Cross **BO**rder **RIS**k assessment for increased prevention and preparedness in Europe

Collection on input data in transboundary regions

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Final Conference of BORIS Project on multi-risk assessment in cross-border areas

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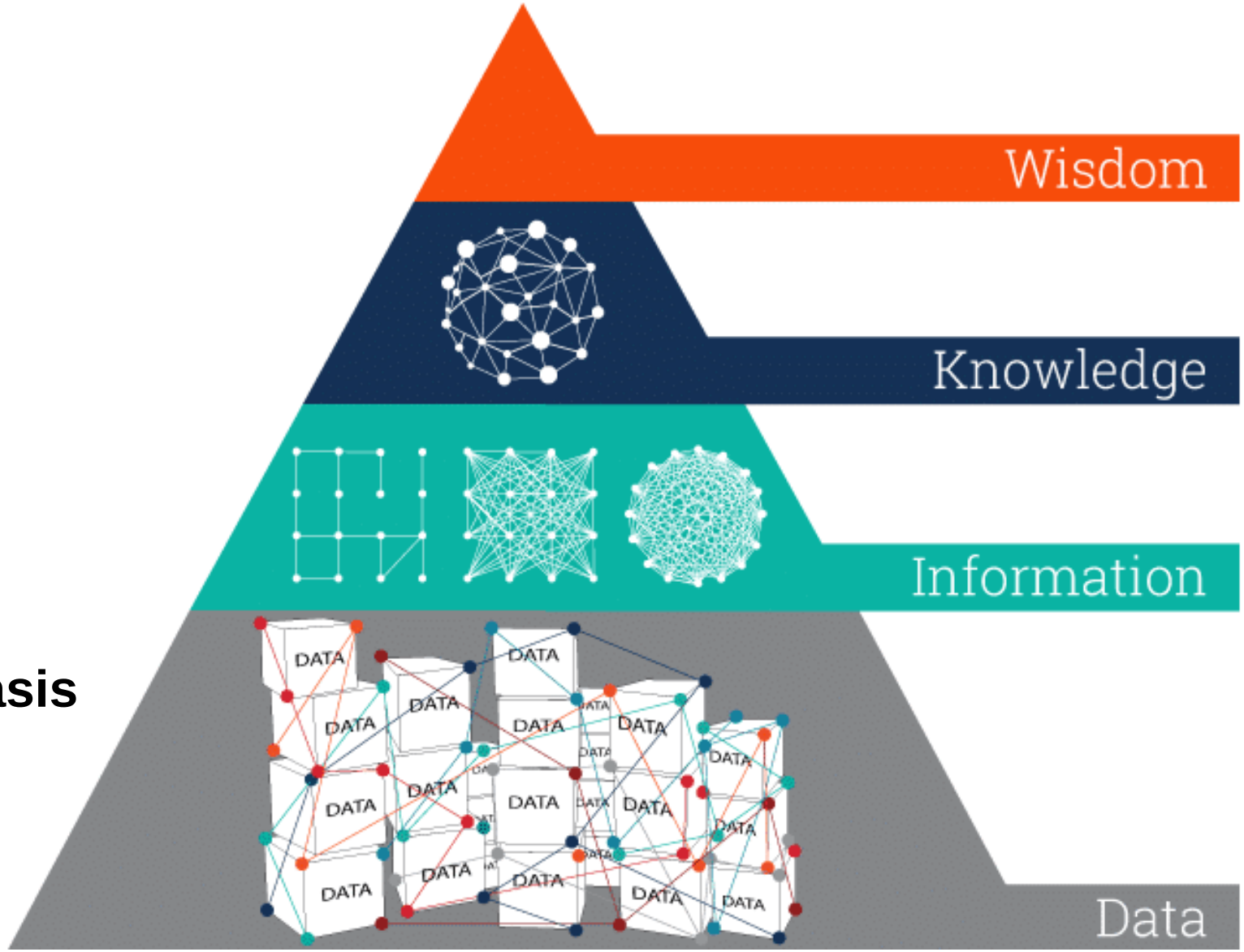
DCNAustria
Disaster Competence Network Austria

Data is the basis



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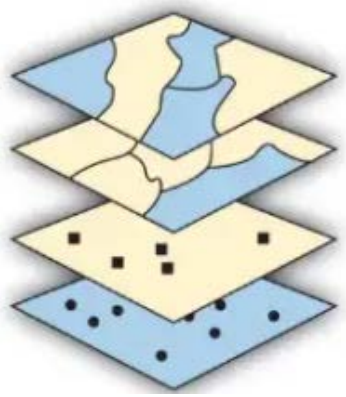
The CROSS-BORDER context

Barriers

- national approaches to risk assessment
- provision of legal frameworks
- data sharing
- available IT infrastructure
- cooperation of thematic experts working on similar risks
- availability of data

Statistical information
Geoinformation



Initial (data) situation

- ↓ **NRAs** mainly based on **deterministic scenario-based risk assessment**
- ↓ **Time-based risk assessment** is an option for unbiased multi-risk assessment in the future.

- ↓ Assessed **data availability and needs** for cross-border risk assessment, obstacles and solutions.

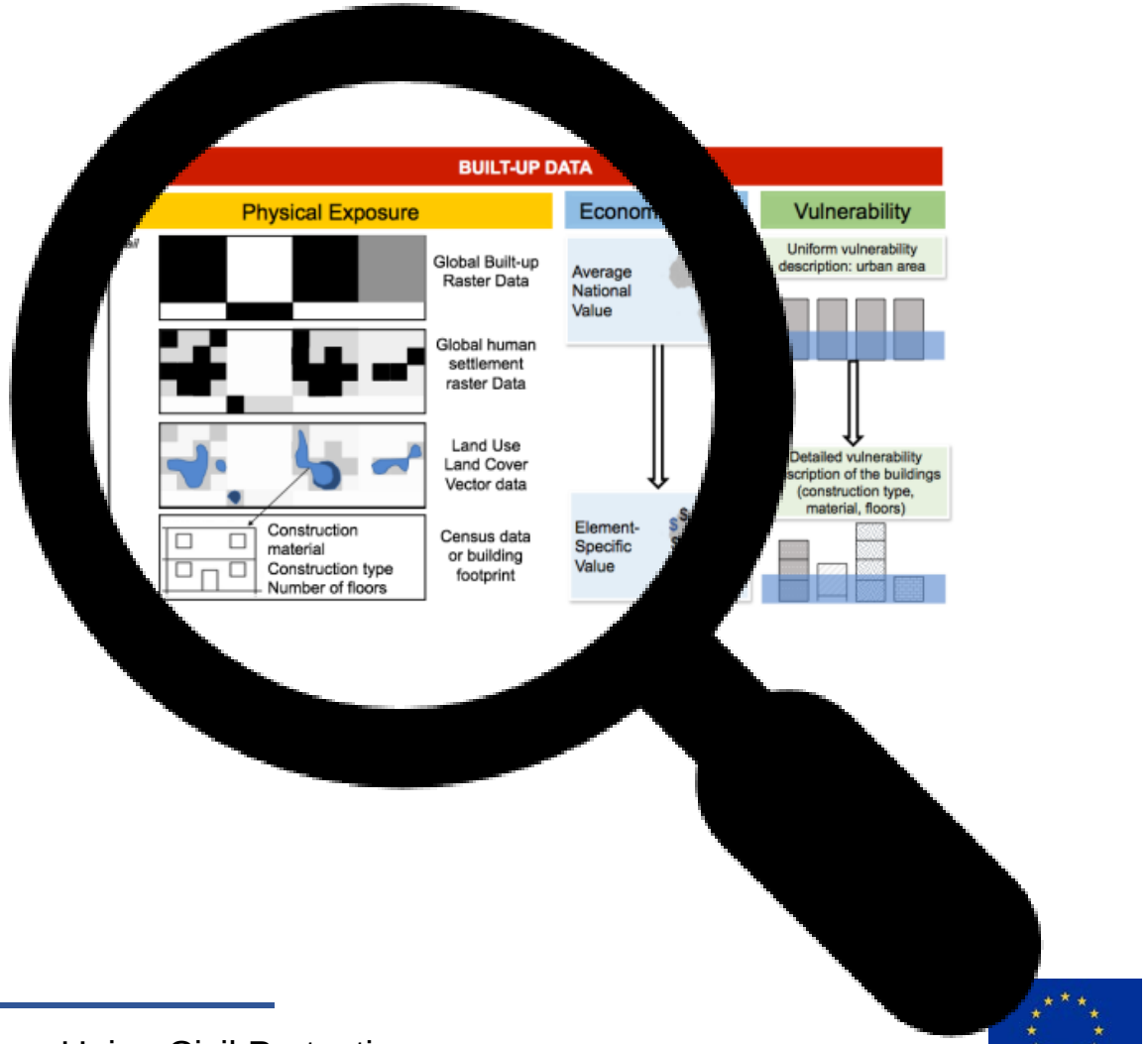
- ↓ Outlined that most of the data needed for exposure and vulnerability and consequently for risk evaluation have **different General Data Protection Regulation** (GDPR) restrictions. Collection and use is determined by different national legislations and stakeholders.

- ↓ BORIS Team agreed to use **municipality level** as the basic spatial unit for development of the methodology and the pilot applications. Focusing on **residential buildings and population** as **assets at risk.**

Analysis of the local data provided by each country and uncertainties

Non-homogeneity of data among the countries

- Identification of **harmonised classes /categories** between the countries
- A baseline assessment: **available datasets at global or european level** are used → reduce uncertainties and show a easily replicable and simpler procedure
- A detailed assessment: **integration local data available** within the different countries → increase in detail and spacial accuracy



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Data for seismic risk

Data available for seismic risk assess

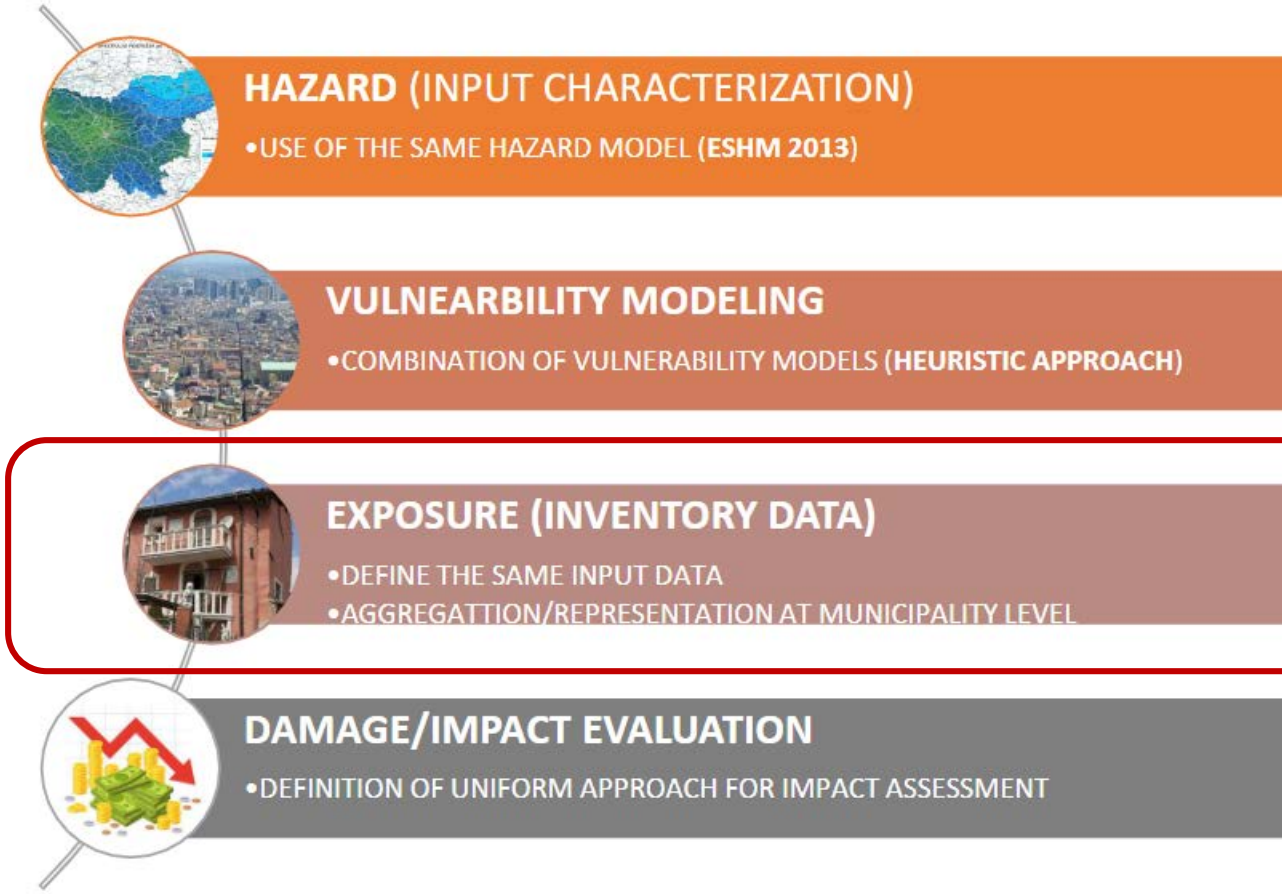


Table 3.3: Data sources and related approaches for building inventory (adapted from Polese et al., 2019)

Source	Building features	Applicability scale	Advantage	Disadvantage	Example applications for inventory
Census data	storey number; construction age; construction material - RC/Masonry/Other; state of preservation	from town districts to regional or national scale	complete database for all the nation; information on both population and buildings; free or low-cost database	Some countries have limited info by census returns; variable size of census unit; data are available in aggregated form at the census tract level for privacy reason; census forms compiled by non-experts	Crowley et al., 2014; Dolce et al. 2021
Remote sensing (HR or VHR imagery)	building shape, position and height	from town districts to regional, national or even larger scale	automatic and semi-automatic detection algorithms are being developed; geo-referenced spread data on potentially very large building stock; can be easily updated	requires processing massive data volumes; necessary the combination with other data sources (e.g. urban context information and/or local surveys on benchmark buildings) to derive attribute type building features (e.g. construction age, roof type)	Miura et al., 2006; Polli et al., 2009
Interview based survey	Detailed spatial and attribute type building features for building typologies and %incidence of building typologies in a district	from town districts to regional or national scale	detailed info for building typologies; speed economic approach	data reliability depends on interviewed experience/knowledge of the built environment	Dolce et al., 2002; Guéguen et al., 2007
Real Estate Register or Cadastral Maps	storey number; construction age; construction material - RC/Masonry/Other; Building location	from town districts to regional or national scale	complete database for all the nation; information on both population and buildings;	Available in few countries; in some cases not free of charge; info on population is available in aggregated form at the census tract level for privacy reason;	Babič et al., 2021b
Building by building	Detailed spatial and attribute type building features	town districts	detailed info for single buildings in a district;	costly and time consuming; difficulty of access to information for not visible features (e.g. horizontal system; strengthening interventions etc.)	Del Gaudio et al., 2015; Polese et al., 2018

Exposure data for seismic risk

Assets at risk – building stock

Building typologies defined based on:

- Construction material
- Age of construction
- Number of storeys

Census data
at municipality level →

	ITALY	AUSTRIA	SLOVENIA
Material	masonry	masonry	masonry
	reinforced concrete	reinforced concrete	reinforced concrete
	other	steel frame, wooden frame	other
Stories	1, 2, 3, >=4	1, 2, 3, 4, 5, 6	1, 2, 3, >=4
Period	< 1919	< 1919	< 1919
	1919 - 1945	1919 – 1944	1919 - 1945
	1946 - 1960	1945 – 1960	1946 - 1960
	1961 - 1970	1961 – 1970	1961 - 1964
			1965 - 1970
	1971 - 1980	1971 – 1980	1971 - 1981
	1981 - 1990	1981 – 1990	1982 - 1990
	1991 - 2000	1991 – 2000	1991 - 2000
	2001 - 2005	2001, 2002 … 2021	2001 - 2007
	> 2005		> 2007

Building by building data were aggregated at **municipality level** considering relevant age ranges.

Exposure data for seismic risk

Assets at risk – building stock

Data gaps and solutions

AUSTRIA
?
?
?
1, 2, 3, >=4
< 1919
1919 - 1945
1946 - 1960
1961 - 1970
1971 - 1980
1981 - 1990
1991 - 2000
2001 - 2002
2003-2004
.....

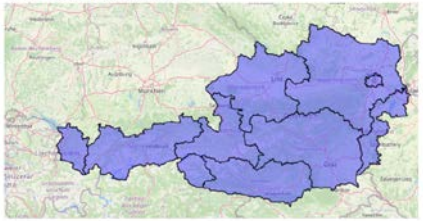
The information about the construction material is just obligatory since 2011. So for up to 80% of the buildings within the pilot municipalities there is no data.

European dataset ESRM20

Data available at federal state level

- Construction Material/Lateral load resisting system
  - Unreinforced masonry
  - Concrete frame with infill panels
  - Concrete wall
  - Wood
  - ....
- Number of storyes
  - Low rise (1-2 storyes)
  - Mid rise (3-5 storyes)
  - High rise (6-10 storeys)
- Design code level
  - Pre code
  - Moderate code
  - High code

ESRM20 Exposure Model



Austrian Pilot Seismic Exposure

To fill gap on material data

Expert Interviews → applying the CARTIS Methodology in Austria

"The CARTIS form has been conceived in order to characterize the built environment of municipalities mainly made of ordinary reinforced concrete and masonry buildings with residential use."

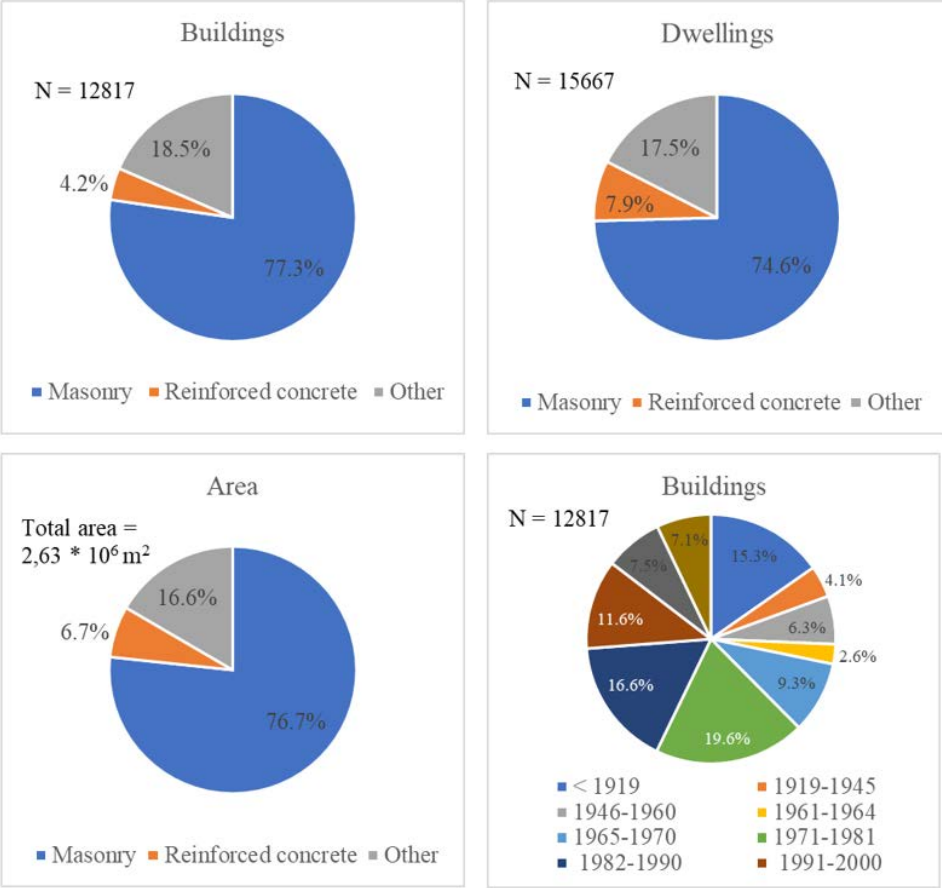
- Interview based method to collect data for seismic risk assessment
- construction experts, architects,

→ Combination with statistical data and validation with ESRM20 data

Construction Period	Material	Stories	Aggregation type	Quality / Sub-categories	Comments on regional differences [Bad Rad & leibnitz]
<1960	Masonry percentage 80%	1-3 stories 95%	Isolated 50%	Irregular, regular Regular, Seismic design	
			Aggregated 50 %		
		4+ stories 5%	Isolated		
			Aggregated 100%		
	Reinforced concrete percentage 15 %	1-3 stories	Isolated		
			Aggregated		
		4+ stories 100%	Isolated		
			Aggregated		
	"Other" percentage 5 %	1-3 stories	Isolated		
			Aggregated		
		4+ stories	Isolated		
			Aggregated		
1961-1980	Masonry percentage	1-3 stories	Isolated		
			Aggregated		
		4+ stories	Isolated		
			Aggregated		
	Reinforced concrete percentage	1-3 stories	Isolated		
			Aggregated		
		4+ stories	Isolated		
			Aggregated		
	"Other" percentage	1-3 stories	Isolated		
			Aggregated		
		4+ stories	Isolated		
			Aggregated		
>1981	Masonry percentage	1-3 stories	Isolated		
			Aggregated		
		4+ stories	Isolated		
			Aggregated		
	Reinforced concrete percentage	1-3 stories	Isolated		
			Aggregated		
		4+ stories	Isolated		
			Aggregated		
	"Other" percentage	1-3 stories	Isolated		
			Aggregated		
		4+ stories	Isolated		
			Aggregated		

Exposure data for seismic risk

Assets at risk – building stock



Results - building typologies based on

- Construction material
- Age of construction
- Number of storeys

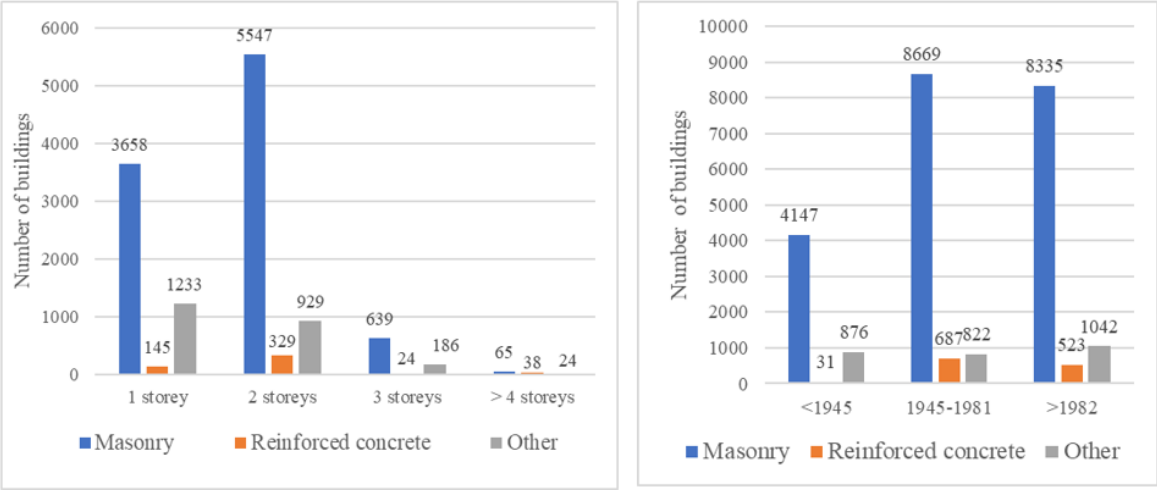


Figure 3.8: Building stock distribution in Slovenia in Pilot 2 region (border with Austria)

Exposure data for seismic risk

Assets at risk – population

Figure 3.9: Distribution of Slovenian population in Pilot 2 region (border with Austria)

Population living in the defined building typologies

Exposure data for flood risk

Assets at risk – population and building stock

- Statistical data
- Available exposure models (not adopted)
- Global datasets on population distribution, settlement identification and land use / land cover
- Building footprints

A **downscaling methodology** to implement the **global information** on the building footprints.

Main elements used for exposure characterization of the
Population → residential population
Building stock → building use, number of storeys

(exposure) DATA

Future needs

- Standardized (available) open data
- More data about other assets at risk e.g. all buildings and infrastructures.
- Development of (european, global) exposure datasets (dynamic datasets / keeping values up to date)
- Standards to build exposure database in transboundary regions
- Hazard model specifically for the cross-border areas / region-specific effects
- Region-specific vulnerability models and / or harmonized european methodology for vulnerability assessment

Thank you !