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
• 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**
• Introduction

• Framework, consisting of three architectural strategies

• Anatomical knowledge map, for design support

• Agenda-setting outlook, for research/development/implementation

• Wrap up
... 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
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

**Intra-element adaptability**
adaptable elements

**Mix Inter-Intra**
replaceable & adaptable elements

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

- Material selection
  - Renewable
  - N-Renewable
- Constructive design
  - Rigid
  - Lenient
- Architectural aesthetics
  - Fixed
  - Loose

Design outcomes: AMENITIES

- OUTPERFORMING CURRENT STATUTORY REQUIREMENTS
  - Responsible architecture
    - Durable
    - Sustainable
  - Continued usage
    - Affected
    - N-Affected

... as design support

Apartment house in Hamburg (D) by Gerber Architekten

Other ....

Other ....
Anatomical knowledge map

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  - Renewable
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- Other ....

... as design support

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BUILDING WITH ADAPTIVE ABILITY

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

Silverplaatoren in Antwerp (B) by architect Jul De Roover (1978) > a33 (2013)
Anatomical knowledge map

**Design decisions:**
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  - Other ....

**Design outcomes:**
- AMENITIES
  - Responsible architecture
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**OUTPERFORMING CURRENT STATUTORY REQUIREMENTS**

**MIXED MODE:**
- partly outperforming,
- partly adaptive

**BUILDING WITH ADAPTIVE ABILITY**
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... as design support

versatile consultation

Leads to ...

Needs ...

... as design support
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.
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 Bist 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?
• Advocates & adresses
  … 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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