

Building Attribute Ruleset for Taipei Building Stock

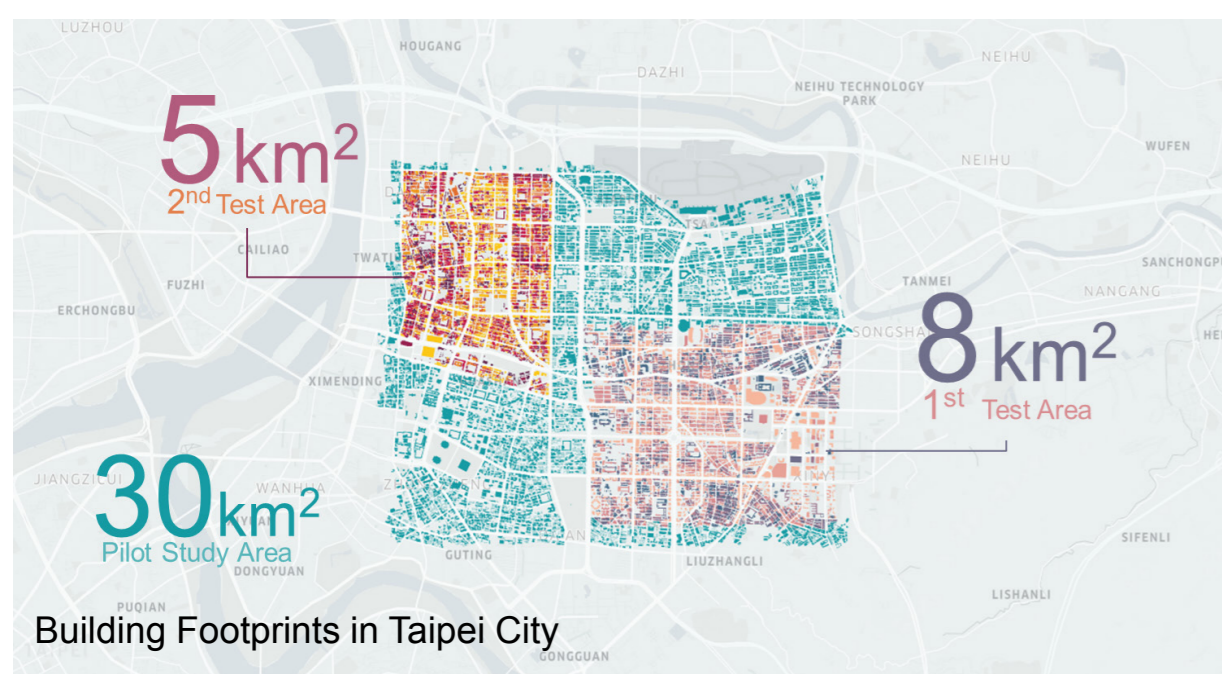
- Development of Economic Exposure Data (EED) for cities requires detailed characterization of building attributes such as building height, footprint area, occupancy, age, construction type and replacement cost
- Rulesets for such building attributes are developed for Taipei using building heights and footprint areas as inputs
- These rulesets will later be modified and used for three S.E. Asian cities of Jakarta, Manila and Bangkok using building heights and footprint areas extracted from high resolution satellite imagery in a sister project

**Kuo-Shih Shao, En-Kai Lin,
Yi-Rung Chuang and Kuan-Yi Lee**
Disaster Prevention Technology Research Center
Sinotech Engineering Consultants, Inc., Taipei, Taiwan

Tso-Chien Pan and Edmond Y.M. Lo
Institute of Catastrophe Risk Management, NTU, Singapore

Study Area, Data Source and EED Ruleset

Taiwan Building Administration Data (TBAD) data used to develop rulesets (16,000 buildings over 30 km² for age; 7,000 over 2 test areas of 13 km² for other attributes). Test dataset comprised 2205 extracted building polygons.

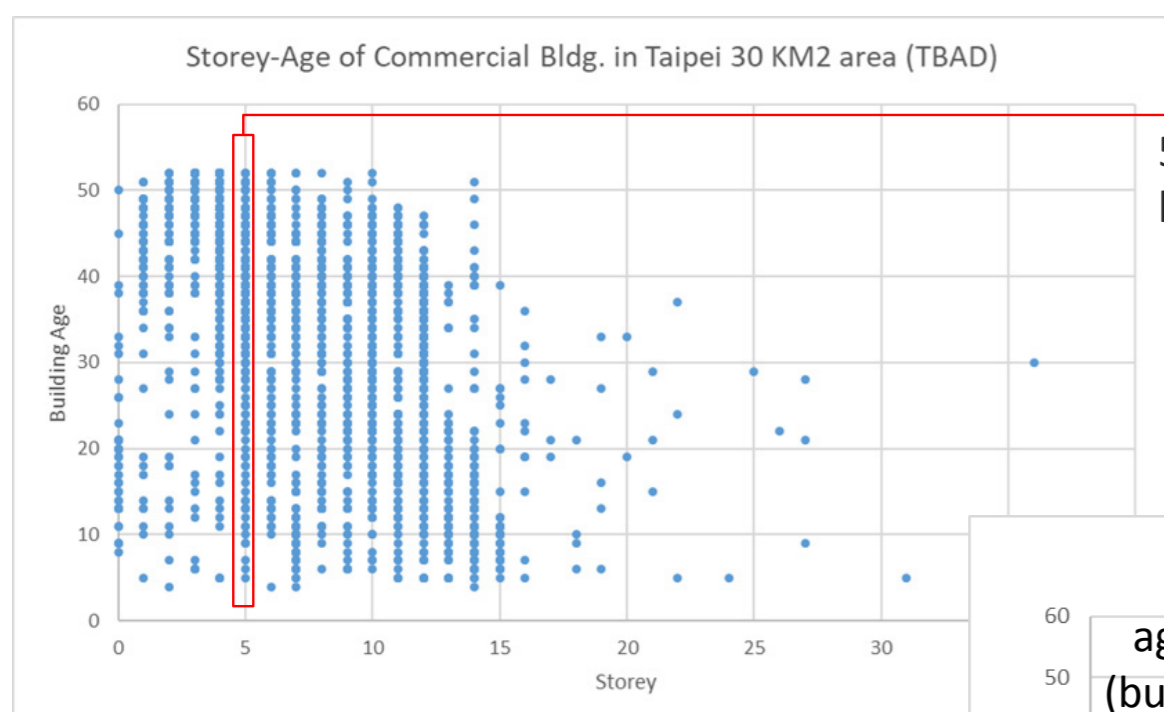


Occupancy	TBAD dataset	Test dataset	Description
Residential (1290, including mixed)	4,700	1,290	Apartment, house, villa, townhouse, etc.
Commercial (851 plus 37 light industry)	2,200	851 plus 37 light industry	Shopping mall, theaters, restaurants, arenas, office building, banks, light industry, etc.
Public (27)	100	27	School, government office, train station, gas station, hospital, activity center, museum, park, etc.

EED ruleset	Reference sources	Ruleset
Occupancy	Taipei Zoning map plus new ruleset for Mixed	Residential, Mixed, Commercial (includes light industry) and Public
Num of storeys	Extracted building height, Taiwan building code /regulation	Inter-storey height of 3.3 m for residential; 3.6 m for others
With / without basement	Taiwan building practice	Storey \geq 5 has basement Storey $<$ 5 w/o basement
Age	TBAD Statistics	Age (year built) band as dependent on # storeys and occupancy
Construction type	TBAD Statistics	B+RC, RC, SRC, Steel as set by age-band and occupancy
Building Repl Value	Open issue	Calculated using Taipei reported 2014 construction cost tables

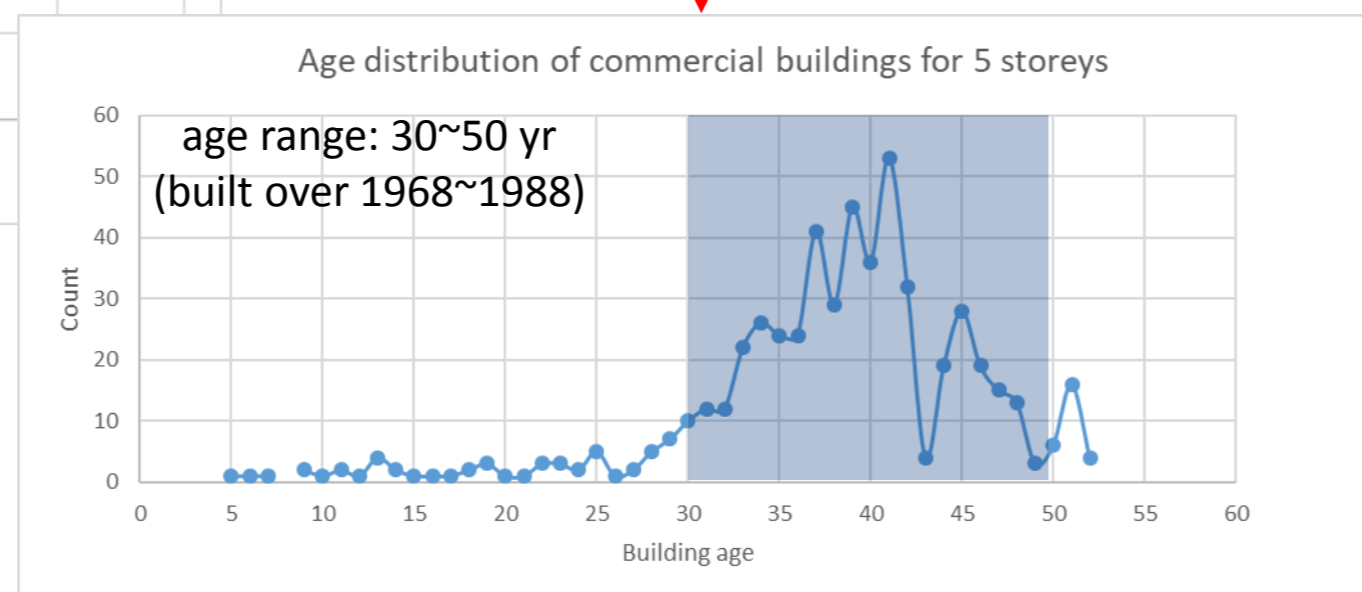
Building Age Bands set by Occupancy and Storey Height

Storey Height sets Construction Type

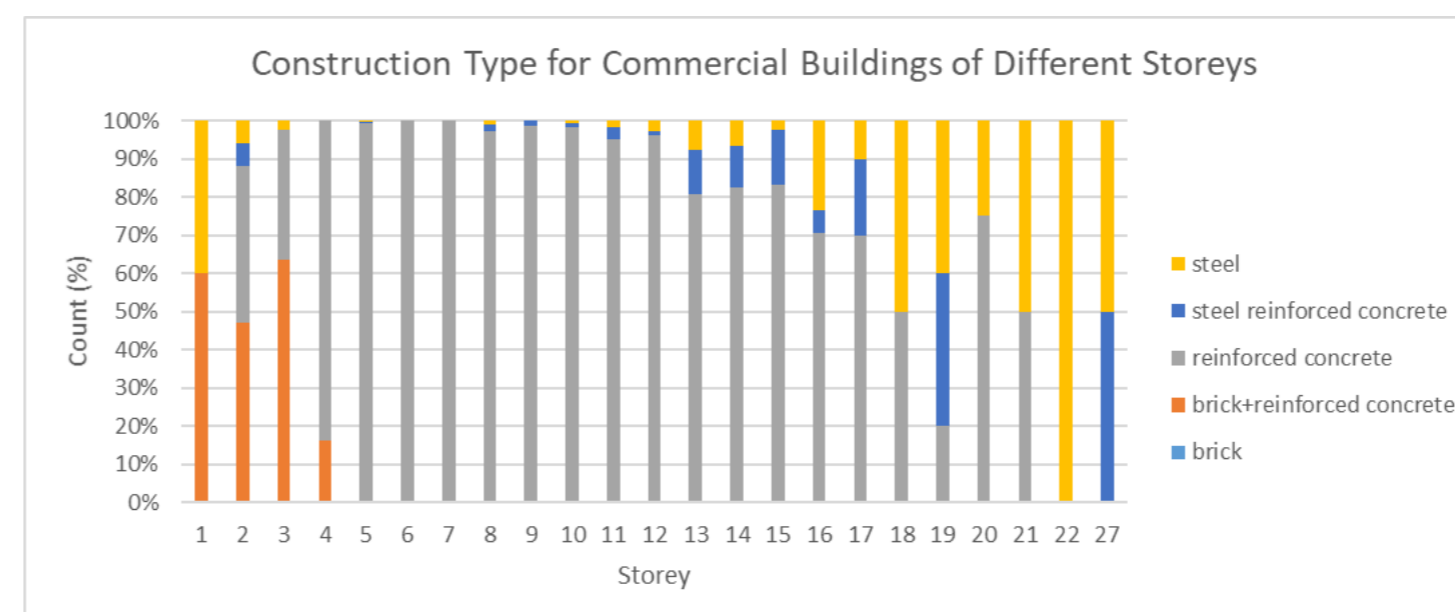


546 Commercial Buildings with height 5-storeys

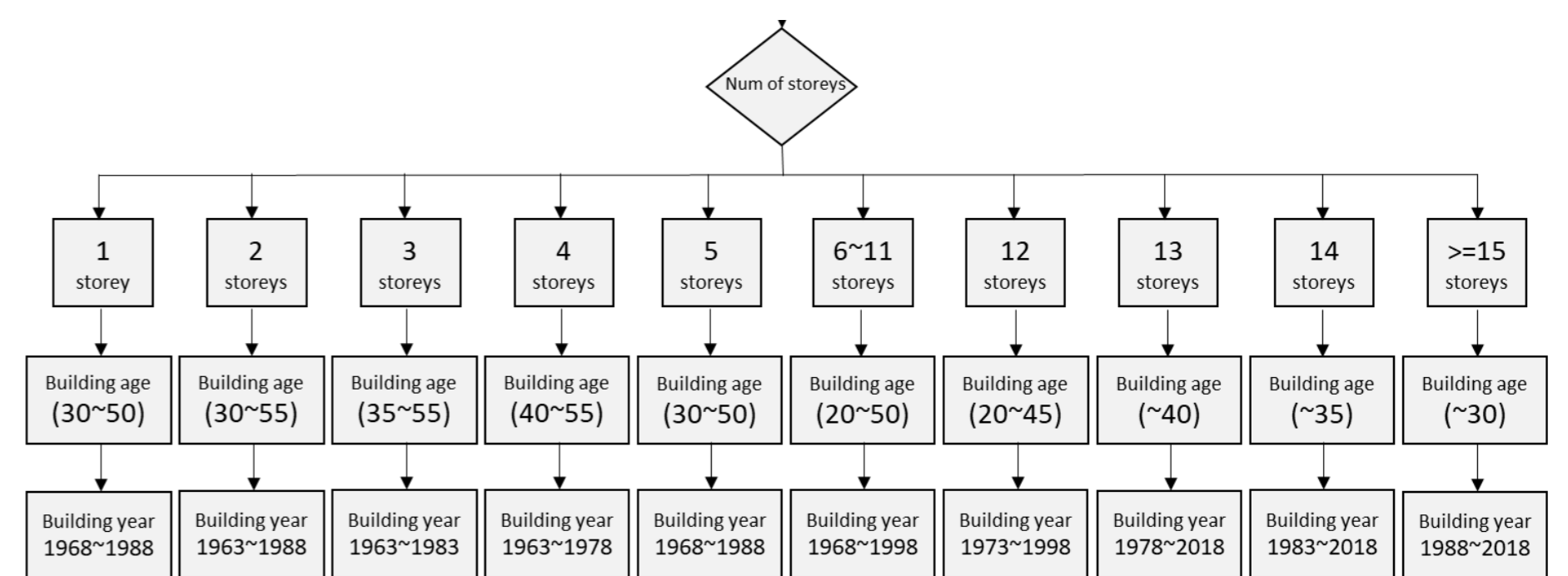
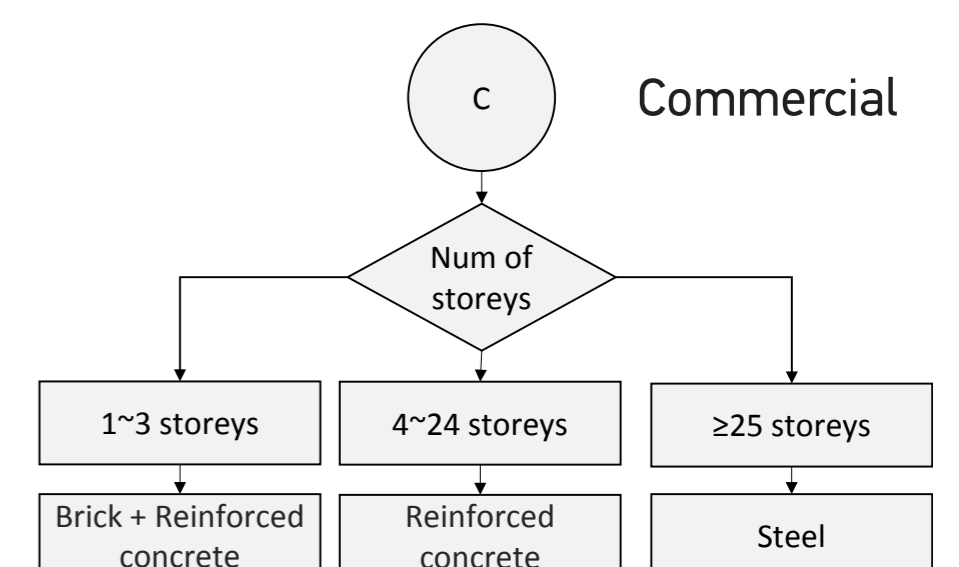
Building count within the age range: 473/546 (87%)



Set age band by examining age distribution of bldgs of each storey from TBAD statistics



Construction Type



Summary

- Project developed rulesets for ready evaluation of building attributes using height and footprint area extracted from satellite imagery as inputs
- Prediction accuracies exceeding 80% achieved
- Inherent variability exists when estimating building replacement cost by construction cost versus insured amount
- Developed ruleset for building attributes together with height and footprint area form a detailed Economic Exposure Dataset suitable for insurance applications.

Accuracy

Attributes		Correct count	Overall Accuracy
Num of storeys	abs(dS) \leq 1F	1800	81.6%
	abs(dS) \leq 2F	2107	95.6%
	abs(dS) \leq 3F	2166	98.2%
With / without basement		1800	81.6%
Occupancy		1841	83.5%
Construction type		1954	88.6%
Age band		1810	82.1%

Accuracy Check on 2205 extracted building polygons