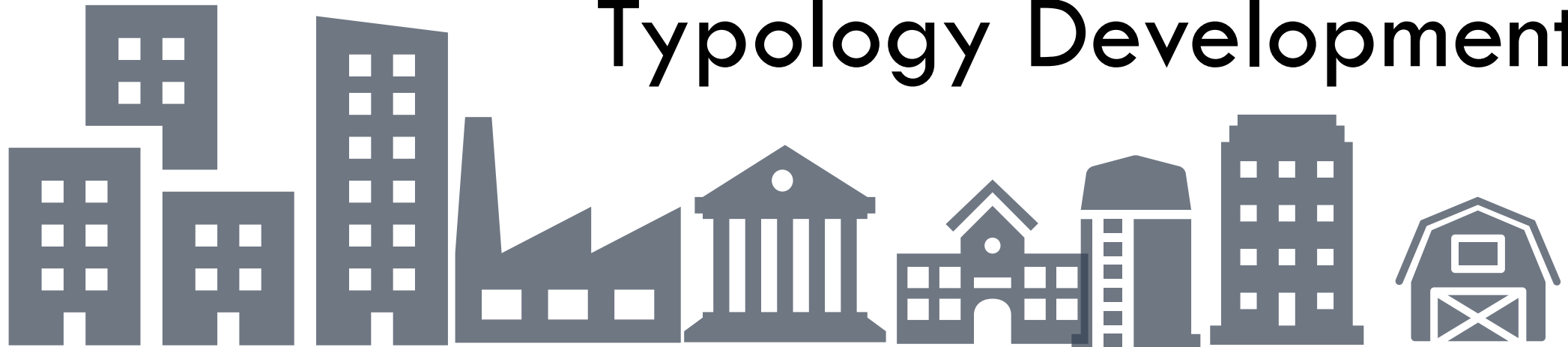


Non-Domestic Building Typology Development



A German Perspective

Julian Bischof – Institute for Housing and Environment,
Darmstadt, Germany

Research Database Non-residential Buildings

STATUS

GOAL

Sample size:	100.000 Building Polygons in an multi-stage sampling procedure	
Screened (on site):	61.000 Building Polygons	100.000
	29.000 Non-Residential Buildings identified	50.000
Interviews:	~ 1.500	10.000
In-depth Interviews:	~ 50	1.000

Typology Aims

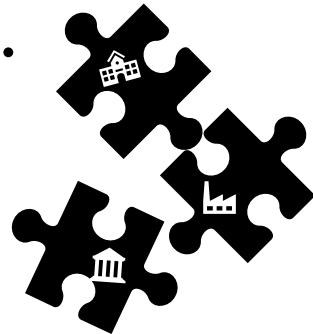
- **Communication** via example buildings → Case Studies
- **Comparison** of Building Energy and Emissions (Functional Units)
- **Universal methodology** for building stocks of different countries
- **Operational** Energy and GHG-emissions demand calculation
- **Embodied** Energy and GHG-emissions estimation
(maintenance and end of life)
- **Refurbishment Options**
- **Anything else?**

Quality Ideals

- Based on **representative Data**
- Values with **standard deviation, projection factors and variance**
- Label for **original variables**
(measured data → height)
- Label for **calculated variables**
(calculated or assumed variables → U-Values)

Clustering the Non-Domestic Building Stock

- Age Bands
 - Building Energy Legislation
 - Structural Building Regulations/Standards
- Building Category
 - Commercial, Retail, Industrial, Public
Office, Hospital, Petrol Station ...
- Building Geometry
 - Compactness A/V, Small, Large
- Construction Type
 - Structure: Lightweight/Heavy;
Basement: Yes/No; Roof-Type: Flat/Pitched
- Building refurbishment
 - Refurbished/Un-Refurbished (Systems?)



Age Bands – Legislation Based

Energy Legislation	Structural Regulations
DIN 4108 – „Wärmeschutz im Hochbau“ 1952	Prussian Regulations
Wärmeschutzverordnung (thermal protection ordinance) 1977	DIN 1045 (1925-09) TGL 0-1045 (1963-04) & TGL 33 402 (1980-10) DIN 1053 (1937-02) TGL 0-1053 (1963-03)
Energieeinsparverordnung EnEV (energy saving ordinance) 2001	Eurocodes EN 1990 to EN 1999 2002 – Law status since 2012 in Germany

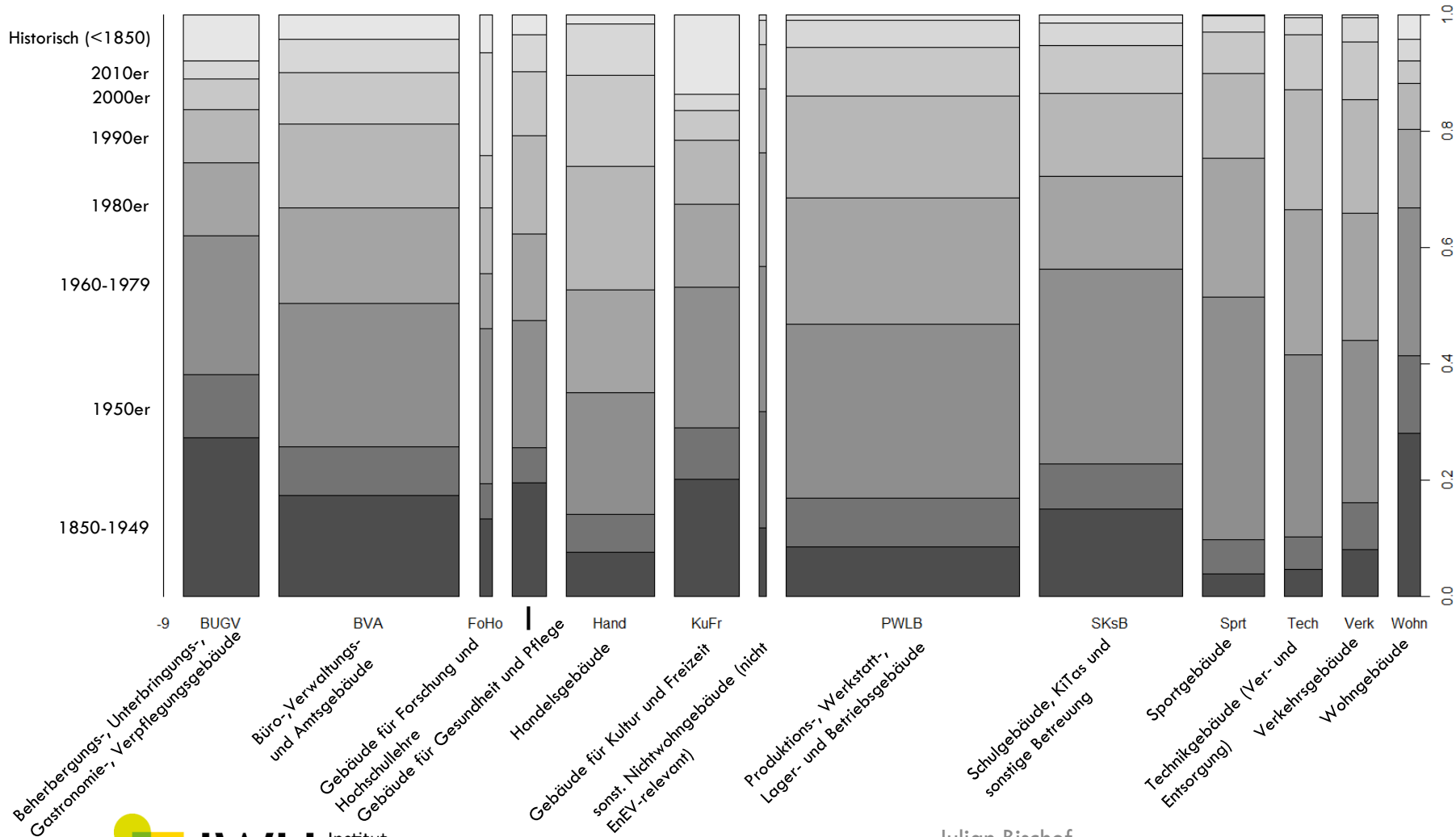
Age Bands – Legislation Based

N°	Construction Year Class	Historical Period	Characterisation
1	A	... 1859	pre-industrial period, characterised by handcraft; built on experiences; hardly no legal requirements; use of locally available materials
2	B	1860 ... 1918	period of promoterism ("Gründerzeit"), rapid expansion of the cities and growing industrialisation; standardisation of construction principles; different regional manifestations
3	C	1919 ... 1948	increasing industrialised production of building materials; use of cost efficient material-saving constructions; standardisation on national level
4	D	1949 ... 1957	simple building techniques of the post-war period; often use of debris materials; further development of construction standards (introduction of DIN 4108 – "Wärmeschutz im Hochbau" in 1952); introduction of social housing principles
5	E	1958 ... 1968	requirements on thermal insulation in force (DIN 4108 – "Wärmeschutz im Hochbau"); further industrialisation of building construction; development of panel buildings (GDR: "Plattenbauten")
6	F	1969 ... 1978	new industrial building techniques (sandwich elements); also introduction of pre-fabricated single family houses (lightweight constructions "Fertighaus"); thermal insulation becomes more relevant in consequence of the first oil crisis
7	G	1979 ... 1983	1st thermal protection ordinance (1. Wärmeschutzverordnung)
8	H	1984 ... 1994	2nd thermal protection ordinance (2. Wärmeschutzverordnung); GDR: further improved insulation ("Rationalisierungsstufe III") market introduction of low energy houses, supported by regional grant programmes
9	I	1995 ... 2001	3rd thermal protection ordinance (3. Wärmeschutzverordnung); consideration of a bonus in the tax in case of realisation of a low energy house
10	J	2002 ... 2009	energy saving ordinance ("EnEV 2002"), considering building and heat supply system; KfW grant programmes ("KfW-Energiesparhaus 60 and 40", Passive Houses)
11	K	2010 ...	new requirements of energy saving ordinance ("EnEV 2009") on the level of low energy buildings new KfW grant programme regulations ("KfW-Effizienzhaus 70, 55 and 40", Passive Houses)

Loga et al. 2012: Scientific Report Germany – Further Development of the German Residential Building Typology; Institute for Housing and Environment, Darmstadt, Germany

Age Bands – Data Driven

Baualter der Gebäudekategorien



Data from Non-Domestic Building Research Database of Germany (DataNWG)

Project currently ongoing.
 Sample size
28,433 Buildings
Descriptive Assessment



Julian Bischof

IBPSA Project 1 – Expert Meeting Paris – October 01-02, 2018

Building Category

Gebäudefunktionen

Data from Non-Domestic Building Research Database of Germany (DataNWG)

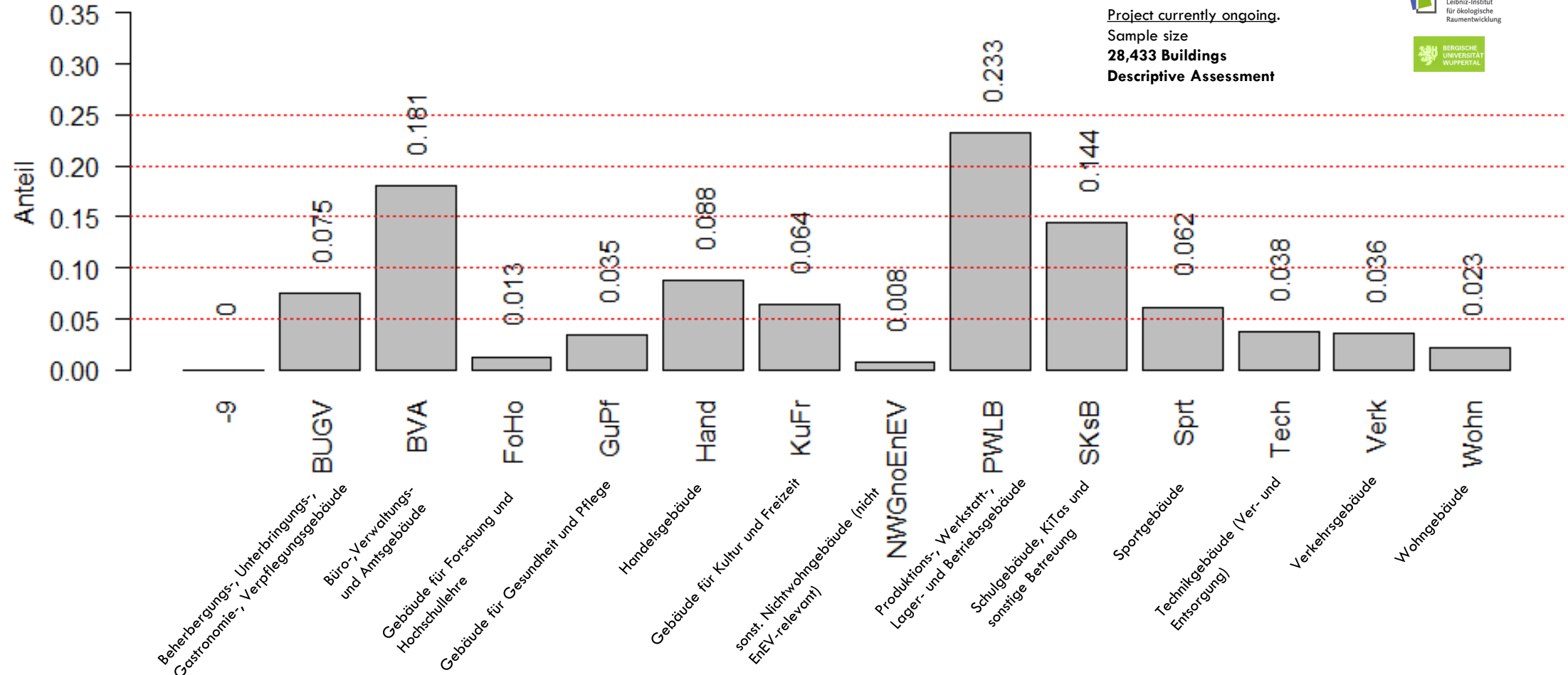


Project currently ongoing.

Sample size

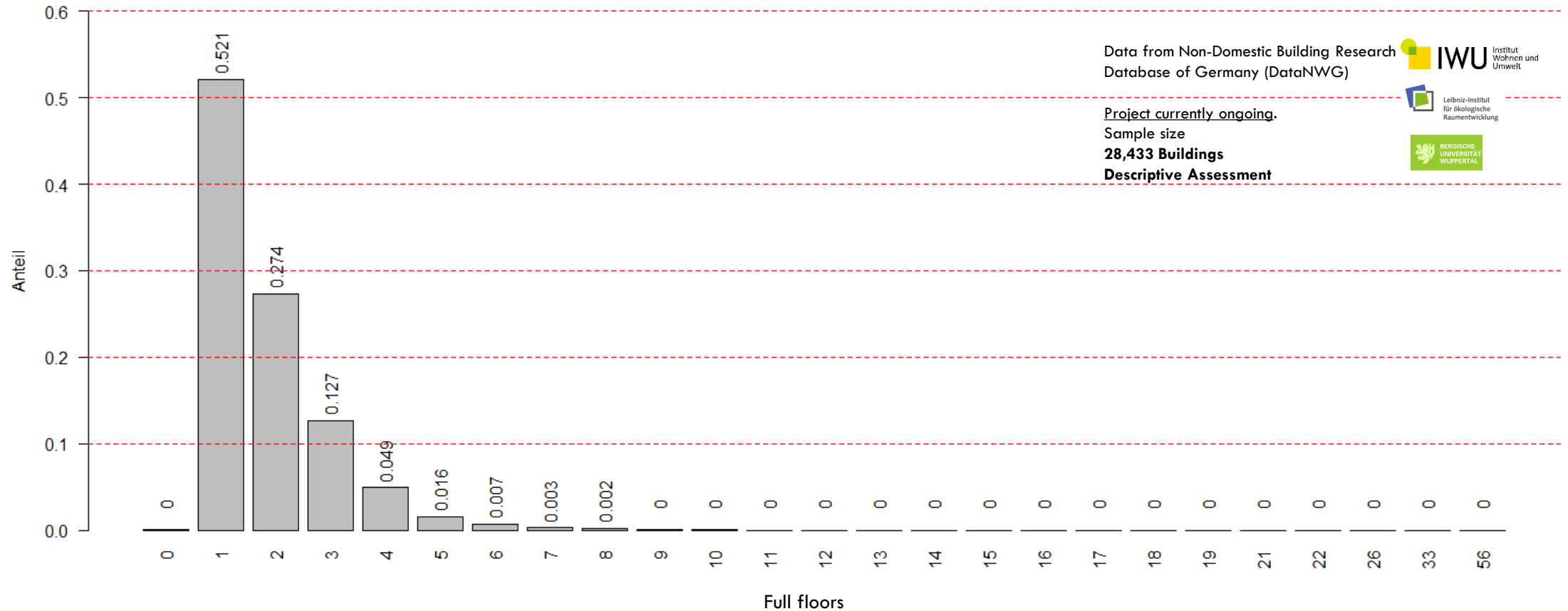
28,433 Buildings

Descriptive Assessment

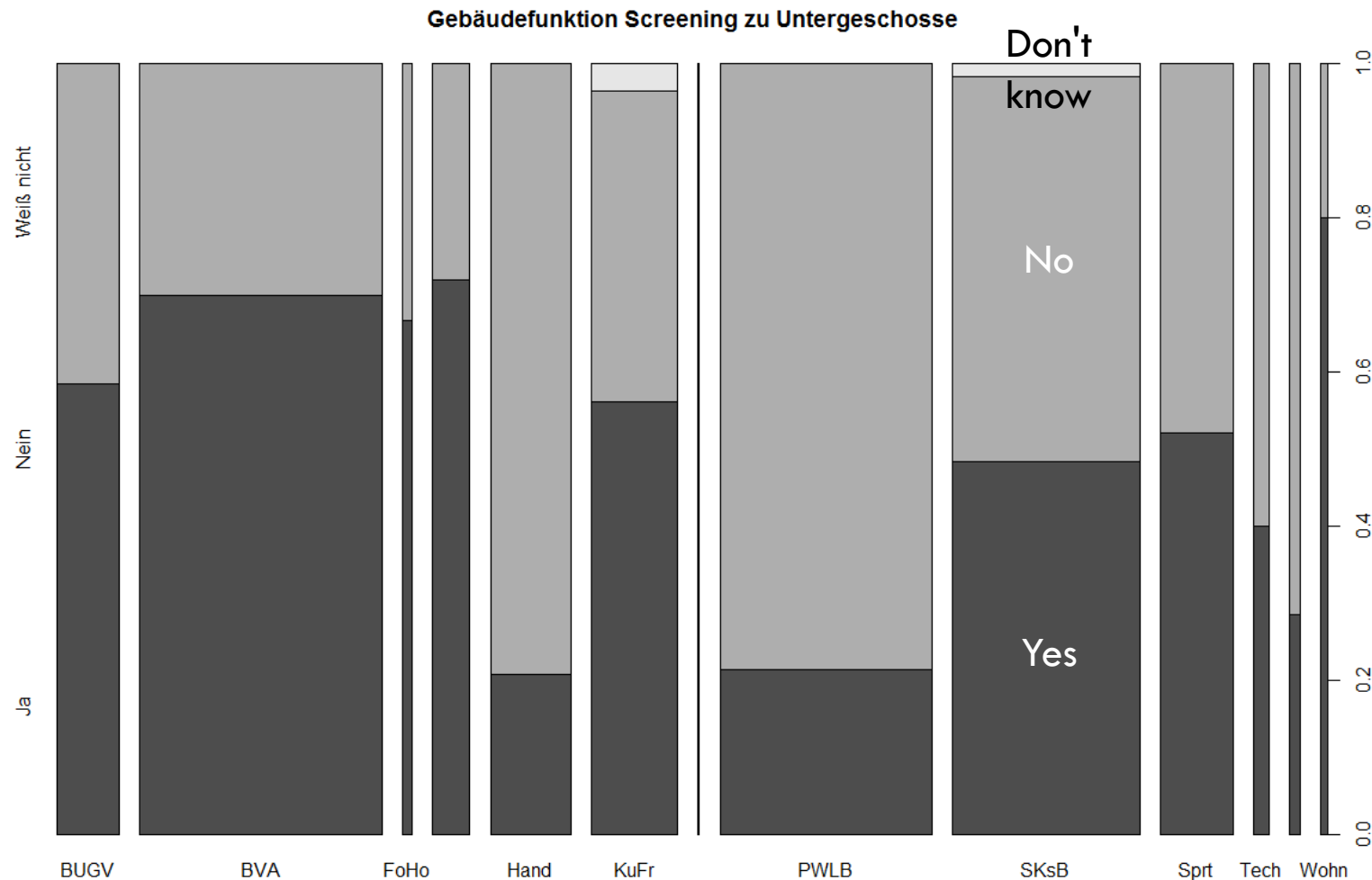


Geometry

Vollgeschosse gerundet



Construction Type – Basement Yes/No



Data from Non-Domestic Building Research Database of Germany (DataNWG)

Project currently ongoing.

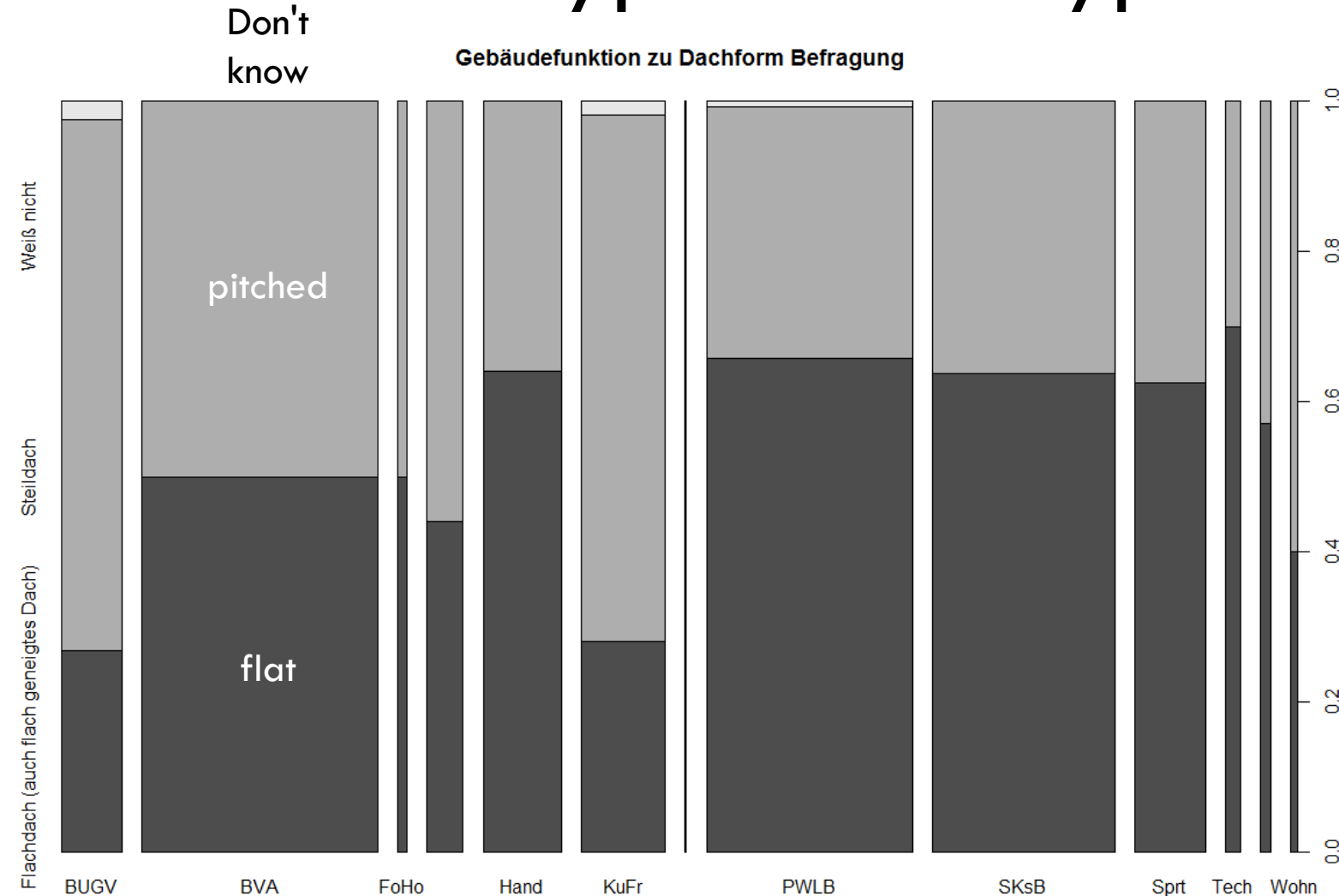
Sample size

677 Buildings

Descriptive Assessment



Construction Type – Roof type flat/pitched



Data from Non-Domestic Building Research Database of Germany (DataNWG)

Project currently ongoing.

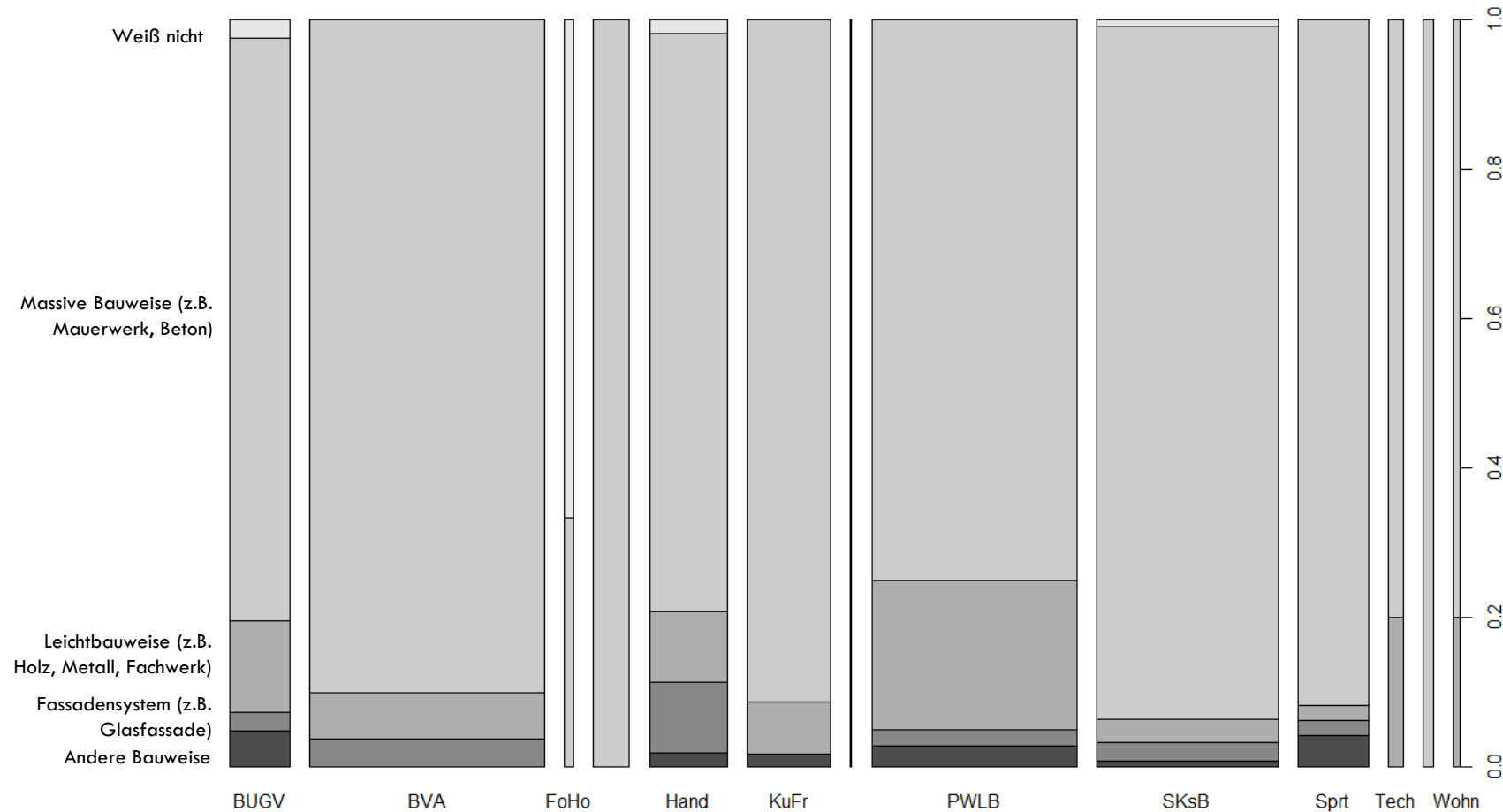
Sample size
28,433 Buildings

Descriptive Assessment



Construction Type - Structure

Gebäudefunktion Screening zu Bauweise Fassade Primär



Data from Non-Domestic Building Research Database of Germany (DataNWG)

Project currently ongoing.

Sample size

677 Buildings

Descriptive Assessment



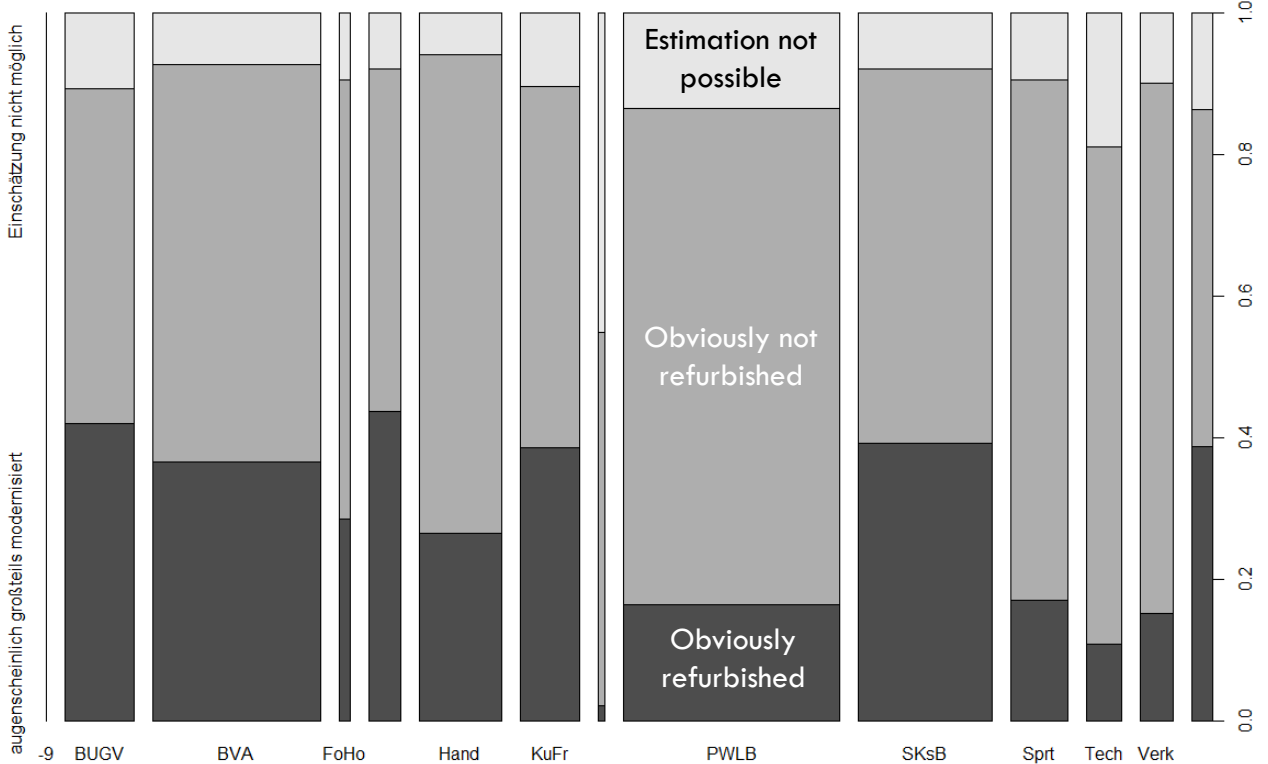
Modernization

Project currently ongoing.
 Sample size
677 Buildings
Descriptive Assessment

Has building been refurbished?

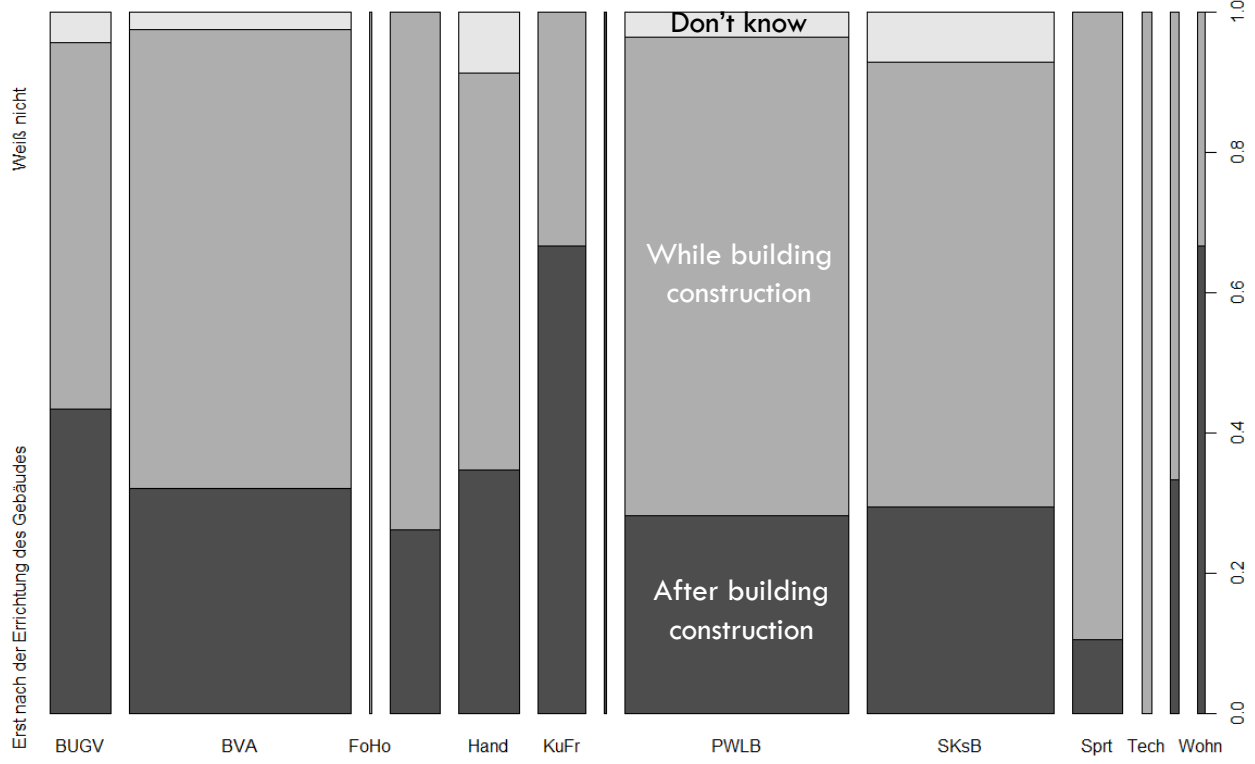
Modernisierungszustand der Gebäudekategorien

Project currently ongoing.
 Sample size
28,511 Buildings
Descriptive Assessment



When was the insulation applied?

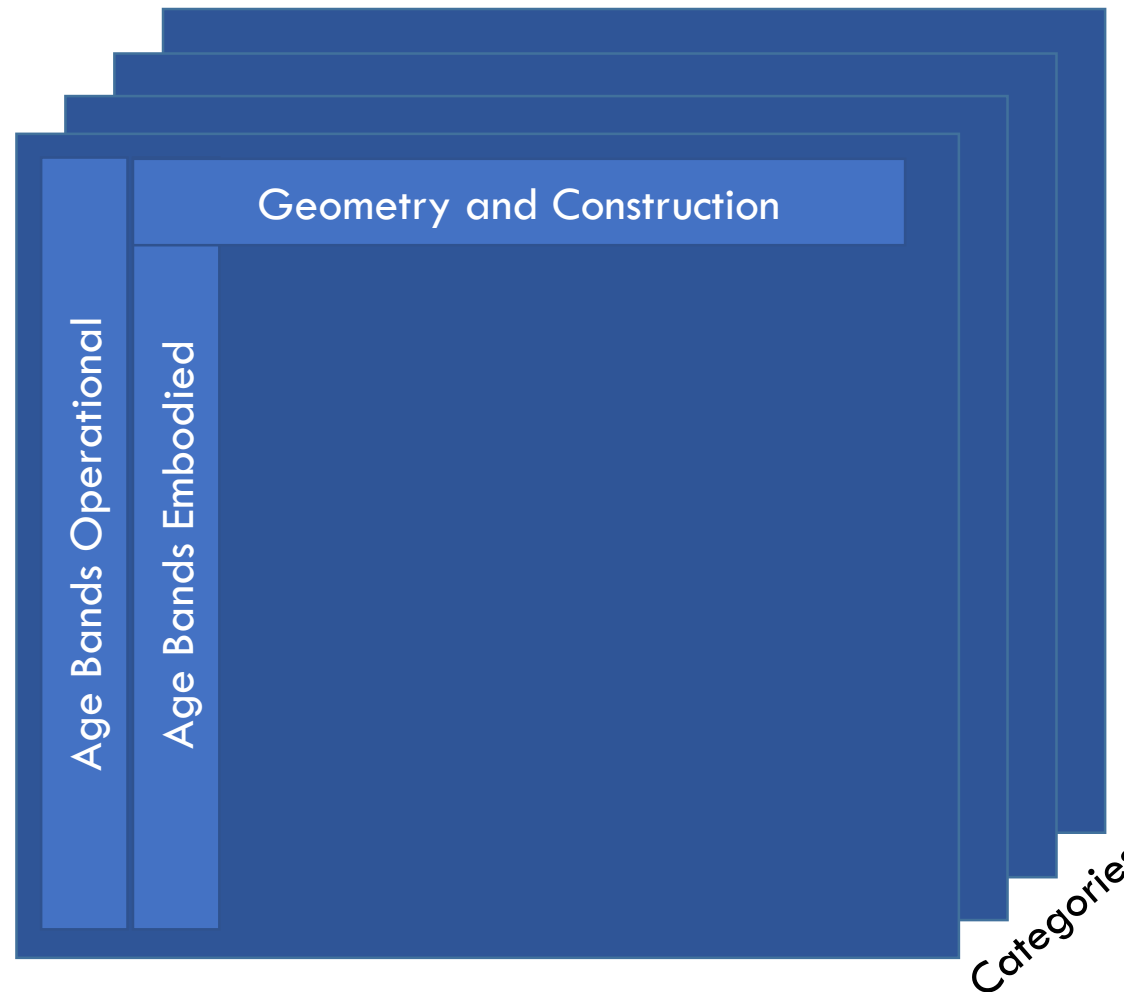
Gebäudefunktion zu Außenwand Gedämmt Zeitpunkt



Cluster Matrix Proposal

If possible data driven to represent current status of building stock. Historic building attributes that are not current anymore (refurbishments) are generally not of interest for operational building simulation.

Legislation driven as change of total building structure is unlikely.



Separated by building usage category and modernization

