

# **Architectural Strategies for Long-Term Obedience to Increasing Building-Constructive Energy Performance Requirements**

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# Introduction

- Topic

... 'future-proofing' built works of architecture, frames within the sustainability quest

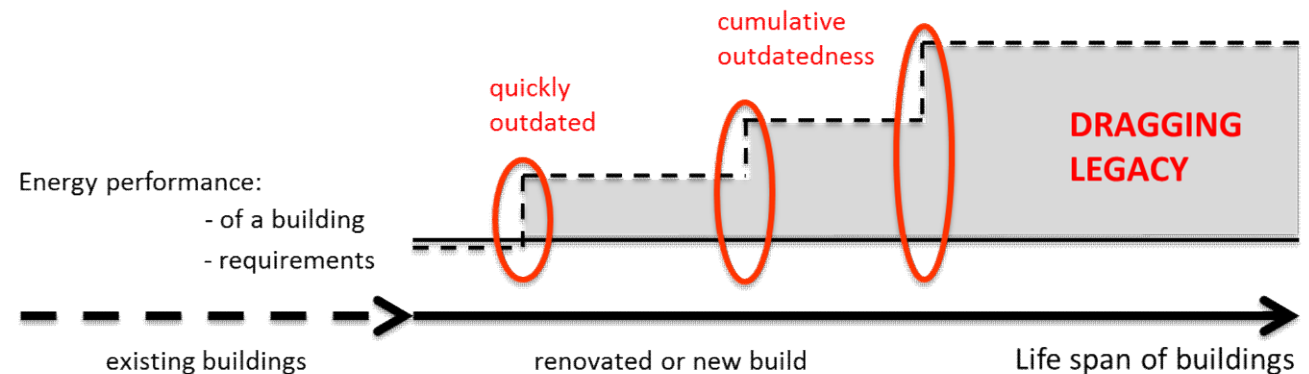
- Findings > Incentives

... design teams / literature hold a rather **narrow approach to 'future-proofing'**:

- **physical-spatial aspects** (e.g. extendibility, partitionability, reconfigurability)
- **building-technical aspects** (e.g. source/system for heating, ventilation, cooling)

... rapidly increasing energy performance requirements for new build & renovation

... futures thinking regarding the energy performance of the building envelope is not commonly addressed > **dragging legacy**



# Introduction

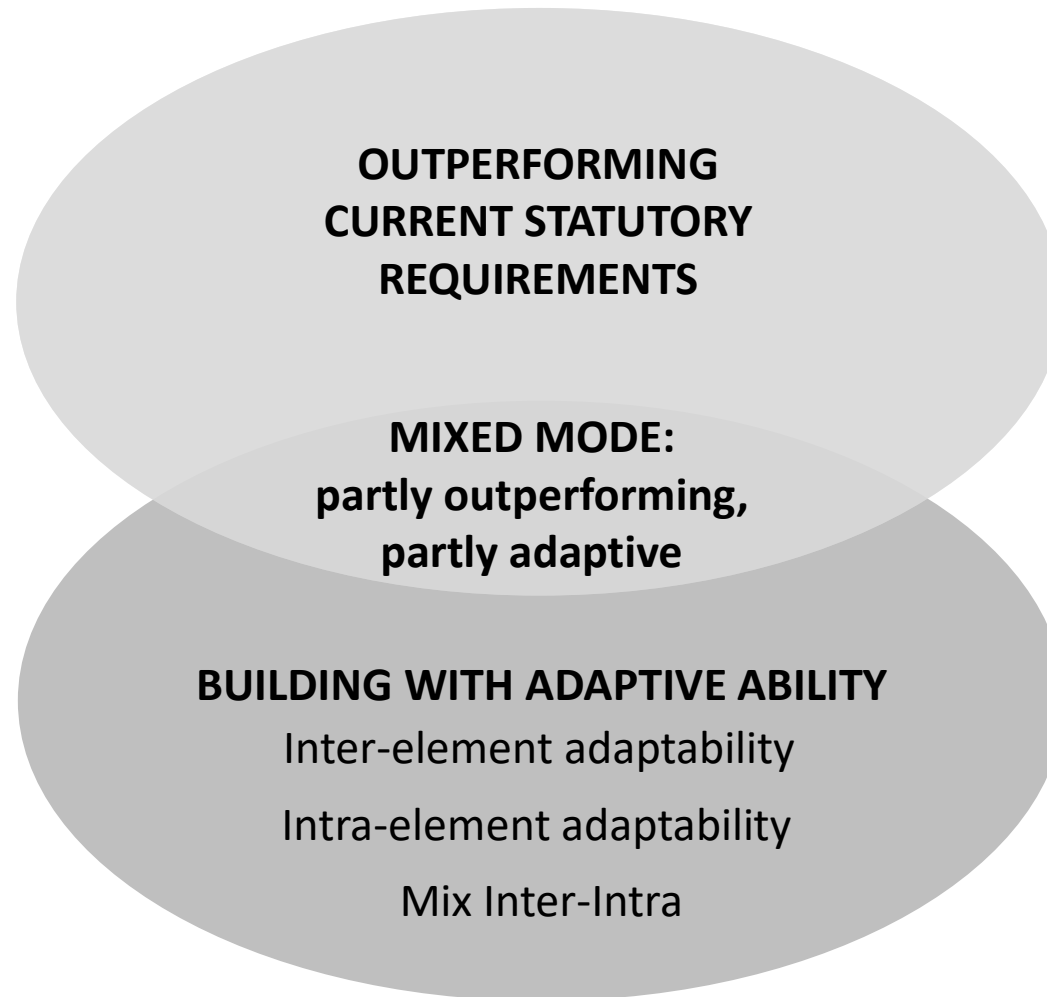
- **Problem statement** ... narrow approach to 'future-proofing':
  - **Hindrance** for a good communication, dissemination and implementation
  - **Intricacy** for positioning current research, and for setting an agenda for future research
  - **Dragging legacy** for achieving fully future-proof buildings as part of the concept of sustainable development.
- **Objectives** ... counter this hindrance, intricacy & legacy by:
  - **Explicit, low-complexity framework of architectural strategies** enabling and facilitating building envelopes long-term obedience to increasing energy performance requirements with a(n) (appropriate) terminology & a substantiated/illustrated interpretation
  - Introduction of a tentative **anatomy of each architectural strategy as a knowledge map** to guide design decisions from the early design stages
  - **Agenda-setting reflection for research & practice**
- **Limitations** .... **Concept paper**, based on reflection (needs validation)
  - Rather 'out-of-the-box', as **real-life examples are rare / nonexistent**

# Content

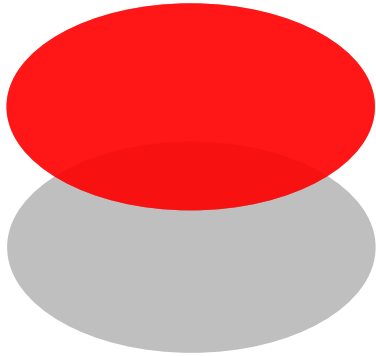
- Introduction
- **Framework**, consisting of three architectural strategies
- **Anatomical knowledge map**, for design support
- **Agenda-setting outlook**, for research/development/implementation
- Wrap up

# Framework

... of architectural strategies for long-term obedience to increasing building-constructive energy performance requirements



# Framework



## OUTPERFORMING CURRENT STATUTORY REQUIREMENTS

installing the outstanding energy performance endowment at first construction

- philosophy of 'choose or lose'
- currently the prevailing view to future proof

Multi family house in Darmstadt (D) by Wolfgang Feist



Single family house in Gent (B) by Arch. Cauchie / Wienerberger-Recticel

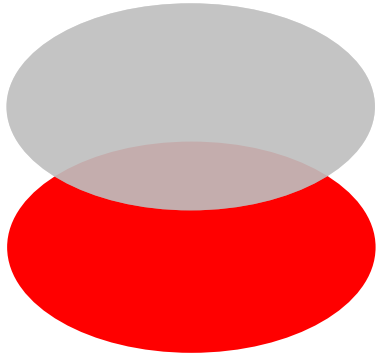


Single family house in Kalmthout (B) by Eprojecten



# Framework

Relevant for  
circular economy



## BUILDING WITH ADAPTIVE ABILITY

providing flexibility which facilitates later transformations to higher energy performances

- 'wait and learn' principle: keeping the possibility to decide later
- necessitates the use of options, which facilitate transformations when relevant developments occur

### Inter-element adaptability

replaceable  
elements

Row houses (NL) by  
Koopmans Bouw b.v. & Teha Groep b.v.



### Intra-element adaptability

adaptable  
elements



Mix Inter-Intra  
replaceable & adaptable  
elements

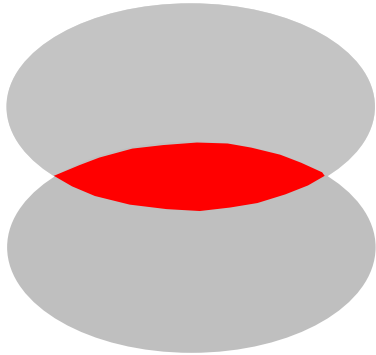


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# Framework

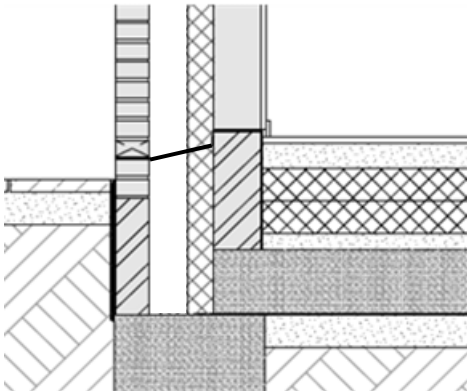
Relevant for  
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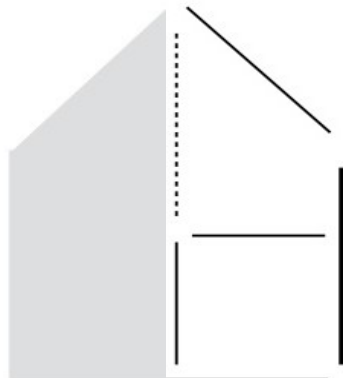
**MIXED MODE: partly outperforming, partly adaptive**  
installing the outstanding endowment at first construction for long-lasting, rather rigid building elements, and providing flexibility for other building elements

- Selection in view of practically and financially feasibility, aimed life spans, architectural preferences, urban contexts and building-constructive methods

Adaptable façade, outperforming floor



Mixed outperforming and adaptable building



SlimFit houses in Almere (NL) by SVP Architectuur en Stedenbouw





# Anatomical knowledge map

- Sustainability = ‘wicked’, ‘complex’, ‘messy’, ...
- Sustainability successes are rather rare
- ‘Design paralysis’ due to complicatedness
  - ‘Epistemic uncertainty’: the subjective feeling of uncertainty caused by a situation in which a designer has insufficient knowledge – or cannot easily retrieve appropriate knowledge from memory – to be able to recognize a situation and act appropriately
  - Detrimental for efficiency and effectiveness of DPs and design outcomes
- Likely to be tackled by a **good design support**
- **Tentative anatomical knowledge** map for design support when designing for long-term obedience to increasing building-constructive energy performance requirements.
- **Relates design decisions (variables) to design outcomes (amenities) through the identified architectural strategies**

# Anatomical knowledge map

**Design decisions:  
VARIABLES**

... as design support

**Design outcomes:  
AMENITIES**

**Material  
selection**  
Renewable  
N-Renewable

**Constructive  
design**  
Rigid  
Lenient

**Architectural  
aesthetics**  
Fixed  
Loose

Other ....

**OUTPERFORMING  
CURRENT STATUTORY  
REQUIREMENTS**



**Responsible  
architecture**  
Durable  
Sustainable

**Continued  
usage**  
Affected  
N-Affected

Other ....

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## **BUILDING WITH ADAPTIVE ABILITY**

Inter-element adaptability  
Intra-element adaptability  
Mix Inter-Intra

**Responsible architecture**  
Durable  
Sustainable

**Continued usage**  
Affected  
N-Affected

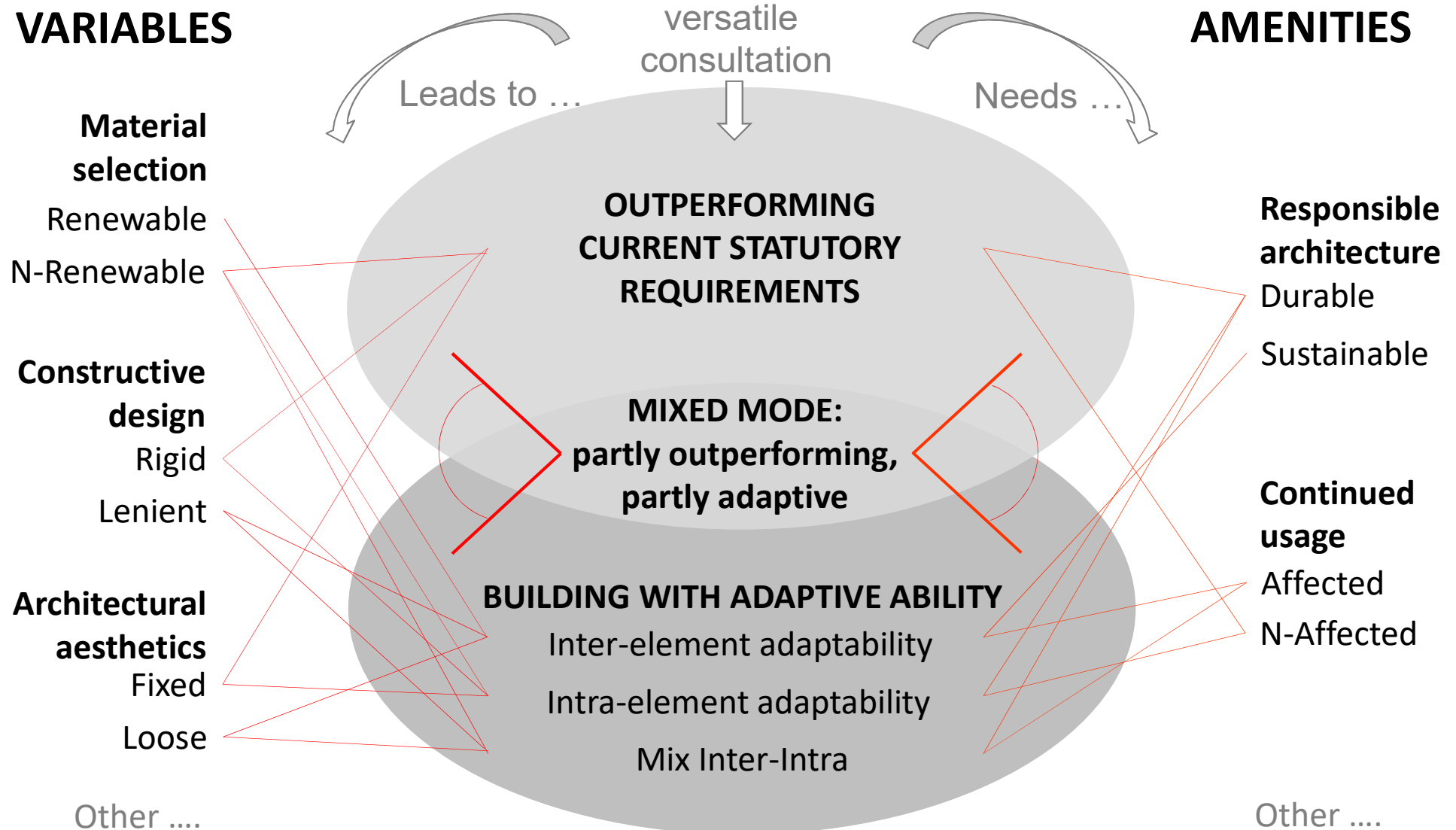
Other ....

# Anatomical knowledge map

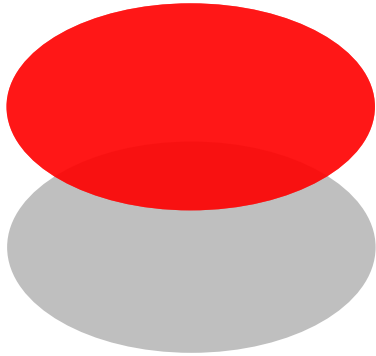
**Design decisions:  
VARIABLES**

... as design support

**Design outcomes:  
AMENITIES**



# An agenda-setting outlook

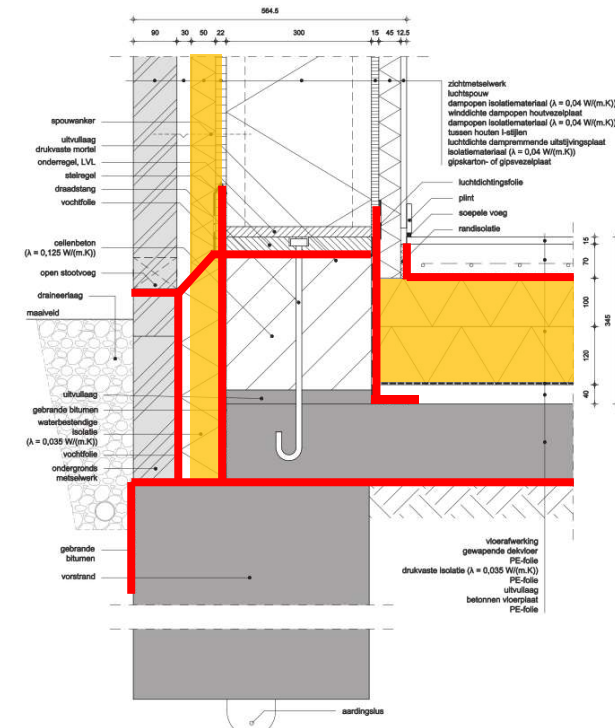
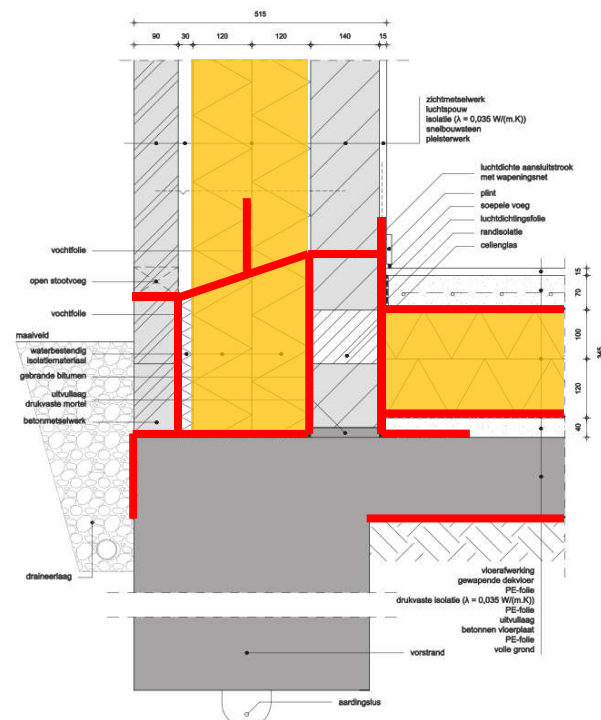


## Durability of outperforming constructions

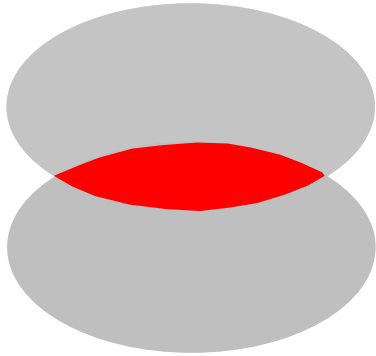
Equal durability of **parts** and wholes?

Especially for **locked-in materials/layers**, e.g. insulation & foils

- Existing configurations of building-constructive concepts and constructive junctions need to be analysed and if needed adjusted.



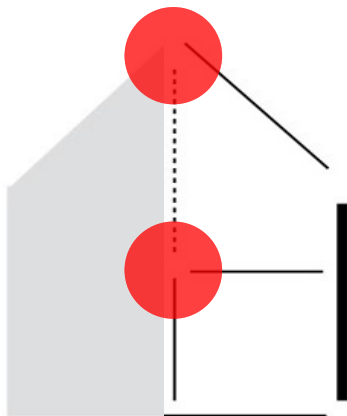
# An agenda-setting outlook



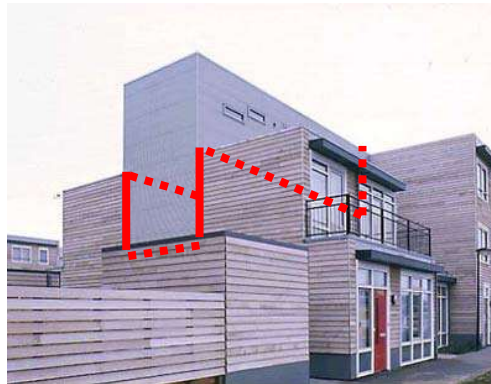
## Mixed mode: attuning outperforming and adaptive building elements

Different building-constructive concepts meet  
Challenging constructive junctions (avoiding cold bridges, ensuring wind/water/vapour tightness) influencing performances on building physics (transmission losses, condensation)

- Building-constructive concepts addressing different architectural strategies need to be attuned, specifically at the meeting points, the constructive junctions > *Atlas of details?*



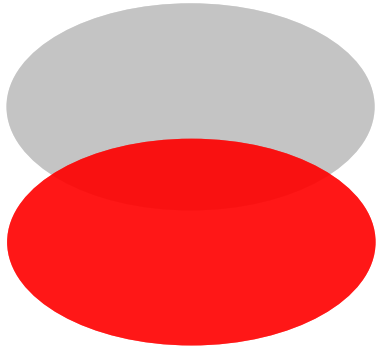
SlimFit houses in Almere (NL) by  
SVP Architectuur en Stedenbouw



Elemental Chile project by Pastel & Kunzl



# An agenda-setting outlook

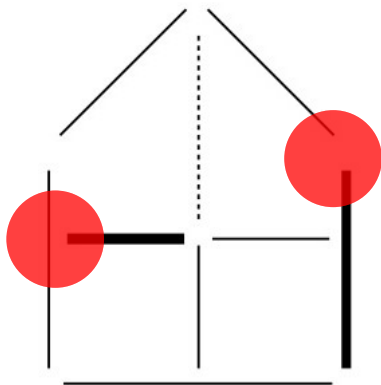


## Facilitating Inter-element adaptability

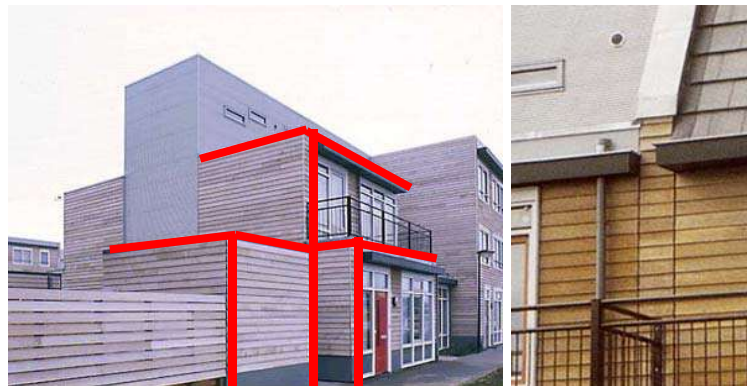
Degree of demountability and genericity?

Within and between building-constructive concepts and between changeable and permanent building parts

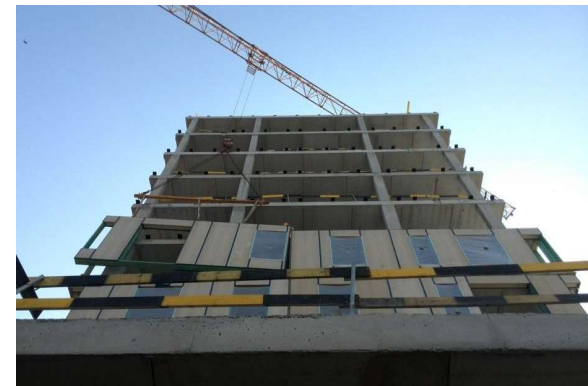
- In order to facilitate/promote the implementation, building-constructive concepts, and especially constructive junctions, need to be fine-tuned and/or redesigned > **Atlas of details?**



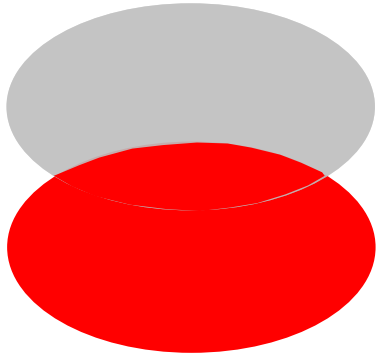
SlimFit houses in Almere (NL) by  
SVP Architectuur en Stedenbouw



Housing block in Antwerp (B) by  
Crepin Binst Architecture & Stramien



# An agenda-setting outlook



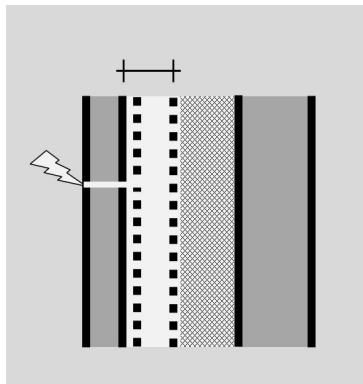
## Development of Intra-element adaptability

Promising innovation in the building sector

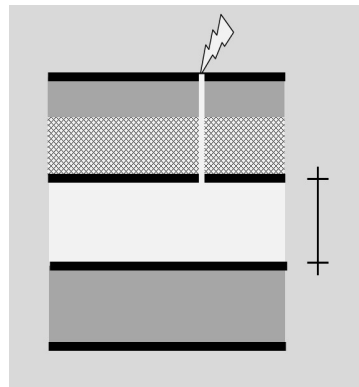
- ✓ PLANET: material flow ↘
- ✓ POLITIC: impact work ↘
- ✓ PROSPERITY: costs ↘
- ✓ PEOPLE: identity =

- An exploration and validation of the principle for different building-constructive concepts (heavy-weight, light-weight, hybrid), building typologies (single family houses, dense housing projects, offices), on- and offsite building methods, etc. is needed

Increased cavity wall width?



Integrated floor cavity?



Other possibilities?





# Wrap up

- **Advocates & addresses**

- ... the need for **'futures-thinking'** regarding the long-term obedience of buildings to increasing **building-constructive energy performance requirements**.

- ... **enriches prevailing approaches of 'future-proofing'** (physical-spatial and building-technical aspects), towards fully future-proof buildings

- **Introduces**

- ... a **framework** of architectural strategies, supplemented with an **anatomical knowledge map** for design support

- ... **low complexity and tentative** ...

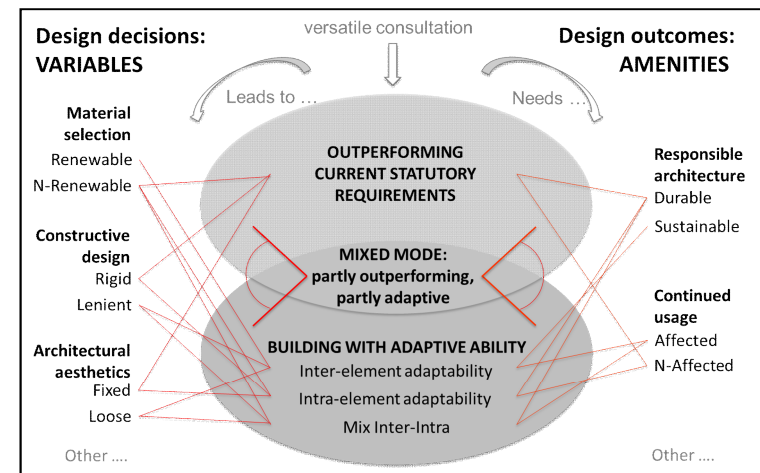
- **Urges**

- ... for future research and development (constructive detailing), to incentivize

- > building industry for implementation of strategies for ...

- > policy makers to upload building codes with requirements for ...

**Future-proofing  
building-constructive  
energy performances**





Thank you.

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