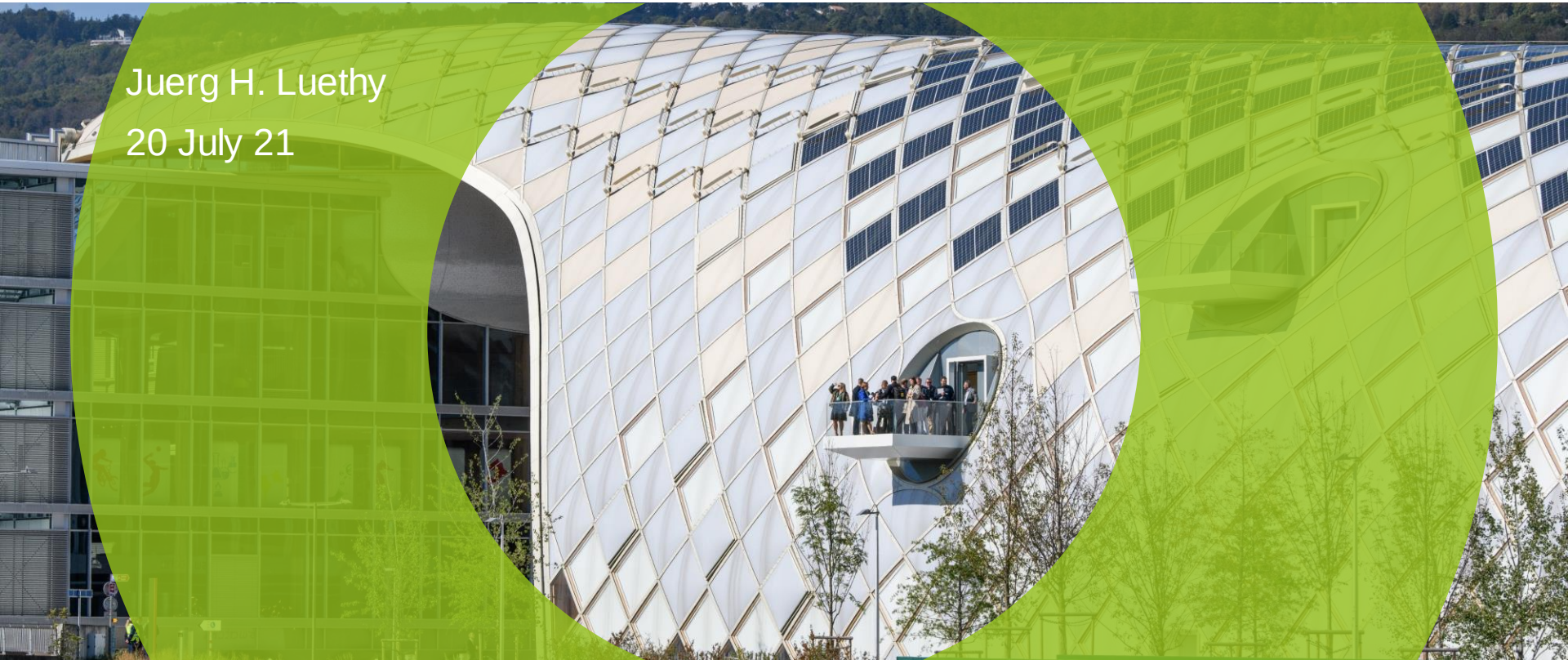
Benefits of a nation-wide multi-purpose building data set for land management

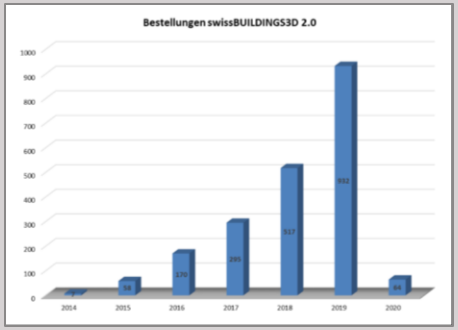
Juerg H. Luethy

20 July 21



Introduction

- Growing demand on building information
- Many data sources exists but they are not aligned and harmonised
  - What is the meaning of «one building»?
- Transition towards digital design, construction, and operation
  - Building Information Modelling (BIM)
  - International Standardisation ISO 19650
  - Increasing demand for unique and stable key as common identifier (cross-domain)



Objectives of the study

Main objective

- Development and creation of a basis for the initialisation of a new, interdisciplinary data model "Official Building CH".

Tasks

- Investigate the need and potential of an "Official Building CH" product.
- Develop a proposal for the term "building" (i.e. one discrete object).
- Develop a draft data model for "Official Building CH" (including a study of variants, taking into account existing national and international standards).
- Develop a roadmap for further steps

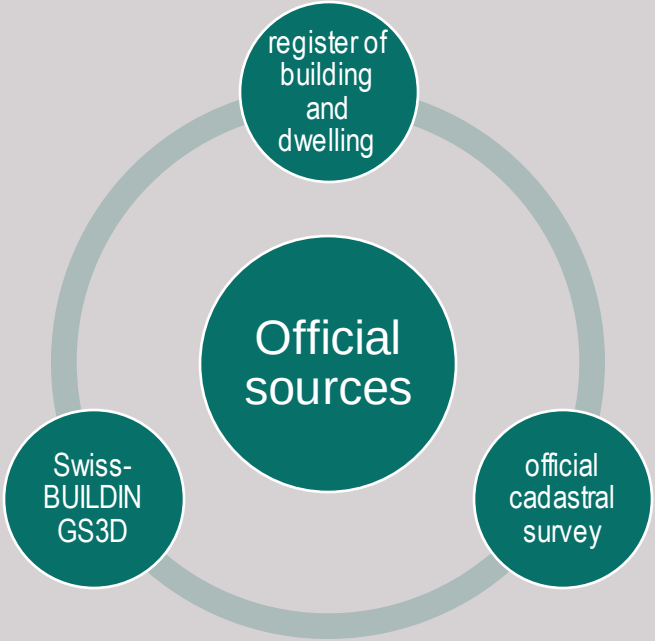
Vision for a building data set

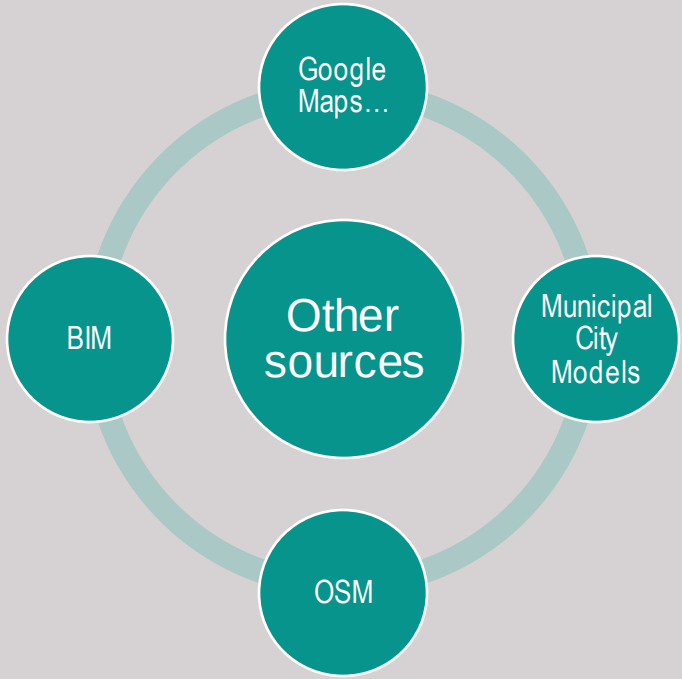
With respect to Land Management but not restricted to

- Country-wide data set on buildings which suits demands of
  - Strategic land management (master plan)
  - Operation land management (land use plan)
  - Monitoring and evaluation

- Building information which
  - covers 4 dimensions
  - contains all relevant (publicly accessible) information; year of construction, heating system,
  - can be linked to other (restricted) information – like land ownership, residents
  - can be locally enriched for specialized needs
  - is continuously updated

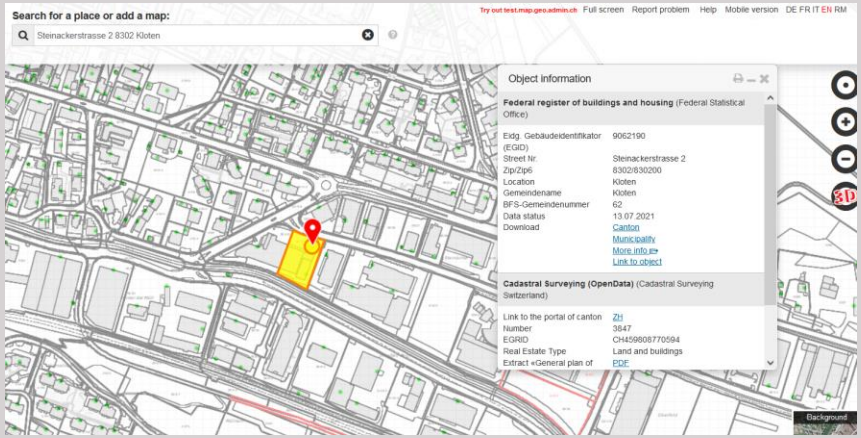
Situation analysis - Existing building data





Public data sources

Register of building and dwelling overlayed with cadaster



Federal register of buildings and housing (Federal Statistical Office)

Gebäudeinformationen	
Eidg. Gebäudeidentifikator (EGID)	9062190
Kantonskürzel	ZH
BFS-Gemeindenummer	62
Gemeindename	Kloten
Eidg. Grundstücksidentifikator (EGRID)	CH459808770594
Grundbuchkreisnummer	-
Grundstücksnummer	3847
Suffix der Grundstücksnummer	-
Typ des Grundstücks	-
Amtliche Gebäudenummer	1654
Name des Gebäudes	-
E-Gebäudekoordinate	2687058.672
N-Gebäudekoordinate	1256093.098
Koordinatenherkunft	Amtliche Vermessung, DM.01
Gebäudestatus	Gebäude bestehend
Gebäudekategorie	Gebäude ohne Wohnnutzung
Gebäudeklasse	Industriegebäude
Baujahr des Gebäudes	1968
Baumonat des Gebäudes	1
Bauperiode	Periode von 1961 bis 1970
Abbruchjahr des Gebäudes	-
Gebäudefläche [m2]	1024
Gebäudevolumen [m3]	-
Gebäudevolumen: Norm	-
Informationsquelle zum Gebäudevolumen	-
Anzahl Geschosse	8
Anzahl Wohnungen	-
Anzahl separate Wohnräume	-
Data status	13.07.2021
Eingangsinformationen	
Eidg. Eingangsidentifikator (EDID)	0
Eidg. Gebäudeadressidentifikator (EGAID)	101203404
None	2

Public data

3D building models - Swiss-BUILDINGS3D

acht grad ost

Some conflicts between data sources

acht grad ost

swissBuildings: 1 object
Cadastral data: 6 objects

swissBuildings: 1 object
Cadastral data: missing

swissBuildings: missing
Cadastral data: 1 object

Geometric inconsistencies

Which object represents a single building?

Situation analysis – results

- There is a growing demand on harmonised building information:
  - Inter alia carbon footprint estimated by inhabited space (and the heating systems)
- There is great interest in a harmonised term "building“,
- There is a strong to very strong interest in a standardisation of building information,
- In particular, the following requirements are demanded of an "Official Building CH":
  - Uniform terms are to be used, considering the definitions from the RBD (building term) and the standards and norms defined by the Swiss Society of Engineers and Architects (SIA) on building spaces and volumes.
  - The definitions must not contradict legal building terms or masses.
  - Existing data, standards and processes are to be used, not a greenfield start.
  - Differentiation to “other structures” is important.

Situation analysis - relevant international standards

LandXML

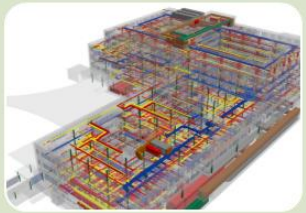
Focus on civil engineering, surveying and documentation

Australia: e-Paper

CityGML

Focus Visualisation, City-wide data sets

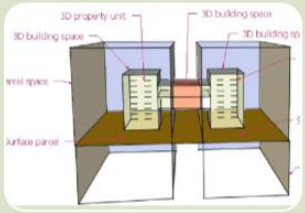
OGC Standard



IFC

Focus Digital Construction

ISO 16739, buildingSmart Standard



LADM

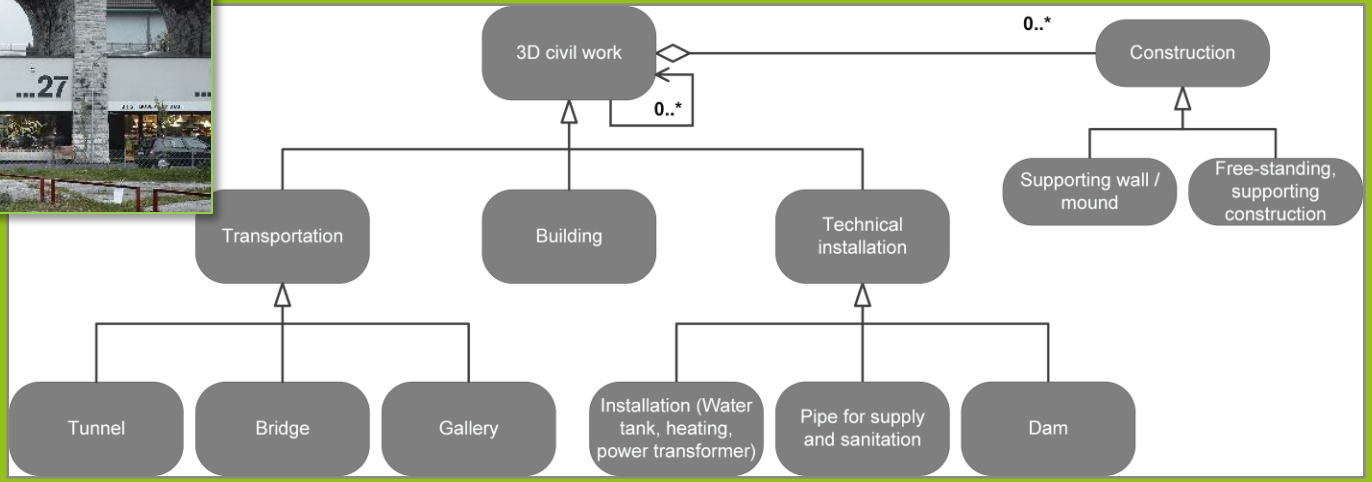
Focus Ownership (Rights, Restrictions and Responsibilities)

ISO 19152 Standard

Results - Positioning of «building» vs. «civil work»

Source: www.baunetzwissen.de

Is a civil work always a building when the definition is fulfilled?
For which purpose has a civil work been established
What is the current purpose?



Results - Considerations on Data Model

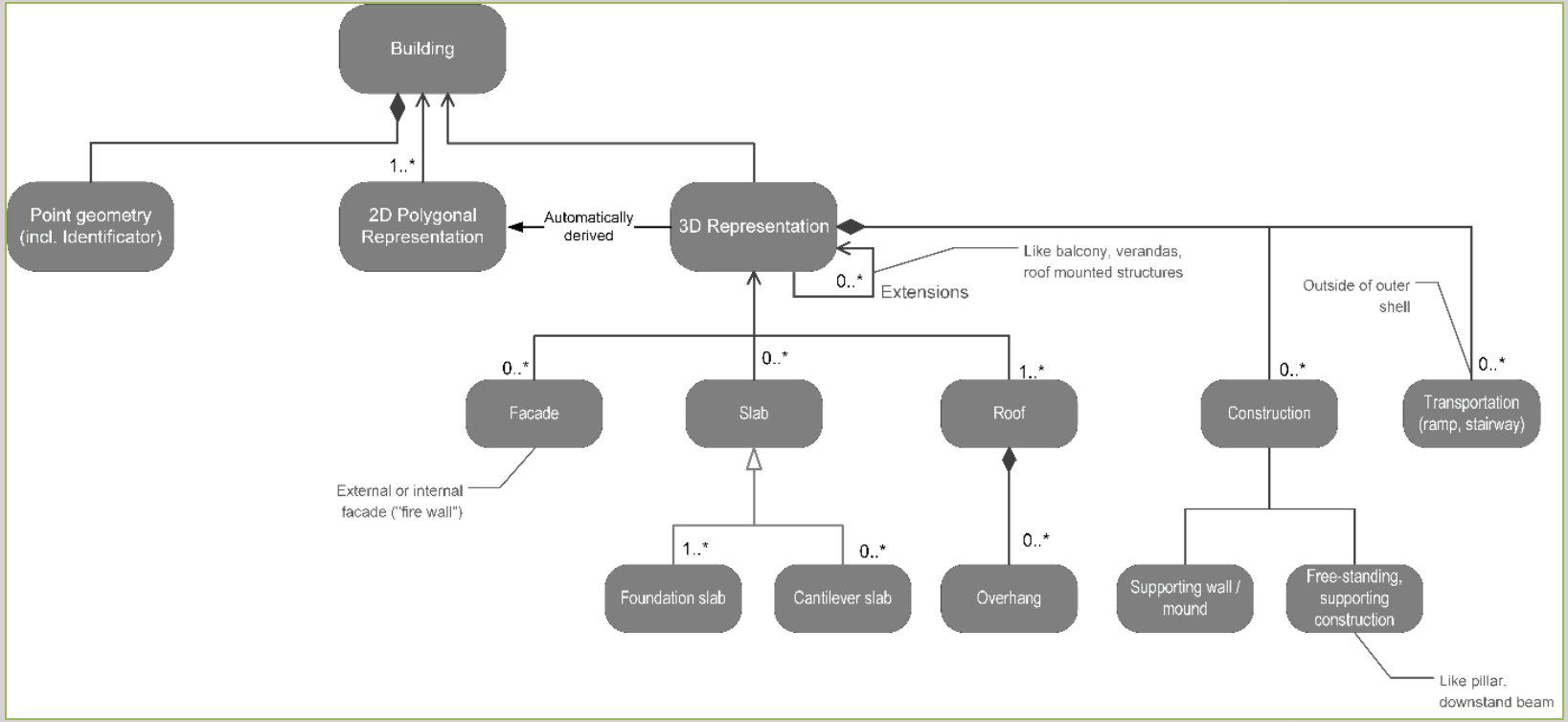
Variants

- *1:1 takeover*: Use an international standard 1:1
- *Adaptation*: extend and adapt the international standard
- *Neutral model*: Design own neutral model
  - «Own»: Swiss model
  - «Neutral»: Application-independent, not directly linked to international standards.
  - Boundary constraint: enable bi-directional exchange with IFC and CityGML.

Results - Favoured variant *Neutral Model*

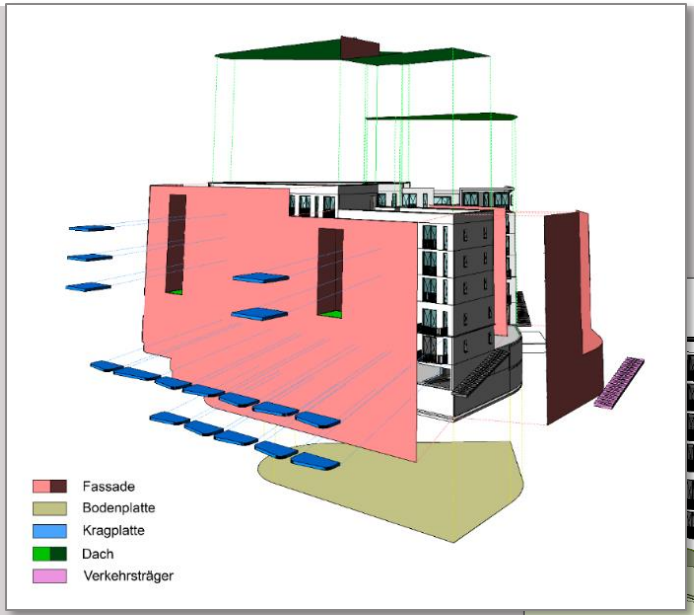
«If you can’t break the silos, connect them.»

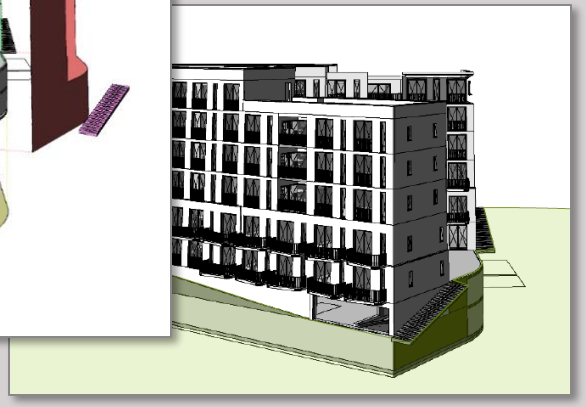
Class diagram with details of the 3D structure



Implementation of data model in IFC data set

- Class roof (green)
- Class slab (olive)
- Class facade (red)
- Classes Construction and Transportation (purple)

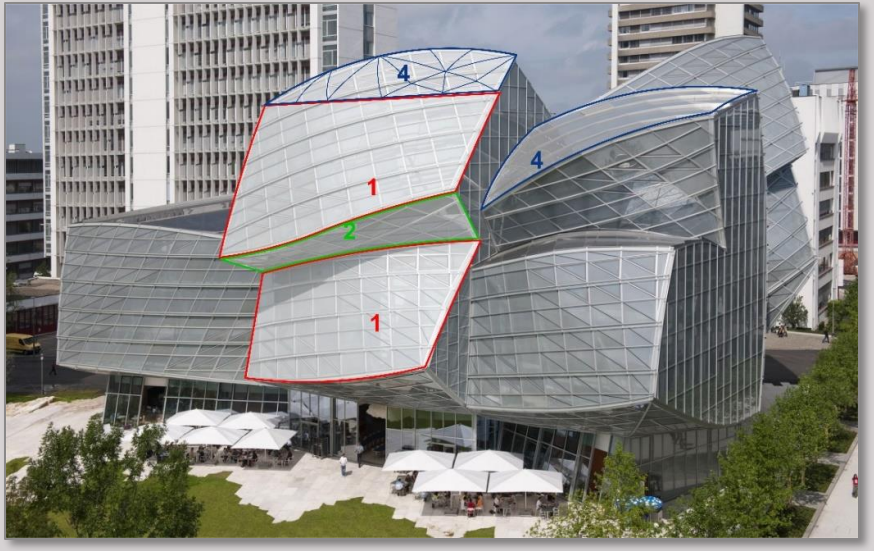




data source: SIA documentation D 0270

Plausibility checks on various buildings

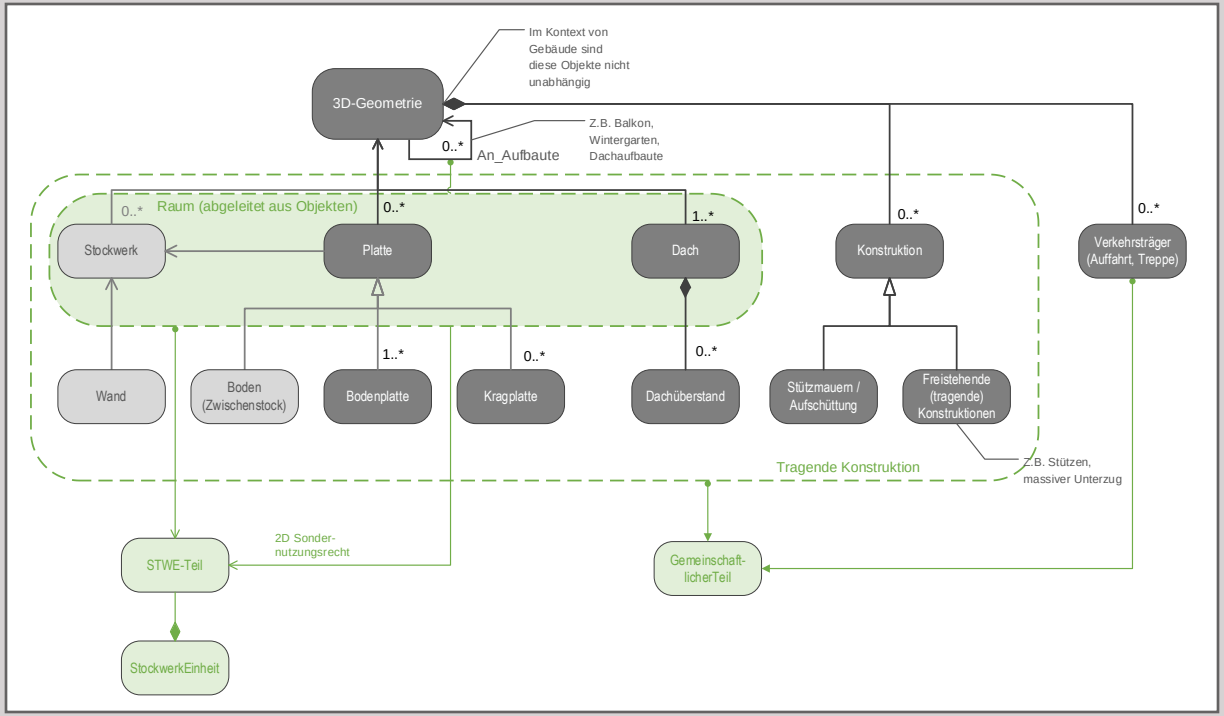
Solution approach for the "Actelion Business Center Basel" in the new data modell. Focus: on cantilever slabs and constructive elements



Solution approach for the "Gehry Buildings" in the new data modell. Focus: on Roof-wall transition and triangular mesh for curved surfaces

Extendability of the data model

Condominium ownership



Some opportunities land management questions

- Analysis of current building structure
  - Where is a high potential for densification of the structure? → Building size, age, income structure
- Combination of existing land use with master planning
  - What is the impact of densification? → visualisation, shadow casting, traffic
  - What is the future demand on public infrastructure: schools, hospital, public transportation, where are suitable locations?
- More accurate estimation of carbon footprint based on building size, number of floors, age of building and installed heating system

Conclusion

- Designed data model sucessfully validated against complex buildings
- Proposed data structures cover all components of the building that are relevant from the point of view of a national database
- Data model can be extended for specific purposes like condominium ownership in accordance with the national recommendation.
- Use of basic structures from IFC respectively CityGML support to transfer of existing swissBUILDINGS3D database into the new structure as well as to integrate new data in IFC format.

Outlook

- A harmonised, official repository offers users a significant advantage over data from private providers due to its greater reliability and integrability with other data and business processes.
- Timing for a new national standard is perfect as many of the construction processes are in revision.
- The study will now be followed by a conceptional phase for elaboration the data model in more details and assess the transformation and harmonisation of existing data sets.

Discussion

Contact information:

juerg.luethy@achtgradost.ch

D +41 43 500 44 48