sourroundings development
- **material flow** for circular design

GIS and BIM support also **construction and maintenance phase**
- Sensors locations and **real-time monitoring**
- O&M work orders
- ...

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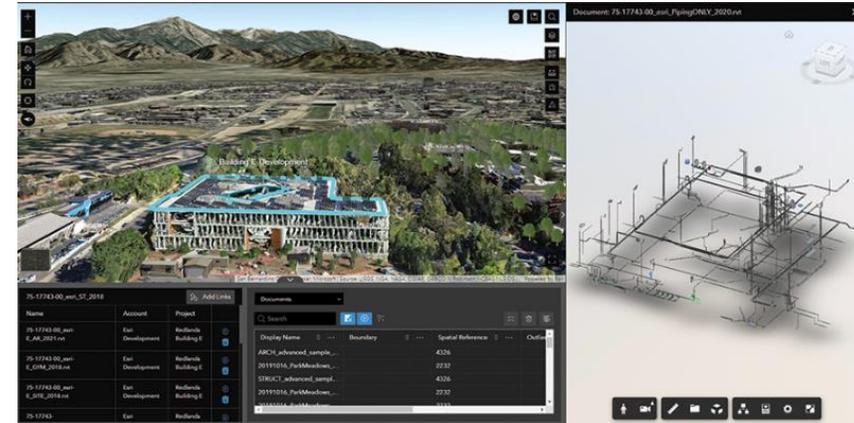
Drone products

Drones have all but eliminated the cost of a top-down view of construction sites.

With ease of capture and speedy processing, a drone can fly over a construction site and provide regular updates on the progress of a project, as well as zoom into potential issues.

Within GIS, drone data can be quickly synced, visualized, and analyzed in the context of its precise location.

Drone data SHALL BE PROCESSED in order to acquire usable products like True Orthos, DTM/DSM, 3D Meshes

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IOT sensors and real-time monitoring

Sensor data together with their locations allow you to keep all the parameters related to safety, efficiency and environmental monitoring under control.

Efficiency & Sustainability

Pour the foundations of St. Paul's Hospital in Vancouver
PCL Construction

Drones, BIM and GIS system

## 500+ trucks into and out of the construction site for 12 hours.

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Sustainability

New San Diego stadium
OCMI Inc.

Reuse materials from the old stadium moving them from the previous location

Drones and GIS system
- Drone flights and image processing **every week**
- Integrated AI calculates volumes to be moved and processed
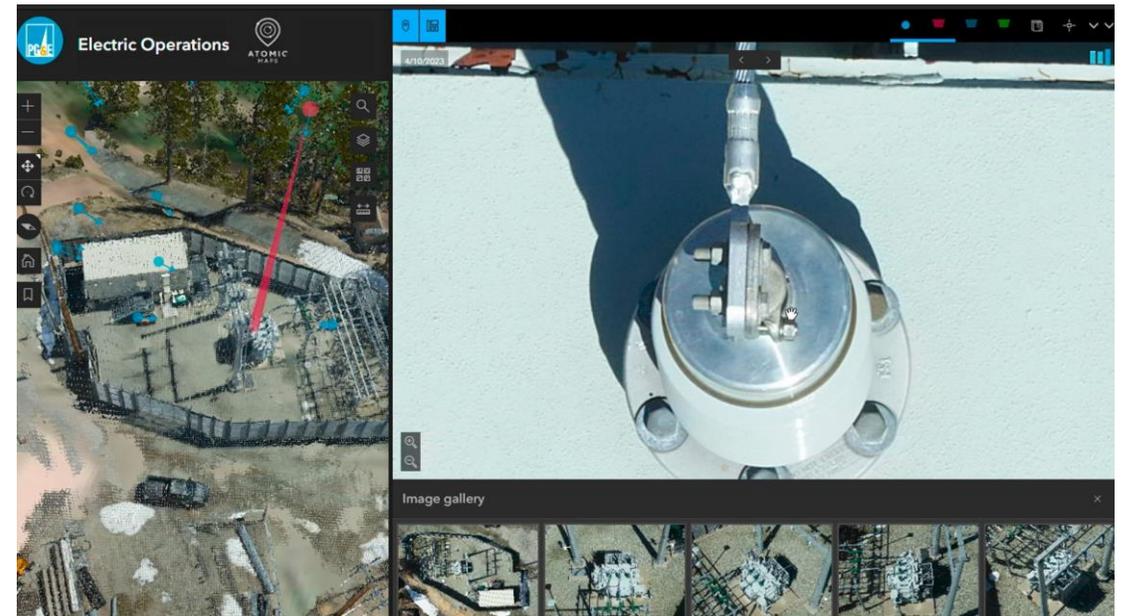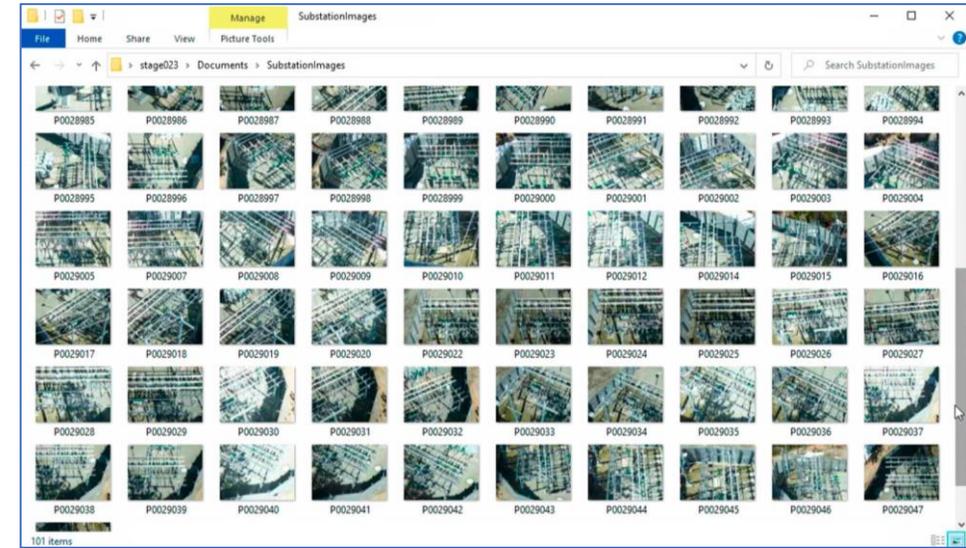- Reporting progresses to stakeholders (3D model)
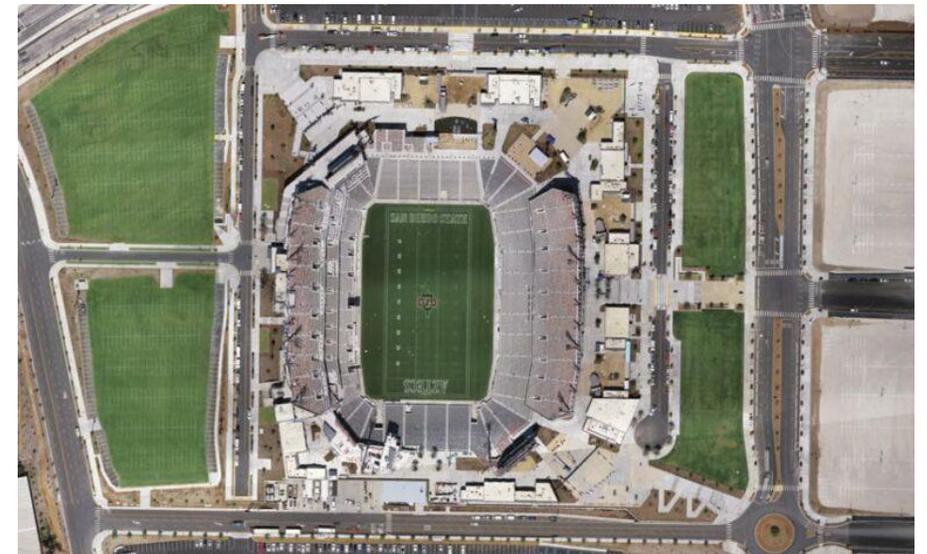
Efficiency & Safety

Electrical substations operations

Drone inspections can improve efficiency and safety in maintenance operations.

A DT based on location intelligence **truly improves** efficiency.

25% time saved to issue a work order
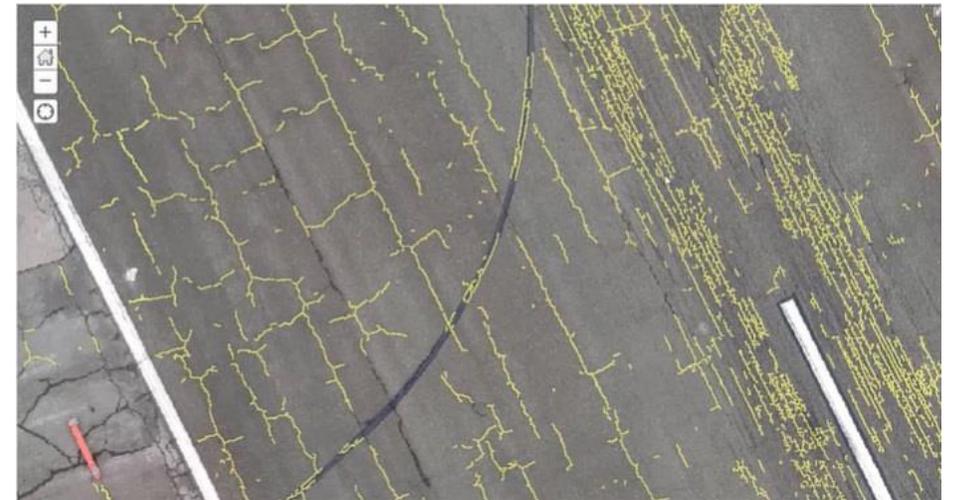
Safety – Drone inspections – GIS and ML

Airport runway inspection

Through drone flight and processing, a simple DT of the runway is acquired.

GeoAI and the Crack Detection model detect and classify cracks

Drone inspection raw data

Detected cracks from true Ortho

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Contacts

Esri Italia, IT

mdeminicis@esriitalia.it

+39 348 1934662 / +39 335 5758262

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