Trendspek

A Guide to Digital Twins

Different Types & How Reality Twins Support Infrastructure

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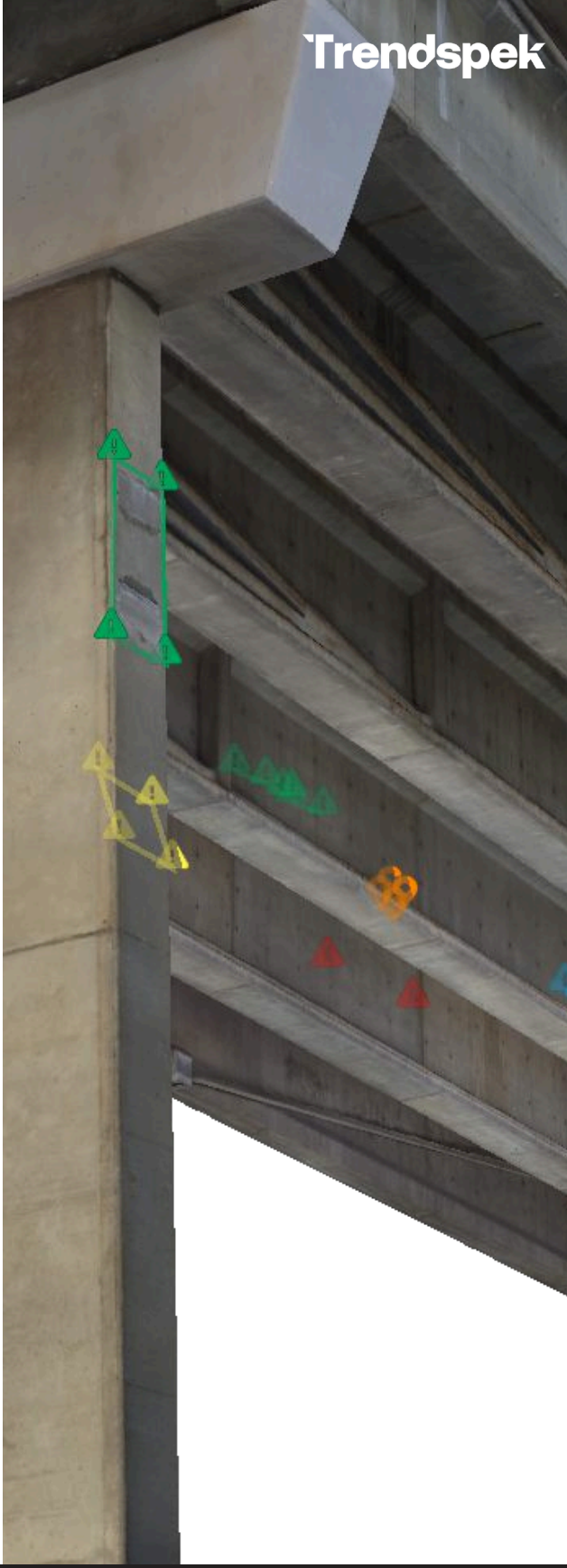
In recent years, digital twins have emerged as a transformative tool for infrastructure management.

In the realm of infrastructure, digital twins are revolutionising how we approach the design, construction, and maintenance of critical structures.

Often referred to as asset twins or Precision Reality Twins, these precise digital representations of large and complex assets (such as bridges, buildings, and energy systems) provide stakeholders unprecedented insights into structural integrity and potential vulnerabilities.

Explore the definition of digital twins and emerging applications across infrastructure in our white paper.



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AAUS INDUSTRY CHAMPION INNOVATION – TECHNOLOGY WINNER 2025

2024 PROPTECH AWARDS WINNER ASSET & FACILITIES MANAGEMENT PROPTECH

The platform to manage built assets, smarter.

Trendspek is a leading Structural Lifecycle Management (SLM) platform that supports digital inspections, reporting, maintenance planning and condition monitoring of infrastructure and built assets.

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Definition

What are Digital Twins?

A digital twin is a virtual representation of a physical asset, system, or environment, continuously updated with data to mirror its real-world counterpart at a point in time.

Digital twins can integrate data from IoT sensors, historical records, and predictive models to enhance asset management, optimise performance, and support decision-making.

Digital twins can be categorised into several types based on their scope, level of detail, and function.

1. Component (or Part) Twin

- A digital twin representing a single component of a system (eg. a sensor, or a motor).
- Used for performance monitoring, defect detection, and predictive maintenance.

2. Asset Twin

- Represents a complete asset, such as a machine, a bridge, or a building.
- Incorporates data from multiple component twins to provide insights into asset health, usage patterns, and lifecycle management.

3. Process Twin

- Represents end-to-end workflows or operational processes
- Such as supply chains, logistics networks, or city-wide traffic systems.

4. System (or Unit) Twin

- Models an entire system made up of multiple assets working together, such as a factory production line, a railway network, or a power grid.

5. Urban or Infrastructure Twin

- A large-scale digital twin of entire cities, infrastructure networks, or regions.
- Used for urban planning, traffic management, disaster response, and smart city applications.

6. Hybrid Digital Twin

- Combines multiple types of digital twins (eg. Asset + Process + Urban) to provide a holistic view of interconnected systems.
- Often used in complex environments such as airports, ports, and smart grids.

Diagram

Different types of Digital Twin and applications

Digital Twin

Component

A singular asset
e.g. sensor, motor

Asset

A complete asset
eg. bridge, tunnel, building

Process

A workflow or process
eg. supply chain, traffic system

System

Multiple assets working together
eg. railway network, power grid

Urban

A large-scale system of assets
eg. entire cities or infrastructure networks

Hybrid

Multiple digital twin types
e.g. airports, smart grids

Definition

What are Reality Twins?

Trendspek's Reality Twins provide an accurate, sub-millimetre representation of assets at a specific point in time.

This level of detail is ideal for visual inspections, regulatory reporting, and lifecycle management

These highly-detailed digital replicas enable asset owners, engineers, and facility managers to gain a full picture of structural health by simply logging in online.

Reality Twins can integrate data from photogrammetry, reality mesh, point cloud, LiDAR or videos/photos to provide spatial scenario analysis of large and complex structures.

With up-to-date digital records of structural condition, this makes it easier to manage critical repairs, optimise performance, and support key decision-making.

While both Digital Twins and Reality Twins create digital representations of physical assets, they serve different purposes.

A Reality Twin is a specialised solution of a Digital Twin designed for asset management, providing a highly accurate, sub-centimetre representation of assets at a specific point in time.

The level of detail that Reality Twins provide is ideal for visual inspections, regulatory reporting, and lifecycle management.

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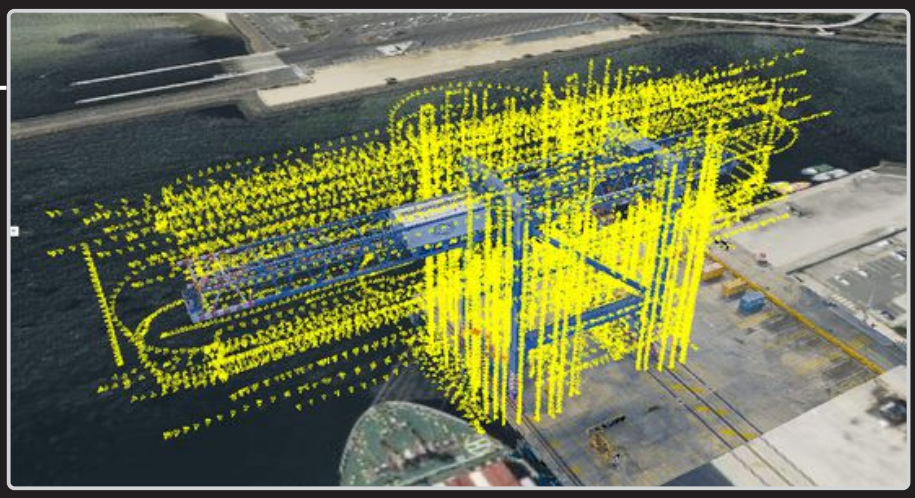
Reality Twins

How are Reality Twins created?

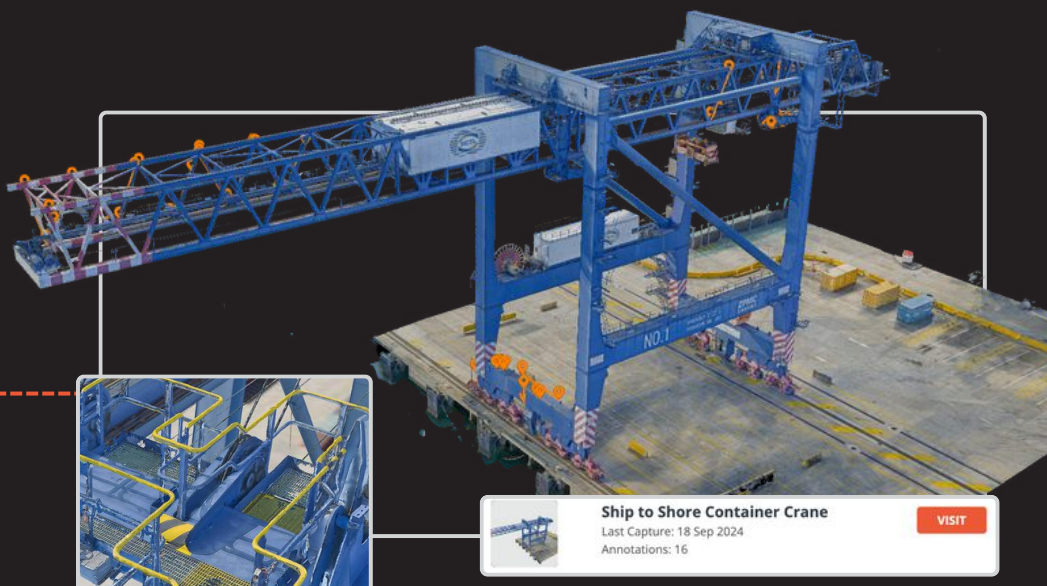
1

Digital Capture
(Drone-Based Photos and Photogrammetry, Thermal, GIS, BIM)



2

Data Uploaded
Processed overnight by Trendspek

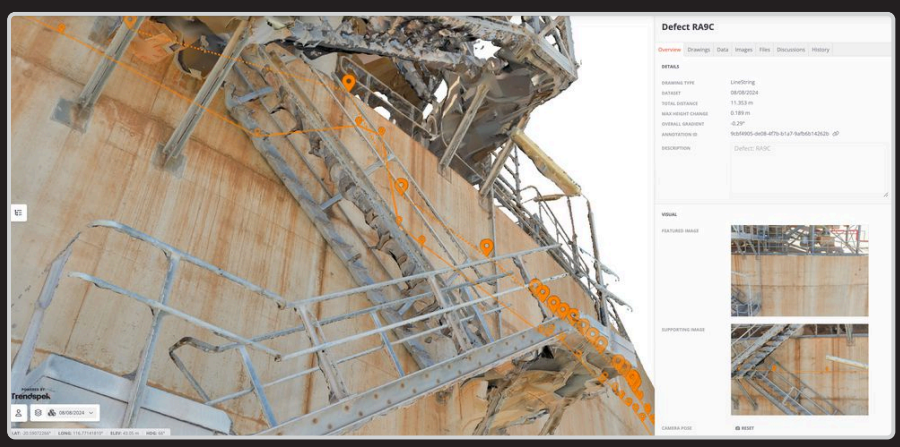


3

Interactive 3D Reality Twin
Accessible via web browser with millimetre detail

4

Virtual Inspections
Condition assessments and analysis, reporting and trend monitoring completed online



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Where Reality Twins deliver maximum impact

Record Management
Centralised, reliable asset data

Inspection
Replacing physical site visits with high-fidelity online inspections

Analysis
Accurate insights verified by multiple stakeholders

Reporting
From static PDFs to layered interactive 3D reports

Decision-Making
Moving from assumptions to evidence-led risk and capital allocation

Planning Remediation
Online assessments & accurate quoting

Remediation Execution
Fewer variations, reduced rework, and faster project completion

Monitoring Over Time
A game-changing way to track structural changes

Comparison of Digital Twin vs Reality Twin

Aspect	Digital Twin	Reality Twin
Purpose	Operational monitoring & simulation	Asset management & visual inspection
Real-time data	Yes, from sensors and IoT devices	No, primarily visual data for analysis
Accuracy	Moderate	High (sub-centimetre level)
Data sources	Sensor data, operational metrics	Photogrammetry, LiDAR, drone imagery
Use Case Examples	Predictive maintenance, simulations	Structural inspections, maintenance planning
Decision Support	Based on operational performance	Based on detailed visual assessment

Key applications of Reality Twins

Trendspek's Reality Twins can be used for a wide range of industry sectors and use cases, from underneath shipping wharves to over large reservoirs.

1. Structural Monitoring

Asset twins can transform the way that bridges, tunnels, and other buildings with restricted or hard-to-reach areas are monitored, providing:

- High-resolution 3D models that detect even the smallest cracks, deformations, or corrosion before they become critical.
- Remote inspections that eliminate the need for costly scaffolding, reducing risk for personnel
- Change detection over time, allowing asset managers to track deterioration and prioritise maintenance.

Real-world example

An owner of a standing reservoir can digitally compare past and present RT models to identify emerging façade damage, ensuring repairs are made before major structural issues arise.

2. City Planning & Smart Infrastructure

City and infrastructure planners/managers can also leverage asset twins to:

- Simulate real-world changes, such as the impact of new developments on surrounding buildings.
- Optimise urban layouts, using millimetre-accurate models to analyse sightlines, airflow, and shading.
- Enhance stakeholder collaboration between architects, engineers, and city officials.

Real-world example

A council can use RTs to visualise how a new building would overshadow nearby public spaces before approving development applications.

Key applications of Reality Twins

Trendspek's Reality Twins can be used for a wide range of industry sectors and use cases, from underneath shipping wharves to over large reservoirs.

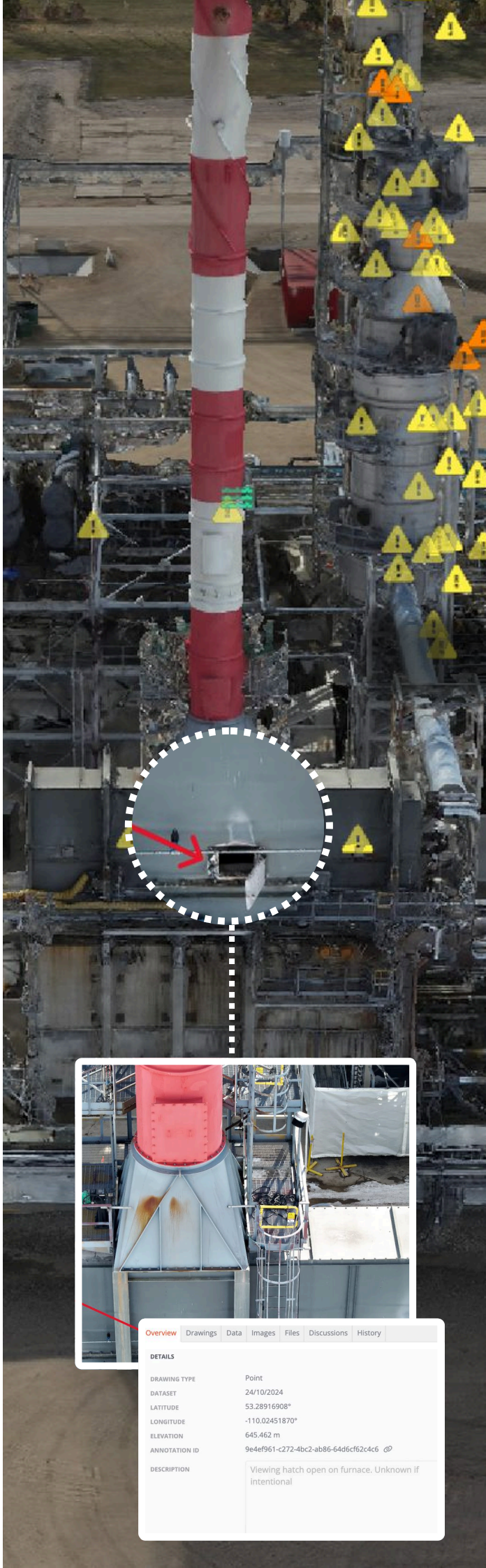
3. Safer Asset Management

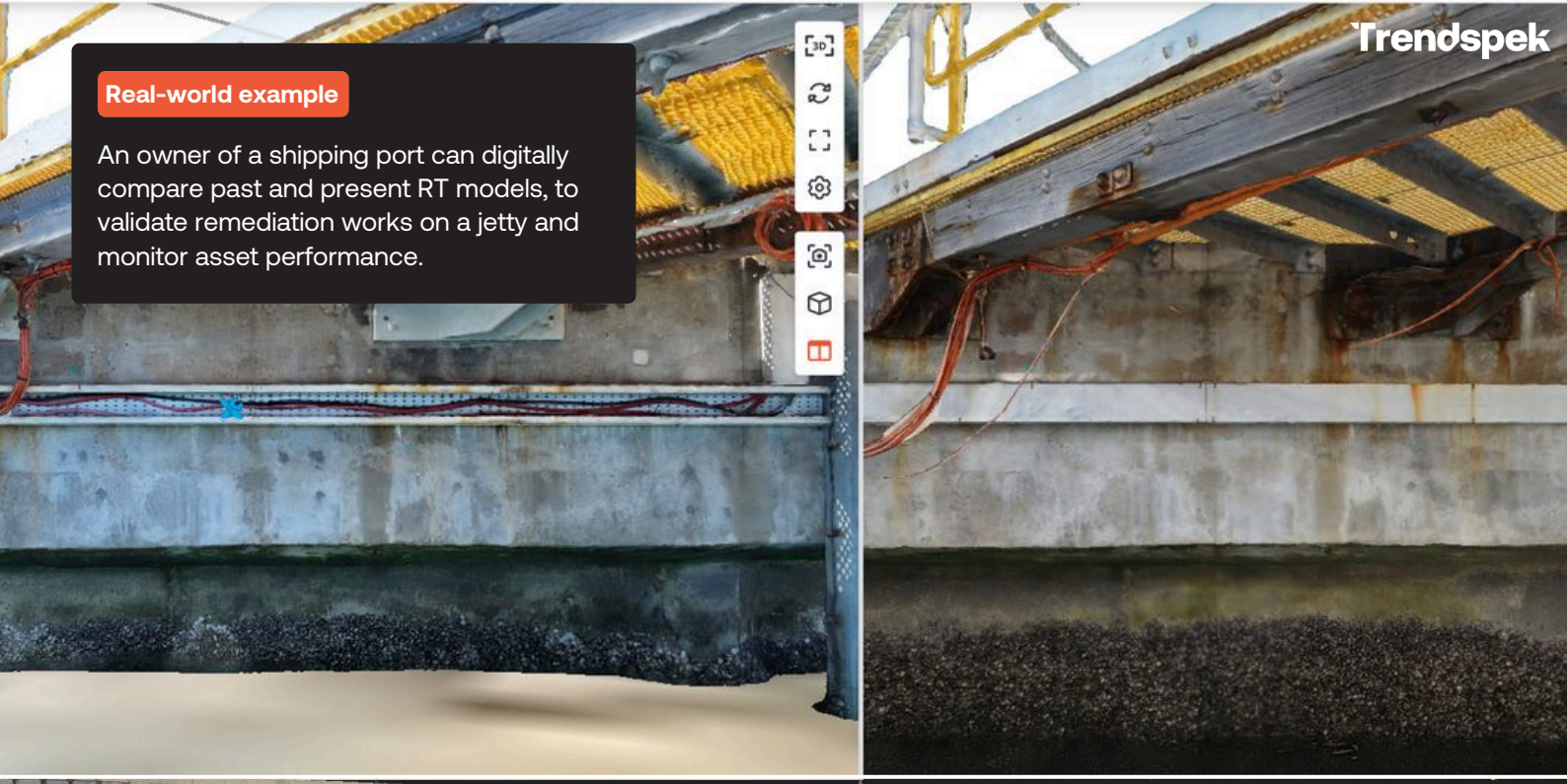
For power grids, water systems, and transport networks, asset twins can improve:

- Predictive maintenance, by identifying risks before failures occur.
- Regulatory compliance, with precise documentation of asset conditions.
- Operational efficiency, enabling teams to plan maintenance without unnecessary downtime.

Real-world example

An energy operator can inspect insulation or steam leaks across a large refinery using RTs, reducing the need for manual, high-risk inspections while ensuring uninterrupted service.



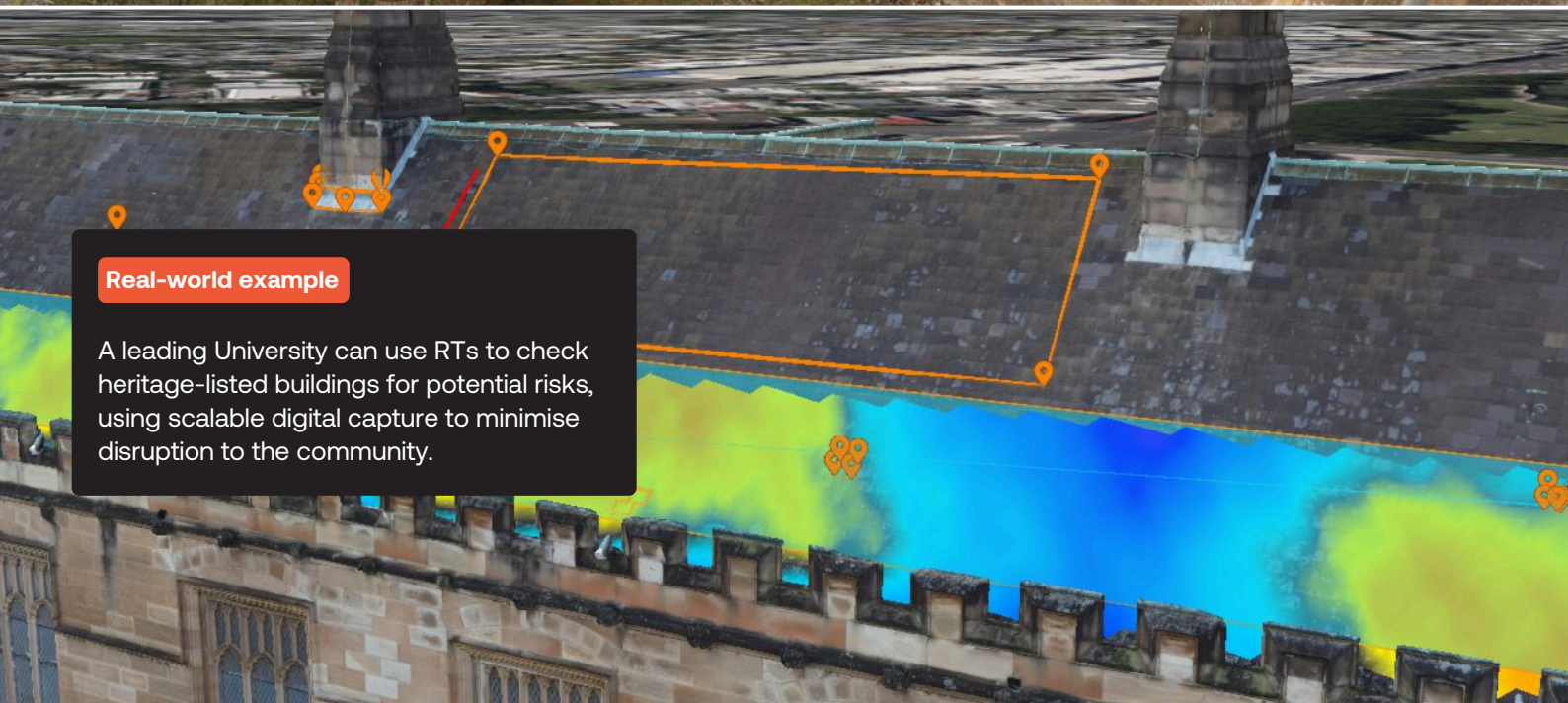


Real-world example

An owner of a shipping port can digitally compare past and present RT models, to validate remediation works on a jetty and monitor asset performance.

Real-world example

A project team managing routine maintenance for a large reservoir can use RTs and thermal imaging to check the condition of concrete dam walls, without extensive site shutdowns or rope access.



Real-world example

A leading University can use RTs to check heritage-listed buildings for potential risks, using scalable digital capture to minimise disruption to the community.

Timeline

History of the Asset Twin

Over the last decade, the technology landscape and outlook for asset management has changed markedly, and there are still many exciting milestones to come as we truly capture the power of AI and machine learning, continue to improve processing power, and enable greater remote management through industrial IoT.

1960s

The basic concept of digital twins, called digital engineering or mirrored systems, was first used at NASA.

1970

NASA used mirrored systems to save the Apollo 13 mission.

2002

Michael Grieves introduced the concept of the modern digital twin product lifecycle management.

2010

NASA updated the name from digital engineering to digital twin.

2013

Cloud computing had advanced enough to support the modern concept of the digital twin.

2014 – present

The use and manifestation of digital twins diverged based on industry requirements.

2021

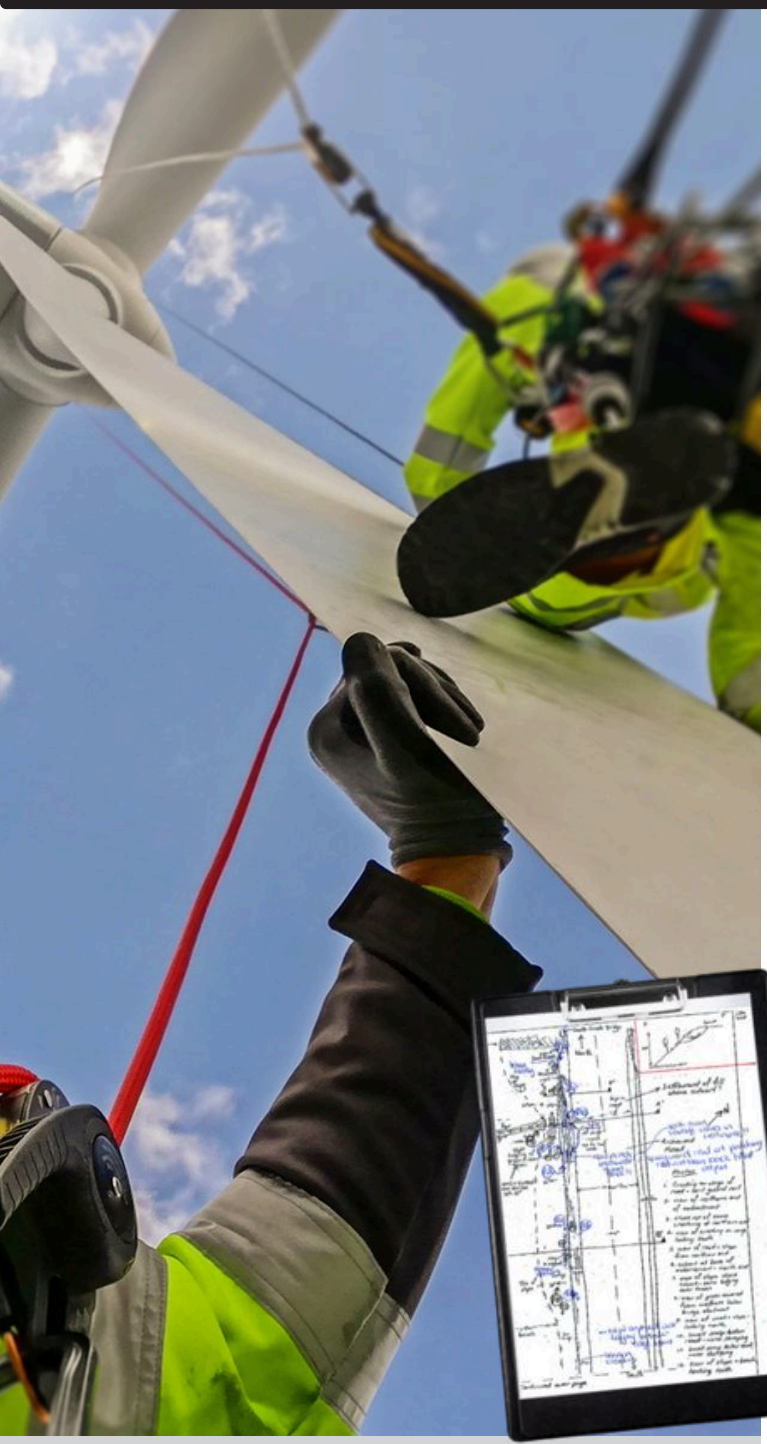
Trendspek launches 'Precision Reality Twin' to define an advanced digital twin, purpose-built for structural asset management.

Why use Reality Twins?

Enhanced data that is useful and actionable

Traditional methods of asset inspection capture rely on abseilers manoeuvring themselves from top of an asset to the bottom, or inspectors on cherry pickers doing the same, taking pictures at various points as they move.

1. Minimal pictures are taken – just enough to include in a PDF report
2. Error prone - only of defects seen at the time recorded
3. Hard-to-reach areas are not photographed at all
4. The quality of pictures is inconsistent
5. Limited photo angles - full context hard to understand



The quantity and quality of data obtained through traditional asset inspections are far from optimal.

Once captured, images—often stored as individual photographs—are typically saved in large files, categorised inconsistently or, at worst, lumped into a single folder.

This leaves asset managers with the time-consuming task of manually searching for defects to include in their reports.

In today's risk-averse asset management industry, a collection of disjointed images without broader context is insufficient for making accurate, data-driven decisions.

With drones and robotics revolutionising data capture—now generating tens of thousands of images instead of mere hundreds—the challenge shifts to how this data is stored, organised, and, most importantly, contextualised.

The issue with traditional reporting is:

- **20%** of defects are untraceable
- **30%** of defects are misidentified
- **3x** more defects are missed
- **10x** longer to produce

Client success story

Cenovus Energy

“

With the Trendspek model, it enables us to create notifications in our computerised maintenance management systems (CMMS). We plan it out, therefore it's more cost-effective. We schedule it and then we execute the repairs.

Now, if you're seeing a major steam leak; or you're seeing frost build up on one of our tank VRUs; or there's cladding that's flopping around in the wind; or something that I have to get to or put hazard mitigation into — we can use the technology.

Marvin Smith
Senior Maintenance Supervisor
Cenovus Energy

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