

#### Infrastructure Lifecycle Hub

# **AI-Volution** of Structural Inspection

Precise | Economical | Sustainable



# **Global** demand

- Ten thousands of qualified engineering consultants are already inspecting hundred thousands of bridges every year
- Infrastructure stakeholders around the world already manage millions of bridges, roads and tunnels
- Intense construction activities further increase already high number of assets that need to be inspected
- **Digitalization and automation** will be the only answer to efficiently manage infrastructure in the future



## Digitized and automized Future inspections

STRUCINSPECT invented and implemented a **new digital inspection process** by combining various process steps of **digital inspection** into a combined workflow.

Multiple **cutting-edge technologies** are used to enable digitization and best possible **automation**.

AI as key technology to improve workflow-efficiency.

The future quality standard. Today!



#### New process

# **Digital inspection**











Al assisted damage detection



Furnishing of data and documents



Define measures and create actionable reports with condition assessment



#### Example flight plan





#### 3.7m 1.5m 200 1.5m 200

# Data capture

#### Set 1

Digital twin (3D Model)

Low resolution images enough

Laser-scan, 360° camera also possible

#### Set 2

#### AI Damage detection

High resolution images needed



# Services Digital twin (3D Model)

 Photogrammetry delivers exact picture locations that even include a camera's positions. Two photos cannot be confused with one another anymore

- Automated algorithms help to standardize imagery over time to deliver comparable results
- Damages have a defined geospatial position and are documented in line with their exact damage geometry

#### **Damage detection**







# **AI Analysis**

- Automatic AI-based damage detection and marking
- AI detects cracks, exposed reinforcement, corrosion of the reinforcement, spalling, and sintering (the detection of damage types will be continuously extended)
- Unique detection rate in terms of precision



#### Precision Damage **location**

- Damage mapping in 2D and
   3D using unique identifiers
- Absolute geo-references

   enabling easy comparisons and
   facilitating maintenance
   activities





## Furnishing of data / Creation of inspection report Data and Reporting

- Online access to the inspection data
- Sort and group damages
- Define ratings and measurements
- Define actions
- Make first cost calculations

 Interface to asset operation software easily possible



by a certified engineer an according to national regulations



#### STRUCINSPECT

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# The way we look at **infrastructure** has **fundamentally changed**

STRUCINSPECT supports the entire process from digital inspection to an efficient infrastructure lifecycle management.





## STRUCINSPECT Hub Structure and inspection overview

≡	STRUCINSPECT									Start a free trial	Schedule a live demo	Û	
	Structures												
楎	Structures												
Q	Structure	C	onstruction year	Structure type	Road type / se	gment	Dimensions	Last inspect	ion Rating	Next inspection	Next inspection status		
×	Carlbergergasse-Brücke			Bridge - RVS						2020	Approved		
C	Drauquerung MA29-demo	2	014	Bridge - RVS	Koralmstreck	e	Width: 13,6 m, Length: 600 m, Area: 8.160 m²	2019					
	Bogenbrücke über Teichl DEMO		015	Bridge - RVS	A9 Tunnelkett	Klaus [PY60.2] W	Width: 14 m, Length: 106 m, Area: 1.484 m²	2020	2 - good condition				
	Nordsund Bru - Farsund	1	971	Bridge - RVS			Width: 12,43 m, Length: 285,1 m			2020	In progress		
	Highway Bridge	1	972	Bridge - DIN1076	Highway		Width: 48,25 m, Length: 8,9 m, Area: 432 m²	2020		2021	Waiting for approval		
		=	STRI	UCINSPECT									Start a free trial
	Inspections												
		1	Inspe	ections									
		Q	Inspection type		Inspection year	Structure	Custom name		Status	Responsible engineers	Start date	End date	3D model
		DIN Hauptprüfung		2021	Highway Bridge	Demo		Waiting for approval	Paul Demo	4.10.2020	28.2.2021	Yes	
		C	DIN Einfa	ache Prüfung	2020	Highway Bridge	-		Finished	-	1.9.2020	1.9.2020	Yes
C		0	Demons	tration	2020	Nordsund Bru - Farsund	Hovedinspeksjon		In progress	-	20.4.2020	21.4.2020	Yes
			RVS Prüt	fung	2020	Bogenbrücke über Teichl DEM	NO —		Finished	-	28.8.2019	30.8.2019	Yes
			RVS Prüt	fung	2020	Carlbergergasse-Brücke	-		Approved	-			Yes
			RVS Prüt	fung	2019	Drauquerung MA29-demo	-		Finished	-	14.10.2019	8.11.2019	Yes



# STRUCINSPECT Hub Individual inspections

Inspections / Inspection-HP-2021-Highway Bridge-Demo											
Overview Damages Images Ratings Measures											
< Inspection-HP-2021-Highway Bridge-Demo 🕅 Download report 🗐 Re-generate report inspection details											
Inspection type DIN Hauptprüfung	Waiting for approvalInspectionStart dateEnd date20214.10.202028.2.2021										
Responsible engineers —	Comment Free Trial - This is your personal demo inspection. Feel free to edit and test our digital inspection features.										
Norm	Structure										
DIN 1076 Weather conditions —	Highway Bridge										



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## STRUCINSPECT Hub Damages detected AI supported

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	Inspections / Inspection-HP-2021-Highway Bridge-Demo / Damages											
<u>þ=4</u>	Overview Damages Images Rat	tings	Measures									
Q	Applied damage filters: Reset fi	lters	Q									
3.1	Damage types	25 of 222 Damages										
$\sim$	Crack × Crack width > 0.1 mm ×		Damage ID	Structure	Rating	EP	Damage catalog reference					
C	Damage types	~	881	Balkenbrücke Lärmschutzwand	S 0 V 0 D 2	No	BSP-ID 006-02-03					
	✓ Crack	254	676	Widerlagerwand	S 0 V 0 D 2	No	BSP-ID 025-04					
	✓ Crack width Greater than (>) ▼ 0.1	25	2031	Widerlagerwand	S 0 V 0 D 1	No	BSP-ID 025-02					
	Crack length		863	Widerlagerwand	S 0 V 0 D 1	No	BSP-ID 025-02					
	<u> </u>	0	1630	Widerlagerwand	S 0 V 0 D 2	No	BSP-ID 025-04					
	Spalling Rust Stain	27 — 0	2065	Kappe - FR Nürnberg	S 0 V 0 D 1	No	BSP-ID 025-06					
	Cavity Moisture	1 1	139	Widerlagerwand	S 0 V 0 D 1	No	BSP-ID 025-02					
	Exposed Reinforcement     Other	17 0	400	Widerlagerwand	S 0 V 0 D 1	No	BSP-ID 025-02					
	Corrosion Gravel Pockets	66 2	1330	Widerlagerwand	S 0 V 0 D 2	No	BSP-ID 025-04					
	Moss Efflorescence	0 2	1798	Widerlagerwand	S 0 V 0 D 1	No	BSP-ID 025-02					
	Compound	6 0	1035	Widerlagerwand	S 0 V 0 D 1	No	BSP-ID 025-02					
			2070	Balkenbrücke Lärmschutzwand	S 0 V 0 D 2	No	BSP-ID 006-02-03					



Schedule a live d

## STRUCINSPECT Hub Damages manually added

#### ≡ STRUCINSPECT



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#### STRUCINSPECT Hub Damages mapped on model

#### ≡ STRUCINSPECT Schedule a live demo Start a free trial Û Inspections / Inspection-HP-2021-Highway Bridge-Demo / Images Overview Damages Images Ratings Measures had Q O Click on 3d mode Download report 🗐 Re-generate report Upload sources $\sim$ Q 🖸 🗶 🗐 Details Overview 978 Batch upload × ID Texture 👻 荘 🖸 🕐 Structure Manual upload 0 881 Balkenbrücke Lärmschutzwand C Damages $\sim$ 237 Damage on image 887 Balkenbrücke Lärmschutzwand No Damage 741 Rows per page: Damage types $\sim$ 180 Crack Spalling 22 Rust Stain 0 Cavity 1 Moisture 1 Image view (Image ID: 64) Back to grid view Exposed Reinforcement 15 🗃 🖬 🖸 🗙 Other 0 ⊙ + -Add damage/image 👻 🚦 53 Corrosion Gravel Pockets 2 Moss 0 88 Efflorescence 2 Compound 127 Not assigned 0 Structures ~ 123 978 0 | 503 ▼ Widerlager 1 (Nürnberg) - FR Salzburg 0 | 105 103 < 938 of 978 > Widerlagerwand 78 🔻



## **STRUCINSPECT Hub** Individual damage rating and grouping

٩	Click on 3d mode	Download	report	🗐 Re-gener	ate report Lay	vout 👻 🛛 🍯		E 88 📼	4
Ø Overview		::× E	Details				Bulk operat	ions v	×
Texture → 辈 () ⑦		I	D	Structure	Туре		Ratings	(	
			▶ 2108	Flügelwand	Compound		S 0 V 0 D 1	₽ :	
			2104	Flügelwand	Moisture			:	
Ø 2108 2028 3			1876	Flügelwand	Spalling			:	
			1889	Flügelwand	Exposed Reinfo	rcement	S 0 V 0 D 2	:	
			1877	Flügelwand	Spalling			:	
Image view (Image ID: 965) Back to grid view Ba	22		1886	Flügelwand	Corrosion		S 0 V 0 D 2	:	
	Add damage/ima	age 🖌 🚦	2028	Flügelwand	Corrosion		S 0 V 0 D 2	:	
1876 2028 1889 1888 1888 888 89 2018	4 808	5f 078 \			Rows per page:	50 🔻	1-7 of 7	< >	
	<u>898</u>	51970 2							



# **STRUCINSPECT Hub Ratings and measures**

#### STRUCINSPECT $\equiv$ Schedule a live demo Ĺ Start a free trial Inspections / Inspection-HP-2021-Highway Bridge-Demo / Ratings <u>h-1</u> Overview Damages Images Ratings Measures QT Do' Bulk assign Q Rating Structures/Damages Construction year (age) Damage type Dimensions EP Rating comment X Structures \_ Unallocated Superstructure (Highway Bridge) C 1972 (49) Length: 8,9 m, Width: 48,25 m, Condition rating 2.2 \_ Highway Bridge \_ Area: 432 m² Ratings \_ Condition rating 2.0 \_ Substructure Condition rating 1.7 \_ Condition rating 1.7 \_ Superstructure Bearing \_ **STRUCINSPECT** Roadway \_ expansion Inspections / Inspection-HP-2021-Highway Bridge-Demo / Measures joints <u>1---1</u> Overview Damages Images Ratings Measures Pavement \_ Waterproofing, \_ Q drainage Recommended measure \_ X Edge beam Other \_ Repair spallings with exposed reinforcement Þ C equipment Туре Minor rehabilitation work Date proposal Long-term (within 10 years) Comment Cost Assigned to Structures Structure components Damages 6 item(s) STRUCINSPECT.COM

# Lifecycle analysis Predictive analyses and lifecycle management

#### **Current situation:**

- Usually only a few scores are used to predict ageing and cost models for a bridge
- Without detailed damage information costs for maintenance activities are often rough estimations

**Outlook:** 

- The AI technology supports identifying damages automatically on a pixel-precise level
- Thousands of data sets can be used:

Input data

**Ai-supported** 

- To simulate precisely ageing and cost scenarios
- o Plan maintenance activities
- Calculating exactly required materials





# **Augmented reality** services (planned)



#### Augmented reality services:

- Save time and costs when planning activities
- Digital results into the real world to provide information directly on spot
- Efficiently guide engineers to specific areas of concern to inspect, control or maintain



#### Digital inspection and lifecycle management hub What are the benefits ?





# Get in contact Thank you for your attention





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