

STRUCINSPECT

Press information

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1. Executive Summary

1.1 Abstract // Key messages

STRUCINSPECT operates the world's first Infrastructure Lifecycle Hub for digital infrastructure inspection and lifecycle management. Founded in 2019 as a joint venture of PALFINGER, VCE Vienna Consulting Engineers ZT GmbH and ANGST Group, STRUCINSPECT provides expertise, digital services, and services for digital inspection of essential infrastructure. Together with their customers, STRUCINSPECT develops individually configurable business solutions to precisely capture inspection data, process it efficiently and use it for effective maintenance decisions. In doing so, STRUCINSPECT makes use of state-of-the-art technologies such as artificial intelligence (AI), drones or Building Information Modeling (BIM).

The web-based Infrastructure Lifecycle Hub forms the core of the solutions and combines all technologies, services and functions for structured data storage and processing. This enables bridges, tunnels, and dams, for example, to be inspected and maintained in a safe, sustainable, and resource-saving manner. Furthermore, essential steps of digital structural inspection such as the assessment of groups of components can be conveniently performed on the platform and shared with others. By enabling different stakeholders and systems to access the same database, STRUCINSPECT creates maximum transparency, efficiency, and interoperability.

STRUCINSPECT leverages its expertise, networks, and technologies to guide their clients in transforming their traditional infrastructure inspection and management into a highly digitized process. Based on the clients' strategic goals, the most appropriate technologies are selected, configured and operational processes are re-implemented. Typical customer goals that STRUCINSPECT achieves with digital transformation include significantly increased infrastructure availability during inspection, complete and structured documentation, or reduced maintenance costs.

Currently, STRUCINSPECT has 32 employees and is already represented in Germany and the USA in addition to its headquarters in Vienna.

1.2 Company Profile STRUCINSPECT

STRUCINSPECT is a joint venture between PALFINGER, VCE and ANGST Group founded in 2019. By providing digital services and establishing the world's first digital infrastructure management hub, the **Infrastructure Lifecycle Hub**, STRUCINSPECT maintains infrastructure worldwide in a safe, sustainable, and resource-efficient way. The Infrastructure Lifecycle Hub, the online collaboration platform, forms the core of the company. The platform combines technologies and functions in the field of holistic digital infrastructure management. The offering is primarily aimed at established infrastructure operators and inspection engineers with an openness to future-oriented and digital solutions. The functions offered can currently be applied to the asset classes bridges, tunnels, and dams.

1.3 Facts & Figures (As of December 2022)

Company Name	PALFINGER Structural Inspection GmbH STRUCINSPECT
Year of foundation	2019
Management	Albrecht Karlusch
Shareholder	PALFINGER AG VCE Vienna Consulting Engineers ZT GmbH, ANGST Group (represented by Vermessung Angst ZT GmbH)
Employees	32 (Stand November 2022)
Headquarters	Austria Campus 3 Jakob-Lind-Straße 5/ 6. OG 1020 Vienna
Other locations	Germany, USA
Product	Infrastructure Lifecycle Hub + Services + Tools + Integrations

1.4 Management – Albrecht Karlusch



Managing Director und Expert for digital transformation

- General Manager with practical experience and strong expertise in strategy and digitalization
- More than 14 years of experience in innovation management as editor, reviewer, entrepreneur, and manager
- Studies in technology and economics as well as certificates from renowned (inter)national universities

1.5 The Investors



*STRUCINSPECT is a joint venture between PALFINGER AG, **VCE Vienna Consulting Engineers ZT GmbH** and the **ANGST Group**.*

PALFINGER AG, the international technology and engineering company, is the world's leading producer and supplier of innovative crane and lifting solutions. With more than 12,600 employees, more than 30 production sites and a global sales and service network of around 5,000 support points, PALFINGER meets the challenges of its customers and creates added value from them. In doing so, PALFINGER is consistently pursuing its path as a provider of innovative, smart complete solutions with increased efficiency and better operability and is leveraging the potential of digitalization along the entire production and value chain.

PALFINGER AG has been listed on the Vienna Stock Exchange since 1999 and achieved record revenue of EUR 1.84 billion in 2021. In 2022, PALFINGER will

celebrate its 90th anniversary under the motto "Celebrating the future since 1932".

The high-tech oriented engineering office **VCE Vienna Consulting Engineers ZT GmbH** mainly works in the four fields of infrastructure and transport routes, building and industrial construction, development of condition assessment of supporting structures as well as life cycle engineering. Thanks to years of industry knowledge, VCE has outstanding expertise especially in the field of life cycle analysis and asset management. This is the foundation of its interest in the development of a digital building inspection and its participation in STRUCINSPECT.

The **ANGST Group** has been active in the construction and real estate sector for over five decades. As specialists in mobile mapping, professional drone use and photogrammetry, they bring relevant expertise to digitalized inspection processes.

2. STRUCINSPECT **Business Solutions**

At a glance: *STRUCINSPECT accompanies their customers in transforming their traditional infrastructure inspection and management into a highly digitized process. For this purpose, STRUCINSPECT offers individually configurable business solutions. Depending on the requirements, these solutions are a compilation of the most suitable technologies, process adaptations, and expert knowledge in the field of structural inspection, which are brought together in a central location in the Infrastructure Lifecycle Hub.*

STRUCINSPECT combines technological expertise and close project support at every stage of the collaboration. In addition, STRUCINSPECT takes on a consulting role to ensure the best possible configuration of the business solutions. The phases are divided into Requirements Analysis, Solution Design, Long-term Agreement, Roll-out, and Operation Phase.



2.1 Requirements Analysis

The collaboration starts with a thorough analysis phase, during which STRUCINSPECT gets to know the specific needs of their customers.

2.2 Solution Design

STRUCINSPECT's team of experts develops a precise strategy for the digital transformation of the client's processes and deployed technologies. The result is a step-by-step plan for the successful digital transformation of these very technologies and associated processes.

2.3 Long-term Agreement

The successful development of the customized solutions is followed by the agreement of a long-term cooperation.

2.4 Roll-out

The agreed solutions are implemented, accompanied by the team of experts. Customers receive comprehensive training in the use of the functions and are guided through the digital inspection process.

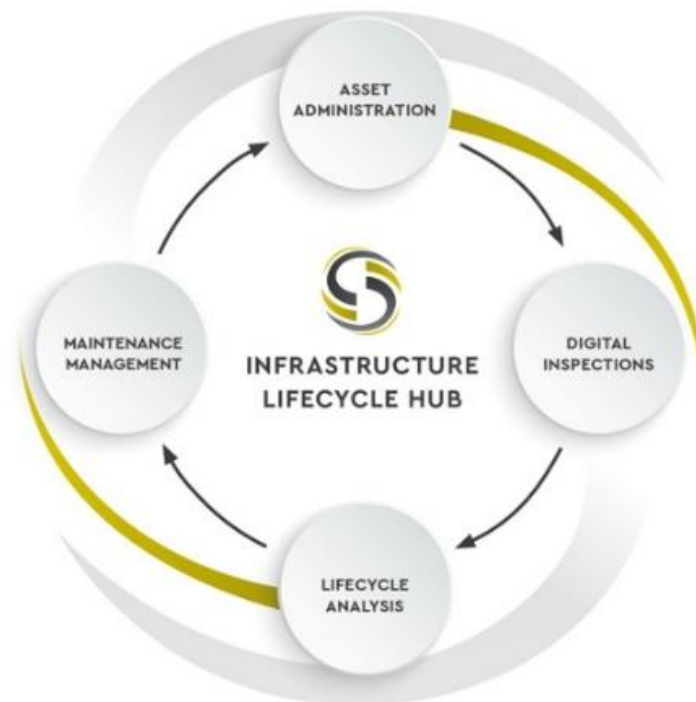
2.5 Operation Phase

The agreed services are applied to a larger portfolio of infrastructure assets. The focus is on long-term customer satisfaction, which is ensured through close contact with the customer and continuous improvements.

STRUCINSPECT supports their customers optimally on their digitization path and is the reliable partner in this transformative phase. The individual configurability of services ensures that customers receive solutions tailored precisely to their needs. This ensures the greatest possible added value in both the short and long term.

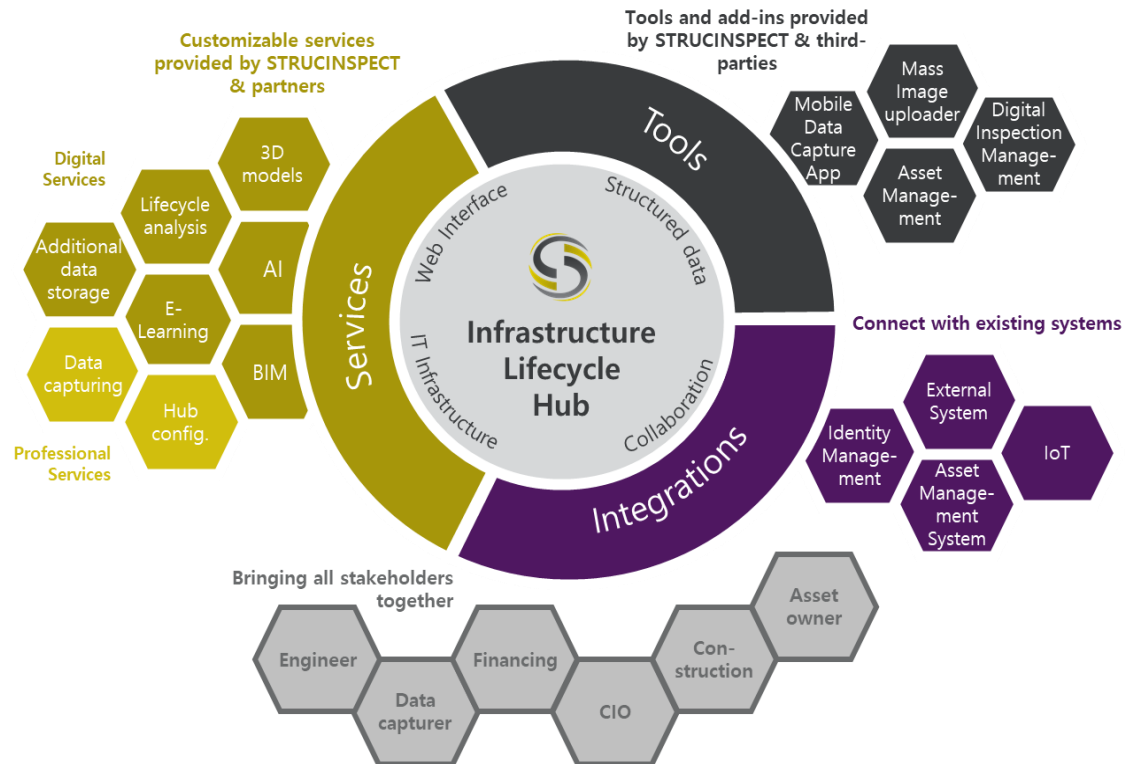
3. Infrastructure Lifecycle Hub – A platform as an anchor point

At a glance: *The Infrastructure Lifecycle Hub is a platform for collaboration in infrastructure management. On the one hand, digital building inspection tasks can be performed directly on the platform, and on the other hand, it serves as a central interface for the documentation and structuring of data. All stakeholders access the same database, thus creating increased transparency and efficiency.*



The Infrastructure Lifecycle Hub covers functions in the areas of asset management, maintenance management, and lifecycle analysis. Access can be granted to all stakeholders - from engineers and inspectors, data collection experts, asset owners and operators, to maintenance contractors. Providing relevant data along the value chain enables everyone involved in the process to work more efficiently.

Within the Infrastructure Lifecycle Hub, STRUCINSPECT customers have access to a comprehensive portfolio of technologies and services:



3.1 AI-Assisted Damage Detection

The AI supports the engineers objectively and with consistent quality and accuracy with suggestions for classifications. The AI-assisted damage detection always proceeds according to the *principle of human autonomy*. The AI provides suggestions, the final decision is always made by the human.

3.2 Building Information Modeling – BIM

In Building Information Modeling (BIM), relevant building data is digitally modeled, combined, and recorded. In the Infrastructure Lifecycle Hub, it is possible to transfer the results of the inspection into the BIM format.

3.3 3D Models using Photogrammetric Methods

Photogrammetry can be used to create 3D models from simple photographic images. From overlapping photos of a structure, the two-dimensional data is read out and converted into 3D models.

3.4 3D Damage Mapping

Each damage can be displayed both two- and three-dimensionally. The detected damages can be merged with the created 3D model.

3.5 Hub Configuration

In the Infrastructure Lifecycle Hub, specific norms (e.g. DIN 1076), workflows and reports can be created according to the customer's needs.

3.6 E-Learning

If the customer wants to train their own engineers on the new technologies as part of the business solution, e-learning courses can be booked.

3.7 Life Cycle Services

The data obtained and processed from the digital inspection can be used for lifecycle analyses or the calculation of critical construction sections and those requiring repair work.

3.9 Data Capturing

If the customer has a digital data capturing system already in use, it can be optimized and connected to the Infrastructure Lifecycle Hub. If the customer needs services or technologies from the field of data acquisition, these can be organized by STRUCINSPECT.

3.9 External System

If the customer wants to further process the data in his own systems, these can be connected to the Infrastructure Lifecycle Hub via API.

3.10 Identity Management

If the customer wants its employees to access the Infrastructure Lifecycle Hub as part of a single sign-on, identity management can be implemented.

3.11 Mobile Data Capturing

If the customer wants to access the damage data from the Infrastructure Lifecycle Hub or add new damages on the go, a mobile data capturing app can be integrated into the business solutions.

4. The **benefits** of Digital Infrastructure Management

Several benefits result from digital infrastructure inspection and management for asset owners, operators, and inspection engineers.

- Continuous value generation through **structured data**
Structured data makes it possible to filter out important information immediately.
- **Repeatable** processes
Repeatability increases the accuracy of the results and leads to consistently high quality and reliability.
- Optimized **resource management** through increased **efficiency**
Improved workflows lead to more targeted and cost-efficient use of resources.
Optimized resource management enables the exploration of new business opportunities.
- Optimized Building **Lifecycles**
Lifecycle Analysis provides information on the remaining service life of structures.
Comparing different lifecycle scenarios enables a long-term strategic planning.
Life-cycle assessment also provides information about the current worth of the asset.
- Realization of the **Digital Transformation**
Digital transformation is the basis for accelerated business processes, cost reductions, increased labor productivity, higher efficiency and optimization, and improved quality assurance.

5. STRUCINSPECT History

At a glance: *The ever-growing number of infrastructure buildings requires innovative technologies to inspect and maintain them efficiently. New technologies such as drones initially multiply the available data. Turning this into real and sustainable added value for customers is STRUCINSPECT's core competence. The Infrastructure Lifecycle Hub as the core enables the flexible integration of different technologies and systems for efficient data acquisition, storage, processing and interpretation. This turns data into maintenance decisions with real added value. Decisions that increase infrastructure safety or reduce repair costs. Ideally, even both at the same time!*

The number of infrastructure buildings worldwide is increasing rapidly. Together with those already in place, they need to be inspected, maintained, and managed on an ongoing basis. The extent of urbanization and the high energy and resource consumption of the construction sector call for fundamental improvements in maintenance. In the past, building inspection was done

manually, using costly and resource-intensive methods. Meanwhile, new technologies such as drones are being used more and more for data acquisition without being able to efficiently process the resulting data amounts. To be able to create sustainable added value from the available data, the entire value chain must be considered and thought of in end-to-end solutions. To open up these perspectives for digital infrastructure inspection, PALFINGER Structural Inspection GmbH was founded in 2019.

5.1 From the idea to the foundation of STRUCINSPECT

The original idea of a digital, AI-assisted structural inspection arose in a research project at the Technical University of Graz in cooperation with the ANGST Group. This project met with similar considerations in PALFINGER's core organization, which observed a change in its market for bridge inspection equipment: More and more customers were looking for holistic solutions and the applicability of new technologies. To actively shape these changes in the market, cooperation between **PALFINGER**, **VCE** and the **ANGST Group** took place in 2017. In the pilot project, the Falkenstein Bridge in Carinthia was digitally inspected. The findings of this first joint project contributed to the foundation of one of the first corporate start-ups in Austria. The goal was to develop a new solution and its own business model from which an entire industry would benefit.

In 2019, PALFINGER Structural Inspection GmbH was founded. Since then, STRUCINSPECT has been working on the integration of new technologies into the central Infrastructure Lifecycle Hub - with the aim of offering new end-to-end solutions in the industry.

5.2 STRUCINSPECT – first modes of action

As a start-up, STRUCINSPECT operates in a market that has not yet been fully explored and proceeds according to a highly innovative business model. In digital infrastructure inspection and management, **large amounts of data** are processed. STRUCINSPECT organizes this data for inspection engineers and decision makers and makes it applicable. Behind this is a systemized and goal-

oriented work process that usefully links the individual technologies already available.

5.3 The Start: project-based working

STRUCINSPECT initially conducted many pilot projects with well-known infrastructure operators. This allowed the Infrastructure Lifecycle Hub to quickly be tested for functionality and customer feedback to be incorporated. The positive feedback from operators led to the further development of the platform, but also of the company itself.

5.4 STRUCINSPECT as a technology provider

STRUCINSPECT has demonstrated in projects that digital infrastructure inspection not only works reliably, but also brings many benefits. To be able to offer its own technologies and capabilities on a larger scale, the next step followed: STRUCINSPECT acted as a technology provider and the Infrastructure Lifecycle Hub moved further into the center of the offer. Customers were able to use the platform's functions independently by creating a user profile.

To generate the greatest added value for their customers with the available resources, the Infrastructure Lifecycle Hub forms the central interface.

Technology forms the core of the services. Experts are available as consultants to provide customers with optimum support and to tailor the business solutions precisely to their needs. STRUCINSPECT is thus making a significant contribution to the digital transformation of the inspection industry.

6. Success Stories at a glance

STRUCINSPECT has been able to demonstrate its potential in several projects. Reference examples for the asset classes bridge, tunnel and road are listed below.

Autobahnring A99, Autobahn GmbH, BIM-Digitization and AI Damage Detection

„Autobahn GmbH is a German company responsible for the planning, construction, maintenance, financing and asset management of German highways.“

Facts & Figures:

Location: Munich (Germany)

Year of construction: 1972

Dimensions: 48,25m / 8,9m / 432m²

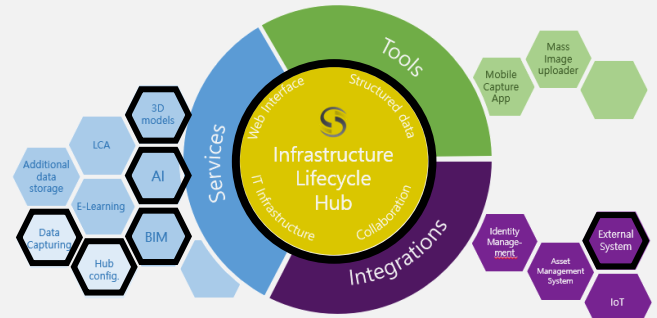
Challenges:

The project with Autobahn GmbH was a bridge inspection on the A99, involving surveying work on the bridge and the larger surrounding area in preparation for a future demolition and thus new construction. STRUCINSPECT was faced with the challenge of demonstrating the ability to provide the digital decision-making basis for a complex demolition and new construction project during ongoing operations.

Benefits:

Performing the inspection and area survey at the same time shortened the process and saved time. The use of digital technologies enabled the collection of more structured data of the bridge and information about the surrounding area, which allowed for an improved decision-making process. AI-assisted damage detection enabled higher accuracy of results, minimizing safety risks during deconstruction and reconstruction.

STRUCINSPECT Services:



- ✓ Data Capturing support
- ✓ AI assisted Damage Detection
- ✓ 3D Modeling using Photogrammetry
- ✓ 3D Damage Mapping
- ✓ Export of inspection results to BIM-Format IFC04



Aerial View Autobahnring



BIM Model



Digital 3D Point Cloud



BIM integration of the AI detected damages

Summary	Location	Clashes	Ingenieurbau
Eigenschaft	Wert		
Abmessungen	Abplatzungsfläche: 45.66dm2		
Bauwerk_Bauteil	Flügelwand_(Widerlager_1_(Nuernberg))		
Dauerhaftigkeit	2		
ID_Nummer	1876		
IFC_Bauteilklasse	IfcBuildingElementProxy		
Klassifikation	Bauwerksprüfung		
Modellstruktursschlüssel	7836628_A1_Bauwerksprüfung_011		
Prüfbericht	/Prüfbericht/PRUEFBERICHT_7836628_1_2020H.PDF		
Prüfdatum	von_11.08.2020_bis_20.11.2020		
Schadensnummer_SIB-Bauw.	[59]		
Schadensbeispiel	BSP-ID_021-08		
Schadensbild	/Schadensbilder/1876.jpg		
Schadensstyp	Abplatzung		
Standortsicherheit	0		
Status	Bestand		
Verkehrssicherheit	0		
X-Koordinate	320702409.2562634198		
Y-Koordinate	5340212.140966344		
Z-Koordinate	503.90083235321293		

Export of structured data in IFC Format

Metro, Subway Tunnel Inspection

„An urban metro system in the United States.“

Facts & Figures:

Location: USA

Challenges:

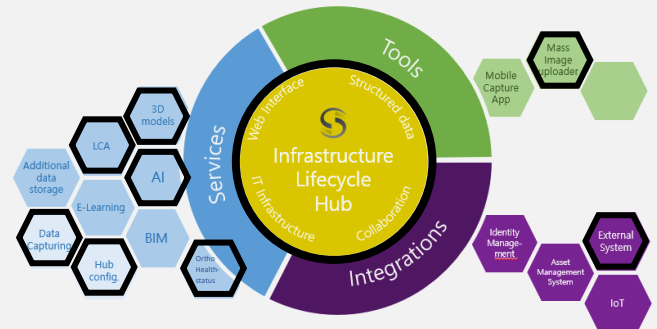
The customer was looking for ways to perform inspections of a metro tunnel network digitally and more efficiently, from data collection to reporting. The goal was to reduce the high inspection costs due to night shifts and the corresponding long downtimes of the tunnels.

Benefits:

A whole range of benefits have been realized:

- The closing time of the tunnels was reduced immensely. While data collection alone previously took 16 night shifts, this time was reduced to 3 hours with STRUCINSPECT's digital inspection process, a 79% reduction.
- Structured data was provided in a manner tailored to the client's needs.
- With full documentation of all defective and non-defective sections, as well as AI-assisted damage detection, a much higher level of transparency and accuracy was achieved.
- Health status could be precisely calculated for small sections. As a result, maintenance measures can now be planned precisely for the actual damaged areas. This leads to a reduction of the tunnel length to be rehabilitated by 30% in the coming year.

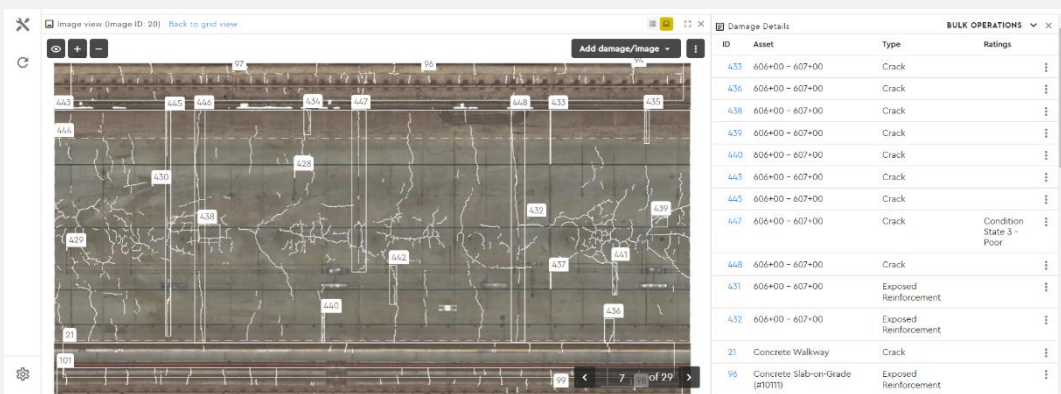
STRUCINSPECT Services:



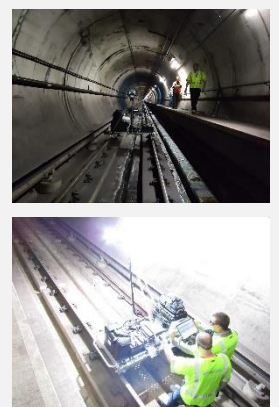
- ✓ Data Capturing Support
- ✓ AI assisted Damage Detection
- ✓ 3D Modeling using Photogrammetry
- ✓ 3D Damage Mapping
- ✓ Export of inspection results into BIM-Format IFC04
- ✓ Training of external partner
- ✓ Orthophotos
- ✓ Customization of the Infrastructure Lifecycle Hub
- ✓ Optimized Health Status Analyses
- ✓ Export of multi-layer report PDFs



Metro Station



AI assisted damage detection using orthophotos in the STRUCINSPECT Infrastructure Lifecycle Hub



Data Capturing

Hydropower plant, *Dam Inspection*

„One of the largest electricity suppliers in Austria.“

Facts & Figures:

Location: Austria

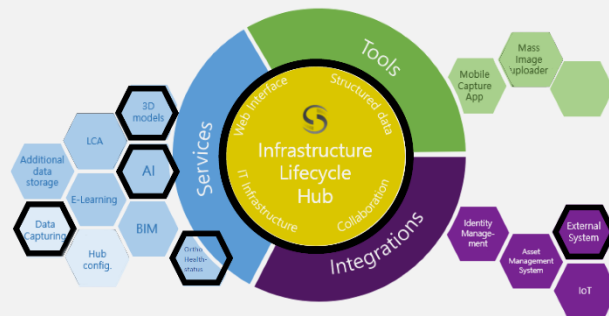
Challenges:

The customer was looking for an efficient and cost-effective solution for inspecting its dams. Concrete dams have a rough surface, with rough edges, heavy efflorescence, and moisture. The focus here is on surface analysis and the creation of data structures for different departments. The aim is to reduce consequential damage through early detection and resource-saving maintenance work in order to largely reduce the risk "from hairline cracks to cost-intensive damage".

Benefits:

The main benefit was the accurate and efficient inspection process and inspection report achieved through more structured data for decision making.

STRUCINSPECT Services:



- ✓ Data Capturing Support
- ✓ AI assisted Damage Detection
- ✓ 3D Modeling using Photogrammetry
- ✓ 3D Damage Mapping
- ✓ Orthophotos



3D Model



Sample Image

7. Awards



State Award Digitalization 2020



Digital Impuls Award 2020



Iceberg Innovation Leadership Award 2020



Building Smart Award 2021



eAWARD 2022 – Category „machine learning and artificial intelligence“



BATIMATECH Award 2022, Montreal/Canada – nominated

8. Q&As

What is the USP of STRUCINSPECT?

The online collaboration platform combines technologies, services and functions to inspect and maintain infrastructures with digital technologies in a safe, sustainable and resource-saving way.

What is the ownership structure?

STRUCINSPECT is a Joint Venture between **PALFINGER AG**, **VCE Vienna Consulting Engineers ZT GmbH** and **ANGST Group**.

Who is the target group?

Inspection Engineers, Infrastructure Operators and Owners, Innovation Managers & Digitization Officers

What is the process of setting up and executing a project?

STRUCINSPECT Business Solutions go through the phases: requirements analysis, Solution Design, long-term agreement, roll-out and operations.

What are the average costs and what are the long-term cost savings?

It is not possible to give a uniform indication of costs and cost savings. Each customer is individual and has to base its maintenance decisions on a different number of infrastructures of varying complexity. Accordingly, the technologies used, and the costs of digital transformation vary significantly. In general, however, the more assets the customer manages and the more the customer wants to invest once in solution design and digital transformation, the greater the long-term cost savings that can be achieved with the new technologies.

In which markets is STRUCINSPECT operating?

STRUCINSPECT is currently active in over 15 countries worldwide.