Case Study – Scan to BIM
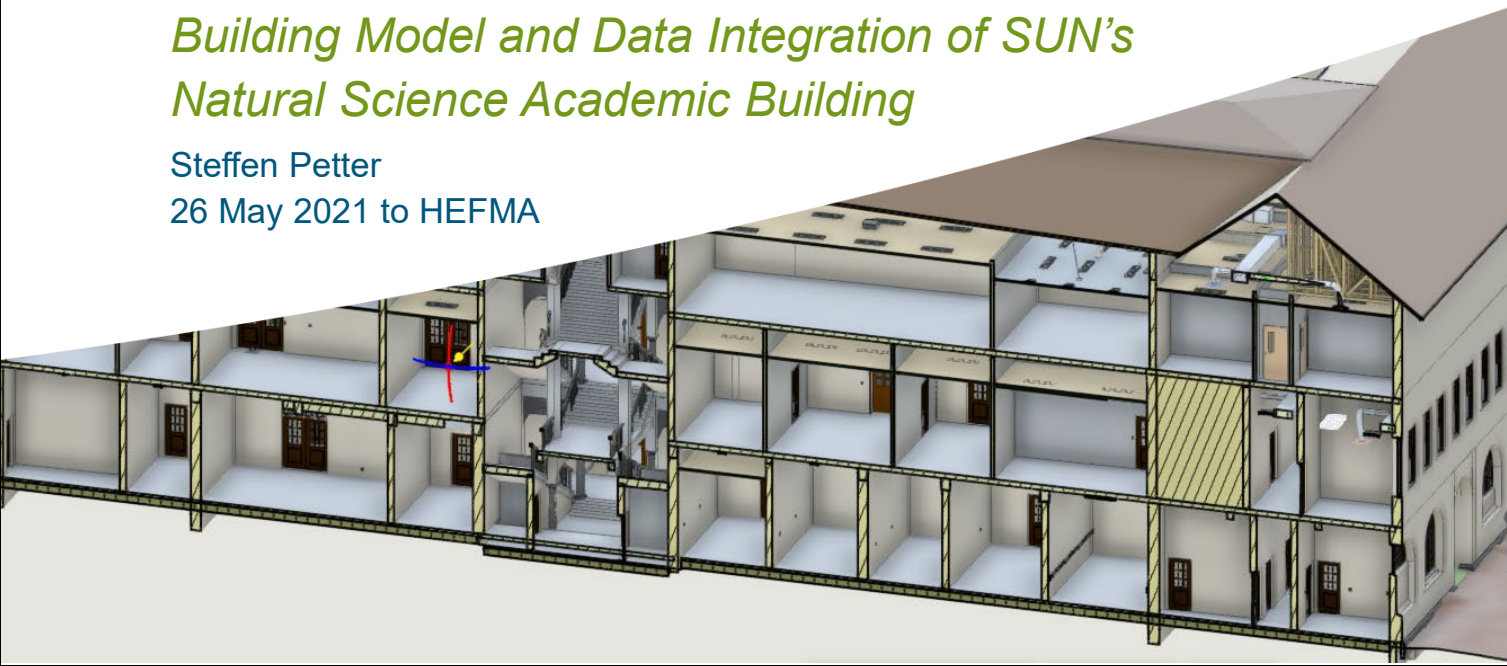
Building Model and Data Integration of SUN's Natural Science Academic Building

Steffen Petter
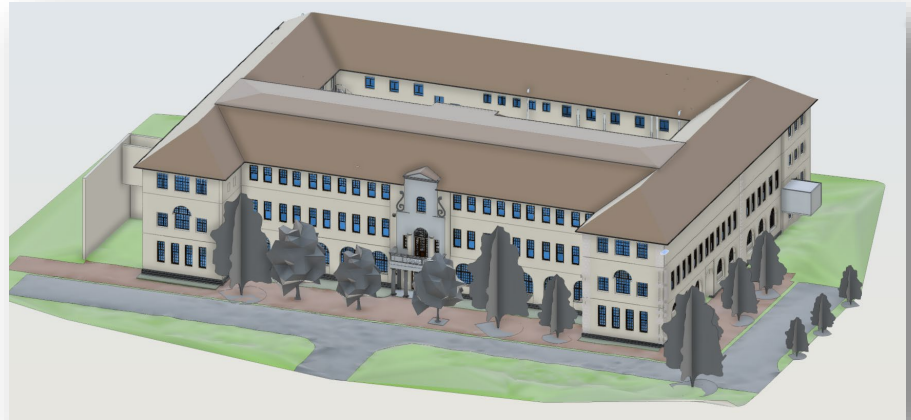26 May 2021 to HEFMA

Content

- Project Context

- Approach and Process

- BIM Framework

- Scanning

- Modelling – Reverse Engineering

- Data Exchange and Integration

- Embedding into GIS

- Questions and Discussions

Royal HaskoningDHV

Project Context

- Pilot Project of Stellenbosch University to scan an existing building and create a building information model from the visible areas and services

- The data model should be based on best practice but also with the view of future integration and interoperability with other systems of the university, such as Planon and GIS

- Development of an initial information requirement framework

- Proof of concept

Under Construction

Scanned Area

Royal HaskoningDHV
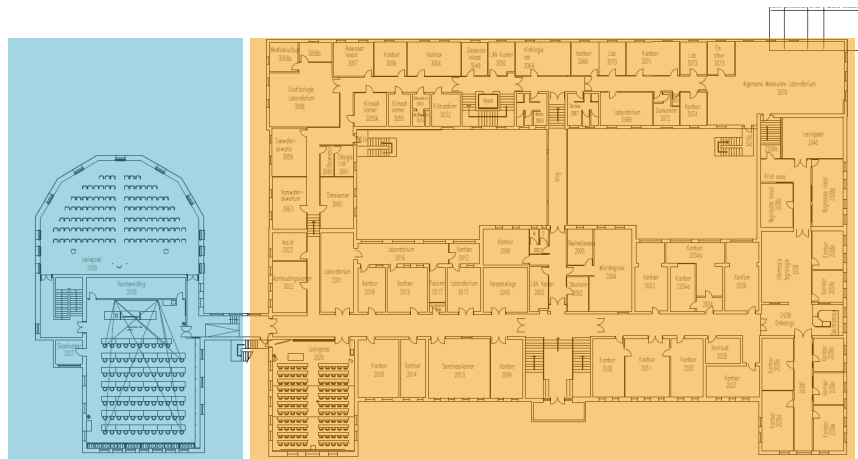
Approach and Process

SCAN to BIM to AM PROCESS

Royal HaskoningDHV

SCAN TO BIM PROCESS

SCAN TO BIM	FULL SERVICES & INTERIOR MODEL	INFORMATION INTEGRATION

SCAN TO BIM

CLIENT ENGAGEMENT. EXPLORING CLIENT REQUIREMENTS (EIR)

PLANNING & STRUCTURING

EMPLOYER'S INFORMATION REQUIREMENTS (EIR)

BIM EXECUTION PLAN (BEP)

EXISTING DATA EXCHANGE

EXISTING LAYOUT DWG'S

ADDITIONAL INFORMATION AVAILABLE?

PRE-PLANNING
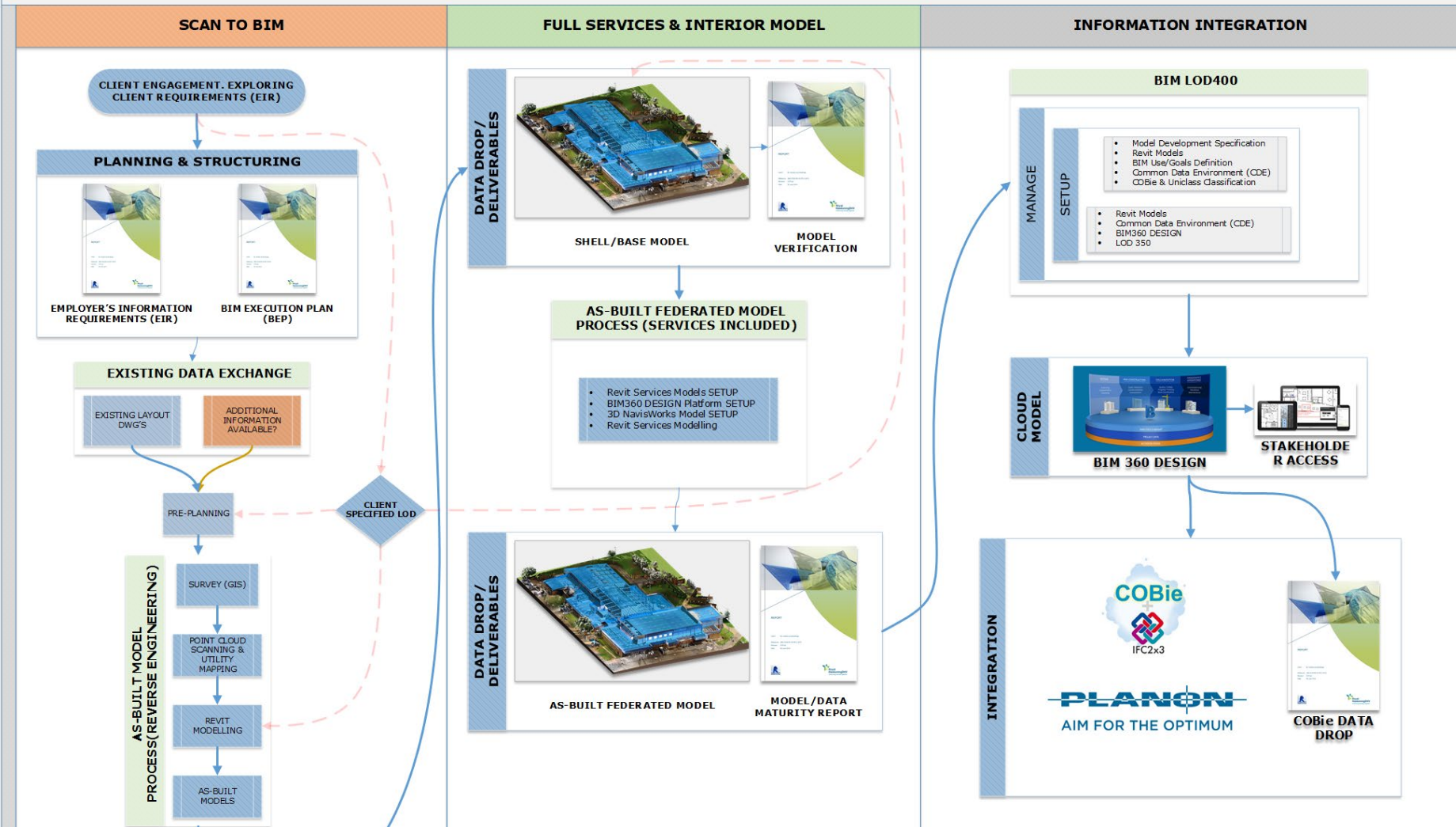
CLIENT SPECIFIED LOD

SURVEY (GIS)

POINT CLOUD SCANNING & UTILITY MAPPING

REVIT MODELLING

AS-BUILT MODELS

AS-BUILT MODEL PROCESS(REVERSE ENGINEERING)

FULL SERVICES & INTERIOR MODEL

DATA DROP / DELIVERABLES

SHELL/BASE MODEL

MODEL VERIFICATION

AS-BUILT FEDERATED MODEL PROCESS (SERVICES INCLUDED)

- Revit Services Models SETUP
- BIM360 DESIGN Platform SETUP
- 3D NavisWorks Model SETUP
- Revit Services Modelling

DATA DROP / DELIVERABLES

AS-BUILT FEDERATED MODEL

MODEL/DATA MATURITY REPORT

INFORMATION INTEGRATION

BIM LOD400

- Model Development Specification
- Revit Models
- BIM Use/Goals Definition
- Common Data Environment (CDE)
- COBie & Uniclass Classification

- Revit Models
- Common Data Environment (CDE)
- BIM360 DESIGN
- LOD 350

MANAGE

SETUP

CLOUD MODEL

BIM 360 DESIGN

STAKEHOLDER ACCESS

INTEGRATION

COBie

IFC2x3

PLANON

AIM FOR THE OPTIMUM

COBie DATA DROP

Selection of BIM Uses

	MATURITY	BIM USES	DESCRIPTION	BENEFIT RANKING	INDUSTRY USEAGE
3D	1	☐ 3D COORDINATION	Clash Detection	1.6	60.40%
	2	☑ DESIGN REVIEWS	Design Reviews in a Virtual Environment	1.37	53.50%
	3	☐ DESIGN AUTHORING	3D Modelling, Renderings, Schedules & Documentation	1.03	42.20%
	4	☐ CONSTRUCTION SYSTEM DESIGN	Construction Modelling	1.09	37.00%
	5	☑ EXISTING CONDITIONS MODELING	3D Laser scanning, Conventional surveying	1.16	35.20%
	6	☐ SITE UTILIZATION PLANNING	Rigging Modelling	0.99	28.20%
	7	☐ SITE ANALYSIS	Optimal Site Location & Orientation	0.85	27.70%
	8	☐ STRUCTURAL ANALYSIS	Structural Analysis	0.92	26.80%
	9	☐ MECHANICAL ANALYSIS	Heating and Cooling Loads	0.67	20.90%
	10	☐ LIGHTING ANALYSIS	Daylighting, Solar Shading and Lux Levels	0.73	16.90%
4D	11	☐ 3D CONTROL AND PLANNING	Machinery with GPS capabilities	1.1	34.40%
	12	☑ PROGRAMMING	URS & Phasing	0.97	30.70%
	13	☐ 4D MODELING	Construction Program Modeling	1.15	29.60%
5D	14	☐ COST ESTIMATION	Prelim Budgets, Cost Estimates, BOQ's and Quantity Take-offs	0.92	24.70%
	15	☐ DIGITAL FABRICATION	Fabrication Models	0.89	14.40%
6D	16	☐ ENERGY ANALYSIS	Building Energy Simulation	0.92	25.40%
	17	☐ SUSTAINABILITY GREEN STAR	Green Star Rating	0.93	23.00%
	18	☐ BUILDING SYSTEM ANALYSIS	Lighting Analysis, CFD airflow and Solar Analysis	0.86	22.30%
7D	19	☑ RECORD MODELING	Operation, Maintenance, and Asset data	0.89	28.20%
	20	☑ ASSET MANAGEMENT	Asset Information Model Linked to CMMS	0.47	9.60%
	21	☑ BUILDING MAINTENANCE	Maintenance Program Linked to CMMS	0.42	4.60%
	22	☐ SPACE MANAGEMENT	Space Management and Tracking Linked to CMMS	0.78	21.40%
	23	☐ DISASTER PLANNING	Building Automation System (BAS) Linked to CMMS	0.26	3.60%
	24	☐ CODE VALIDATION	Building Standards	0.77	18.90%

Royal HaskoningDHV

BIM Framework

- Engagement process (Client Journey) with client to determine the information requirements incl. data integration across organisational units
- Production of 3 major documents:
  - Organisation Information Requirements (OIR)
  - Asset Information Requirements (AIR)
  - Exchange Information Requirements (EIR)
- Systems integration by using attributes already applied:
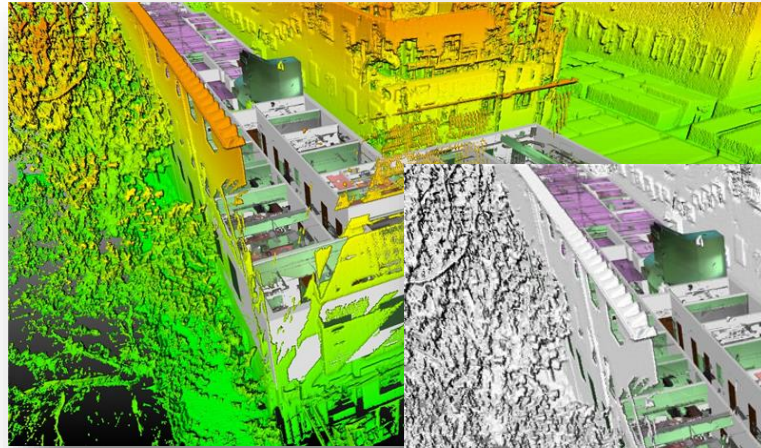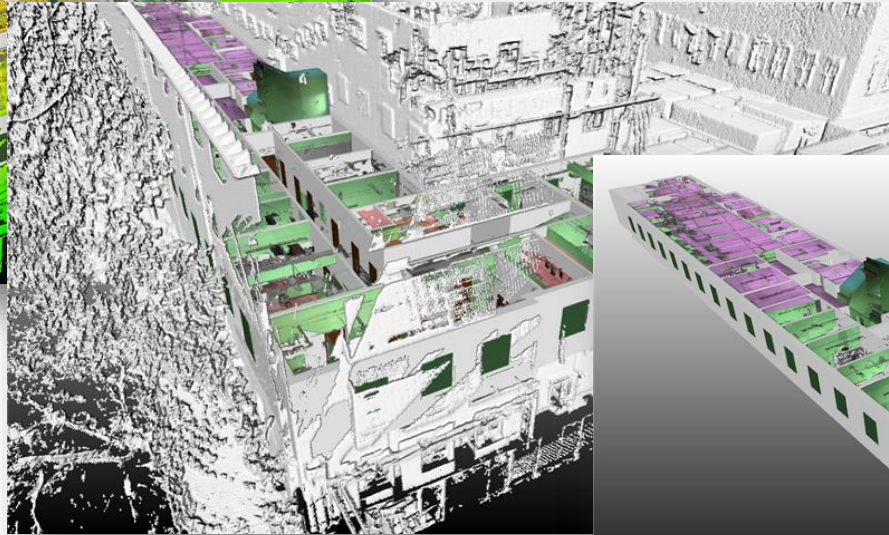 - Space tags,
  - Asset tags, etc.

Royal HaskoningDHV
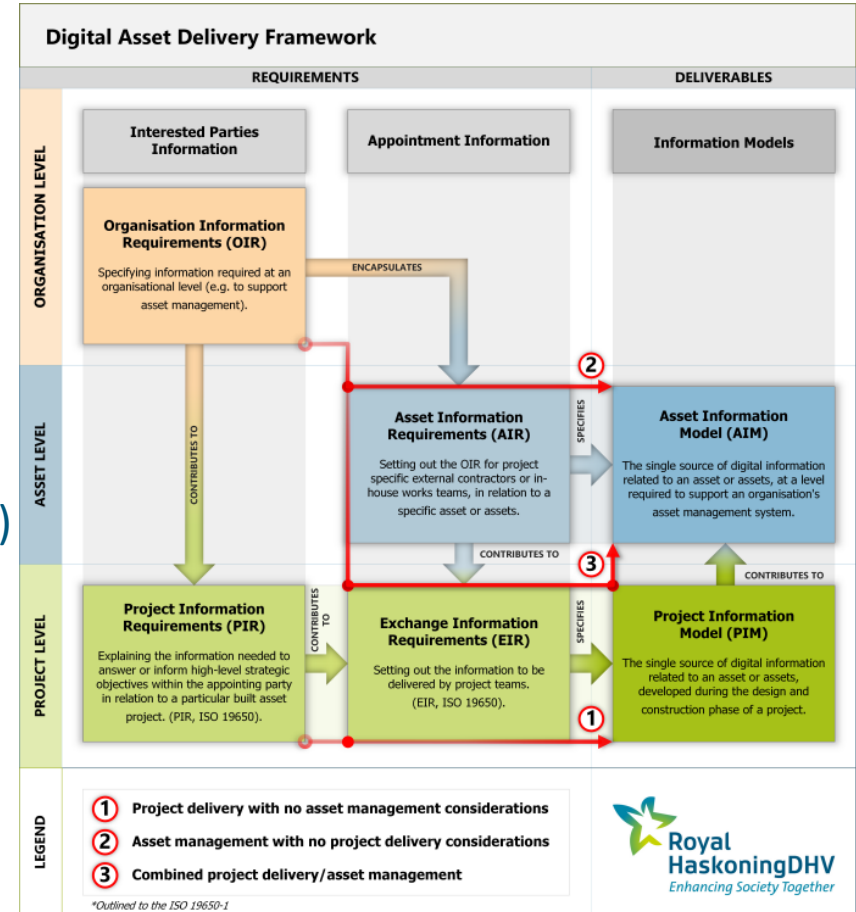
Scanning and Registration

Point Cloud Scan of 107GB data was produced over a 2 weeks process for 8000sqm scanned area
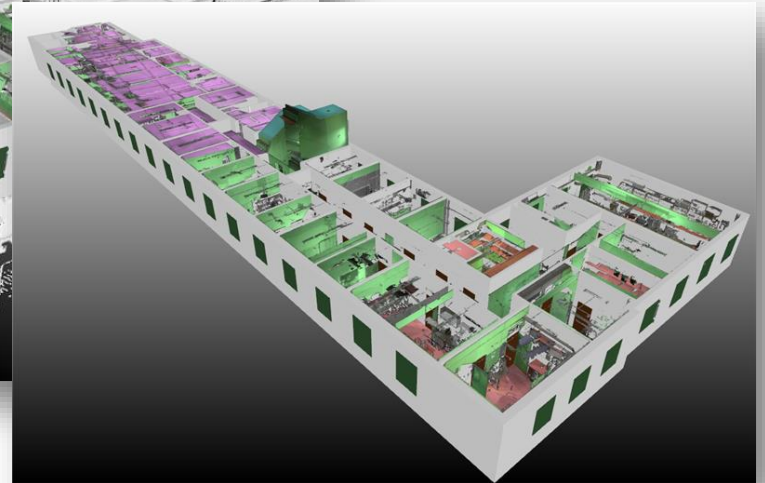
Royal HaskoningDHV

Modelling and Reverse Engineering

1) Analyse data and stitching point clouds

3) Building element definition and attributes assignments (Reverse Engineering)

2) Automatic shape registration via software (Mesh model)

Royal HaskoningDHV

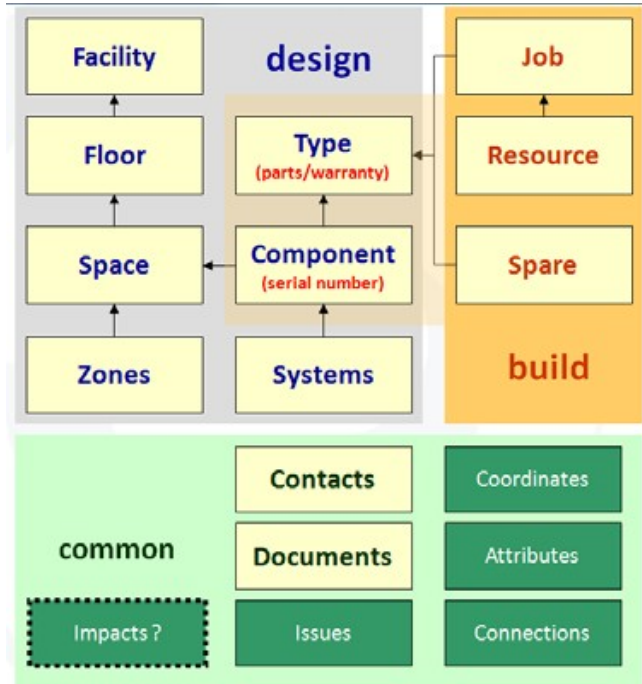# Check and Verification

Vlak 2 (Suid) en 3 (Noord)

Royal HaskoningDHV

Data Exchange and Integration

Construction Operation Building information exchange (COBie)

- Building Information Model structured according to UNICLASS 2015 (as outcome of Asset Information Requirements) -> Planon supports data exchange based on structured data: Uniclass, COBie
- Adding client specific attributes e.g. SpaceTags and Asset Identifier amongst others to enable information exchange between systems

Royal HaskoningDHV

Integration of Planon

- Mapping based on unique identifier (space id)
- Revit export to Excel for tabular mapping (space id to room incl. additional info)
- Re-import into BIM model
- COBie mapping (incl. SUN specific attributes)

SUN	Revit	COBie	Type	Group
ROOM NUMBER	Number		Text	Indentity Data
BUILDING	SUNBuildingNumber		Text	Indentity Data
Match "FLOOR"	*Level*		*Text*	*Indentity Data*
FLOOR	SUNFloor		Integer	Indentity Data
DESCRIP	Name		Text	Indentity Data
OUCODE	SUNOuCode		Integer	Indentity Data
SOCCATEGOR	SUNSocCategor		Integer	Indentity Data
ROOM CODE	SUNRoomCode		Text	Indentity Data
SPACECATEG	SUNSpaceCateg		Integer	Indentity Data
SPACEID	SUNSpaceID		Integer	Indentity Data
STATIONS	SUNStations		Integer	Indentity Data
Match "SQM"	*Area*		*Area*	*Indentity Data*
SQM	SUNSqm		Area	Indentity Data
Building Name	Building Name		Text	Indentity Data
SITE_NAME	SUNSiteName		Text	Indentity Data
FACULTY	SUNFaculty		Text	Indentity Data
DEPART	SUNDepart		Text	Indentity Data

SUN Shared Parameter
Revit built in Parameter

Royal HaskoningDHV

Embedding BIM into GIS via ArcGIS Web AppBuilder

SUN Campus Map Link

Royal HaskoningDHV
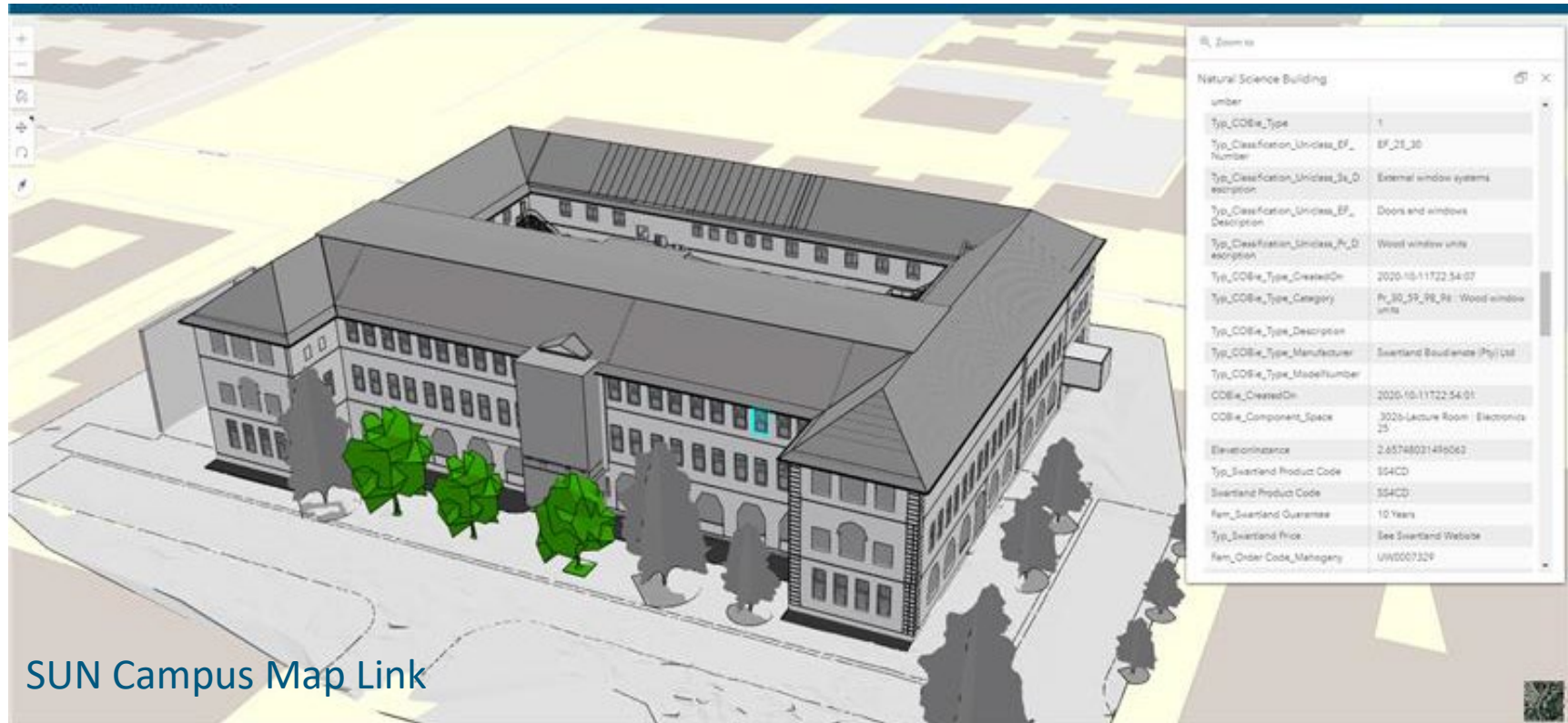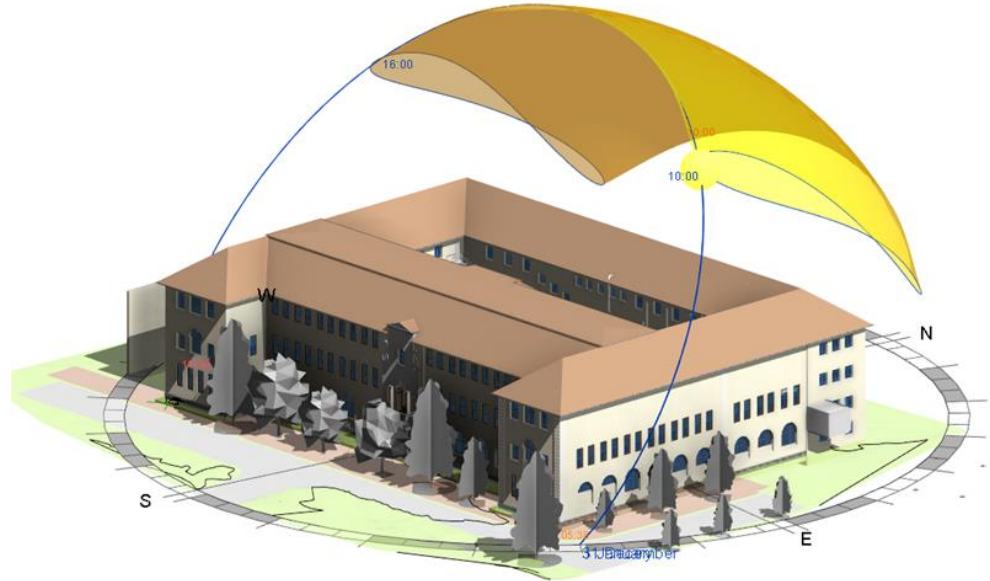
Questions ? (after presentations)

Space Planning

Solar Study

Royal HaskoningDHV