TRANSFORM
Transformable structures for sustainable development

TRANSFORM is the research team within the Vrije Universiteit Brussel’s æ-lab that studies the effect and feasibility of constructing in a transformable way. Gathering expertise on the modelling and assessment of materials, components and structures that anticipate change, we enable better informed policy and design decisions.

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The TRANSFORM research team finds its roots in the spontaneous collaboration between prof. Hendrickx and prof. De Wilde. In 2003, they identified the need for a new way to design and build. As a sustainable answer, they defined an innovative strategy that is based on time as the fourth dimension and anticipates the continuous change it brings to our built environment.

In 2009, prof. De Temmerman became chairman of the team, merging the defined strategy with his knowhow on mobile and deployable structures. As a result, considerable expertise on structures that can transform was compiled.

Today, the researchers of TRANSFORM are engaged in the technical and structural performance of transformable structures, their safety, their environmental and financial life cycle impact as well as in their implementations at an urban scale.

Niels De Temmerman prof. dr. ir. arch., team manager
Anne Paduart dr. ir. arch., project manager

Project researchers
Waldo Galle, dr. ir. arch.
Aushim Koumar, dr. ir.
Kelvin Roovers, dr. ir. arch.

PhD researchers
Stijn Brancart, ir. arch.
François Denis, ir. arch.
Camille Vandervaeren, ir. arch.

Project architect
Stijn Elsen, ir. arch.
The researchers of our team are engaged in diverse specific aspects of transformable structures. The following expertise is part of our portfolio we wish to share with architects, engineers, developers, constructors, building owners and policy makers.

**TRANSFORM** defines sustainable project ambitions in collaboration with all project’s stakeholders, for example when preparing a design contest. This we do by setting goals, deliverables and transitions paths. Therefore we take into account nothing less than the triple bottom line: people, planet, profit.

**TRANSFORM** assesses qualitatively and quantitatively the reuse potential of existing buildings and the ecological and financial impact of divergent design options. Therefore we take a life cycle perspective and valuate scientifically the yield, sensitivity and risk of one option against another.

**TRANSFORM** advises designers and owners. Based on the assessments, we formulate advises, guidelines and project priorities. Therefore we use our own and other’s data considering context and ambitions. This allows stakeholders to take well considered and reasoned choices.

**TRANSFORM** supports design and development processes. Therefore, we use self-developed design strategies, step-by-step guides and hands-on tools (image left). Therefore, scenario thinking is our main thing. For all collaborators this raises enduring awareness of the long term impact of initial design choices.

**TRANSFORM** creates building typologies and components to realise a built environment that support change more efficiently. Therefore, we consider relevant standards and norms, and continue a prototyping programme in collaboration with technical institutes and companies.

Want the support of our team for your project?
Contact one of our team members.
ONTWERPSTRATEGIE

Het zijn ontsluitingsstrategieën die bepalen hoe v
AANPAASBAAR als het erg makkelijk verbv
nieuwe noden. Een ruimte, gebouw of
ingebouwde nieuwe noden kan worden aange
nieuwbouwstrategieën aange
nieuwbouwstrategieën aange

POLYVALENT GEBOUWEN

een gebouw of ruimte is po
noden te voldoen zonder ni
liggingen hebben die de w
 Philosophie van een makke

SCENARIO’S PLANNEN

Door onze snel veranderende levensstijl is het onm
Wel kunnen we met ons ontwerp anticiperen op verant
klaar is voor de gevolgen van bepaalde onzekerheden
scenario’s een ontwerp alternatief aanknappen, hoe me
Scenario’s zijn geen voorspellingen. Het zijn uitdaging
nogen evolueren. Het zijn opgevolgingen van gebeurtenis
van het verleden, maar een samenspel van relevante
coherente verhaallijn, gedurende een overeengeko

TEMPLATE

GEGEVEN

deze aannames vormen de
Ingezette elementen van het scenario

known unknowns

dezelfde onbekende zijn
een randvoorwaarde
Voor het scenario

unknown unknowns

dezelfde onbekende

TITEL

zo weet iedereen over welk
scenario de discussie gaat

Beschrijving

wat er in het scenario gebeurt
en dat vanaf vandaag

SCHETS

voor wie een visueel
heeft
TRANSFORM
Towards a circular economy in construction

2015-2018
Buildings as Material Banks (BAMB)
A European commission Horizon2020 research project

With the BAMB project a consortium of 16 partners, including TRANSFORM, from 8 European countries are working together with only one mission: enabling a systemic shift in the building sector by creating so-called circular solutions.

Each brick, board, piece of wood or glass has its value. However, these materials are rarely reused during refurbishments, instead they are wasted and become a cost instead of an asset. Sustaining the value of materials is nevertheless the key to a sustainable resource use. Therefore, buildings must act as banks of materials – slowing down the depletion of resources to a rate that suits the capacity of our planet.

The BAMB project is developing and integrating tools that will enable the shift from static building to circular buildings. First, by developing Materials Passports and guiding towards Reversible Building Design. To bring these concepts also to everyday practice, BAMB also investigates circular business models and policy propositions.

During the project the developed leverages will be demonstrated and refined through 6 international pilot cases, one of them being the Circular Retrofit Lab. This lab will be built in Brussels at the heart of the VUB campus. In the upcoming years, demountable, adaptable and reusable building solutions for partitioning, services, furniture and the façade will be integrated and evaluated in the lab.

To build this pilot case, TRANSFORM and its research partners are working together with pioneers and frontrunners of the sector, like product developers, entrepreneurs and enterprises that support a circular economy.

Want to test your own product in our Lab? Check the project’s website
www.vub.be/arch/ae-lab/projects/circularretrofitlab
TRANSFORM

Some completed projects and studies

After almost fifteen years of research, 10 doctoral dissertations, the recruitment of new team members and the uptake of national and international research projects, TRANSFORM keeps innovating. Nevertheless, looking back to our most interesting collaborations and deliverables allows us to present the societal and practical challenges we find most important.

2014 -2015
Design for change: development of a policy framework and action plan

Commissioned report
Environment, Nature and Energy Department of the Flemish Government LNE

Today, policy makers understand the importance of ‘design for change’ but acknowledge that its implementation is missing at the same time. Therefore, this study was commissioned to identify further milestones for the integration of ‘design for change’ in the Flemish construction sector and to formulate advisory guidelines for policy makers and designers.

In this project TRANSFORM proposed a policy framework of ‘design for change’, developed and tested design guidelines for the transformational capacity of buildings and assessed local and global cases.

2014-2015
Sustainable project ambitions for the Brussels Library and Learning Centre

Commissioned consultancy
BELLIRIS, Université libre de Bruxelles ULB and Vrije Universiteit Brussel VUB

To enhance the international importance of Brussels Beliris invests in construction project in various fields. On the table is the realisation of a new Library and Learning Centre on the border between the Université Libre de Bruxelles and the Vrije Universiteit Brussel. With the ambition to realise a sustainable landmark, consultants of different fields have been invited to further develop the plan.

In her consultancy TRANSFORM developed the project ambitions related to sustainable development in preparation of the design contest and therefore defined design goals and criteria.
2014-2015
The sustainable transformation of Van Der Meeren’s student houses

Commissioned consultancy
Vrije Universiteit Brussel VUB, infrastructure management

As an alternative to the demolition, the transformation and reuse of the modular student houses is studied. In order to understand both the financial and the environmental impact, TRANSFORM conducts Life Cycle (Cost) Analyses of alternative transformation strategies. These analyses are done at four interacting design levels, including site, building, components and time.

This study is a thorough analysis of the short and long term feasibility of a transformation of Van Der Meeren’s student residences and resulted in policy advices, project priorities and design examples.

2012-2016
Transformable construction with conventional building materials

Doctoral research by Mieke Vandenbroucke
Agency for Innovation by Science and Technology IWT

In this doctoral research the initial environmental impact of conventional building methods and their transformable alternatives are compared with their corresponding life cycle environmental impact. With the aid of Life Cycle environmental assessments, it is calculated after how many different use cycles transformable building elements can result in environmental life cycle savings.

This evaluation approach is used to optimise the design of transformable building components and their reversible connections. For each conventional building method (e.g. masonry) this optimisation is performed.

2012-2016
Scenario based life cycle costing, the financial feasibility of transformable building

Doctoral research by Waldo Galle
Research Foundation Flanders FWO

Today, the financial effects of transformable building are hardly understood. However, the constantly changing configuration that is typical of a transformable dwelling is expected to have an important impact on its life cycle cost. Therefore, this research aims at a scenario-integrated life cycle costing method that allows the insightful assessment of life cycle savings.
The research outcomes will allow assessing and formulating a critical position on the financial feasibility of transformable building, particularly in relation to design and refurbishment scenarios.

2012-2015
Dynamic Reuse Strategies for the retrofitting of post-war housing in Brussels

Research project
Brussels’ Institute for scientific research and innovation INNOVIRIS

It is essential to envisage dynamic concepts during the renovation of our building stock in order to anticipate various types of ‘change’ that naturally take place during the remaining life cycle of buildings. Buildings renovated according to dynamic design principles can be more easily adapted without significant generation of demolition waste and requiring less new building materials in the future.

With this research project TRANSFORM transfer scientific results about dynamic retrofitting to practical examples for architects that are facing the retrofitting of post-war buildings in Brussels today.

2012-2013
Case study: Transformable building at the Mahatma Gandhi neighbourhood

Commissioned report
Public Waste Agency of Flanders OVAM

With this case study located in the city of Mechelen, it has been shown that transformable building can bring important environmental advantages when it is compared with conventional construction practice in a life cycle perspective. Moreover, the study illustrated that a dynamic design strategy can be used for social housing at the element, building and district level.

Therefore TRANSFORM evaluated dynamic alternatives by life cycle environmental and financial impact analyses. Additionally, recommendations for a successful integration in social housing were given.

2010-2016
Enhancing the adaptable capacity of urban fragments

Doctoral research by Pieter Herthogs
Flemish Institute for Technological Research VITO

Sustainable urban development is increasingly studied using dynamic theories such as resilience, adaptation or transition – theories based on the acknowledgement of a
complex, uncertain and changing future. However, can a built environment that is purposefully designed for change better support the future goals and evolutions of urban neighbourhoods?

As the proof of concept of a larger methodological framework, this thesis provides SAGA the Spatial Assessment tool of Generality and Adaptability, and Materialised Futures a participative design exercise.

2006-2012
Re-design for Change: A 4Dimensional renovation approach

Doctoral research by Anne Paduart
Agency for Innovation by Science and Technology IWT

During today’s renovation buildings are being upgraded according to problems known today. However, future uncertainties such as thermal building upgrades, layout alterations or radical transformations are inevitable, however not anticipated. To tackle the high material consumption and waste production needed for each destructive intervention, dynamic renovation concepts have to be incorporated.

The approach developed in this thesis reveals how future resource demand and waste production can be reduced, diminishing the environmental and financial loads of buildings over their total life cycle.

2005-2007
Transitional housing for emergency situations and large renovation projects

Commissioned report
Flemish Ministry for Home Affairs, Urban Policy and Housing

Commissioned by the Flemish Ministry of Housing in preparation of a large renovation plan of her housing stock, a dismountable and movable dwelling typology has been designed and evaluated with this project. This includes the development of a kit-of-parts with modular design guidelines as well as the individual components: volumetric, planar and linear.

In this study both the technical and physical performance of three transitional housing typologies have been assessed, providing practical insight in their feasibility.

Find more projects via
www.vub.ac.be/arch/transform
The ongoing transition towards a circular economy requires that materials reaching their end-of-life are reused and recycled again and again. Applying this to the built environment, existing buildings will become the material sources of future construction projects.

Proceeding from this reality, the research project Bâti Bruxellois: Source de nouveaux matériaux or BBSM, wants to prepare the construction sector for the vast amount of materials that will be released the upcoming decennia during the energetic refurbishment of Brussels’ building stock, and will reinforce current reuse practices in the capital region. Therefore, research partners UCL, BBRI, ROTOR and VUB bring together their complementary expertise supported by the European Regional Development Fund EFRO/FEDER.

Since October 2016, post doctoral researchers Waldo Galle and Anne Paduart of the TRANSFORM team are reappraising under the supervision of Niels De Temmerman the design choices that are deemed to lever materials’ current and future reuse. The resulting insights will be collected in a series of booklets offering architects, contractors and students insights, practical tools and templates empowering them to design a circular built environment.

Curious if the outcomes are already there? Check the project’s website www.bbsm.brussels
The first spin-off founded

In November 2016, Aushim Koumar defended successfully his PhD research on the design, analysis and optimisation of scissor structures for disaster relief. The results of this research, combined with the experience of professors Niels De Temmerman, Tine Tysmans and business developer Baudouin Hubert, gave rise to the establishment of the first TRANSFORM spin-off.

Transformactive designs and builds deployable scissor structures (image left). These mobile and temporary structures offer qualitative spaces for disaster relief, out- and indoor events and many other occasions. Scissor structures have indeed the advantage to be fast and easy to deploy, while demonstrating a significant volume expansion. Further, they offer an eye-catching shelter and have a relatively high structural performance.

Transformactive is founded by a team of progressive researchers and highly motivated entrepreneurs. Recently, the spin-off obtained a 50.000 euro grant to build more prototypes and was selected for the Start it @KBC accelerator program. During this program, Transformactive will be supported with continuous mentorship and training from June 2017 onwards.

Want to become one of Transformactive’s clients?
Contact us via www.transformactive.be
TRANSFORM
Digital modelling and parametric tools

2015 -2021
BIM protocol and parametric components for transformable structures

Doctoral research by François Denis and by Camille Vandervaeren
Agency for Innovation by Science and Technology IWT

Transformable buildings and components can be efficiently designed using a Parametric Design process modelling the way they move, adapt, etc. Simultaneously, the industry is in constant need of information that complements the project drawings. The added value of a combination of both is to be found in all the stages including conception, elaboration and future transformations of the building.

Therefore, François Denis and Camille Vandervaeren are working toward the establishment of methods and tools that allows designers to benefit from parametric design, building information management BIM and the added value of their integration, in support of the assessment and of the life cycle management of transformable buildings.

Moreover, as one of the main objectives of the TRANSFORM team remains to spread the knowledge it gathers to all stakeholders François Denis is member of the ‘BIM & ICT’ technical committee of the Belgian Building Research Institute (BBRI). In this position, he has been consulting three of BBRI’s working groups: Protocols, E-catalogues and Education.

Is your project the ideal case for testing this cutting-edge research? Contact one of our team members.
TRANSFORM
People we worked for and with

Brussels Environment, Nature and Energy Department of the Flemish Government LNE, Public Waste Agency of Flanders OVAM, Provinciale ontwikkelingsmaatschappij Oost-Vlaanderen, Flemish Institute for Technological Research VITO, Belgian Building Research Institute BBRI, EPEA, BRE, Flemish Agency for Social Housing VMSW, Red cross Flanders, Batir Université libre de Bruxelles ULB, Royal Danish Academy of Fine Arts, Green Building Lab University of Twente, Department of Architecture KU Leuven, Kinetic stuctures lab University of Notre Dame Indiana, Architecture et climat Université Catholique de Louvain-la-Neuve, Technische Universität München, Universidade Do Minho, Sarajevo Green Design Foundation, Zuyd Hogeschool, Brussels’ Institute for scientific research and innovation INNOVIRIS, Agency for Innovation by Science and Technology IWT, Research Foundation Flanders FWO, European Regional Development Fund FEDER, Cooperation for Belgian investments in Brussels BELIRIS, Hahbo, Geberit, Saint Gobain Group, Wall LinQ, Skillpod, IBM, Sundahus, Drees & Sommer Advanced Building Technologies, Wienerberger, Tecniho, Victor Buyck Steel Construction, Groep Van Roey, Kumpen, BAM Construct, BESIX, G30, ORI, SECO, IFMA, ADEB-VBA, BAM, CFE, Kaderstudio, KPW Architecten, OSAR Architecten, AREAL Architecten, DIAL Architects, CONIX RDBM Architects, ROTOR, 51N4E Architects, Labland vzw, ...
TRANSFORM
Mission Statement

We live in an age where rapid changes in cultural trends, global markets and technological innovation increasingly lead to resource depletion and waste production. Because most of the earth’s mineral and fossil resources are finite, they should be used and reused wisely. As designers, we are challenged to create answers that remain sustainable in a continuously changing context.

The structures of the built environment in which we operate are never end states, but phases of a process. Facilitating transformations is vital to sustainable development. This requires holistic approaches that take change into account and help alleviate future problems.

By introducing transformational capacity at different design levels, we want to maximise the sustainability of settlements, structures and components through time while minimising the waste of resources. We believe that transformability can act as an important catalyst for sustainable development because of the social, economic and ecological qualities it generates over time and the life-cycle resource management it incorporates.

As researchers, we study, analyse, design and assess transformable structures varying in scale, context, time-span and purpose. Through publication, education and projects we share our attitude towards a dynamic built environment.

TRANSFORM research team, part of æ-lab