



# Design for Change: Development of a policy and transitional framework

Summary

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This brochure summarizes the final report of “Design for Change: Development of an Assessment and Transitional Framework”, a project of OVAM commissioned by the Flemish government (Environment, Nature and Energy Department), conducted by a consortium of Unit Smart Energy and Built Environment (VITO), TRANSFORM Research team (Vrije Universiteit Brussel) and ASRO (KU Leuven).

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## Other titles concerning this topic:

- Case Study: ‘Ontwerp van gebouwen in functie van aanpasbaarheid: Mahatma Gandiwijk Mechelen (2013)’
- Design Sheets: Design for Change (2015)
- Brochure: Design for Change: A common language (2015)

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## Summary

In view of the increasing demand for primary raw materials and their finite nature, the financial and ecological pressures on the construction industry will continue to rise. This is why the Flemish 2014-2020 policy programme “Materials-aware Cyclical Construction” resolutely targets the lifecycle management of construction materials and building elements. Also, the extension of the service life of buildings is becoming increasingly important in this respect.

Design for Change (also known as dynamic building) can play a key role in reducing the environmental impact of the construction industry. By anticipating future changes today it is possible to fulfil the ever-changing needs and demands of individual users and society with less polluting and less material-intensive construction works. Moreover, when the possibility exists to disassemble and recycle - or, even better, reuse - building elements, a lot of material loops can be closed.

In practice, Design for Change rarely or only implicitly takes place, although, for example, the current shortage of schools and offices’ high vacancy rate illustrate this need. In reaction, OVAM and its research partners VITO, Vrije Universiteit Brussel and KU Leuven will commit to simplifying the transition to Design for Change and to supporting sustainable building practices. They therefore joined forces in the research project “Design for Change: Development of an Assessment and Transitional Framework” of which this brochure provides a summary.

In the field, there is a demand for better dissemination of information, for a comprehensive design guide and all kinds of demonstration projects. This research project already provides some specific answers, such as a clear conceptual framework, inspiring demonstration projects and practical design sheets. Their usefulness was validated during two ongoing construction projects, while new transitional experiments were defined together with forerunners and freethinkers. These results constitute an inspiring step towards Design for Change and therefore sustainable building practices in Flanders.





## Research Project Introduction

Usually, buildings are designed for a specific family size or work setting without thinking about the **changing needs** of its users and context. As a result, over their lifespan, we must often thoroughly renovate and sometimes completely or partially demolish buildings. At that time, the load bearing structure or other building elements have not always reached their expected service life. They are thus not optimally used, resulting in unnecessary social, financial and environmental costs.

By taking into account **future adaptations** from the design stage, the service life of buildings and their elements can be extended. For example, by designing spaces in a versatile manner and implementing demountable building elements, we can easily adapt a building and efficiently respond to changing needs.

In 2012 OVAM studied the possible effects of Design for Change. However, the Gandhi Study (Paduart et al. 2013) demonstrated that a number of advantages and disadvantages of adaptable building solutions are context-dependent. Hence, the evaluation criteria that were developed had to be tested further and refined in the research project of which you will find a summary below: “Design for Change: Development of an Assessment and Transitional Framework”.

The goal of this project is to **narrow the gap between theory and practice**, by examining and developing specific drivers for the implementation of Design for Change in practice. These drivers include a common language, different demonstration projects, a user-friendly assessment method and illustrating consultancy programmes for current projects.

### A Common Language

To clarify the vast array of concepts, this research project developed a “common language” for the Design for Change concept. It is a simple and structured framework. Currently, this includes 12 definitions that can be used by all stakeholders, including:

*“Design for Change is a design and construction strategy that acknowledges our continuously changing requirements and aspirations for the built environment. The aim of Design for Change is to create buildings that support change more efficiently.”*

### Some Perceptions

To understand what drivers are needed to translate Design for Change into practice, various stakeholders such as architects and manufacturers were interviewed. This is a sample of their various perceptions of Design for Change.

#### Strengths of Design for Change:

- Increased flexibility and versatile use of spaces
- Extended service life and use of the estate
- Decreased environmental impact of buildings
- Decreased renovation costs
- Increased real estate market value

#### Weaknesses of Design for Change:

- Hard to estimate financial savings
- Advantages and disadvantages are context-dependent
- Increased initial investment costs
- Increased need for storage space
- Increased transport costs

#### Opportunities for Design for Change:

- Faster anticipation to demographic trends
- Shrinking and expandable (parts of) buildings
- Economic potential in case of new construction and renovation
- Economic potential for life long housing
- Possibility to increase comfort gradually

#### Threats to Design for Change:

- Unknown to the general public, little awareness
- Complexity of disassembly compared to demolition
- Mandatory restitution of subsidies in case of a change of functions
- Logistical hurdles

## Further reading

On every page, this section refers to publications and websites on this subject and to the chapters of the research report containing more detailed findings.

#### Research project introduction, current perception and development of a common language:

Research Report Chapters 1 and 2

#### Brochure:

Design for Change: A Common Language

#### More information:

Paduart A. De Temmerman N., et al. (2013). Case study, ‘Ontwerp van gebouwen in functie van aanpasbaarheid: Mahatma Gandhiwijk Mechelen (2013)’ carried out on behalf of OVAM, 102p.

## Inspiring Design for Change Projects

Based on a comprehensive list of examples of the Design for Change concept, we have selected and analysed 4 projects in detail: the residential complex “Sterrenveld”, the apartment building “Grundbau und Siedler”, the hospital “AZ Groeninge” and the modular building system “LLEXX”. This analysis shows the Design for Change principles already being applied today, their added value and any difficulties.

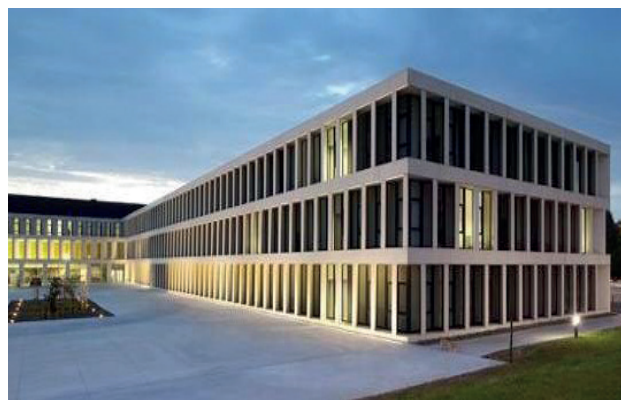
These demonstration projects show that already today, several Design for Change principles are being implemented. At the **building level**, both adaptable and multi-use projects exist. Principles such as “support-and-infill” and “generality” are already often implemented. At **building element level**, sometimes prefabricated and dismountable construction systems are applied that enable the reuse of building elements or their components.



For the housing project “Grundbau und Siedler” a multipurpose but static support was combined with an affordable Do-It-Yourself infill kit to enable simple future adaptations. © IBA Hamburg

**Reuse** of building elements occurs in different projects: with reversible connections, future reuse is made possible. However, less attention is being paid to lifecycle layering and the use of second-hand components.

In the detailed analysis it is striking that Design for Change principles are rarely used because of the **environmental savings** that they can provide, but rather because of the socio-economic benefits they bring. First and foremost, it is easier to respond to changes in family structure, necessary adjustments in case of disability or new housing types such as assisted housing. Only in second place, components and buildings with reversible connections and built according to “pace layering” can be replaced or renovated more easily and with less waste.



AZ Groeninge is a hospital that can be expanded and adapted in the future. The multipurpose support enables adding an extra storey on some wings and allows for various functions. © baumschlager eberle.

Finally, we also remember that currently the potentially higher initial cost is perceived as the main obstacle for investing in Design for Change, even if the final life cycle costs and total environmental will be reduced. Alternative funding methods and innovative business models must therefore be found.

## Further reading

### Analysis of pilot projects:

Project report chapter 3

### Overview of pilot projects:

Project report annex 3

### More information:

IBA Hamburg. (2013). Smart Price House - Basic Building and Do-It-Yourself Builders.

Presentation on International Conference 'Affordable & Sustainable Housing', 2013 watch [www.youtube.com/watch?v=R-W-3nvftVA](https://www.youtube.com/watch?v=R-W-3nvftVA)

[www.osar.be](http://www.osar.be)

[www.azgroeninge.be](http://www.azgroeninge.be)

## Qualitative Assessment and Design for Change Guidelines

	 <b>Interfaces</b>	 <b>Sub-components</b>	 <b>Composition</b>
 <b>Element</b>	Reversibility Simplicity Speed	Durability Reused Compatibility	Pace-layered Independence Prefabrication
 <b>Building</b>	Accessibility	Demountability Reusability Extensibility	Versatility
 <b>Neighbourhood</b>	Clear Adaptable	Retrofitted Dimensioned Removable	Unified Multipurpose Diverse Densifiable

The table above presents an overview of the Design for Change guidelines. A breakdown by scale (element, building, neighbourhood) and by theme (interfaces, sub-components, composition) makes it possible to establish a comprehensive and clear qualitative assessment of the design and construction of a building.

The OVAM study 'Case study, Adaptable Building Design: Mahatma Gandhi District (Paduart et al., 2013) already implemented a **widely applicable assessment framework** with a qualitative and a quantitative approach. This study made it possible to describe the adaptability of building elements, buildings and neighbourhoods as well as to calculate their financial and ecological impact during their entire lifecycle. The quantitative assessments proved to be time-consuming, however, and required very specific knowledge.

Therefore, in this research project, the qualitative part of the assessment framework was further refined and tested. Based on the interviews with stakeholders (see also 'Research Project Introduction') and the analysis of the sample projects (see also 'Inspiring Design for Change Projects') the assessment criteria have been revised and completed with our focus on the building and building element level.

The qualitative part of the assessment framework consists of a set of practical Design for Change **guidelines**. To assist in the application of these principles, each design principle was **discussed and illustrated on a separate sheet**. These sheets are available online and allow designers, developers and policymakers to get acquainted with existing solutions and at the same time provide them with an understanding of the importance of the Design for Change concept. Each principle also includes key questions in order to assess a design alternative.

The table above presents an overview of all Design for Change guidelines. The synchronous treatment of three scales (building elements, buildings and neighbourhoods) ensures a holistic approach. To ensure the cohesion between these scales, all the guidelines are divided into three themes: the interfaces between components, the characteristics of those sub-components and their composition.

### Further reading

#### Refinement of the assessment framework and development of design principles:

Project report chapter 4

#### Sheets with design principles:

[www.ovam.be/veranderingsgerichtbouwen](http://www.ovam.be/veranderingsgerichtbouwen)

#### More information:

Paduart A. De Temmerman N., et al. (2013). Casestudy adaptable building design: Mahatma Gandhi Neighbourhood Mechelen, carried out on behalf of OVAM, 102p.

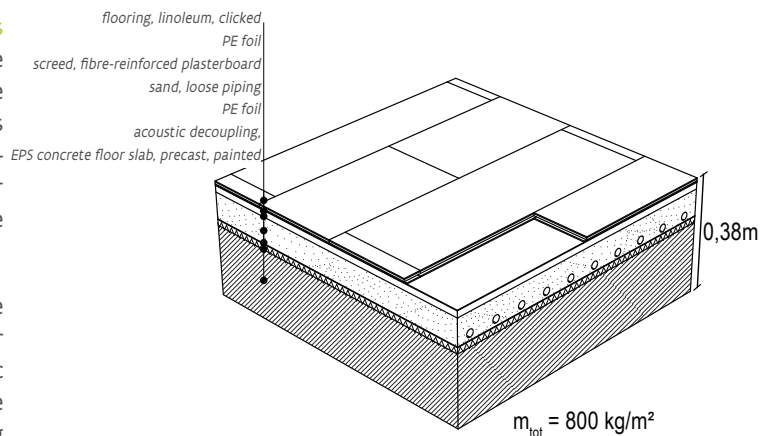
# Design and Quantitative Assessment of adaptable Building Elements

For two specific projects (see also 'Consultancy programmes on Ongoing Construction Projects: an Experiment'), we have proposed different building elements that are an adaptable alternative to the conventional proposals of the architects involved. These alternatives consist of reversible connections enabling, for example, the modification of an apartment or school's floorplan, quickly and without much trouble, while reusing the components at the same time.

Of course, these alternatives must fulfil the same specifications as the conventional building elements. Our proposals therefore have the same thermal and acoustic properties and provide the same level of fire safety. In the final report, we discuss adaptable exterior walls, separating walls and floors based on space and function, including the technical details of their composition.

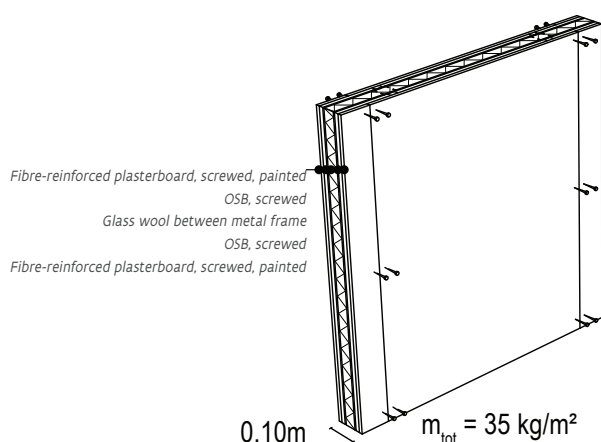
We then quantitatively assessed each alternative: both their initial and entire lifecycle impact was calculated in financial and environmental terms. This was done in accordance with the assessment framework of Paduart et al. (2013), and builds on both the SuFiQuaD-method developed by Allacker et al. (2011) in respect of the financial impact, and on the MMG determination method, defined by Debacker et al. (2012), with regard to the environmental impact.

The calculations show that often the alternative building elements have a higher **initial financial and ecological impact**. This is because more material is used in a building element Designed for Change than for a conventional element in order to meet the same requirements.



This alternative structure of a floor for a school has a slightly lower financial lifecycle cost than a conventional floor. Due to the high cost of disassembling and reassembling, the savings drop if more changes occur. Nevertheless, the environmental benefit rises in case of an increased amount of changes as materials are reuse during every alteration.

If the entire lifecycle is examined, however, it appears that compared to a conventional element, the environmental impact of the alternatives decrease when more changes are expected. In the calculation of the financial **lifecycle impact** the cost of disassembling was assumed to be equal to the high labour costs for the assembly. Consequently there are usually no financial savings in the long term. These dismantling costs must therefore be investigated further.



This separating wall with reversible connections is based on the technical details from the Gandhi report (Paduart et al. 2013). The initial environmental impact of this adaptable alternative is higher than that of its conventional counterpart, but when several adjustments are expected this alternative is the most interesting from an ecological perspective.

## Further reading

### Design of the building elements:

Project report paragraphs 5.3.1.2 en 5.3.2.2

### Assessment of the building elements:

Project report paragraphs 4.4

### More information:

Allacker, K. et al. (2011). SuFiQuaD: Sustainability, Financial and Quality Evaluation of Dwelling Types, on behalf of the Belgian Science Policy. 107p.

Debacker W., Allacker, K., De Troyer, F. et al. (2012). Environmental Performance of Materials used in Building Elements, on behalf of the OVAM, 361 p.



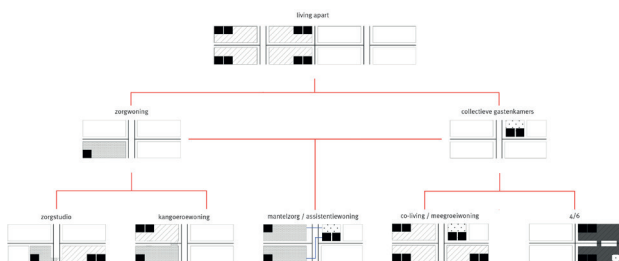
# Consultancy programmes on Ongoing Construction Projects: an Experiment

To validate the new insights and improved assessment framework, two consultancy programmes were started and successfully completed for specific construction projects. For each trajectory, we provided basic information to the architects, made a qualitative assessment of their design proposals, and also performed quantitative lifecycle analyses. In addition to the adaptability of the designs, this consultancy clarified their long-term financial and ecological impact.



One of the consultancy processes was the renovation of the VMSW apartment building on the Hoogbouwplein in Zelzate. © KPW Architects

The renovation of the VMSW apartment building on the Hoogbouwplein in Zelzate is a project by KPW Architects. During the consultancy programme, the qualitative assessment was a catalyst for an innovative and future-oriented design process. The process was developed as an investigative design exercise using **future scenarios** and the development of a “family tree” of compatible housing types. Thanks to this approach, KPW Architects **became increasingly aware of the long-term consequences of their design choices**.



Based on the qualitative advice provided through the design guidelines, KPW Architects developed a “family tree” showing how standard apartment types could evolve in the future, e.g. into kangaroo, assisted and informal-care apartments. © KPW Architects

The new extension of the GO! primary school De Vlindertuin in Mechelen is a project by AREAL Architects. The focus in this consultancy programme was on the component level: several alternative walls and floors were developed (see also '**Design and quantitative evaluation of adaptable building elements**') with attention for the reversibility of the connections and the durability of materials, crucial to enable disassembly and reuse. Also examined was how a modular measurement can increase reuse potential.

Besides interesting practical experience, both consultancy processes also provided the following insights:

- 1. Raised awareness, common expertise and intense collaboration** between architects, consultants, governments, producers, contractors and building owners is crucial in responding to the long-term consequences of today's design decisions.
- 2.** The descriptive analyses of Design for Change cases indicate that multi-use and adaptable construction can provide **considerable social gains**: renovations are less intensive and more material efficient, while buildings can always be adapted to changing expectations.
- 3.** Combined with lifecycle calculations based on realistic scenarios, it proved to be possible to make **focused ecological choices** on a case-by-case basis. Moreover, adaptable element solutions can be limited in quantity and only used in situations where frequent adaptations are expected.
- 4.** However, there is a need to elaborate calculation methods and to collect appropriate financial data. Nevertheless it is clear that labour costs, material prices and new construction techniques will be crucial for the **economic feasibility** of Design for Change.

## Further reading

**Advisory programmes on Ongoing Construction Projects:**

Project report chapter 5

**More information:**

<http://www.kpw-architecten.be/Hoogbouwplein>

<http://www.arealarchitecten.eu/projects/bsgo-de-esdoorn-te-mechelen>





## Recommendations and Further Actions for Design for Change

This project shows that further actions are required for a broad implementation of the Design for Change concept in practice. This will require designers, policy makers and research institutions to collaborate.

### Designers

Designers should be provided with better understanding of the strengths of Design for Change in order to adopt it already from the design stage. The online availability of sheets including design principles, practical examples and references are a first step, but further **awareness** among designers and builders remains key.

In conducting this study, it has been repeatedly shown that no standard solutions exist for the implementation of the Design for Change concept. Therefore, for every design challenge it is important to seek appropriate solutions. This can be done by **informing** designers with research-based advice and useful tools.

### Polymakers

The design and construction industry requires clear and integrated tools that contribute to making Design for Change decisions and applying these in practice. Discussions have taken place with specific policy administrations such as VMSW, AGION and VIPA on the integration of the reviewed assessment framework in existing practice and policy instruments.

Five recommendations are provided: a gradual **integration** of the assessment framework, starting a Belgian learning network, creating a stimulating Living Lab, the development of an appropriate economic framework and the focused support of fundamental and innovative research.

### Researchers

In order to quickly, directly and accurately perform the assessments, in particular the lifecycle analyses, the calculations and the data processing must be adapted to the dynamic nature of adaptable buildings. This project required making manual adjustments to conventional methods, but the translation into design and policy instruments will require a **workable methodology**.

Attention points are the accurate modelling of replacements, integrating uncertainty parameters, collection of relevant labour costs, comparing building types, the preparation of design catalogues and reinterpretation at neighbourhood level.

Design for Change is the goal of one of the five transitional paths the OVAM has put forward in its policy program “Materials-aware circular Construction”. The transitional approach means learning by doing. Hence, short-term experiments that can propel a major social transition are also needed.

In this project, together with forerunners and freethinkers from practice as well as administrative mediators, we defined four short-term experiments for such a transition to Design for Change:

**Meccano for customisable renovation** aspires the co-creation of a “meccano” kit with manufacturers, contractors and DIY individuals for the renovation of existing housing. This could trigger a true transition to an open and scalable system building.

**Supply, a reverse logistics**, is looking into a smart management system for building elements. To this end, real estate companies, demolition experts and distributors will jointly optimise the recovery process of interior elements and façade panelling of existing offices.

**The growing school** focuses on the development and management of school infrastructure evolving in step with the variable capacity and learning methods. The experiment focuses on co-financing in order to achieve a cost-effective logistics network that can be scaled up later on.

**Metabolism Time, a resilient metabolism** wants to furnish the urban laboratory of the city of Ghent, Timelab, with compatible components in order to enable spaces to grow with the fast-changing activities in the lab. This experiment serves as a model for a neighbourhood evolving in step with its inhabitants and their activities.

## Further reading

### A transitional framework for Design for Change:

Project report chapter 6

### General recommendations and further actions:

Project report chapter 7

### More information:

<http://www.ovam.be/materiaalbewust-bouwen-kringlopen>

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