



5. DIGITAL REAL ESTATE SUMMIT 2019

# Performance of the “digital twin”

Matthias Wasem

BIM Facility AG

 **bim facility**  
BEWAKEN & MODELEREN

 **AUTODESK**



Minivan

Mittelklasse

obere Mittelklasse

dena

dena



### VW Passat EcoFuel

### Audi A6 2.0 TDI

Geschwindigkeit  
 Leistung  
 Gewicht  
 Verbrauch  
 entspricht in  
 Verbrauch  
 CO<sub>2</sub>-E  
 Kfz-Ste

Geschwindigkeit	228 km/h
Leistung	130 kW
Gewicht	1.650 kg
Verbrauch (Diesel)	4,9 l/100 km
Verbrauchskosten	1.397 €/20.000 km
CO <sub>2</sub> -Emissionen	129 g/km
Kfz-Steuer	228 €/Jahr
CO <sub>2</sub> - Effizienzklasse	A

227 km/h  
 135 kW  
 1.670 kg  
 8 l/100 km  
 20.000 km  
 57 g/km  
 8 €/Jahr

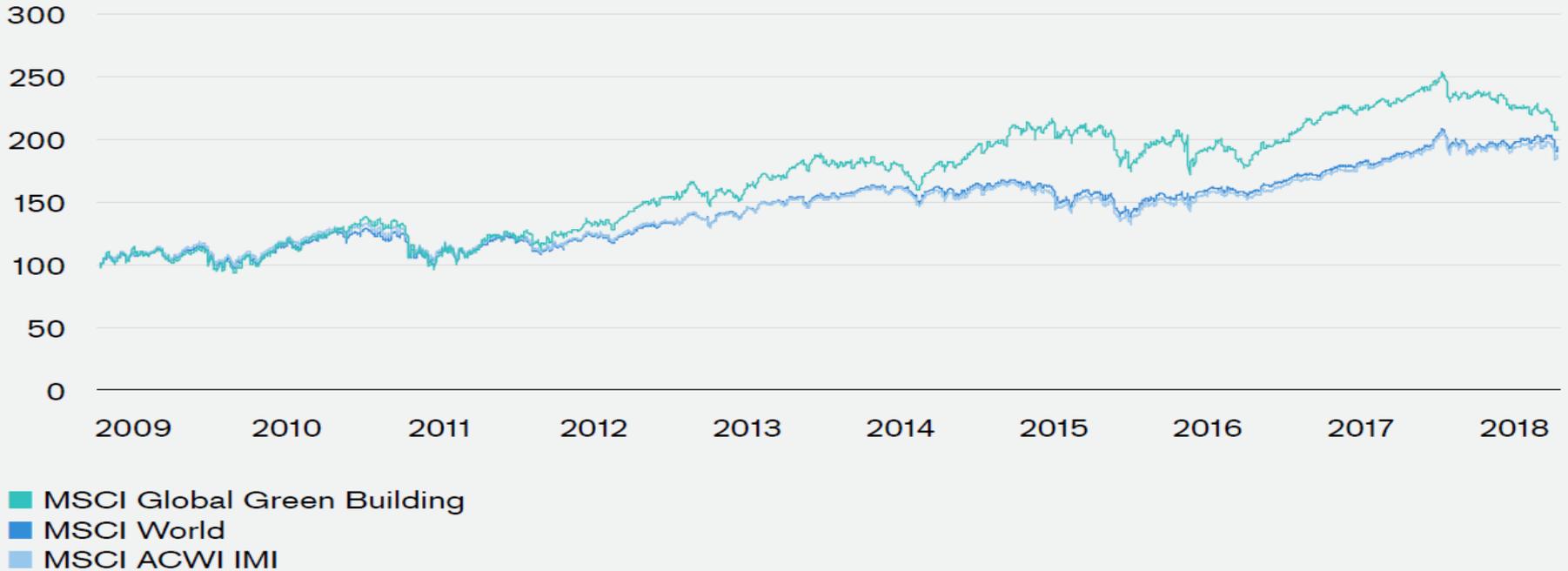
34 km/h  
 77 kW  
 39 kg  
 km/h

Nissan  
 Geschwindigkeit  
 Leistung  
 Gewicht  
 Verbrauch

Gest

# Gesamtperformance-Index – Bruttorenditen

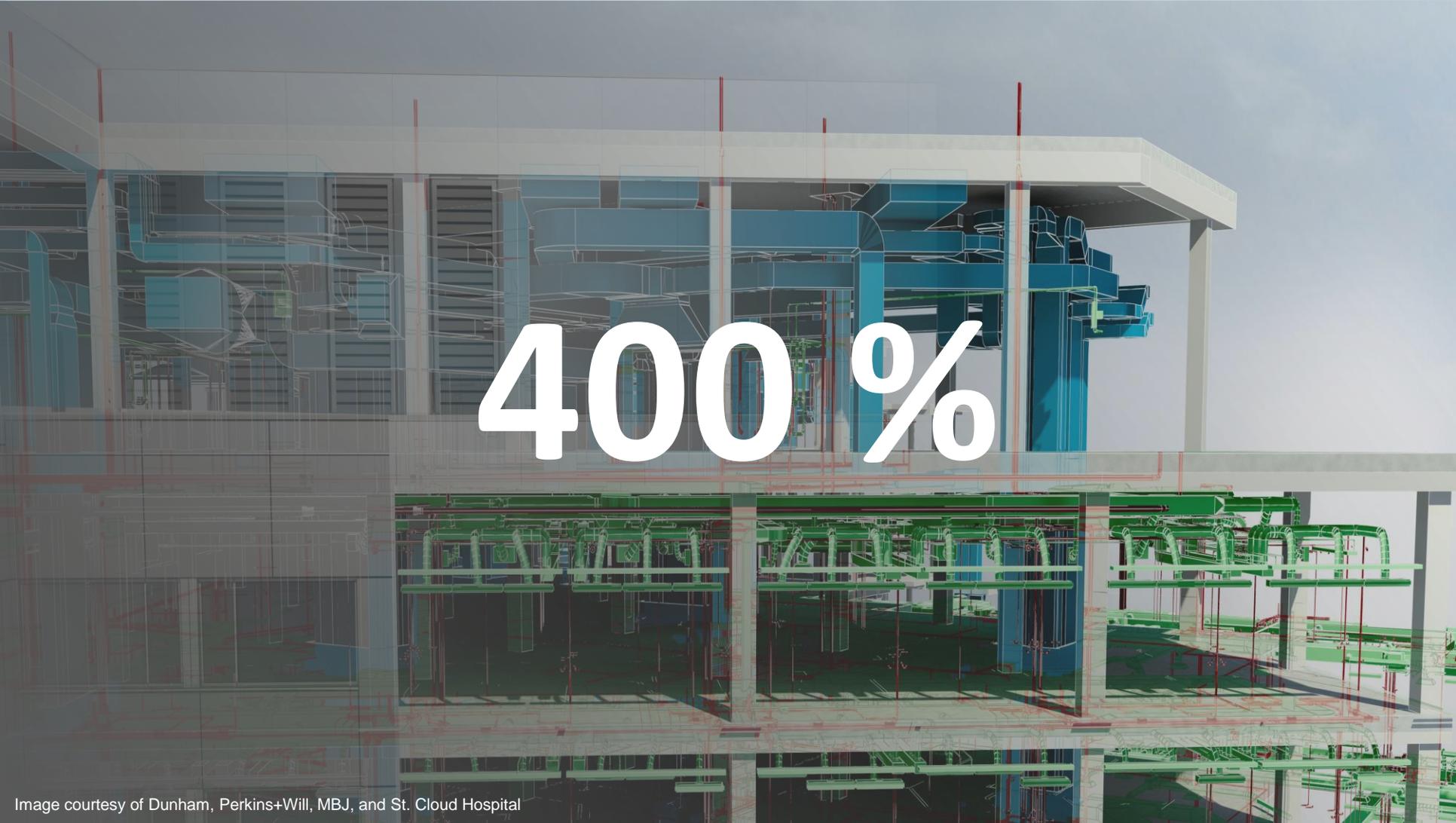
In USD (August 2009–August 2018)



Quellen: MSCI, Bloomberg, Daten per 17.10.2018



Image courtesy of Dunham, Perkins+Will, MBJ, and St. Cloud Hospital



400 %



A dense crowd of people walking down a city street, with a tram visible in the distance. The scene is captured from a low angle, looking down the street, emphasizing the scale of the crowd. The lighting is bright, suggesting a sunny day. The text is overlaid in the center of the image.

**10 MILLIARDEN**

Menschen im Jahr 2050





400 000

MENSCHEN JEDEN TAG









3,600  
mehr Gebäude pro Tag



An aerial photograph of a city, likely Bangkok, showing a dense urban landscape. In the foreground, a multi-lane elevated highway is filled with traffic, including cars, buses, and motorcycles. Below the highway, there are various commercial buildings, some with signs for 'TULIP' and 'Jessico'. The middle ground is dominated by a thick layer of residential and commercial buildings. In the background, a skyline of modern skyscrapers is visible under a blue sky with scattered clouds. The overall scene depicts a bustling, densely populated urban environment.

MEHR  
IST UNVERMEIDBAR







WENIGER

IST DIE REALITÄT 



50%

ABFÄLLE WELTWEIT



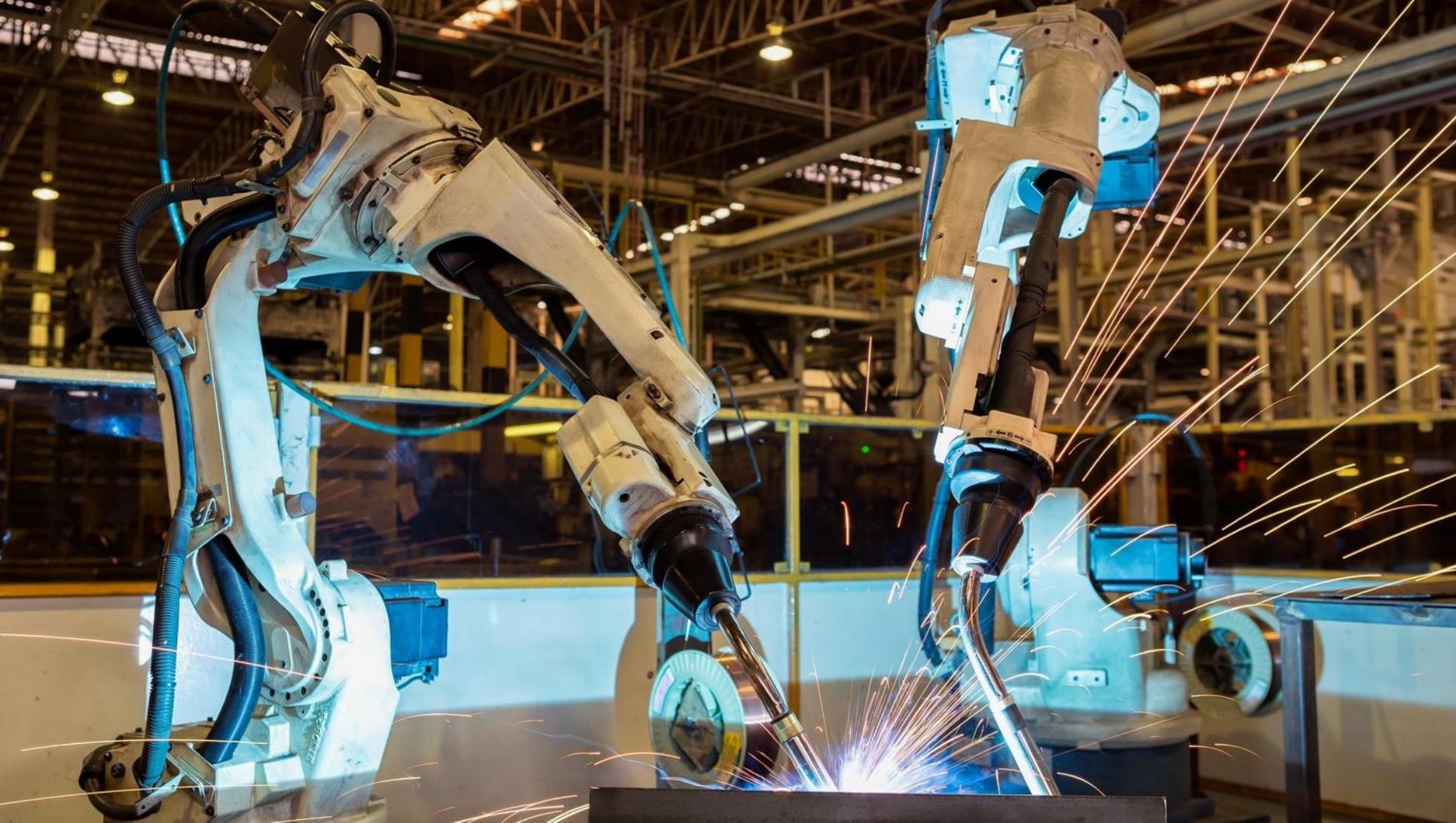
40%

CO2 Emission



70%

ERSATZTEILVERGEUDUNG



A futuristic car interior with a driver looking at a cityscape through a large windshield. The text "CHANCE AUF VERBESSERUNG" is overlaid in white. The car's interior is illuminated with blue light, and the driver is wearing a dark jacket. The windshield shows a cityscape at night with various signs and buildings. The text is centered and reads "CHANCE AUF" on the top line and "VERBESSERUNG" on the bottom line.

CHANCE AUF  
VERBESSERUNG

1

Higher definition  
surveying and  
geolocation



2

5-D Building  
Information  
Modeling



3

Digital  
collaboration  
and mobility



4

The internet  
of things and  
advanced  
analytics



5

Future-proof  
design and  
construction



An aerial photograph of a coastal town, possibly in Norway, with a dense green point cloud overlay. The point cloud is semi-transparent, revealing the buildings and terrain underneath. The town features a prominent white church with a steeple. The foreground shows a steep, rocky slope leading down to a body of water with white-capped waves. The sky is overcast with grey clouds.

**1**

# Higher Definition Surveying





Bahn	Glas	Minuten
1010	10	10
1011	11	11
1012	12	12
1013	13	13
1014	14	14
1015	15	15
1016	16	16
1017	17	17
1018	18	18
1019	19	19
1020	20	20
1021	21	21
1022	22	22
1023	23	23
1024	24	24
1025	25	25
1026	26	26
1027	27	27
1028	28	28
1029	29	29
1030	30	30
1031	31	31
1032	32	32
1033	33	33
1034	34	34
1035	35	35
1036	36	36
1037	37	37
1038	38	38
1039	39	39
1040	40	40
1041	41	41
1042	42	42
1043	43	43
1044	44	44
1045	45	45
1046	46	46
1047	47	47
1048	48	48
1049	49	49
1050	50	50

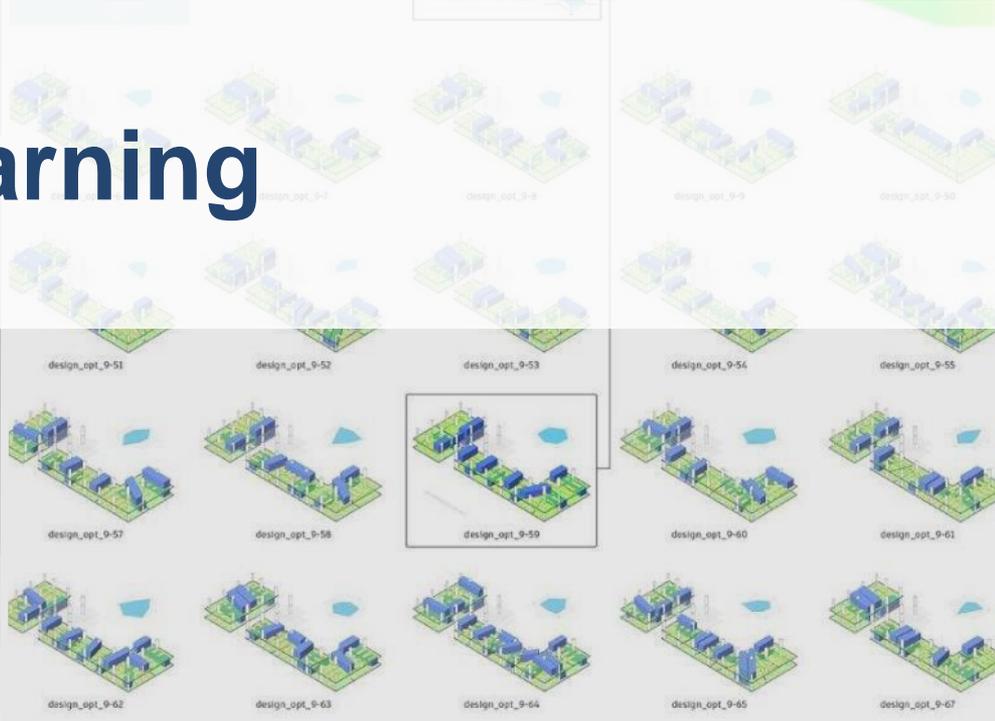




# 2

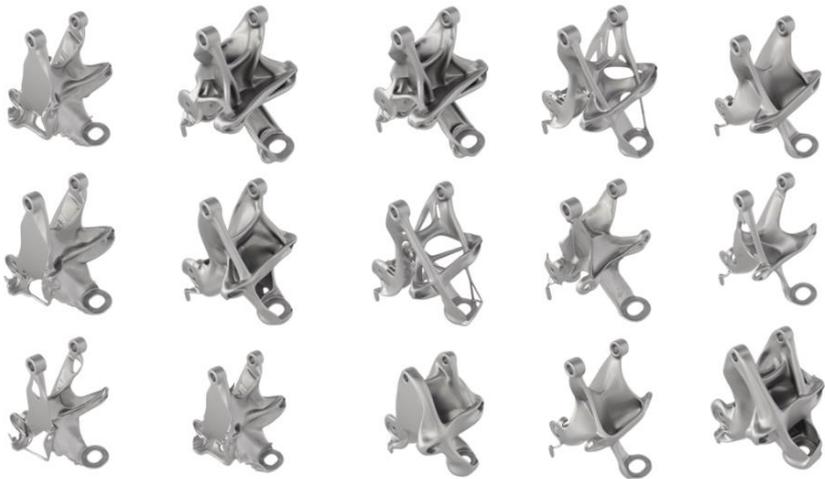
# Machine Learning

2F: Views to outside maximizes exterior views from paths









**Generative Design &  
Additive Manufacturing**



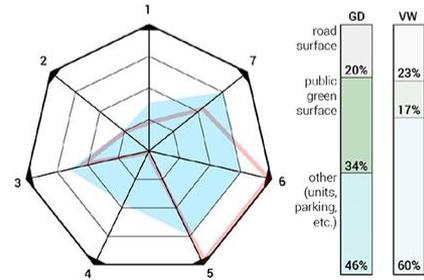
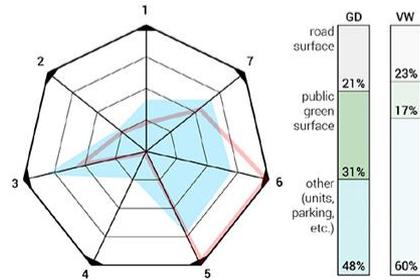
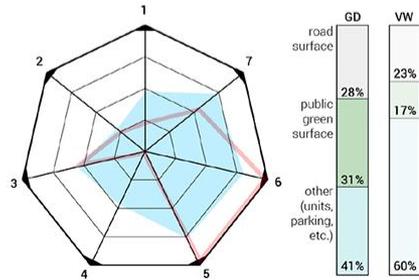
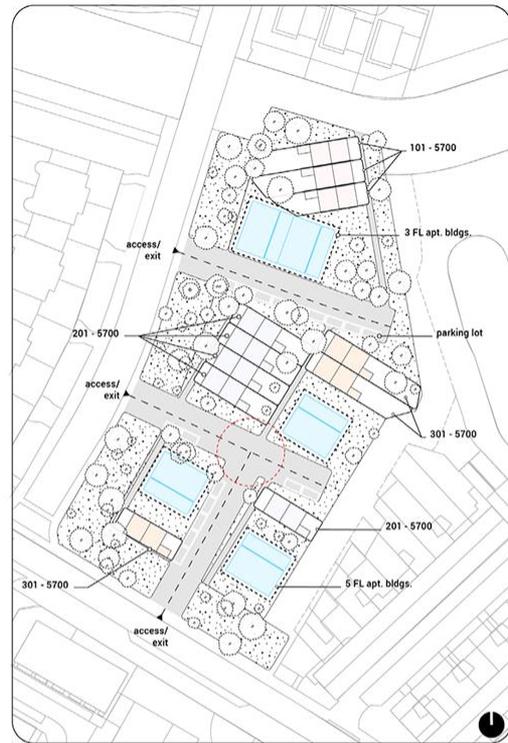
8 components into 1 part  
40% lighter  
20% stronger

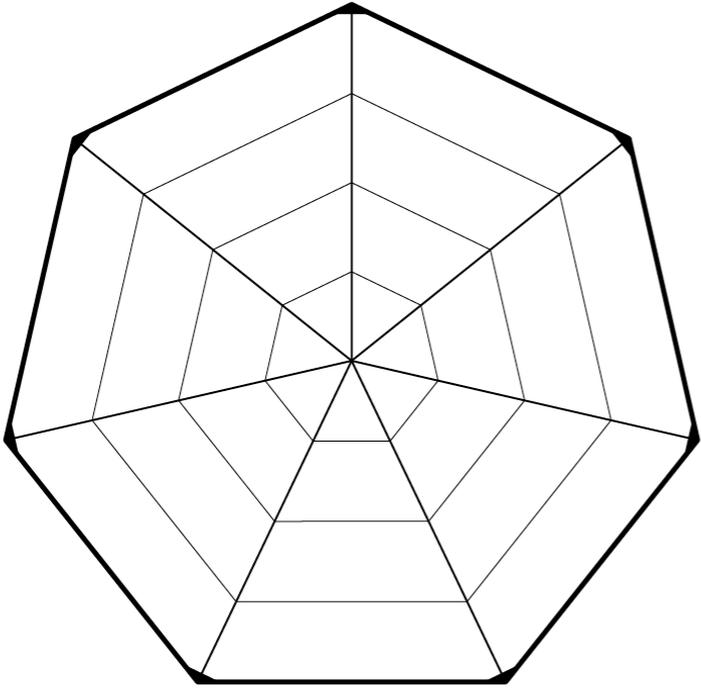


An aerial photograph showing a multi-story building under construction. A large, dark, corrugated metal roof section is being lifted by a crane, suspended by several thick chains. The building's facade features a mix of grey horizontal siding and reddish-brown brickwork. Several windows with white frames are visible. In the background, there are other buildings, some with flat roofs, and a dense area of green trees. The scene is captured from a high angle, looking down at the construction site.

# Generatives Planen



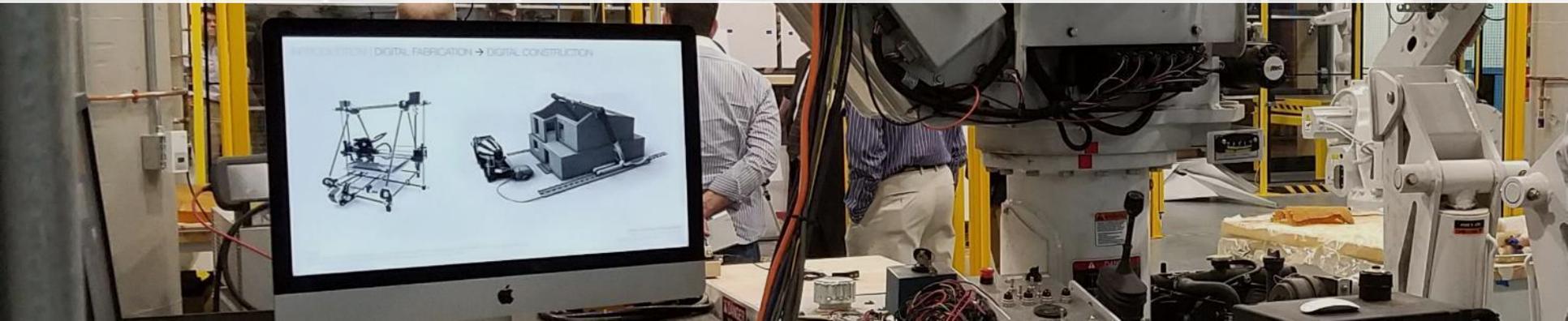






3

## Industrialization of Construction

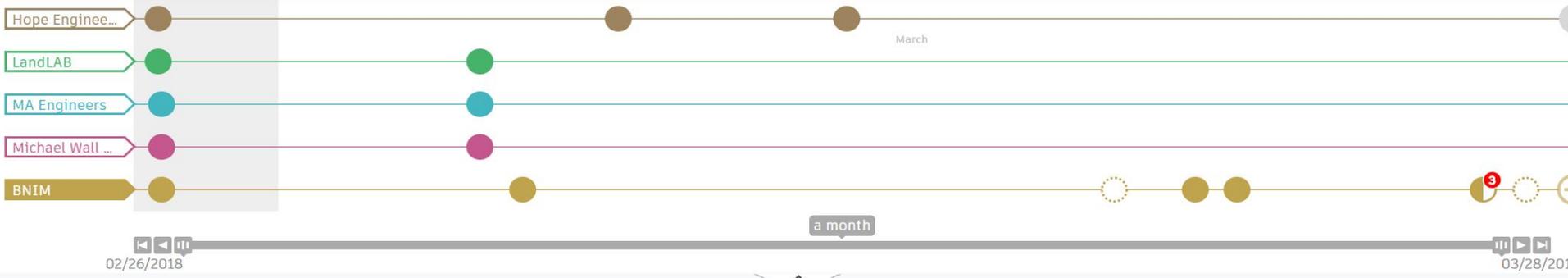


A photograph of three business professionals in a meeting room. They are wearing VR headsets and looking at a large digital display. The display shows a 3D architectural model of a building with various colored beams and structures. The man in the center is pointing at the screen. The woman on the left is looking at the screen. The woman on the right is looking at the man. The room has a dark carpet and a white wall. There is a projector mounted on the ceiling.

4

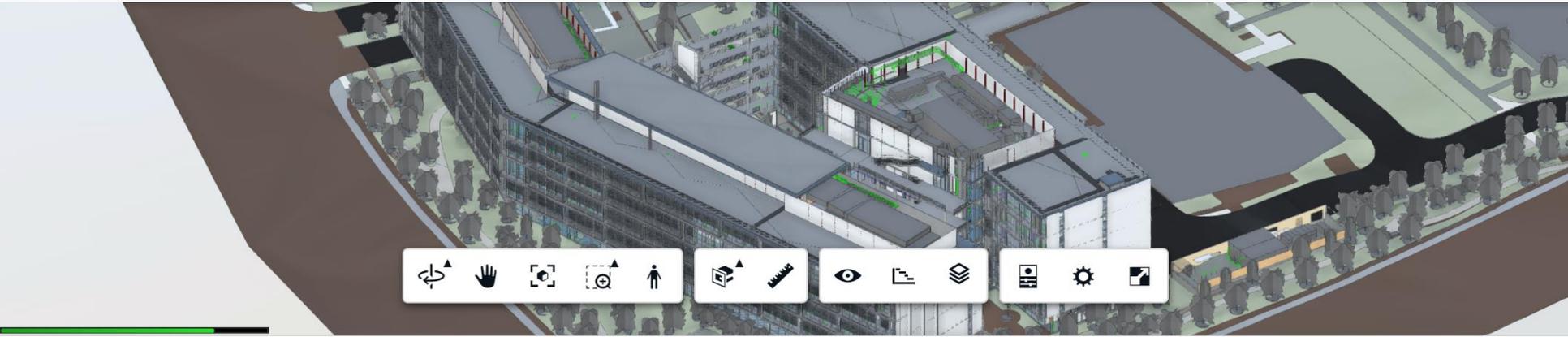
## Digital Collaboration

# Design Collaboration



## BNIM Team

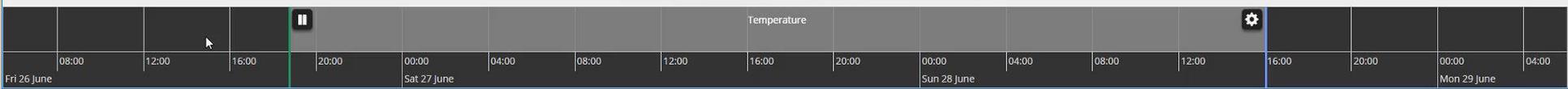
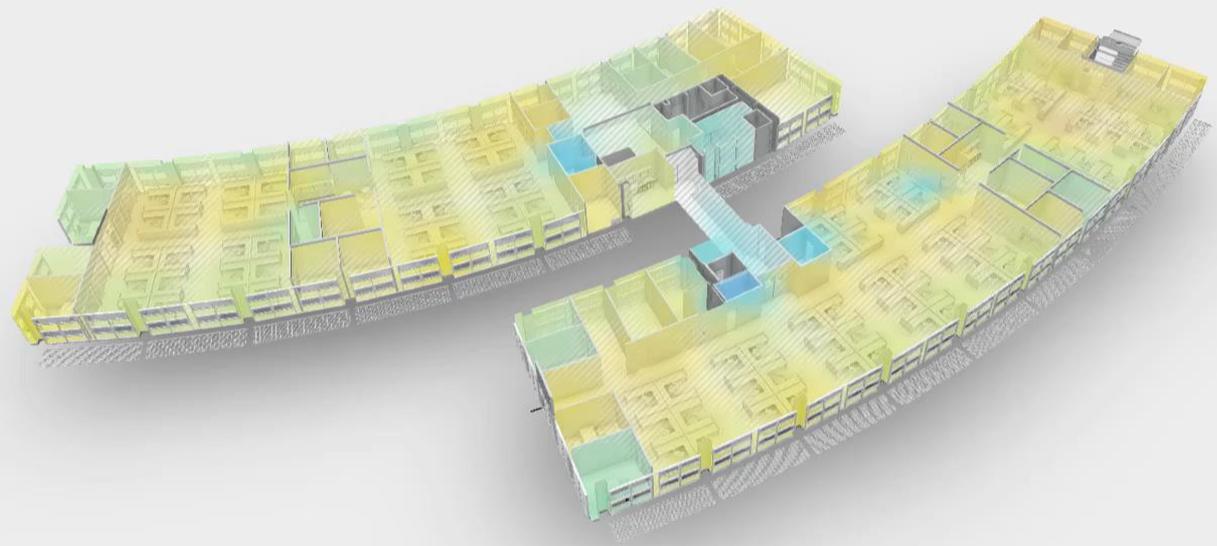
7 Sets   87 Sheets   7 3D views   [Project Model](#)

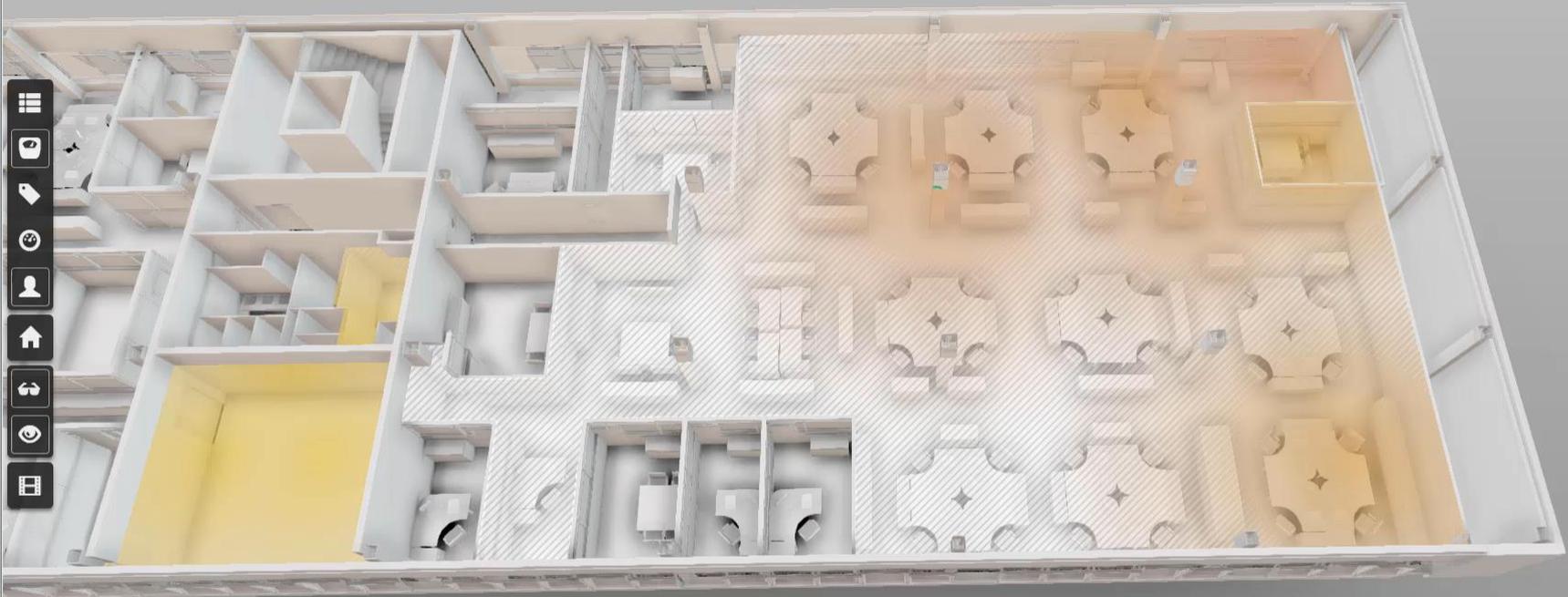




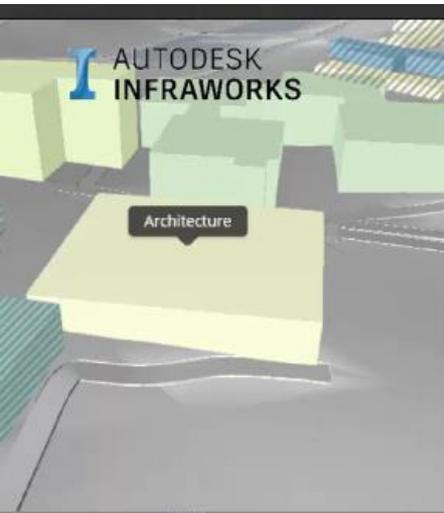
**5**

## **The Internet of Things & Advanced Analytics**





		Temperature										
9 June 2017	Tue 20	Wed 21	Thu 22	Fri 23	Sat 24	Sun 25	Mon 26	Tue 27	Wed 28	Thu 29	Fri 30	Sat 1 July 2017



- Macdorm Library
  - City / Building Area
  - Mackenzie
  - Dunton
  - Loeb
  - Life Science
  - Souham Hall
  - Architecture
  - Unicentre
  - Prescott
  - Steacie
  - St. Patrick
  - Lanark
  - Athletics
  - Glogary
- kWh/m<sup>2</sup>



### Sensor List

Search

Carlton Architecture Building (4)

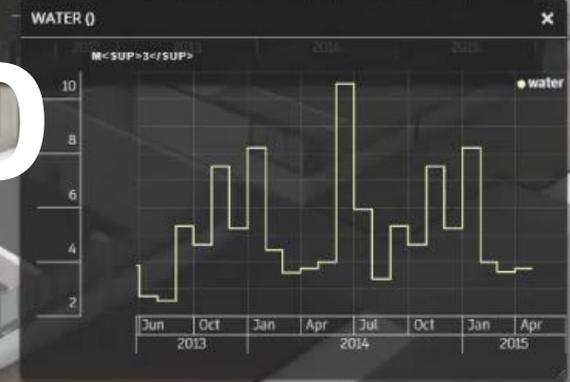
Model Sensors (0)

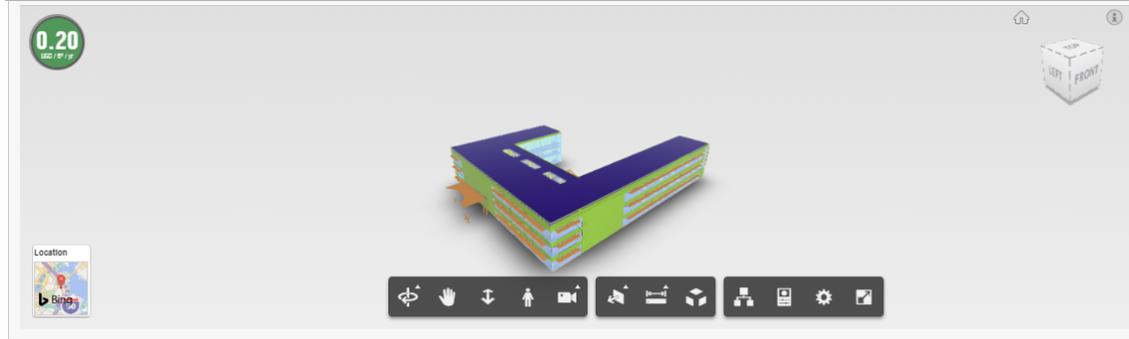
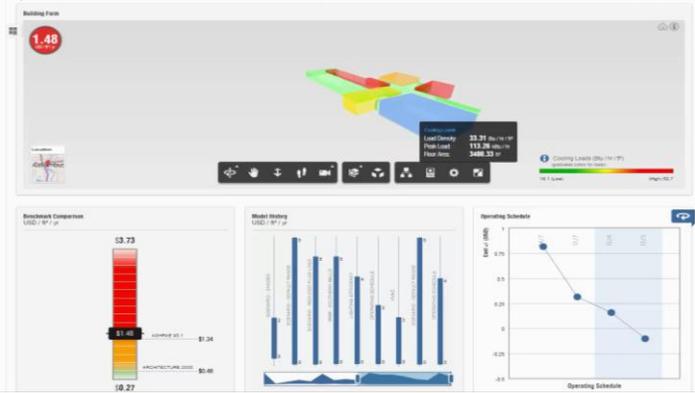
Positioned Sensors (0)

Unpositioned Sensors (4)

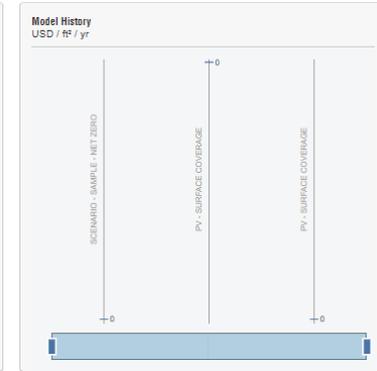
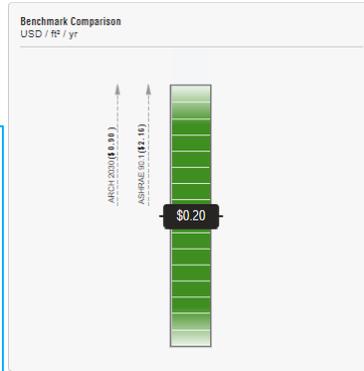
- natural\_gas 3.31 m<sup>3</sup>
- power 1509.55 kWh
- steam 7.59 L
- water 3.76 m<sup>3</sup>

# 6.5%





•Generatives Planen  
 anhand von aktuellen  
 Leistungsmerkmalen,  
 Standort und Materialien  
 =  
 Optimierte Performance



**Building Orientation**

Rotates a building clockwise from 0 degrees, e.g. 90 degrees rotates the North side of the building to face East.

Current Setting:  
0

**WWR - Southern Walls**

Window-Wall-Ratio (glazing area / gross wall area) interacts with window properties to impact daylighting, heating & cooling.

Current Setting:  
30%

**Window Shades - South**

Shades can reduce HVAC energy use. The impact depends on other factors, such as window size and solar heat gain properties.

Current Setting:  
2/3 Win Height

**Window Glass - South**

Glass properties control the amount of daylight, heat transfer & solar heat gain into the building, along with other factors.

Current Setting:  
Trp LoE

# Top-10-Themen des Verwaltungsrates

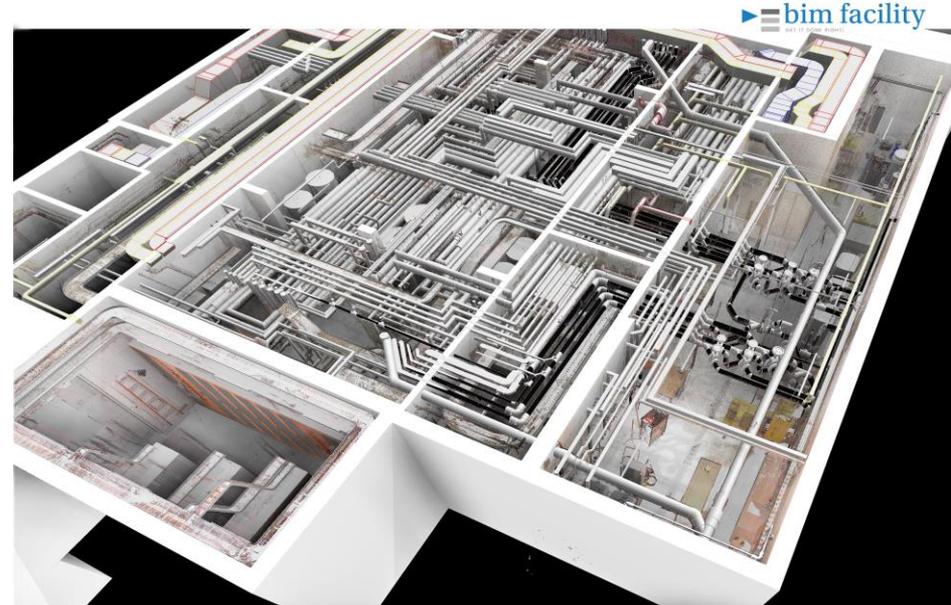
(swissVR Monitor I/2019; Veränderung zu I/2018; Ausblick nächste 12 Monate)

	Rang I/2019		Rang I/2018	Nächste 12 Monate	Themen
	1 (38%)		2 (38%)	2 (37%)	Digitalisierung / Robotik / Automatisierung
	2 (35%)		1 (40%)	1 (39%)	Effizienzsteigerung / Optimierung interner Prozesse
	3 (30%)		3 (35%)	10 (18%)	Erarbeitung einer neuen Unternehmensstrategie
	4 (28%)		4 (32%)	6 (25%)	Personelle Herausforderungen auf Ebene der Geschäftsleitung
	4 (28%)		6 (25%)	3 (31%)	Go-to-Market (Markt- und Absatzstrategie)
	6 (26%)		10 (23%)	4 (29%)	Reaktion auf Marktentwicklung / Wettbewerbsverhalten
	7 (25%)		5 (27%)	4 (29%)	Talent (einschliesslich Recruiting, Retention etc.)
	8 (24%)		11 (22%)	11 (17%)	Corporate Transactions (Akquisitionen, Kooperationen, Fusionen)
	9 (22%)		n/a	7 (21%)	Unternehmenskultur
	10 (21%)		9 (24%)	15 (13%)	Compliance (Einhaltung von Gesetzen und internen Verhaltensrichtlinien)
 Strategie		 Organisation & Prozesse		 HR	 Compliance & Risk

# Bauen mit dem digitalen Zwilling

## Vorteile:

- - 40% Vermeidung von unbezahlten Änderungen
- - 7-15% Prozent Einsparung auf die totale Bausumme
- Genauigkeit Kostenkalkulation 3%
- Minimierung der Projektlaufzeit – 10%
- Projektentwicklung und Entscheidungsfindung - 25%



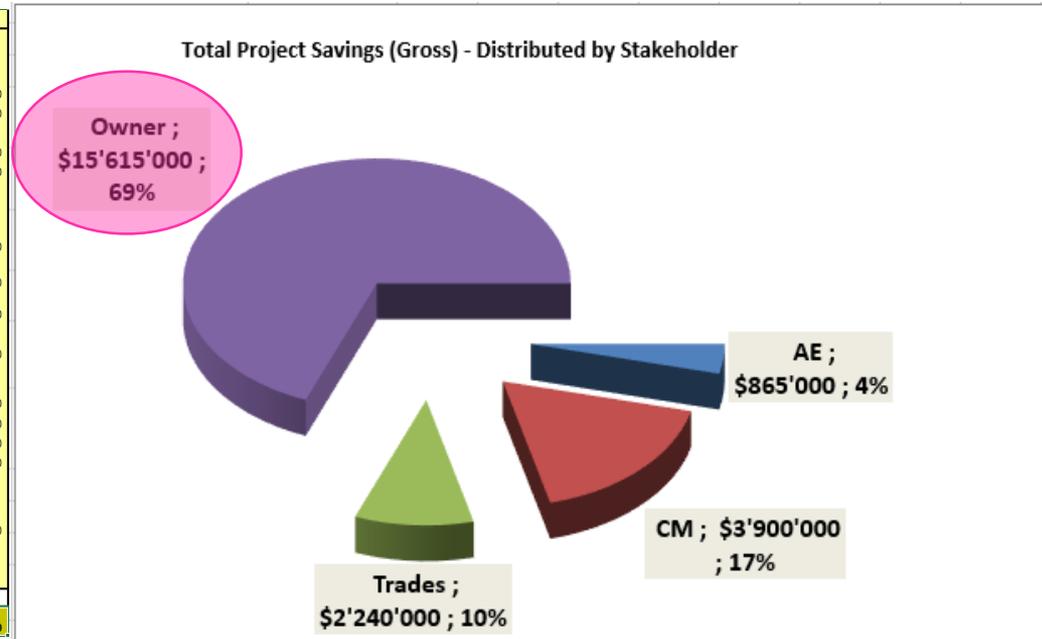
# Bauherr ist der grösste Gewinner beim Bauen mit BIM

Erfahrung aus über 200 ROI Workshops ADSK Consulting weltweit

Beispiel: 200 Mio Bauprojekt  
Einsparung: 11% Gesamt

Bauherr 69% davon = 16 Mio

Savings Description	Project Savings	AE	CM	Trades	Owner
Design Productivity - Parametrically Coordinated Documents	\$ (200'000)	\$ (200'000)			
Model Based Energy and Sustainability Analysis	\$ 2'400'000	\$ (100'000)			\$ 2'500'000
Fewer Owner Changes	\$ 3'000'000	\$ 100'000	\$ 200'000	\$ 200'000	\$ 2'500'000
Fewer and Leaner RFIs Addenda ASIs	\$ 1'000'000	\$ 200'000	\$ 400'000	\$ 400'000	
More Universally understood Scope of Project Design	\$ 2'000'000	\$ 300'000	\$ 400'000	\$ 300'000	\$ 1'000'000
Fewer Design Change Orders	\$ 800'000	\$ 100'000	\$ 100'000	\$ 100'000	\$ 500'000
Easier Quicker Visualization for the GC's, Subs, Inspectors	\$ 870'000	\$ 70'000	\$ 400'000	\$ 400'000	
Lower General Conditions for GC and Subcontractors Shorter Project	\$ 1'500'000		\$ 400'000	\$ 200'000	\$ 900'000
Deliver Earlier C of O and Information-Rich As-Built Model	\$ 4'500'000		\$ 100'000		\$ 4'400'000
Lower Printing, Packing, Copying, Shipping, Receiving, Distributing	\$ 300'000	\$ 50'000	\$ 150'000	\$ 50'000	\$ 50'000
More Organized Efficient Document Management System	\$ 100'000	\$ 25'000	\$ 25'000	\$ 25'000	\$ 25'000
Lower Prices, Less Anticipated Risk by Subcontractors - Prefabrication and Just in Time Deliveries	\$ 1'500'000				\$ 1'500'000
Overall Design Duration	\$ 800'000	\$ 300'000			\$ 500'000
Faster More Accurate Prices	\$ 200'000				\$ 200'000
Smaller, more focused Team	\$ 150'000	\$ 20'000	\$ 50'000	\$ 40'000	\$ 40'000
Higher Quality Facility, Fewer Warranty Problems	\$ 300'000		\$ 150'000	\$ 150'000	
3D and 4D Visualization Logistics/Sequencing Studies - Efficiencies	\$ 3'350'000		\$ 1'500'000	\$ 350'000	\$ 1'500'000
Field BIM - Safer Site, More Control, Digital Survey, Crew Tracking	\$ 50'000		\$ 25'000	\$ 25'000	
		AE	CM	Trades	Owner
<b>Total Anticipated Savings - (Gross)</b>	<b>\$ 22'620'000</b>	<b>\$ 865'000</b>	<b>\$ 3'900'000</b>	<b>\$ 2'240'000</b>	<b>\$ 15'615'000</b>

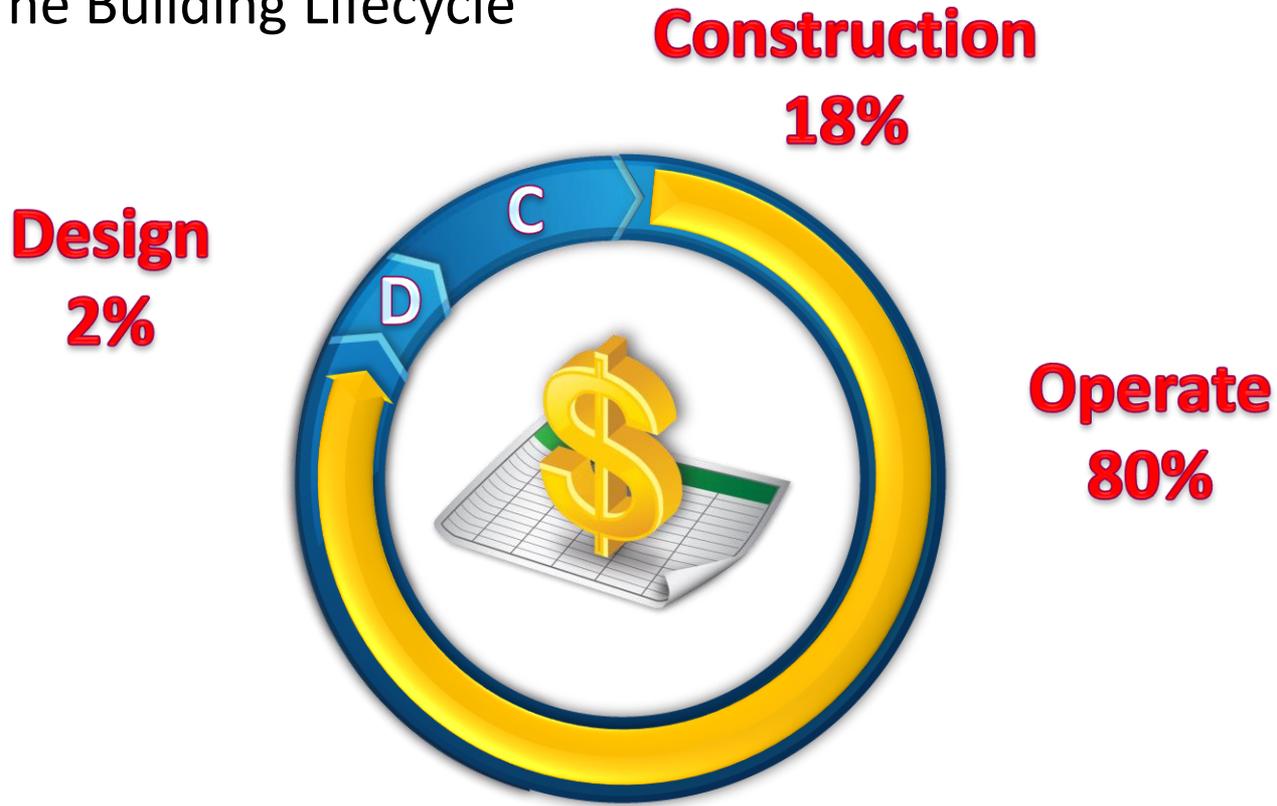


# Digitaler Zwilling über alle Assets



• BIM Process

# The Building Lifecycle

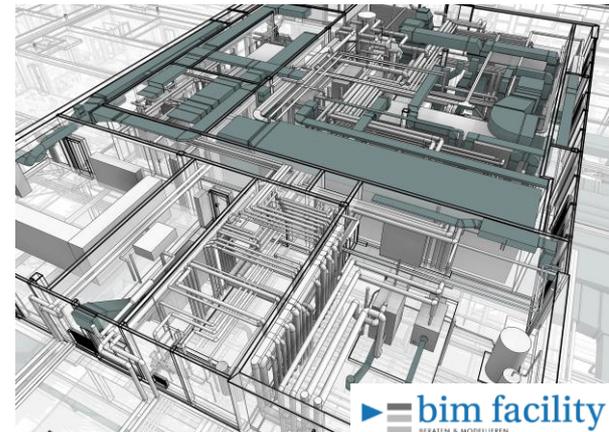


**Building Lifecycle Cost**

# Digitaler Zwilling im Betrieb

Vorteile:

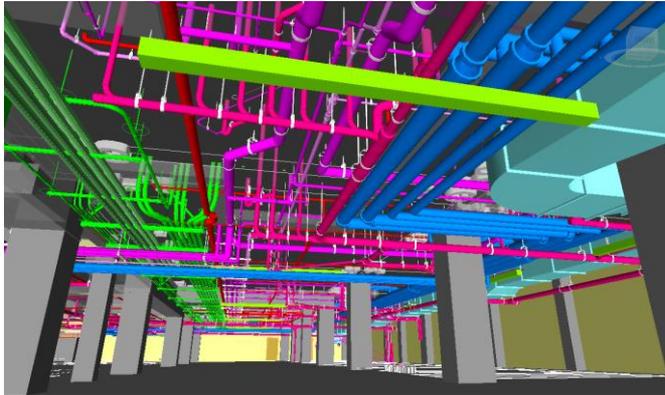
- Einsparung Zeit, 6-24 Monate beim Übergang in Betrieb
- 30% Einsparung Betriebskosten
  - Energie
  - Abläufe innerhalb des Gebäudes ausgerichtet auf die jeweilige Aufgabe
  - Abläufe für die Wartungsfirma



# FM mit BIM (Royal Dutch BAM)

## Vorteile:

- 45% Verbesserung bei Vergleichbarer Servicequalität
- 54% Verbesserung bei Fertigstellung geplanter Wartungsarbeiten
- 25min Einsparung pro Auftrag



IFMA International Facility Management Association

SPOTLIGHT

### Introduction · Reid Cunningham



**BAM FM**

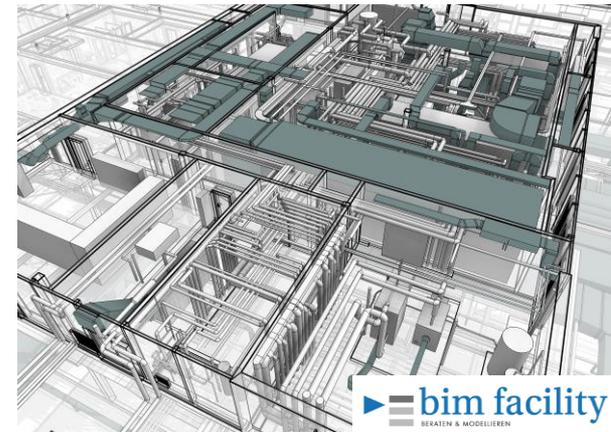
- 60% turnover in PFI
- Public sector health, education, law & order, public sector accommodation
- Long term (25 to 30 years)
- Performance / Availability
- Fixed price
- 40% turnover in maintenance
- Commercial sector
- Static & mobile engineers/technicians

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# Digitaler Zwilling im Assetmanagement

Vorteile:

- Verkauf/Vermietung dank Visualisierung ab Modell
- Verkauf/Vermietung dank einfacher Simulation von Betriebsabläufen und Optimierung mit IOT und BIM
- Verkauf/Vermietung dank Transparenz, welche Materialien und Komponenten sind aktuell verbaut!





**Asset Wert steigt signifikant**



# Performance of the digital Twin

 **bim facility**  **AUTODESK.**  
BEKATTEN & MODELLEEREN

