

**DLA 2018**

Digital Landscape Architecture

May 30 – June 02 in Freising

HOCHSCHULE  
**WEIHENSTEPHAN-TRIEDORF**  
UNIVERSITY OF APPLIED SCIENCES



**DLA 2018 Workshop**  
**The integration of BIM and GIS –**  
**Depicted by current landscape planning examples**

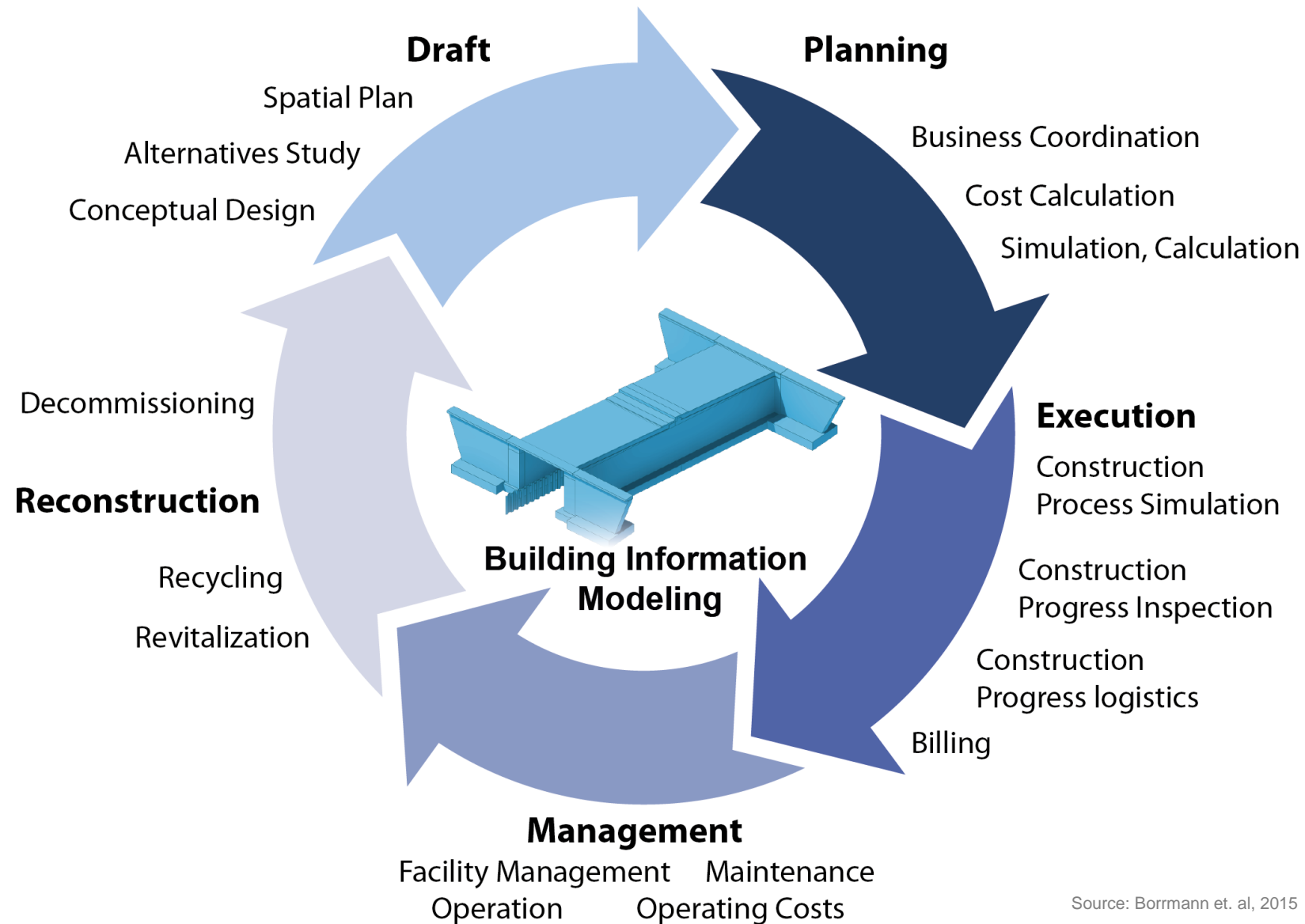
Jörg Schaller, Johannes Gnädinger, Leon Reith

JUNE 91, 2018 4:30 pm to 6:0 pm

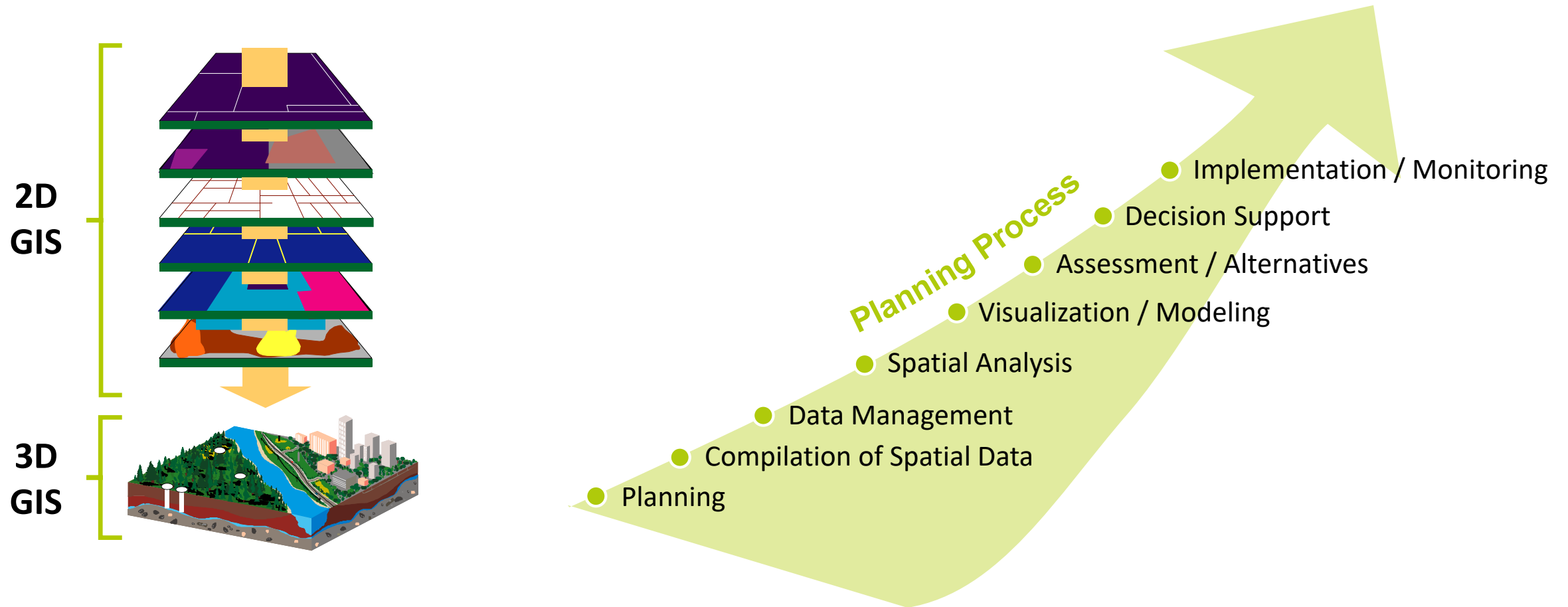
Building/Room D1.310 at Hochschule Weihenstephan-Triesdorf

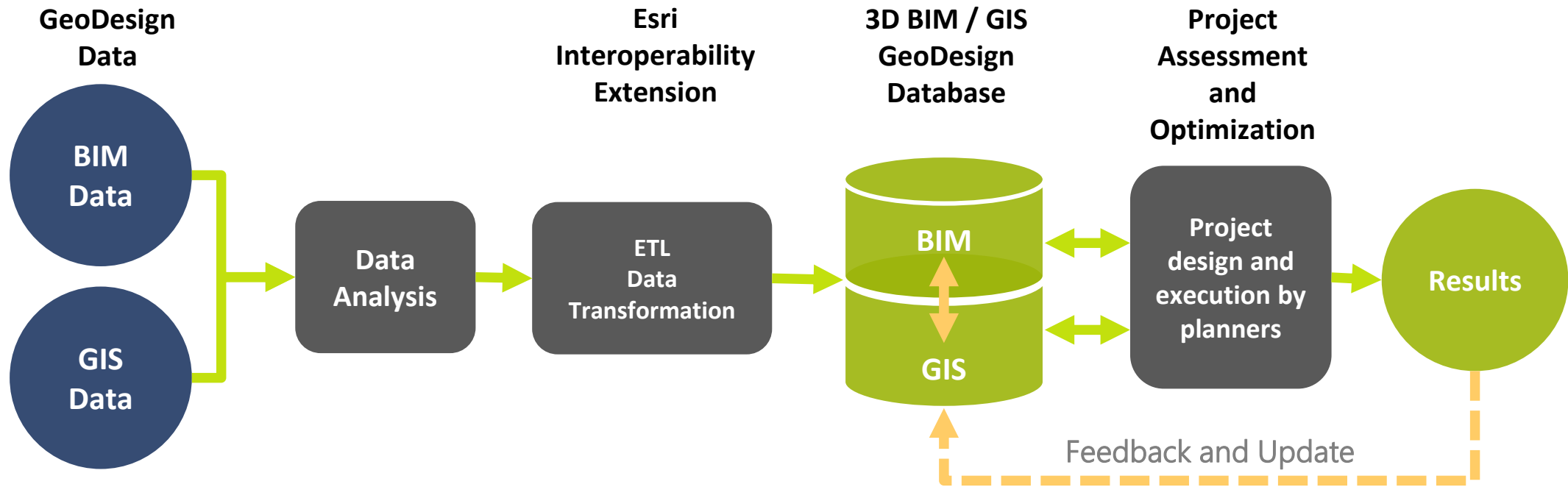


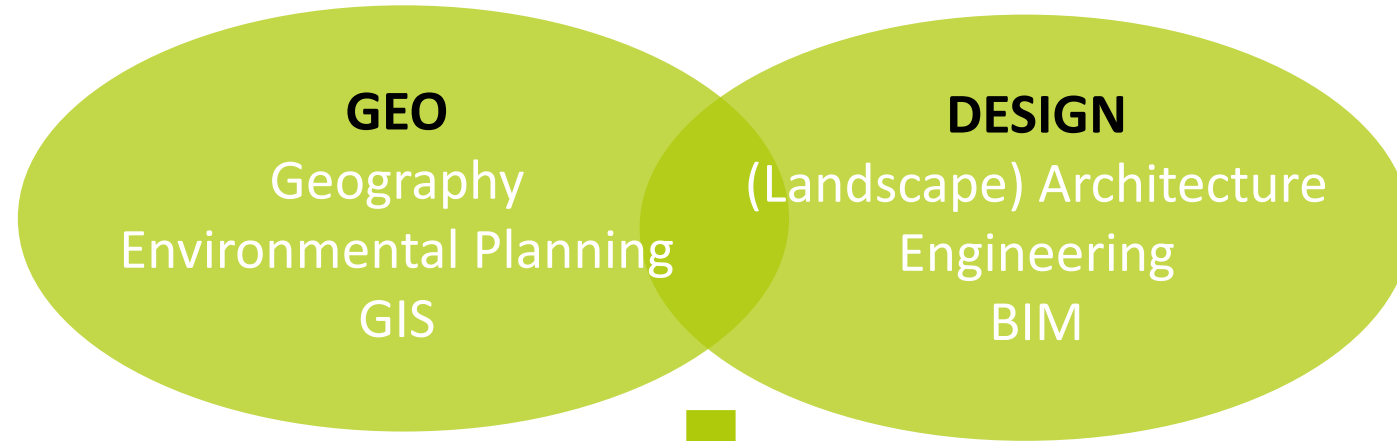
Prof. Schaller UmweltConsult | PSU  
info@psu-schaller.de  
www.psu-schaller.de



Source: Borrmann et. al, 2015



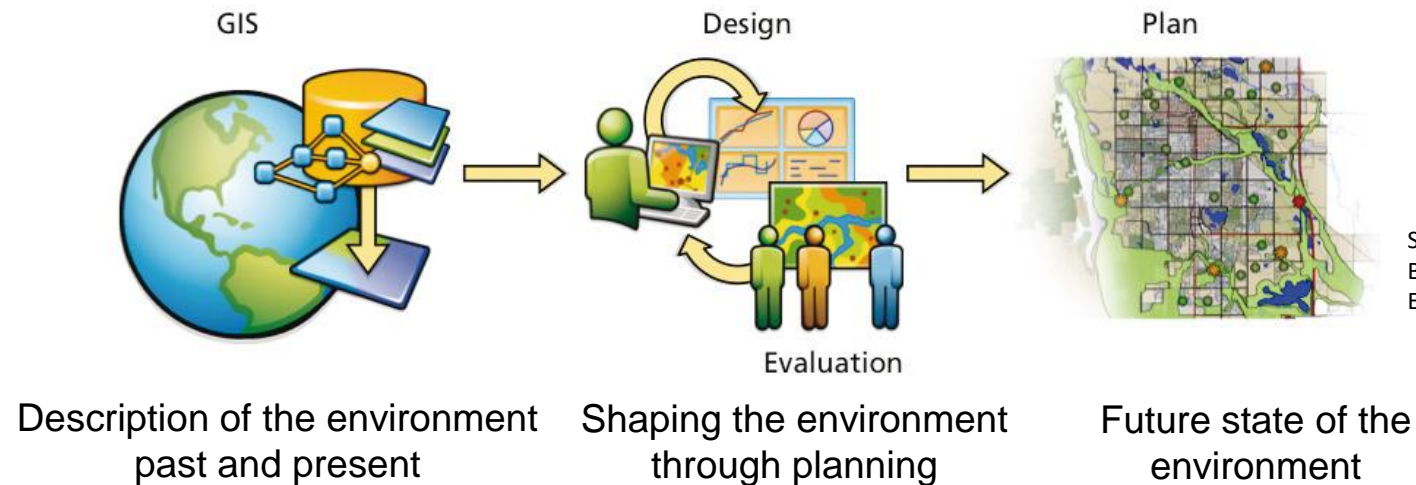




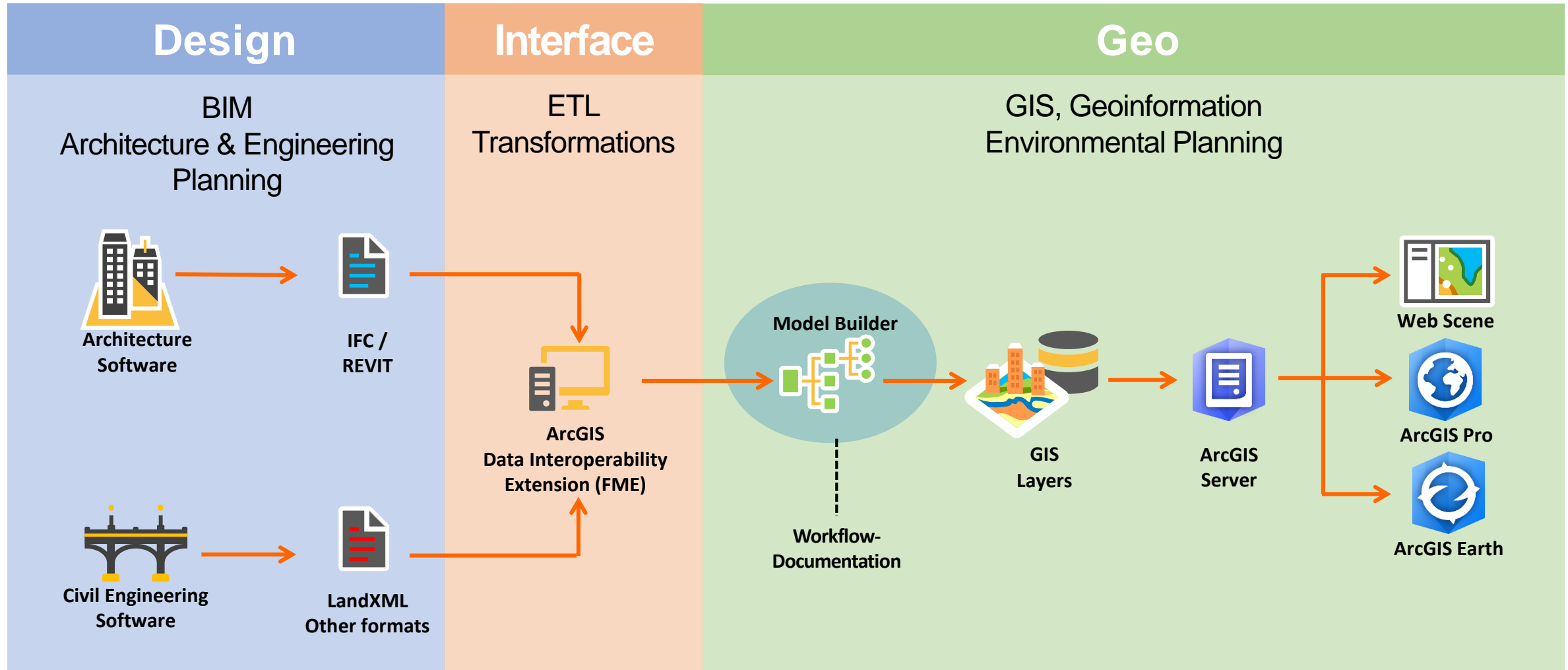
## GeoDesign Concept

“Creativity is the synopsis between two normally independent ways of thinking”

... Arthur Koestler



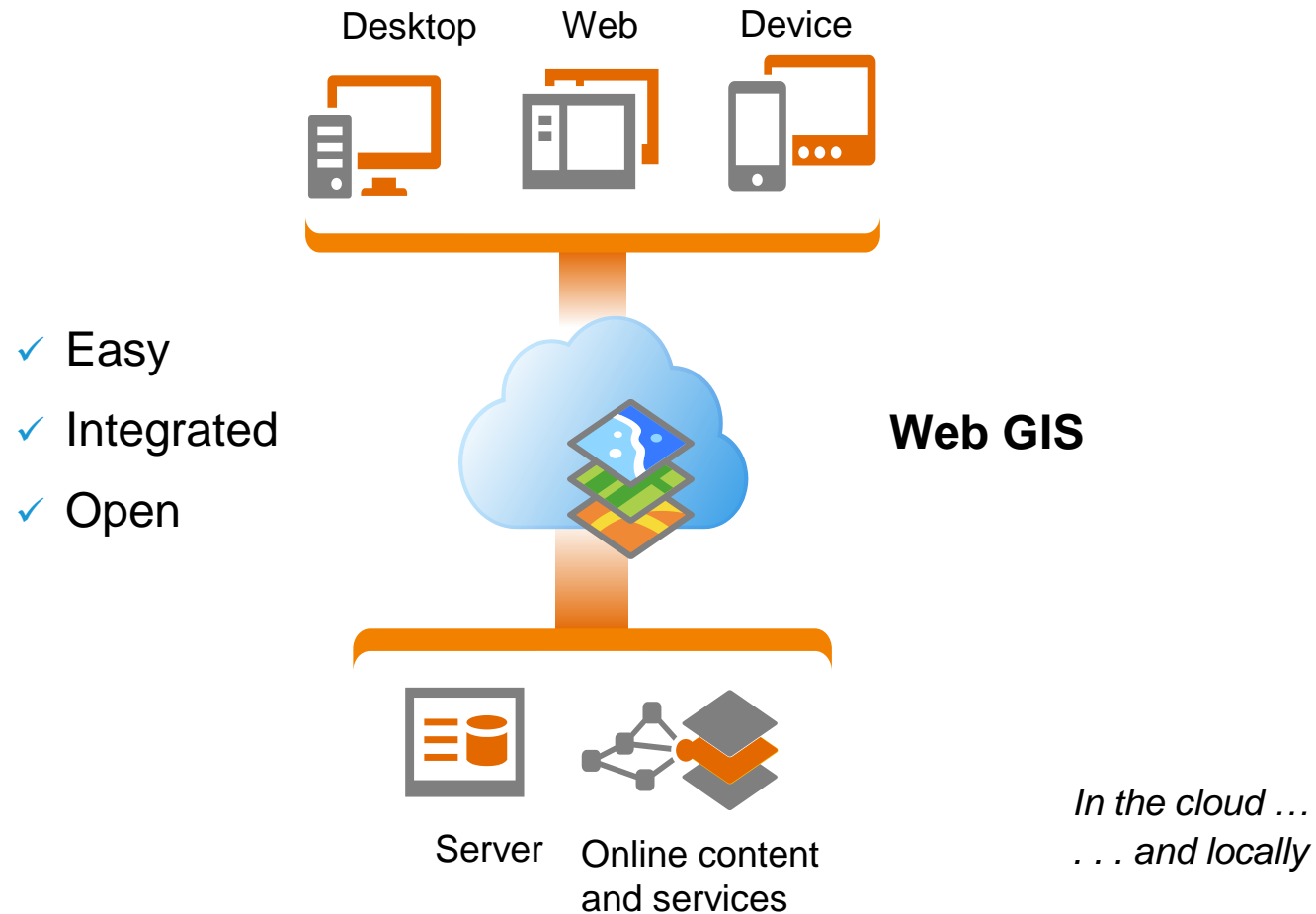
Source:  
 Bill Miller  
 Esri modified



## BIM and GIS data exchange, integration and evaluation

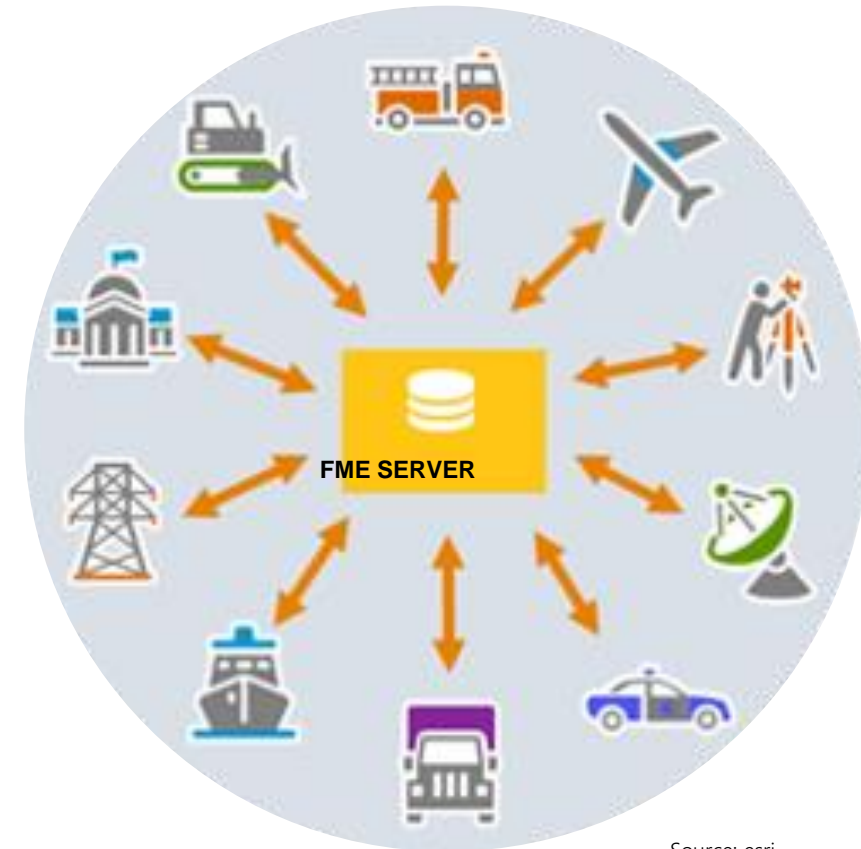
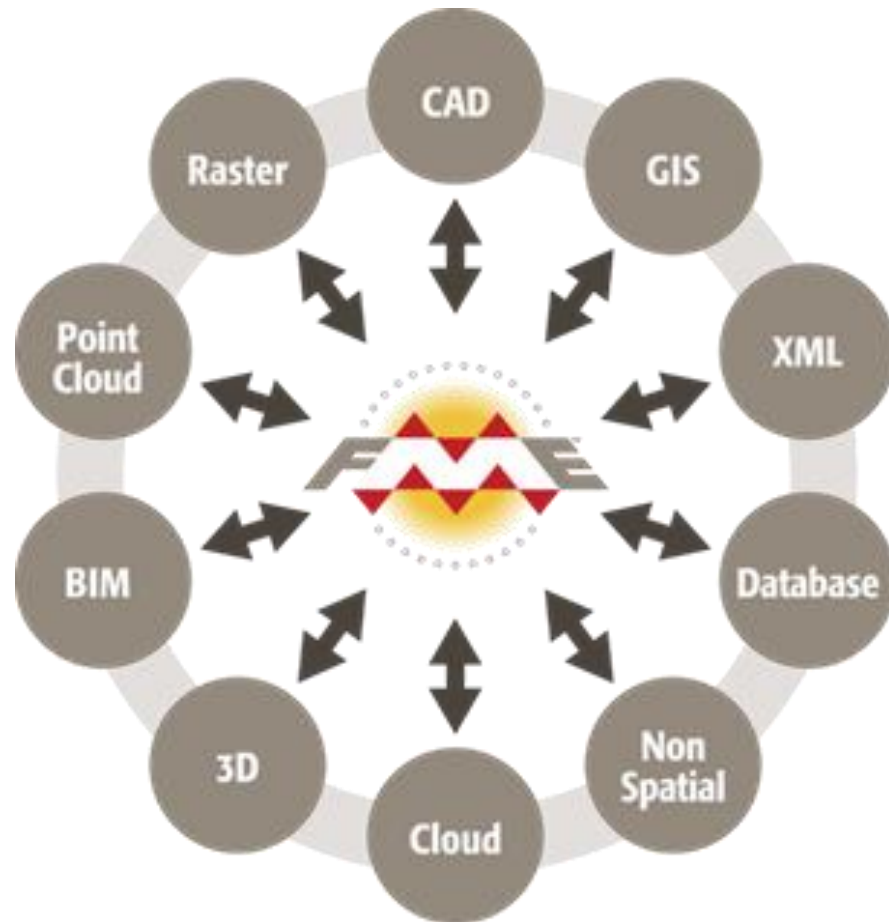
- Easy transfer of BIM data to the GIS environment database with the Esri ArcGIS Interoperability Extension ETL process, georeferencing
- Data exchange between BIM and GIS data
- Development of a shared 2D and 3D spatial data structure for engineering and environmental planners
- Integration of elevation models and survey data
- Integrated analysis and visualization of the building in the landscape

Mapping, analysis and management and exchange of geographical information

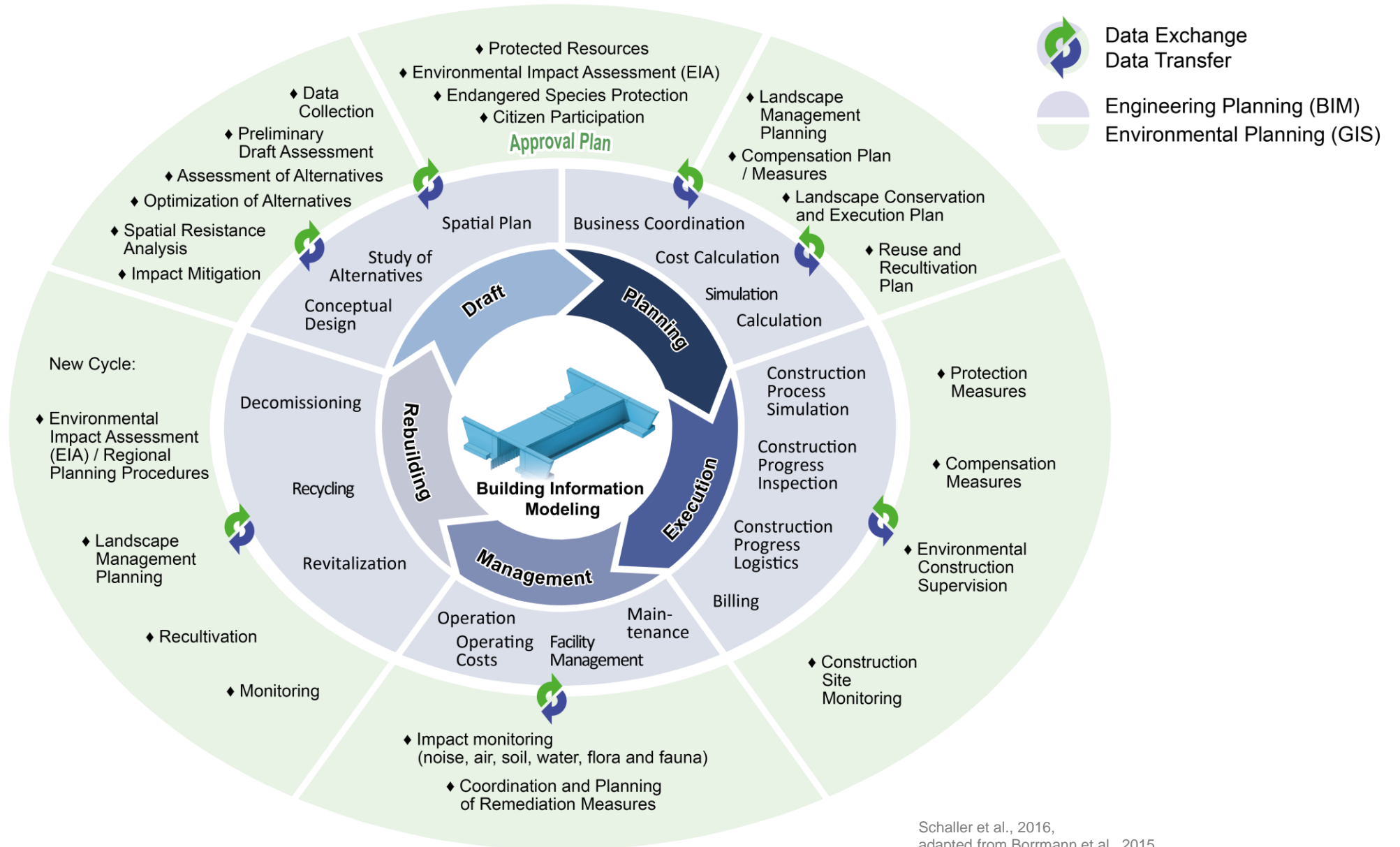




Data exchange utilizing the Esri Interoperability Extension, based on FME-Technology

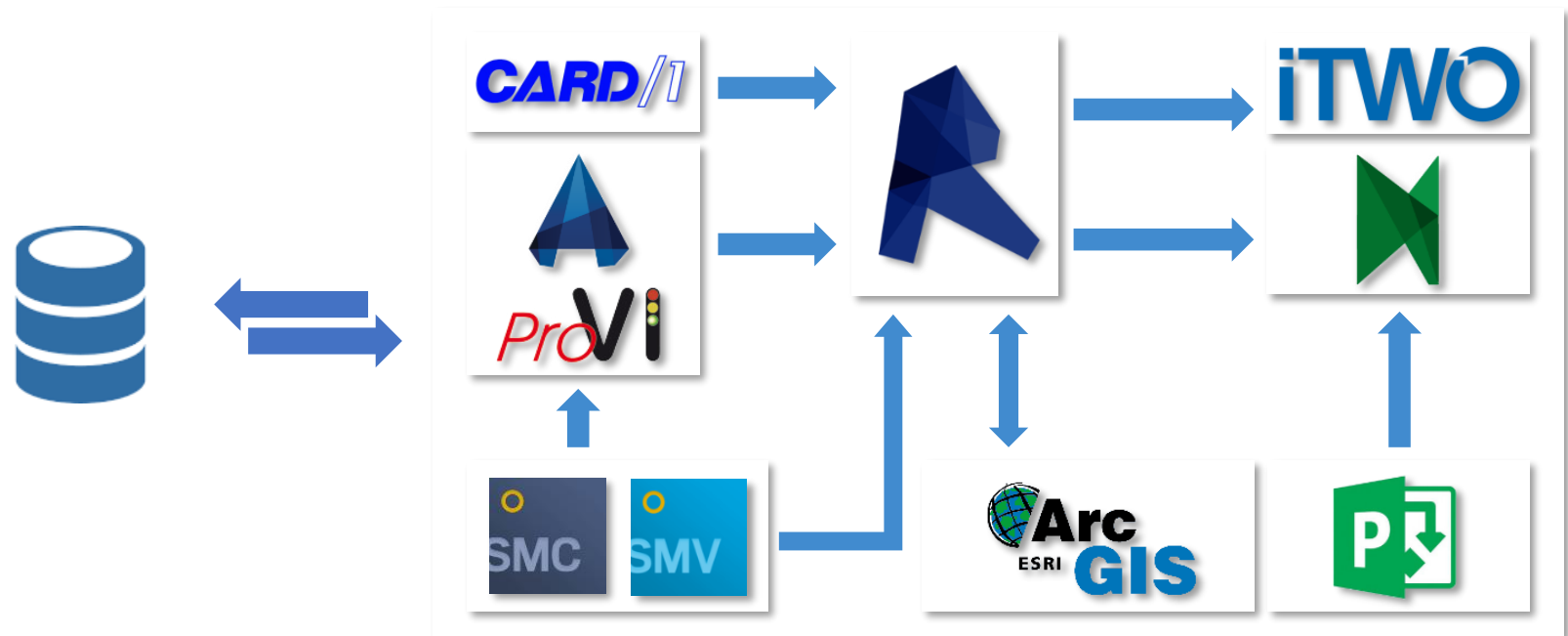


Source: esri



## Single point of truth - central storage location

- Process-oriented filing of models according to service phases
- Storage of graphical and text-oriented data
- Access via rights structure / roles of the participants (e.g. e-mail and password)
- Models in the CDE are always in one of four states:
  - WIP (work in progress)
  - Shared
  - Published
  - Archived

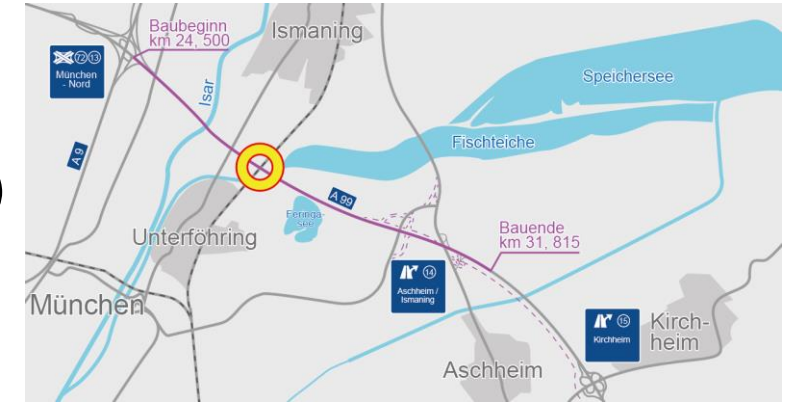


# BIM and GIS Integration

A99-motorway expansion  
and environmental planning

## A99 Federal Motorway Expansion

- Pilot Project of the Federal Ministry of Transportation (BMVI)
- Eight-lane expansion of Autobahn A99 in the Munich Region
- Replacement of the bridge structure over the railway line



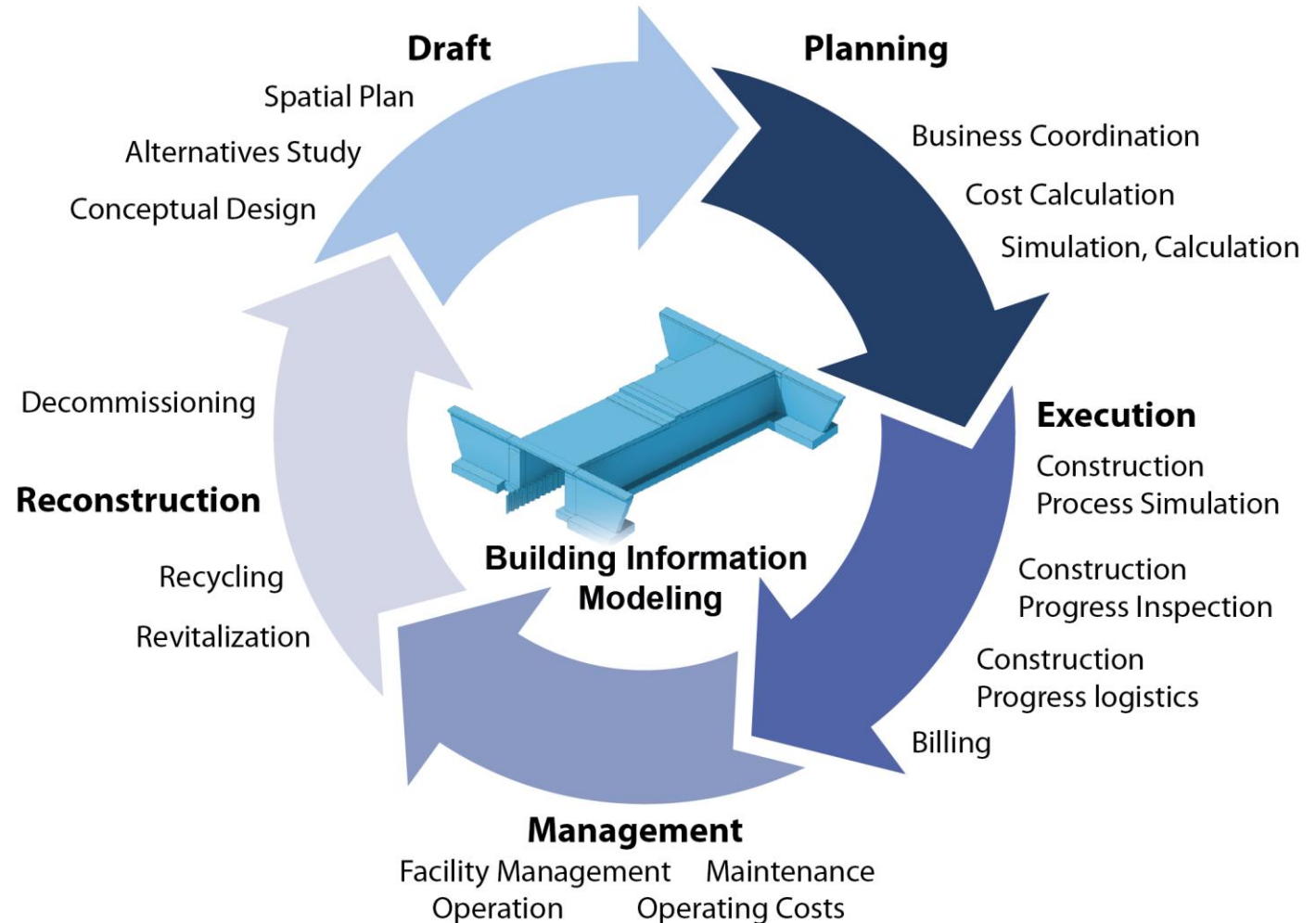
SSF Ingenieure

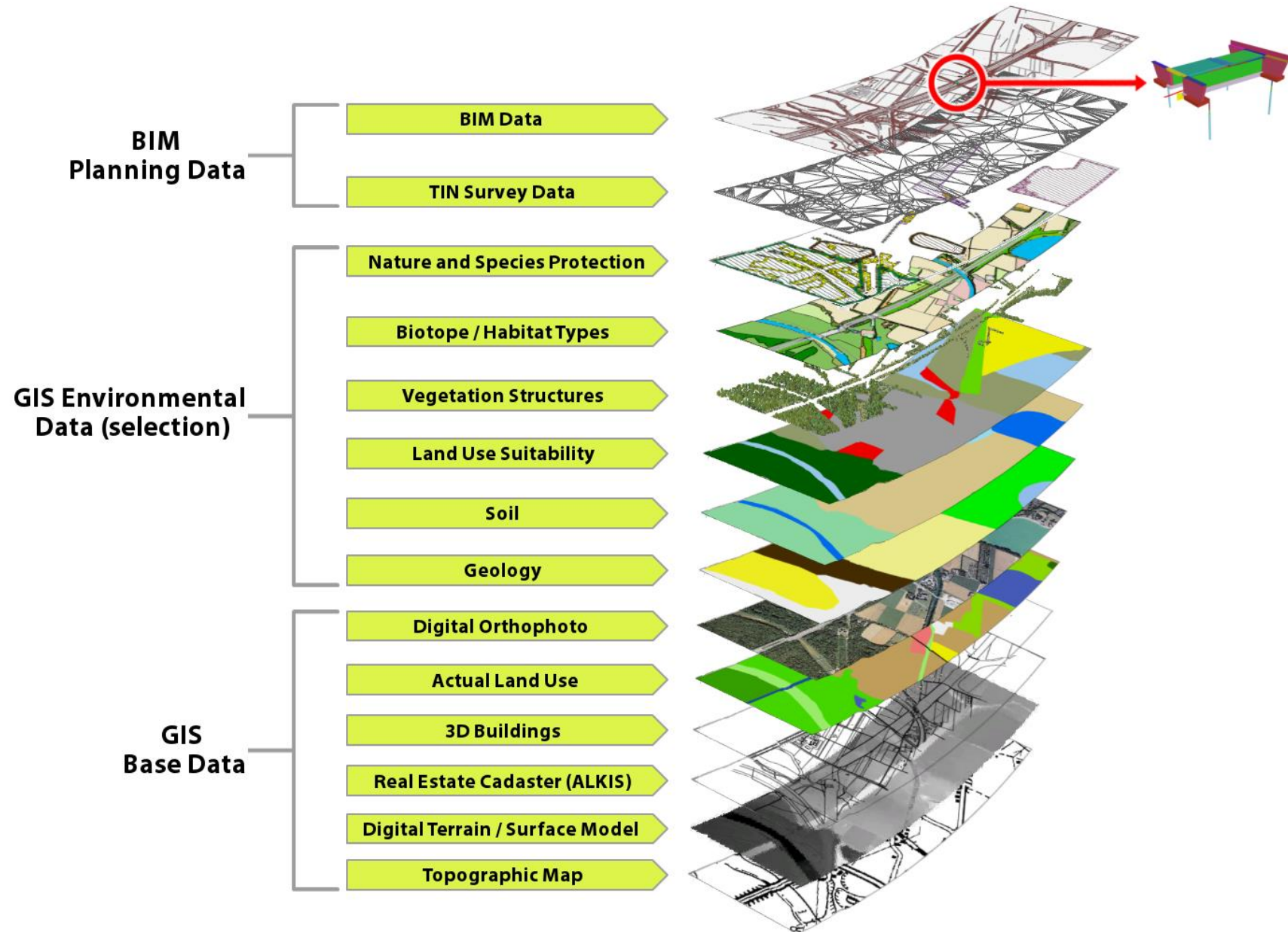
Autobahndirektion Südbayern



- „BIM is based on the idea of a continuous use of a **3D** digital **CAD** building or infrastructure model over the entire **life-cycle** of an engineering or architectural construction project – from design to planning, execution, operation and decommissioning of the project”

Source: Borrmann et. al, 2015





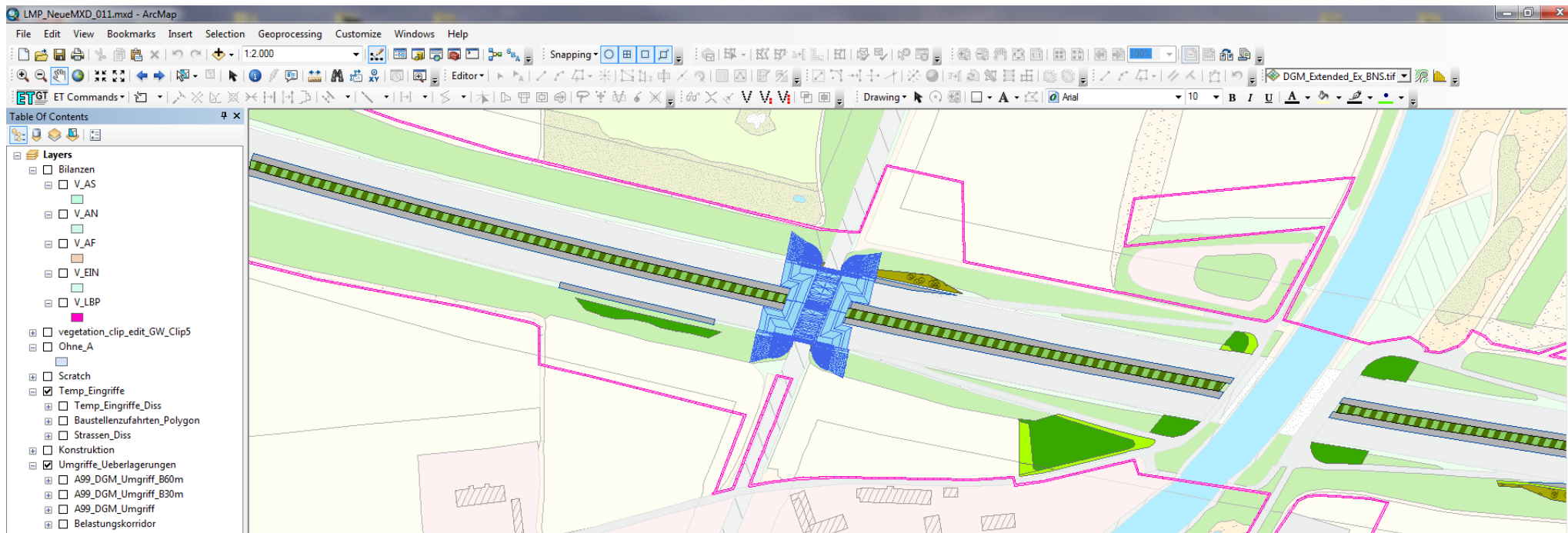
- The BIM/GIS Integration allows:

- Environmental impact assessment
- Nature and species protection requirements
- Landscape Management Planning and execution planning
- Landscape compensation measures
- Ecological construction monitoring and environmental monitoring

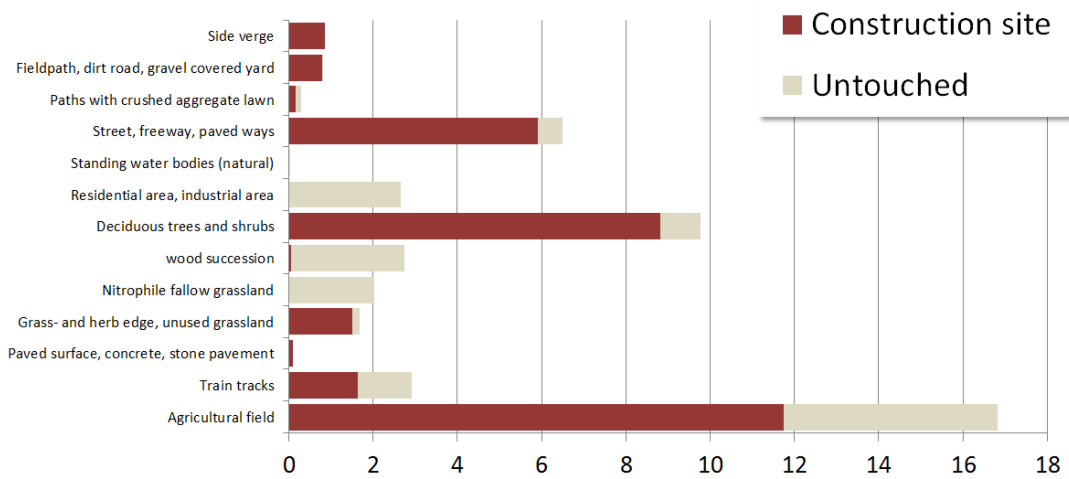
Integration of the structure into the 3D-GIS-Geo and environmental data model



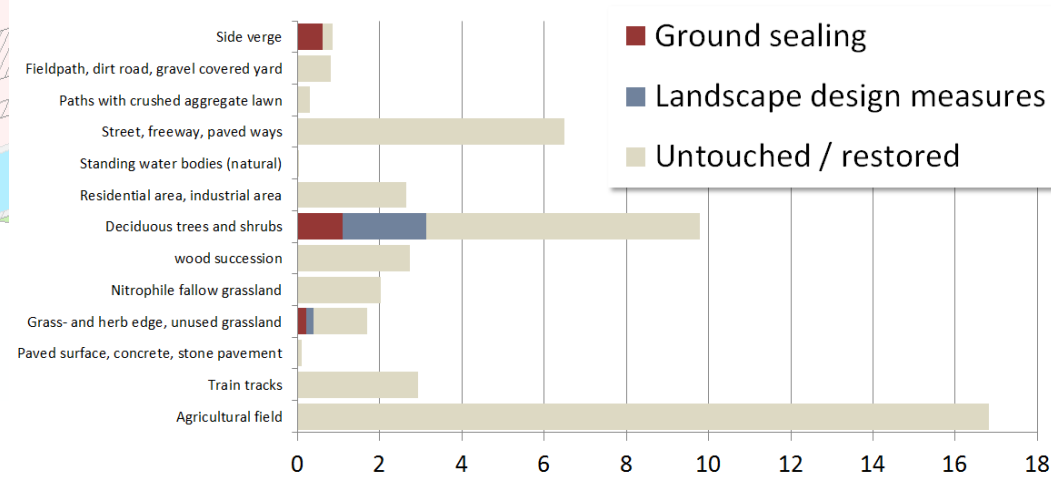




**IMPACTS in 1000 m<sup>2</sup>**

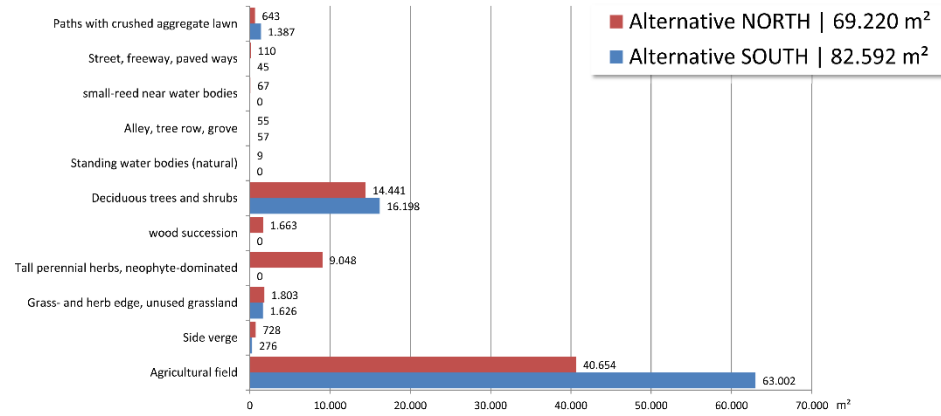


**COMPENSATION in 1000 m<sup>2</sup>**

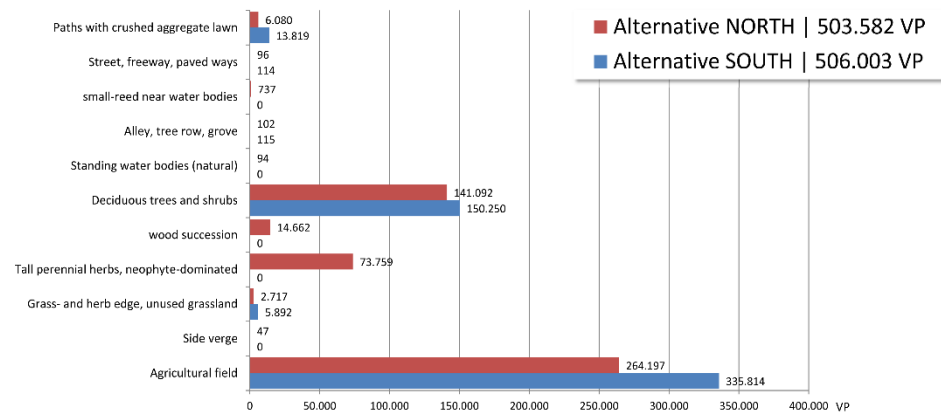




Access alternative comparison by land usage in m<sup>2</sup>



Access alternative comparison by biotope quality in value points

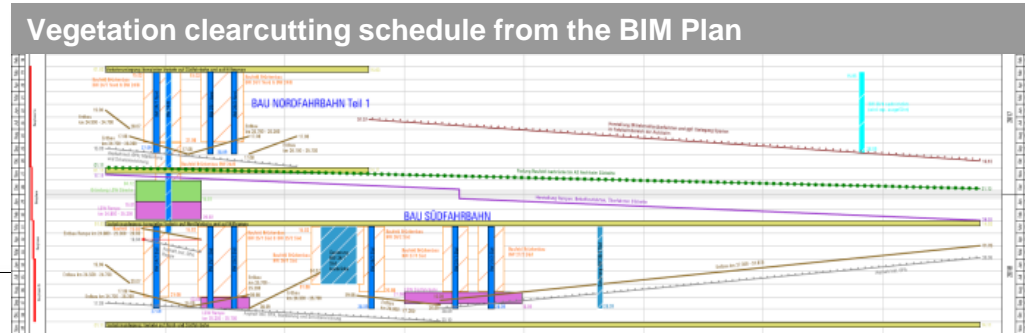


■ permanent  
■ temporary



## Clearing Construction Site Isarbrücke to AS Aschheim South (Construction km 1+300 - 4+700)

**Date: 09.11.2017**



# Morgenstadt Cologne

3D Modeling for Smart City Planning

## GeoDesign Apps & 3D-Modeling for the Smart City Cologne



- 3D-GIS database for analysis & visualization of the district of Mülheim South in its current state, and simulation of future development scenarios

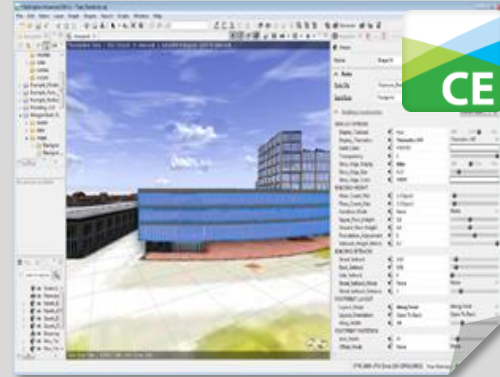




Design-Drafts



2D / 3D CAD BIM  
Integration using the  
Esri Data Interoperability  
Extension



3D GIS Geodesign  
Database

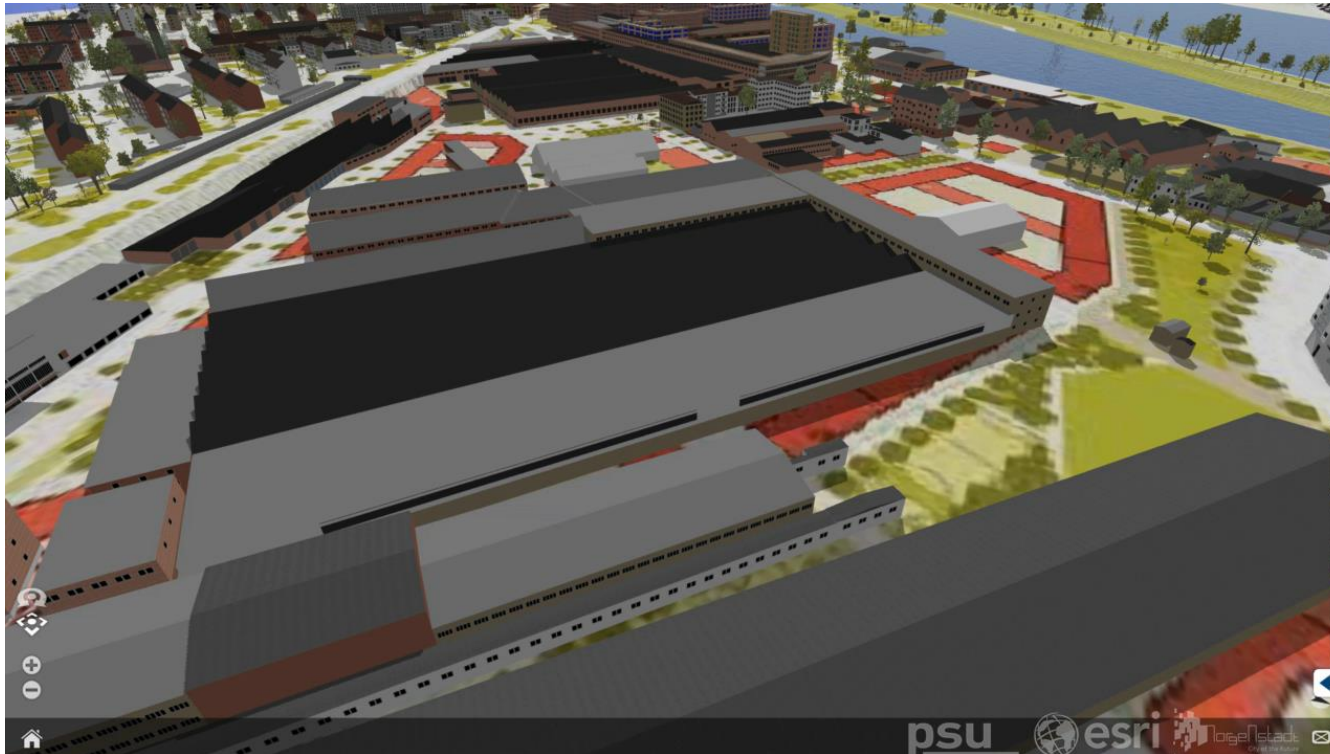


Rendering of Planning  
Alternatives

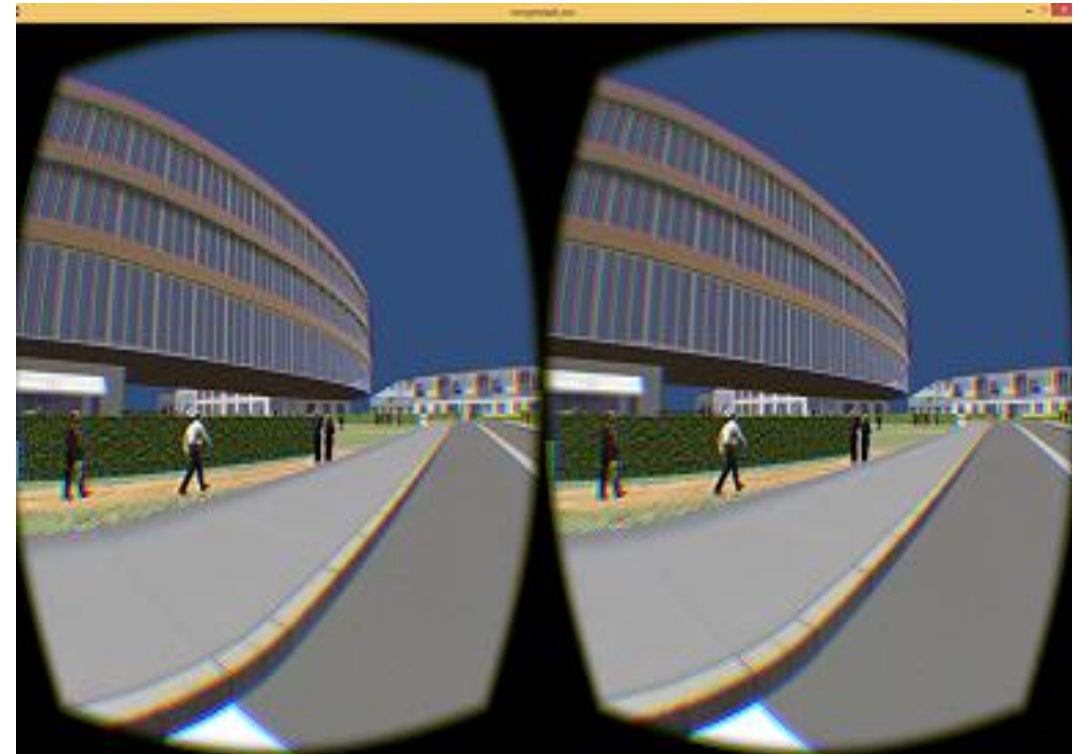




- 3D CE WebScene: status quo x future scenarios



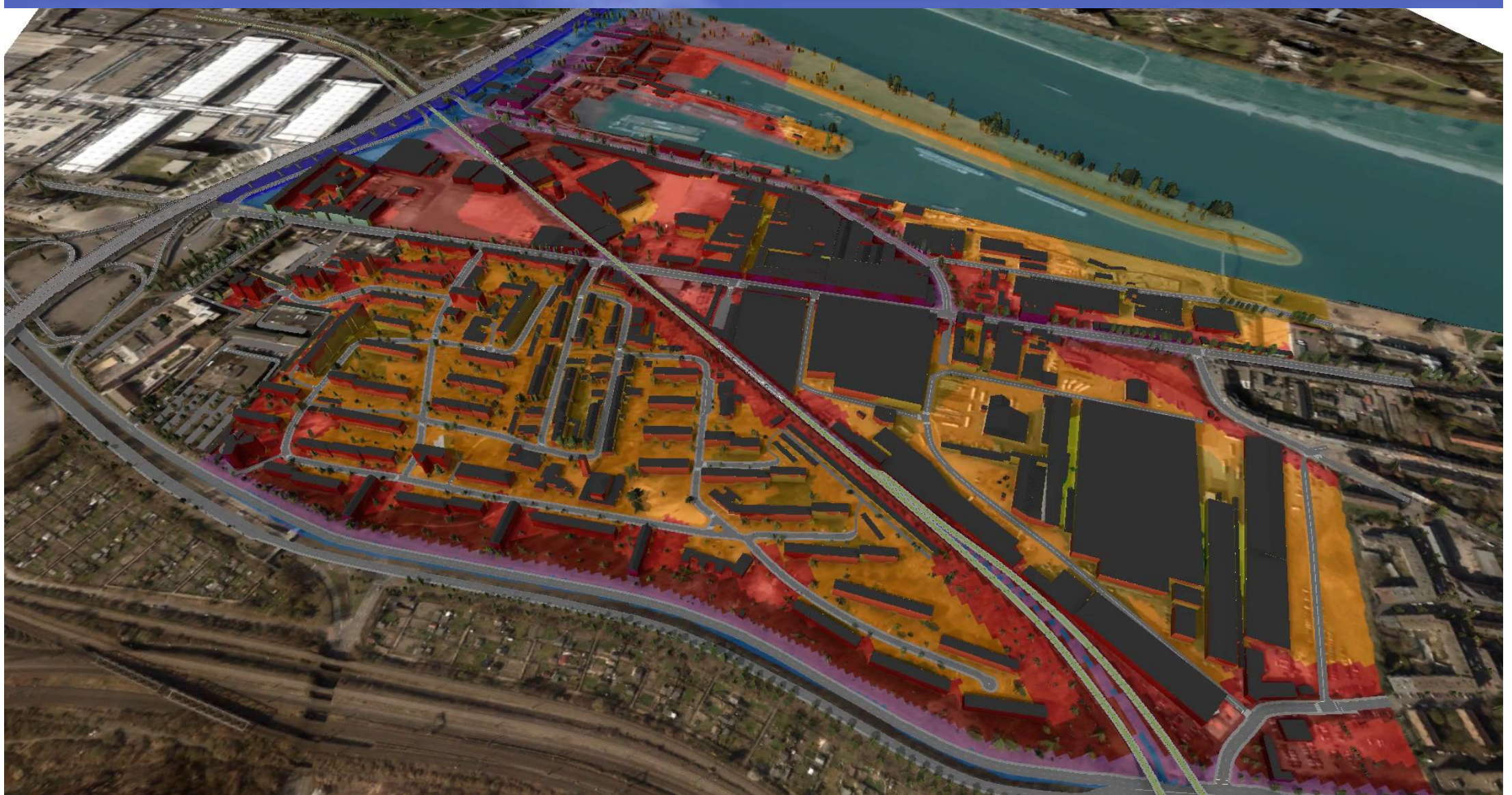
- 3D Tour: Visualization with Oculus VR, AR apps



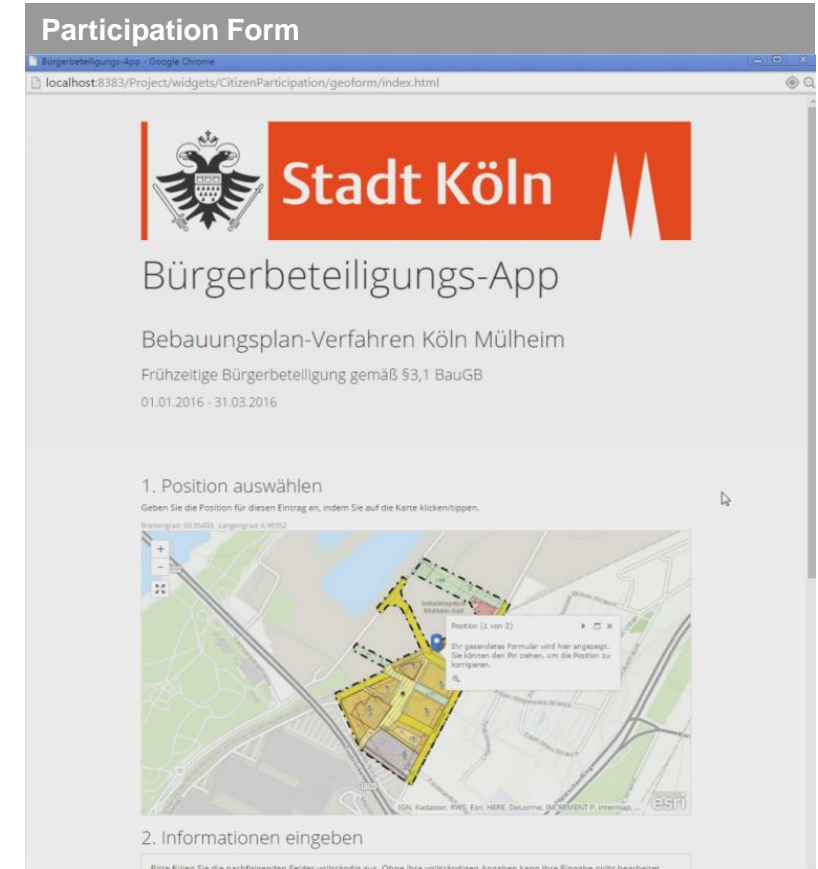
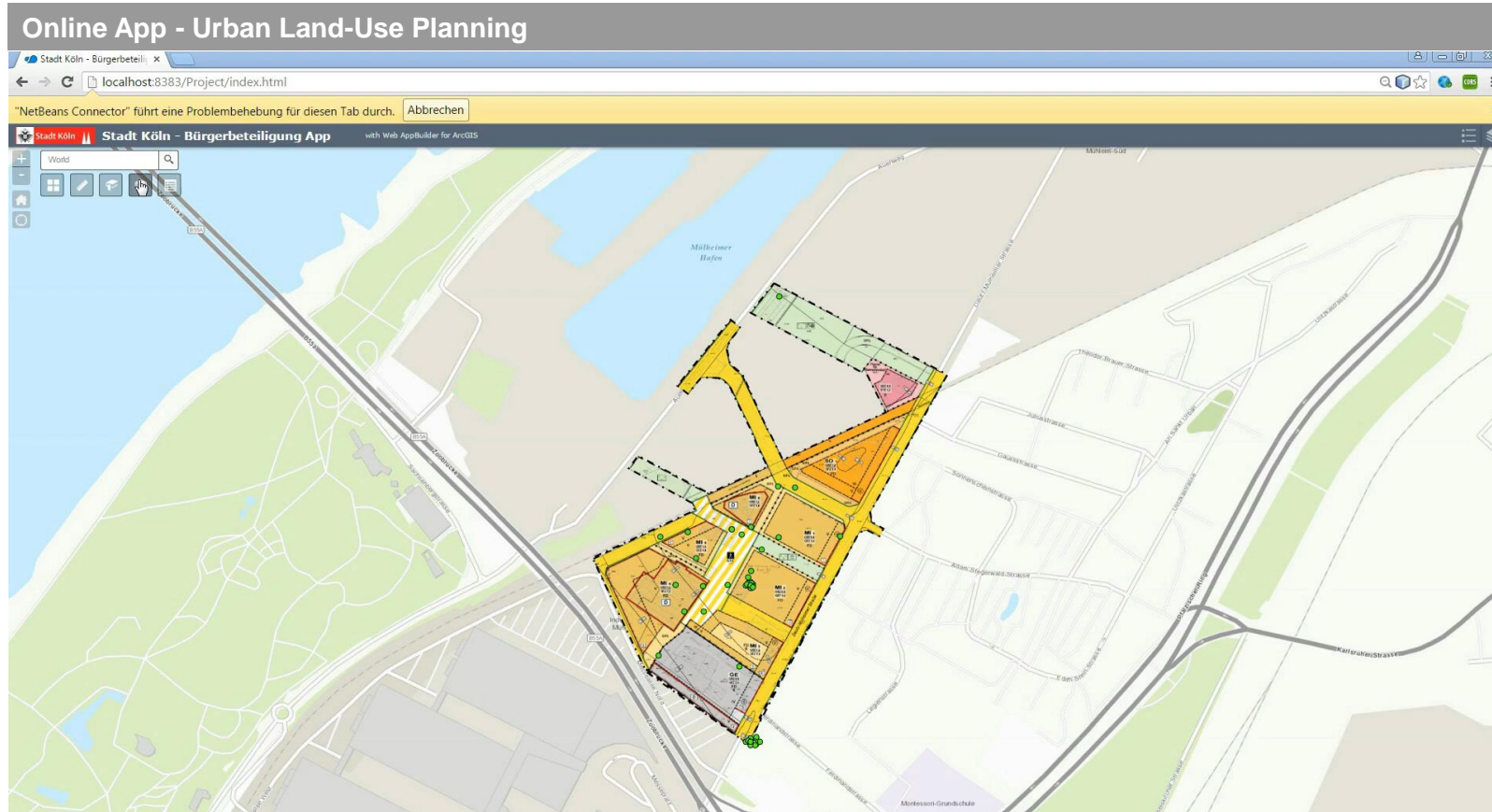












# Technical Explanations and Examples

- File Formats
- Data Interoperability Workflows
- Examples

## IFC (Industry Foundation Classes)

- data model developed by the buildingSMART organisation
- Main purpose: data exchange between CAD tools, cost estimation systems and other construction-related applications.
- Provides a set of definitions for all object element types encountered in the building industry
- Uses a plain text file format

## Multipatch

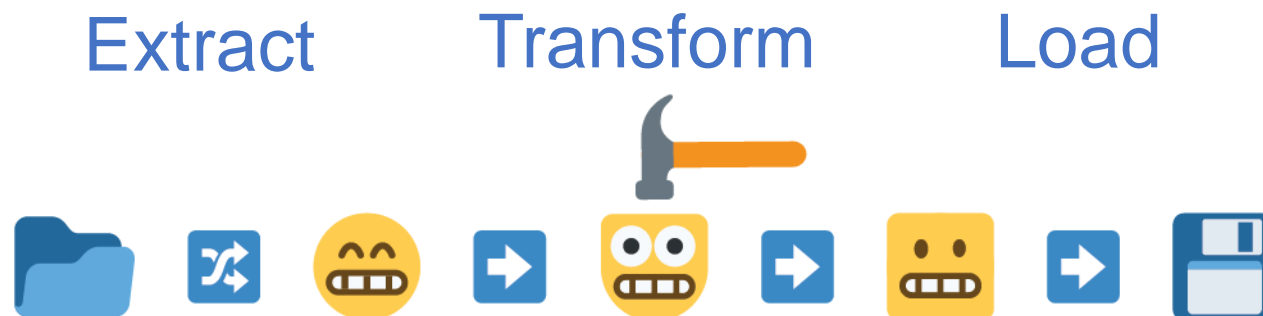
- GIS industry standard developed by Esri
- Used to define the exterior shell representation for 3D objects / volumes
- 3D rings and triangles
- Basically a special type of 3D shapefile which represents 3D objects as polyhedrons



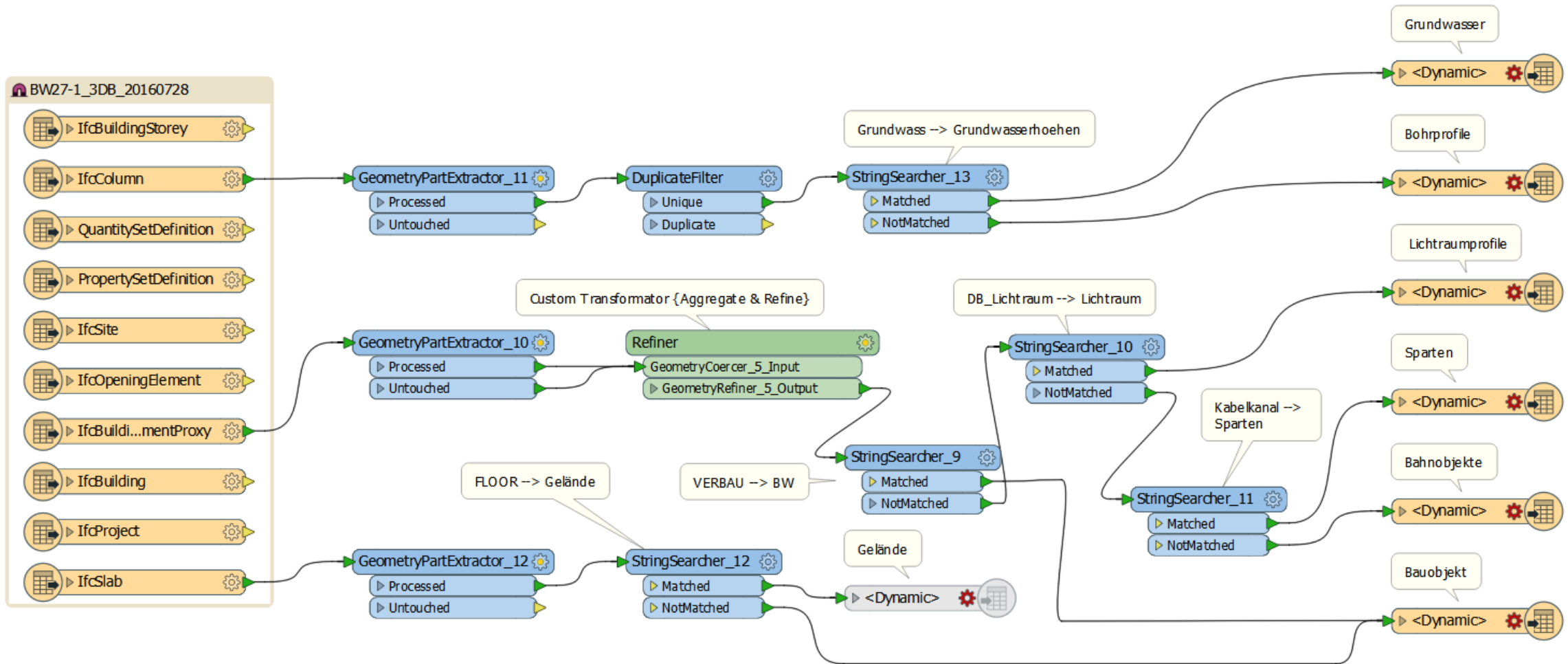
- Data exchange achieved with the Esri Data Interoperability Extension



- This process is known as ETL
- **Extract** the data you need
- **Transform** the data: keep, modify, create, drop or append attributes and geometry
- **Load** / Save the data



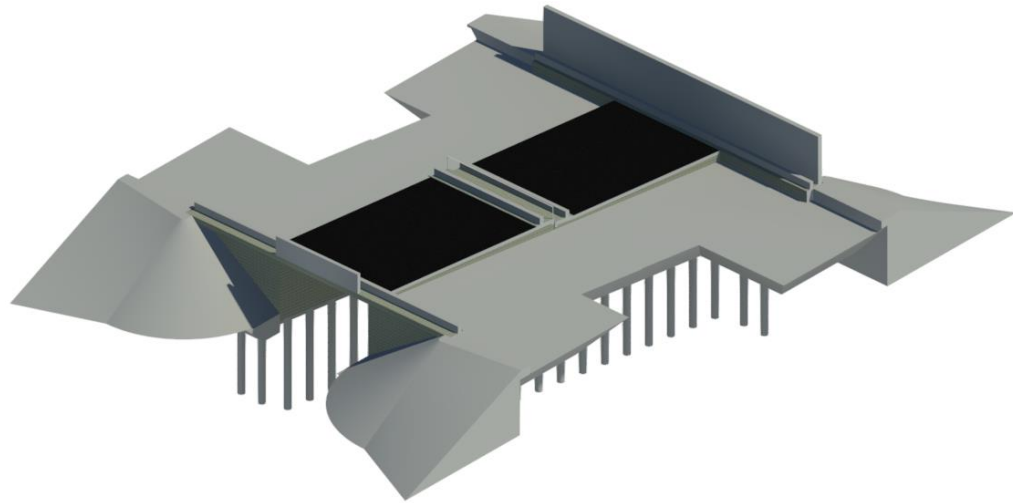
- IFC to Multipatch



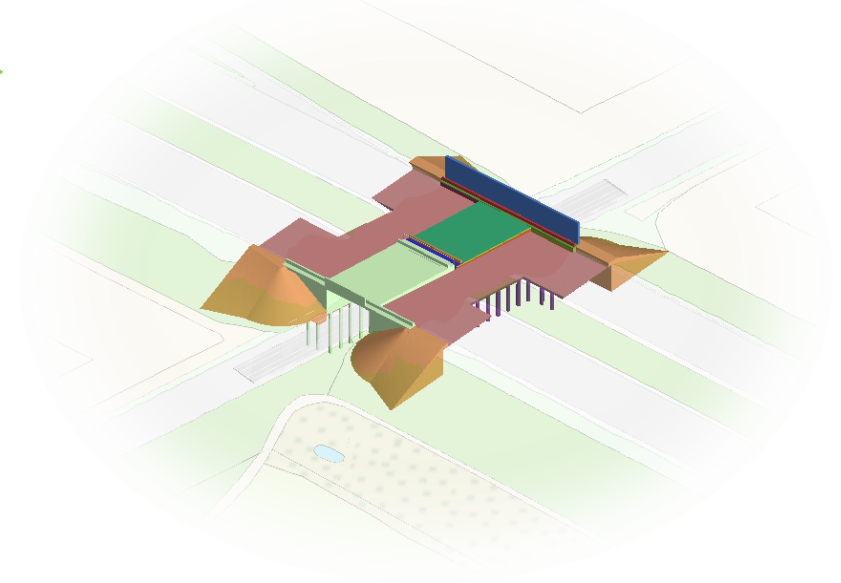
- Specific use cases often require tailored workflows
- File structure is very often quite different and requires analysis
  
- Geometry issues
- Naming issues
- Coordinate issues
- Quality issues
- ...

# Examples

IFC model

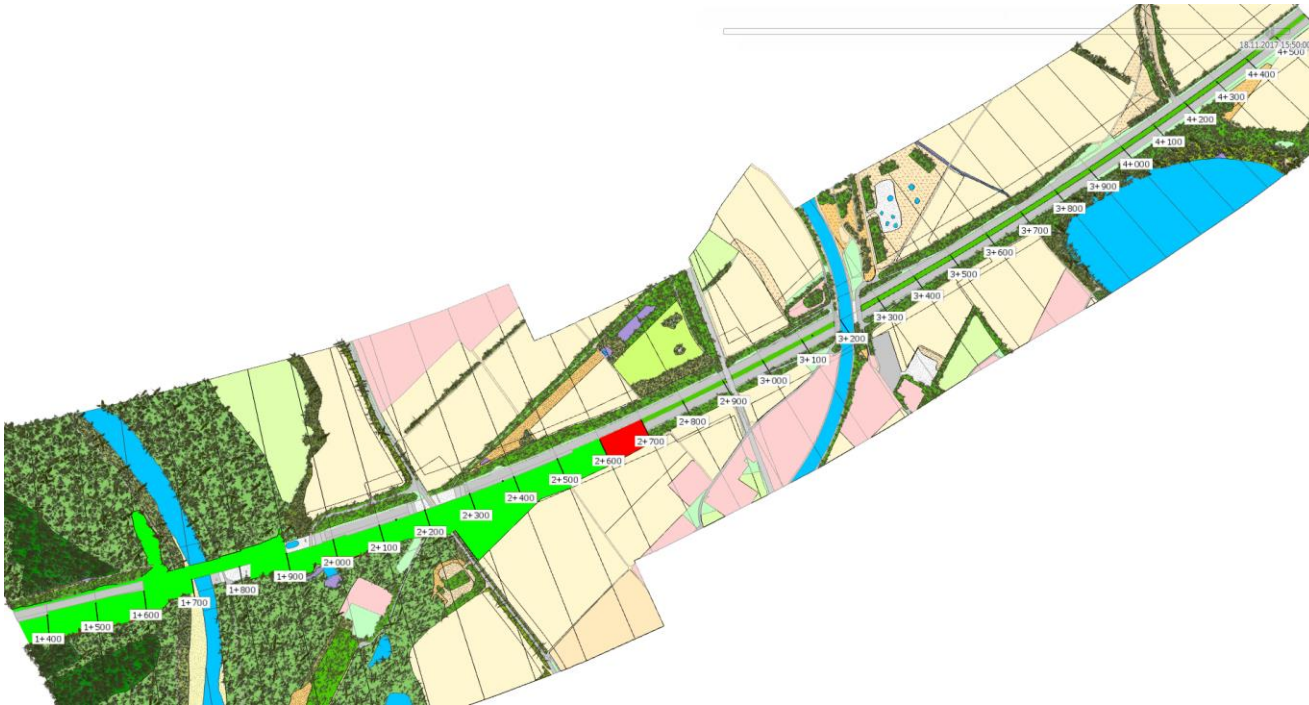


Full geometry with material attributes

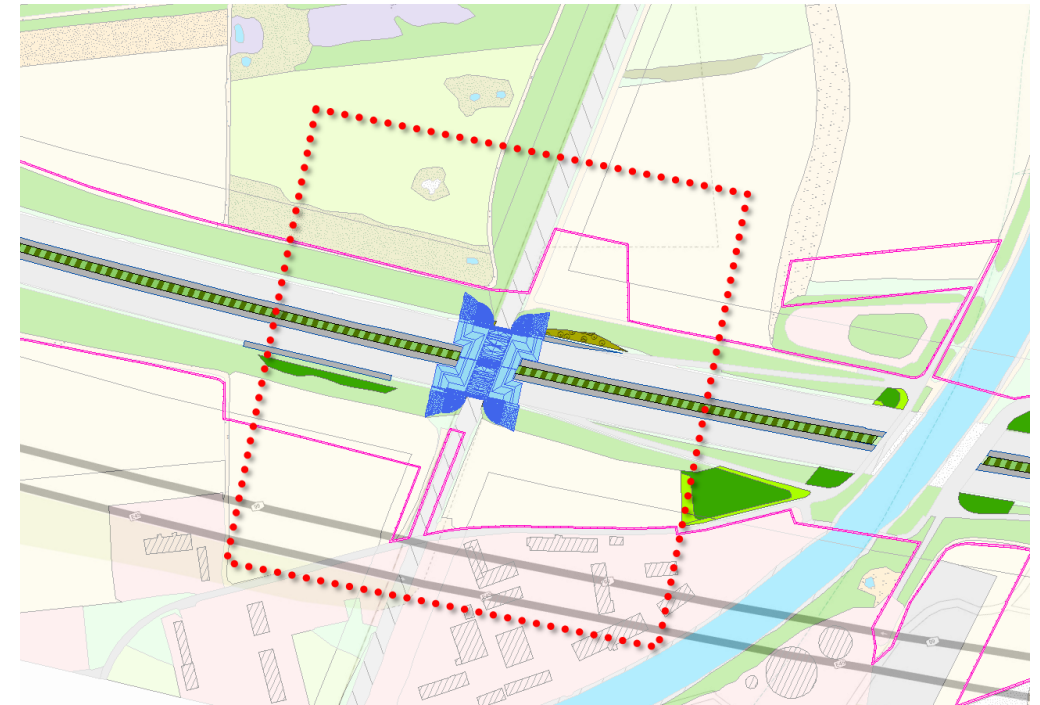


Clearing schedule dates

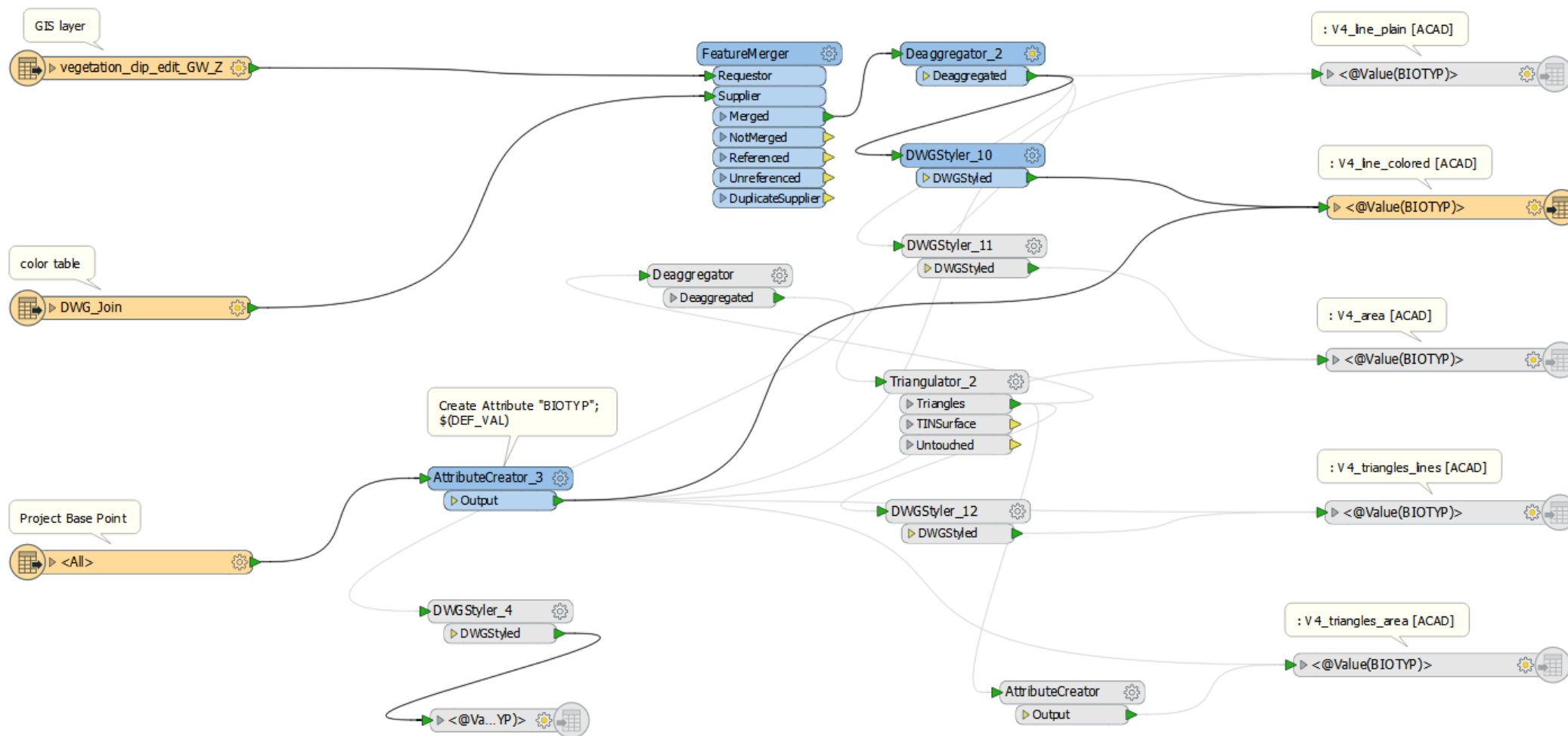
## Clearing schedule / clash analysis



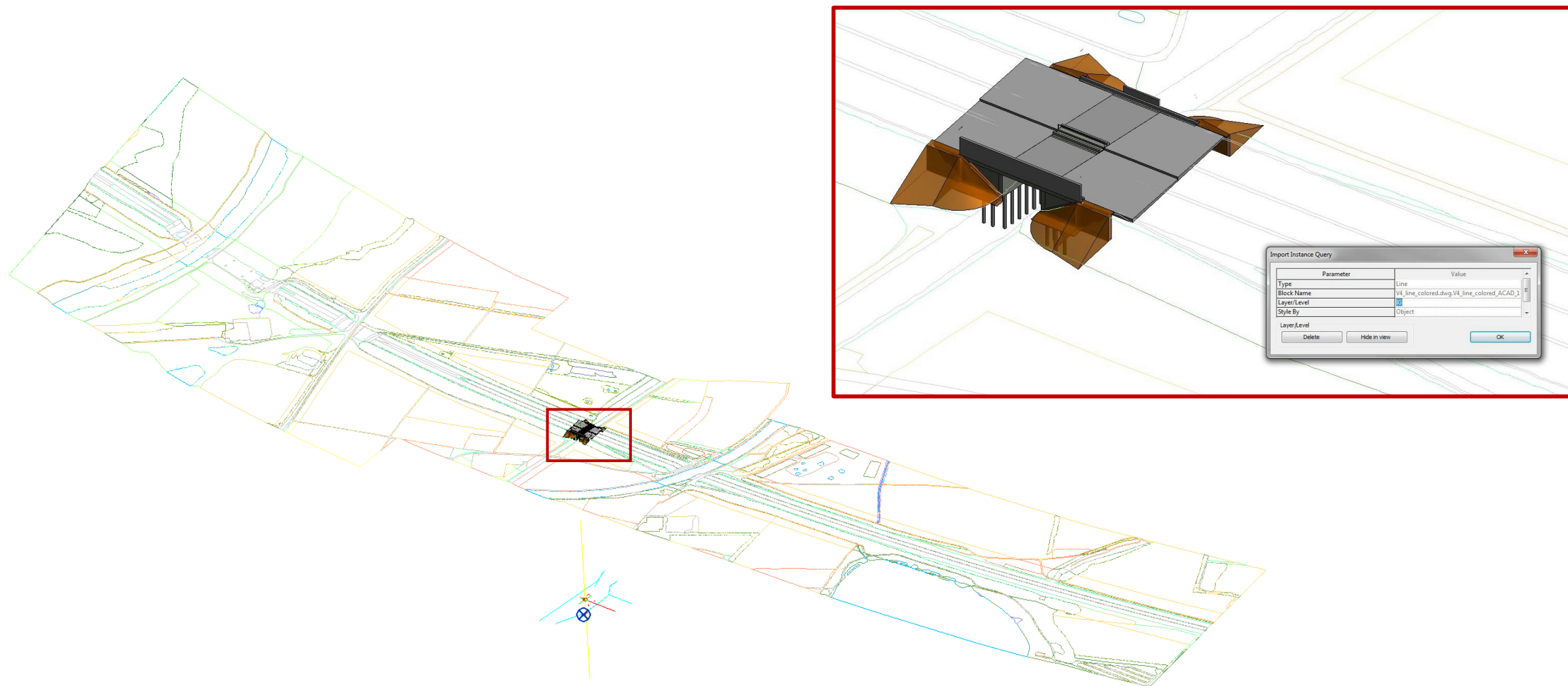
## Assessment of compensation requirements



- Combine GIS features with attribute data, style the data, write as DWG

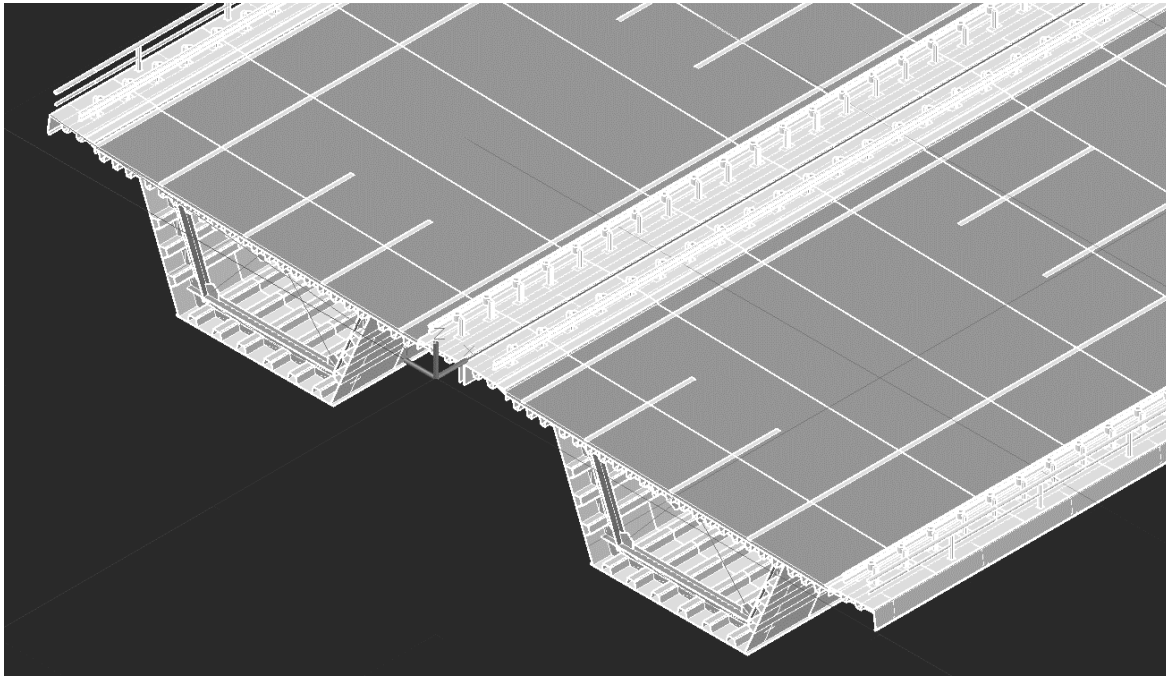


- Results in Revit: color coded wireframe with attributes

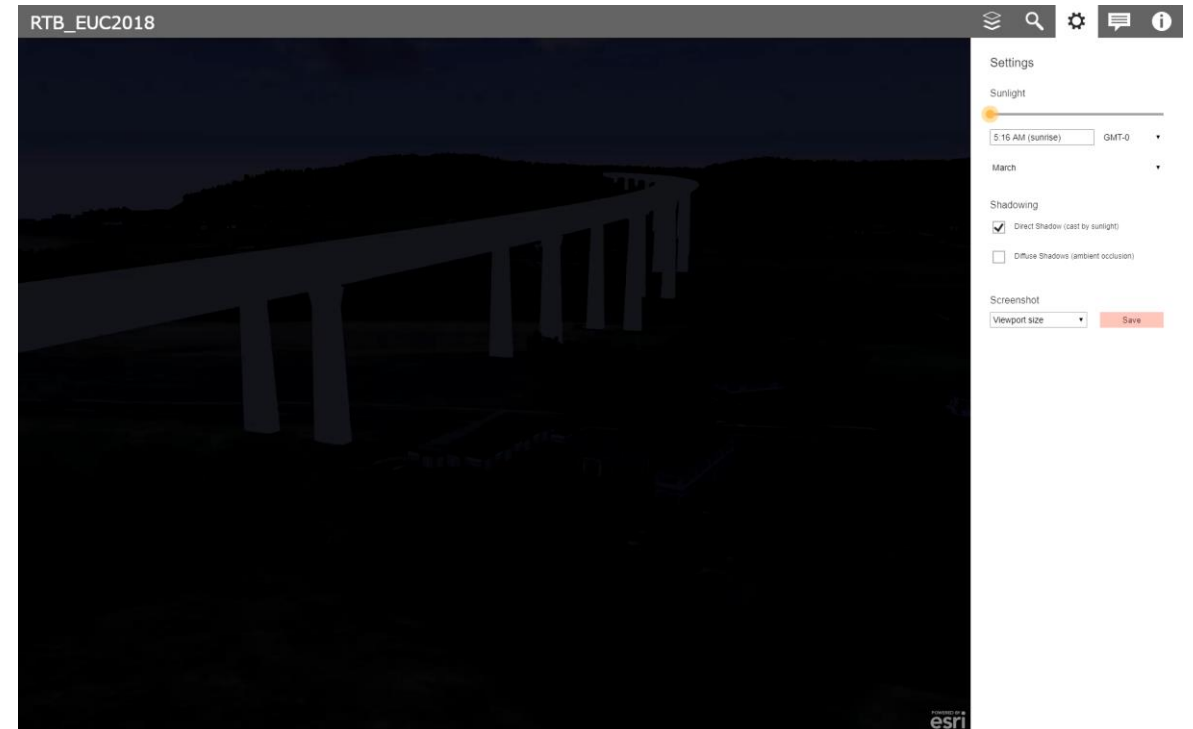




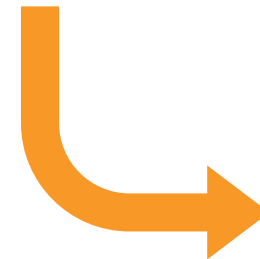
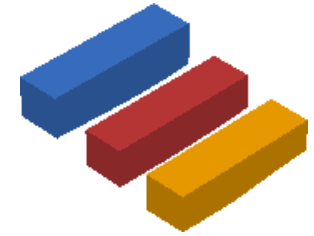
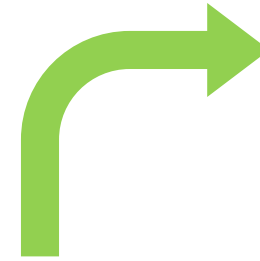
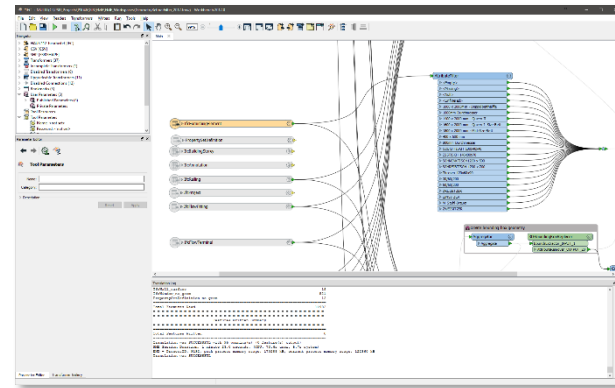
- Shell geometry from full model
- IFC to Multipatch



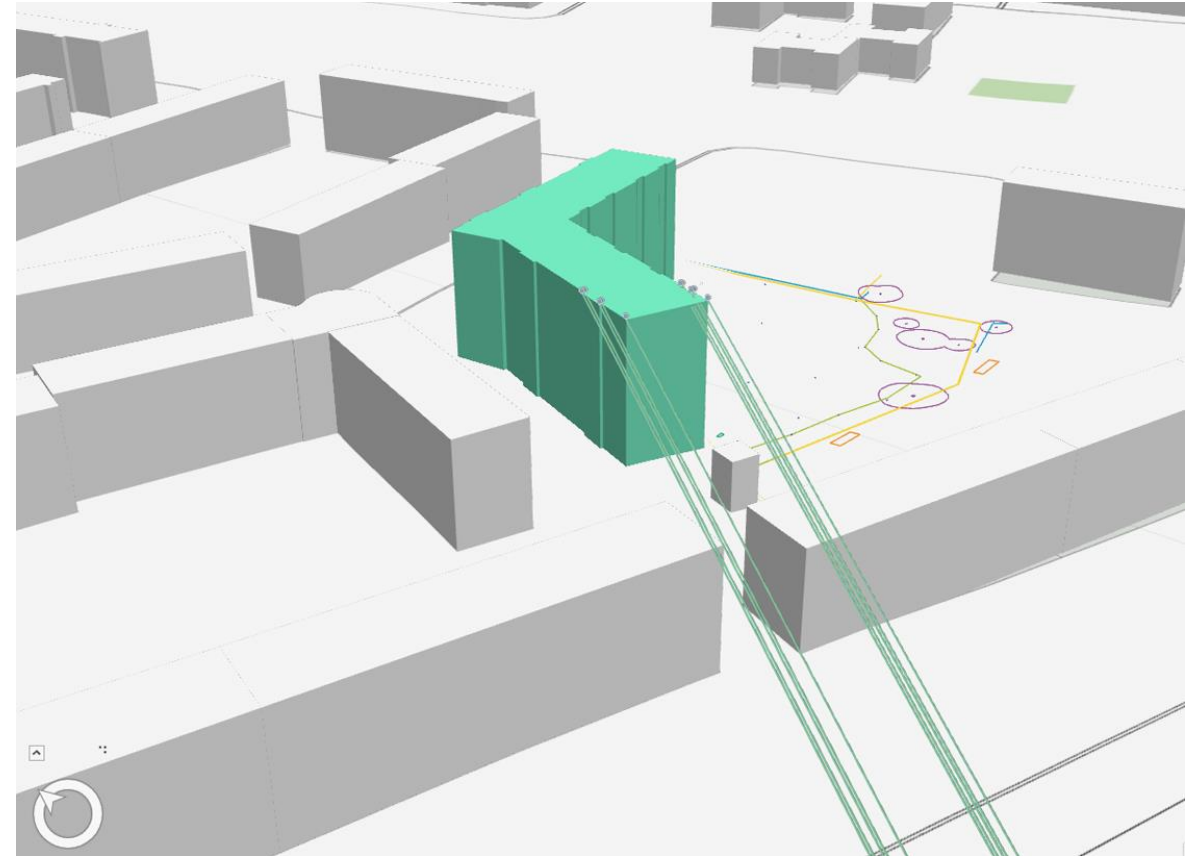
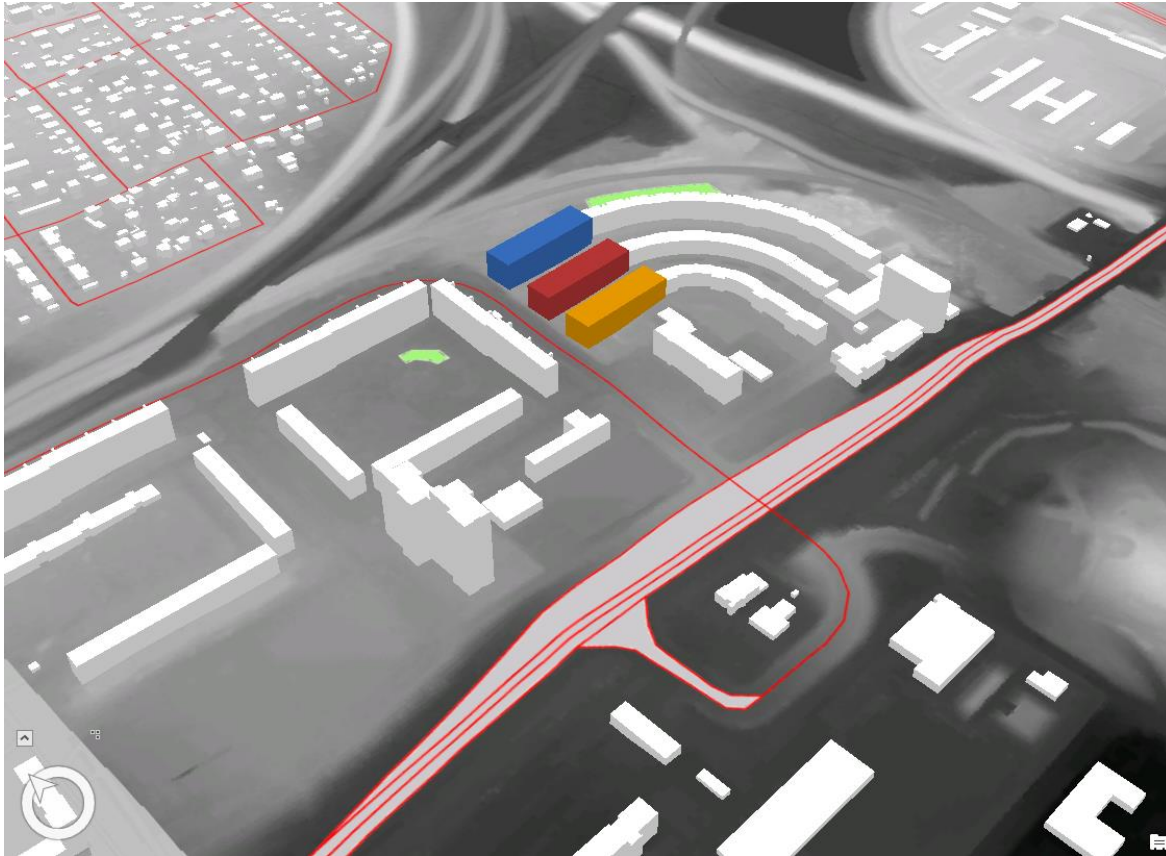
- Visualization of Variants
- Shadow analysis



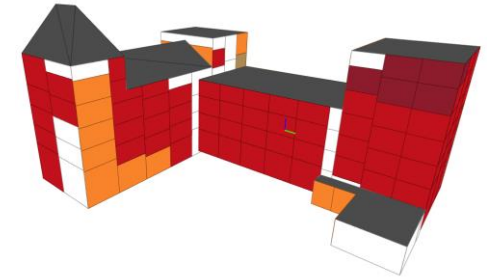
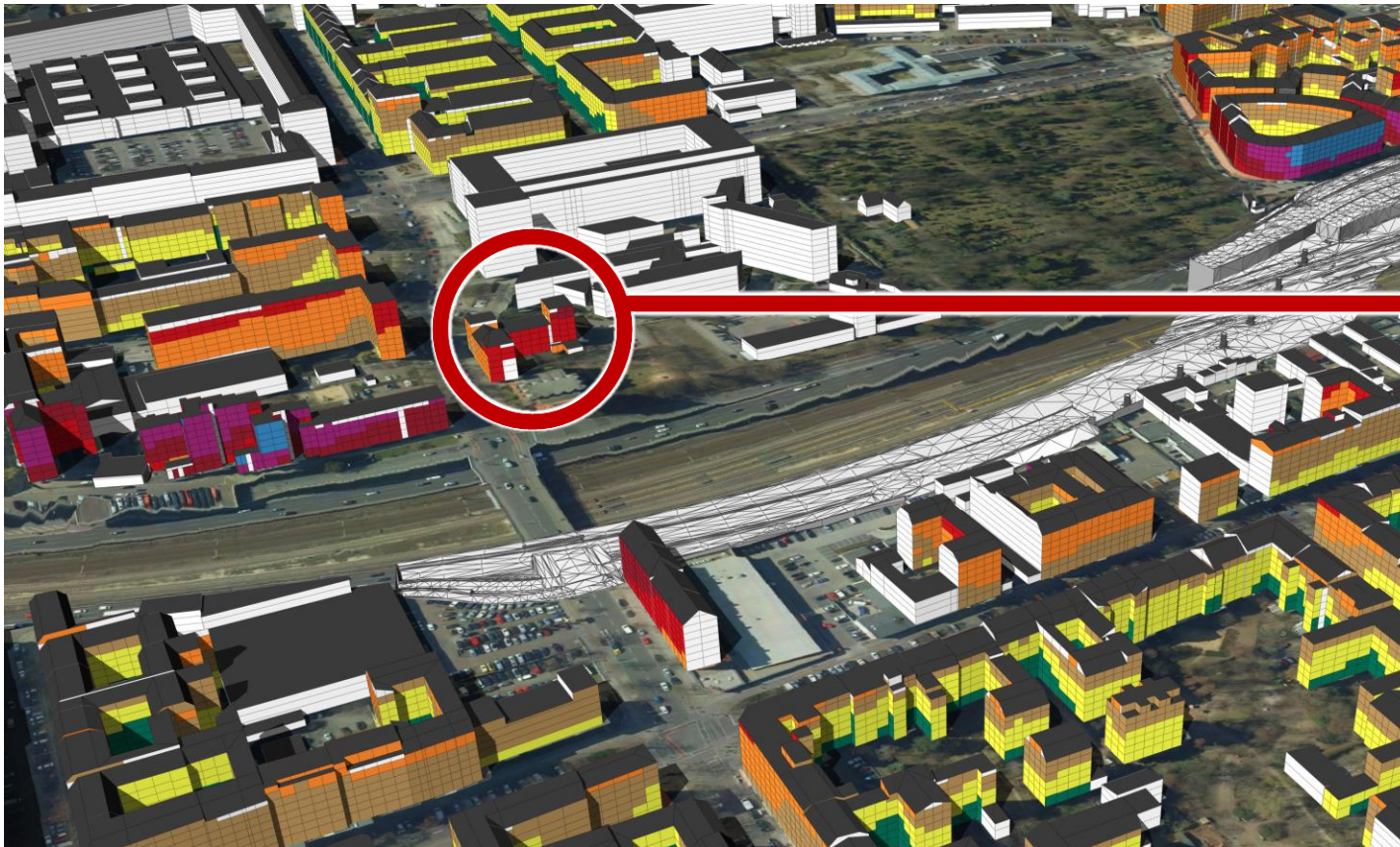
- Filtering
- Generalizing
- Georeferencing



- Various GIS Analyses
- 3D Specific Analyses (Visibility, Sightlines, Viewshed)
- Results as report



- Data from GIS analysis to IFC format
- Keep all attributes
- Integration in a CDE (Common Data Environment)



Properties	Location	Classification	Name	Value	Unit
<b>Element Specific</b>					
			Guid	HKR-4Km69Q6KvnsrmXAaxQQ	
			IfcEntity	IfcWall	
<b>GIS Data</b>					
			_O_LEGEND_URL	<a href="http://psu-schaller.de/REL_tests/IFC_URL/LaermLegendeDIN18005.pdf">http://psu-schaller.de/REL_tests/IFC_URL/LaermLegendeDIN18005.pdf</a>	
			_ABS_GEBHOE	52.77324584	
			_ANTEIL_EW	0.12690190263	
			_BEW_GEB	4.8222723	
			_CREATION_D		
			_FLAECH	279.59399257	
			_FPCOUNT	38	
			_FUNCTION	1144	
			_GEBNUTZUNG	8	
			_GMLID	BLDG_0003000b00082393	
			_HKEY	HAUS5041	
			_IDLOCAL	7	
			_NAME		
			_NUMBER	35096	
			_OBJECTID	136	
			_OG	2.OG	
			_PRZ_WOHNG	100	
			_ROOF_TYPE	1130	
			_STOREYS		
			STREET	Knöhelsdorffstr. 74	

# THANK YOU FOR YOUR ATTENTION

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