

# City transformation



A PUBLICATION  
OF BUILDWISE'S  
VISION COMMITTEE



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# CITY TRANSFORMATION



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## 1. Foreword

***For a research centre like the BBRI, it's important to keep scanning the horizon. To ensure growth in the sector, we need an effective approach, a clear strategy and a strong vision for the future. The BBRI cannot content itself with merely meeting companies' short-term needs. We must also play a visionary, pioneering role in today's society – a society evolving increasingly quickly.***

Our 15 Technical Committees, made up of people working in various building trades, are a permanent, living link to our members' everyday work. As the Centre's hub of activity, these committees determine the priorities for action in their sectors for the next 12 to 36 months, allowing the BBRI's action in the short term to be guided by practice and in line with the industry's current requirements.

Since the construction industry looks to us for advice, in 2020 the BBRI drafted its new strategic plan, Ambitions 2025. This provides our members with inspiration and motivation to meet the challenges they face in terms of technology, costs, the environment and society.

We aim to make a real impact on companies' day-to-day work, whether through our research or by sharing the knowledge we have gathered. The industry must also continue to modernise by adopting new technologies. Over the next five years, we will focus our efforts on three strategic areas: our trades and professions, the Green Deal and Construction 4.0.

Now more than ever, technological developments provide unprecedented opportunities for the construction industry. We are living at a time when the challenges, opportunities and technical possibilities lead us to believe in a bright future. Technology is developing rapidly, and as our education and training advance, our potential to adopt new technologies grows. We are developing clear objectives on ways to tackle trends in society. And there is the political will to join forces behind Europe's long-term aim to become climate-neutral by 2050, in line with the Paris Agreement. The construction industry has a key role to play in several of these changing areas, meaning that we need to establish a clear vision spanning 10 years or more.

Through setting up its Vision Committee in 2019, the BBRI has positioned itself as a long-term source of inspiration. The Committee's members see their role as: "Sharing inspiration and vision as a driver for progress and innovation in construction". We hope that this initial publication will engage and inspire you as we outline, together with you, the future of our industry.

*Olivier Vandooren,*  
*Director General BBRI*





## 2. Introduction

### *‘Sharing inspiration and vision as a driver for progress and innovation in construction’*

The world seems to be turning faster than ever before. While new technologies are emerging rapidly, there can be no denying that we are facing some major social challenges. Naturally, this has an impact on the way we live and build. In these exciting times, it is essential for our companies to have a better vision of the future of the construction sector in the medium to long term.

Set up in 2019, the BBRI’s Vision Committee is tasked with developing a medium- to long-term vision for the construction sector in Belgium, helping to steer the BBRI’s long-term strategy. It aims to assess future developments within the construction sector by mapping and analysing challenges and opportunities, while taking account of economic, technological and social evolutions.

The Vision Committee’s programme for 2020 planned to organise a vision conference with top international speakers and three parallel sessions to take place on 25 March at the IMEC. However, COVID-19 put a stop to that and the programme had to be cancelled at the last minute. Instead, a virtual approach was quickly adopted and a series of three interactive sessions planned.

In these sessions, a number of specialists together with the members of the BBRI Vision Committee reflected on the future of construction, focusing on economic, technological and social developments.

- The session on DIGITAL TRANSFORMATION was held in June, with Alain WAHA as the keynote speaker
- In the September session, the topic of CITY & BUILDING TRANSFORMATION was addressed, with Luk Peeters as the keynote speaker.
- Finally, a session on CIRCULARITY and CHANGING BUSINESS MODELS was held in December, with Thomas Rau as the keynote speaker.

Each digital session consisted of two parts, one week apart.

- A keynote presentation
- A discussion panel, with possible audience interaction via chat and interactive questions. The audience also had the opportunity to contribute to the discussions afterwards via the blog on the vision.cstc.be website.

The aim of the workshops was to develop a vision on the subjects in question. The final vision document for each subject is structured in the following 3 main parts:

- The vision of the keynote speaker,
- A summary of the items debated with the panel of experts, including relevant audience interactions
- A summary vision drawn up by the BBRI Vision Committee

This publication is the second of a set of 3 reporting on the session on City & Buildings Transformation. It contains the keynote speech given by Luk Peeters and the reflections of a discussion panel made up of a number of visionary contractors, assisted by experts from various other professions and segments. We used a PESTEL analysis as a framework to consider the impact on trends at a political, technological, social and legal level. In the process, we tried to look at the trends that our contractors will soon be faced with from a number of different angles.

The concluding remarks in this report summarise the Vision Committee’s reflections which are intended to inspire us and put us on the path to building the digital future in construction. We are sure that this will make exciting reading for you.

Finally, our special thanks go to Wim Straetmans and Cecile Goffaux who chaired this digital session and steered it in the right direction. Thanks go also to the BBRI employees who organised the whole set-up of the digital event so professionally.

*Tom Willemen,  
Chairman of the Vision Committee  
CEO of the WILLEMEN GROUP*

*Bart Ingelaere,  
Deputy Director General, BBRI*



# 3. Keynote

**Luk Peeters, Alexander D'Hooghe, Mae Emerick, Birgit Clottens**

In our practice as architects and planners we work on transforming cities, or building more resilient cities, project by project. We analyse the sites at hand with a view to creating a buildable strategy. The opportunity to participate in Vision 2030 has enabled us to consider the scope of our experience and share a broader vision for the built environment. In our research and design practice at ORG, we are seeing a pattern of environmental and societal issues present in each of our projects.

These environmental issues are associated with the climate crisis and, on a smaller scale, building aimed at improving quality of life and counteracting pollution. At the same time, our society is suffering from fragmentation and disconnection. Societal issues have intensified in an era of populism where people are more and more alienated by their built environment and do not trust the authorities tasked with planning our systems, spaces and places. Indeed, people seem to be rethinking democracy.

Through our work we have detected that this alienation can be categorised into four everyday inabilities fuelling populism and constituting obstacles to making cities resilient. The inability to READ, SHAPE, RELATE, and RECOGNISE create disillusionment, fear and anger in our societies, in turn impeding progress and collaboration.

## INABILITY TO READ

The inability to read our environment is about territorial legibility. Clear characteristics define and distinguish neighbourhoods or regions. Thus, Manhattan looks like Manhattan, Montmartre looks like Montmartre – they are easily distinguishable.

This picture illustrates among other things the relationship between societies and the territory. What used to be a city's readable territory, noticeable in the landscape's background, has now turned into a grey goo. We've lost legibility on a large scale. This is the landscape that we all know. Extending across the world, it's not city, it's not countryside and it's not what we understand as landscape. This grey goo is purgatory, an in-between state that nobody wants.

In the 1960s, the American dream included parkways in nature. Over time, these became purgatory, lacking urban quality and nature. As we continue to address population growth, mobility issues, climate change and other challenges, we are of course in need of further development, but what kind? Certainly, we do not want to design more grey goo. What is important is that any development targets accessibility and urban quality.

Accessibility means, among other things, mobility and connection. New development and mobility are intrinsically related. Population density creates demand and support for mass transport services, a sine qua non for city life. At the same time, life in the suburbs is characterised by the private car use. The peripheries of our cities constitute an underserved transition zone attractive primarily because of the low land prices and spatial quality: the grey goo. Mobility options for traversing the transition zone are few: those without cars in the city have a difficult time reaching the suburbs and those in the suburbs rely on their cars to drive into the city. In such a scenario, car congestion is inevitable, while transportation out of the city is impossible.

Today, this intermediary zone is a unique opportunity to actively connect the urban and suburban tissue. Its historic neglect provides the space to develop a new mobility network composed of multimodal stations, flexible vehicle offerings, dedicated mobility lanes and on-demand services. Combined, these services make optimal use of available technology and create spatial cohesion. A decentralised hub system around a city's intermediary belt is achievable with current technologies and services.

Mobility as a Service (MAAS) providers offer micro-mobility: shared vehicles, scooters and bikes, on-demand pick-up with micro-transit: shared SUVs and private service vans. Each of these providers offers interesting potential for the urban-suburban transition zone. Users are able to organise journeys through mobile apps, while designing transportation infrastructure to organise multi-modal traffic is low-cost and easily integrated into existing roadways.

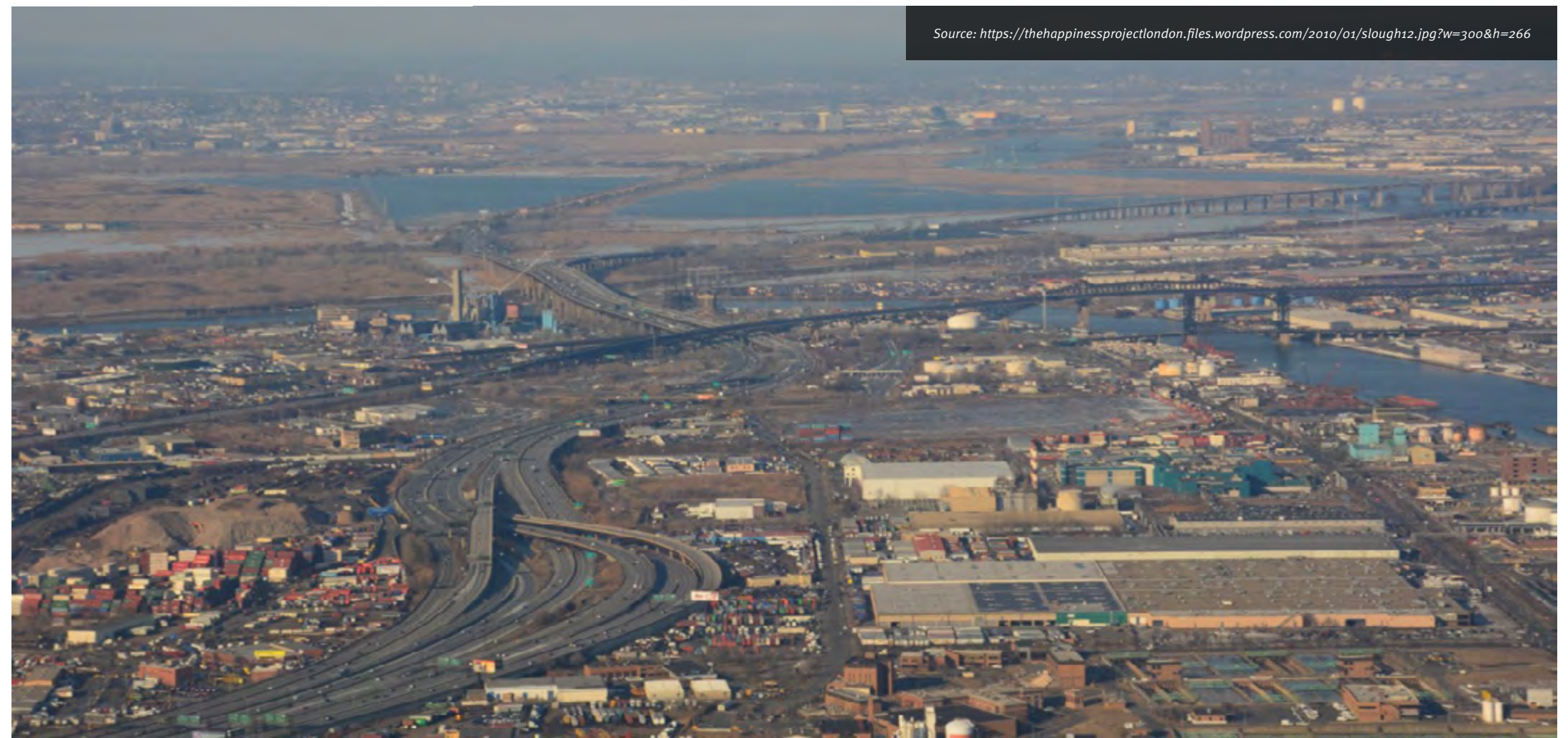
Micro-transit is promising in that it provides efficient, comfortable multiple-person transit through and around city peripheries. The software systems for these services calculate nearby, shared, pick-up and drop-off points. Passengers generally just have to walk a block or so to board a vehicle taking them (near) to their destination.

The operational capacity of micro-transit solutions gets cars off the streets, reducing congestion while at the same time offering a comfortable experience similar to that of a private car, without the responsibility of driving.

Establishing dedicated lanes for micro-transit and micro-mobility services as well as activating selected sites as multi-modal hubs enable a decentralised mobility system. Micro services are based primarily on recent technical technological innovations, creating new mobility offerings and providing new real estate development opportunities, both around multimodal hubs and within upzoning incentives and densification programmes. There is a great potential for collaboration between the real estate development sector and mobility providers through public-private partnerships or subsidy mechanisms, with many stakeholders and commuters in general benefiting from the mobility system upgrades.

Furthermore, addressing current mobility issues not only closes the urban-rural divide, but is also an opportunity to address territorial legibility across a city's urban and suburban tissue by redesigning the public domain. The design work needed for a multimodal shift is not only an infrastructural engineering exercise but also an important task for creating a space that people are able to read.

Source: <https://thehappinessprojectlondon.files.wordpress.com/2010/01/slough12.jpg?w=300&h=266>





The inability to shape our environment concerns the failure to engage neighbourhoods in projects affecting their daily lives. Working with stakeholders and communities helps the design of projects to occur in dialogue with the public. Co-creation, participatory design, coalition-building – all of these concepts, when properly activated, are the antidote to the inability to shape. The key is to activate public participation in a skilful and coherent approach sustainable throughout a project's duration.

proposed capping the existing ring and replacing it with a huge bridge. This led to the first round of public protests. A continuous release of top-down project management over the next decade created a trench-war like environment between the stakeholders.

## INABILITY TO RELATE

The inability to relate to each other refers to social alienation. Successful social cohesion strategies are developed in tandem and within the design process. These strategies help people learn to share spaces in new ways and to develop new kinds of relationships with one another. Put simply, to bring people together, we need to come up with designs that actively bring them together.

Referring back to our work at ORG, we are increasingly focused on designing multifunctional spaces, i.e., spaces that can serve commercial, manufacturing, residential or educational purposes, all of which can shift over time. Flexible-use design requires new construction techniques and strategies to take account of the requirements and ambient needs of each type of use, as well as how multiple uses can combine and share space.

The polarisation of society is easily witnessed here in Belgium. Looking back to a time of greater social cohesion, we come across a period when those with higher education and those with basic education were in regular dialogue with each other. For example, in a Catholic environment, a (catholic) farmer was in contact with a catholic people's representative through the intermediation of the local priest, bishop or a Catholic professor. Political grievances, desires and ideals circulated within an environment allowing cultural exchange between the social classes. The end of this particular social system widened the gap and disrupted contact between socio-economic classes.

In fact, and potentially as a recourse, populist parties are now to a certain extent bridging this gap, though the circulation of interests and values may be superficial or manipulated. This classic system enabled practical day-to-day exchanges through joint activities and points of gathering, and ensured a permanent cultural exchange. In today's attempts to repair social alienation, we must look at approaches connecting people on a practical, day-to-day level. In our work, ORG holds that reintegration can be achieved through building flexible-use structures and developing the productive city.

The Industrial Revolution of the 19th century led to economic and technological progress, but also to cities made unliveable by pollution and featuring poor living conditions for working-class people. In response to toxic cities, modernists promoted cities with a functional separation into manufacturing and residential zones, with a huge impact on 20th-century urban development.

As our cities have continued to grow and expand, we are revisiting the brownfield wastelands of industry, seeking to reintegrate them into the post-industrial urban fabric. The land is being developed with a view to achieving an urban mix, but what is meant by 'mixed'? A mix of commercial and residential use buildings? However, more and more we are seeing that our cities are suffering from social separatism, featuring divisions between groups. At the same time, as urban territories become denser, integrating functions creates accessibility and a multifaceted environment. Consumption and production should be reunited, with technological innovation enabling the coexistence of production and housing.

Cities are set to gain from integrating production. Integrated populations that include skilled labour have an edge in solving a range of challenges requiring technical solutions. Manufacturers bring a material intelligence which – when connected to that of the designers, engineers or scientists – can be leveraged to innovate. Urban manufacturing also offers a vast number of small and medium enterprises highly integrated into the local economy. Moreover, manufacturers can help turn waste into raw materials for new products, supporting the circular economy. Finally, urban manufacturing offers important entry points for workers to gain skills and for the labour market to become more diversified (source: Foundries of the future).

Brussels is playing a pioneering role in the development of the productive city. Its canal zone has been transformed into a large urban laboratory where production goes hand in hand with urban development. For the past decade ORG has been working on this issue, coming up with a number of good practices. One key factor in combining production and housing lies in the careful design of a continuous and active public domain in combination with a well-designed, separate private backyard.





In a recent project alongside the canal, we designed a large industrial facility on the ground floor combined with a huge housing development above. In order to combine production and housing, extreme care has to be taken to come to grips with the nuisance value of industry, i.e. pollution and/or the necessary logistics, while providing space for residents. For example, loading areas for trucks and playgrounds for children must be carefully designed around the same building in a manner preventing the two from ever meeting.

In addition to safety issues, acoustics and air quality are important design considerations. Noise, smells and fumes must all be managed flows and stops. In one design scenario we developed the interior of an urban block as a garden and shared green space, while the exterior was designed for services and loading. Part of the roof was designed as both a green buffer and a visual connection to the industrial layer, providing daylight to the ground floor and acting as a

soft intermediary connecting the two functions. The target is to achieve co-existence and well-used spaces. Mono-functional boxes in our cities belong to the past. We need shared and multi-functional forms built to dimensions able to incorporate all functions. Designing with inclusive heights, vertical circulation, technical shafts, fire safety, etc., create a flexible-use building where uses can shift over time. This flexibility and the mix of functions provide the practical foundation for social mixing.

In multifunctional, mixed-use spaces, urban lobbies serve as a hub for generating contacts but also providing opportunities for people to collaborate or work together. For example, a production facility can also serve as a repair centre for residents, for example bicycle repair. The urban lobby is a place of organised interchange between users, residents, visitors and workers, all within a productive area.

Of course, mixed-use also goes hand in hand with a low environmental impact. In the Broeklin project we had the opportunity to combine all the main business functions into one city block. The design included production facilities for SMEs, offices, educational and cultural facilities, food, retail, urban agriculture and fashion. Within the social context, all sectors are interconnected via a circular economy centre. Beyond its obvious environmental benefit, the centre means that activities and people are functionally linked to one another on a daily basis. Functional loops provide the connective tissue between people that a mono-directional trajectory of production to consumption to waste does not. The circular way of thinking creates practices interconnecting resources and people. The Broeklin project embodies in a single site a design applicable on a multiple scale in broader city systems.

The Broeklin scheme also slashes a building's environmental costs by almost half. The megastructures all

operate on a flexible grid that can change according to needs and use patterns, giving it a lifespan exceeding a single generation. In the construction business, the most sustainable building is one that does not need to be rebuilt. It's built to last, serving many different purposes over time.





## THE INABILITY TO RECOGNISE

The inability to recognise the environment around us, or ourselves in the environment draws attention to the importance of design. The design of things is often seen as sprucing up an object, where the architect adorns a facade. This misunderstood application of design has happened so often that much of the commercial programming surrounding design has been reduced to the concept of frills.

This mistake reduces design to a static, disappointing experience with daily impacts on users. The psychological, social and emotional impacts of a drab or chaotic environment influence our perceptions of the world around us.

Meanwhile, new construction technologies are creating new possibilities to produce materials or structures that would previously have been impossible or too expensive to build. This is an exciting time to explore the capacity of design in the built environment. It's also a further responsibility of the creative industry to create relatable environments, whereby design aesthetics serve many important functions.

So-called functional buildings, such as civic buildings, should be upheld as past ways of reducing abstraction and creating connection and appeal. Churchill said, "We shape our buildings and afterwards they shape us." The covered market hall of the Brussels Abattoir was the only

building that remained after the renovation of its site. Serving as a cattle market, the attention to detail and design quality embodied in the structure had the power to emphasise the importance of that function.

As Frank Lloyd Wright put it, "form follows function". But this quote is often misunderstood. Form and function should be one, joined in spiritual union. When Le Corbusier started designing huge apartment buildings, much attention was paid to the human scale, to outdoor quality spaces and to multifunctional rooms, meaning that, although the buildings have an abstract form, they have retained their aesthetic and functional quality.

We are now in a post-abstract period of extreme functionalisation and construction rationalisation. We hear of the construction sector being critical of architects redesigning everything every time. Of course, things can be rationalised. There is a very thin line that we must be continuously mindful of: while a building must not be too expensive, we must always consider empathy in its form. It's a never-ending search for the right balance, a combination of rationality and abstract design with empathetic, accessible architecture.

An empathetic yet functional design bestows security and recognition in the built environment. Conversely, an overdose of abstraction brings daily trauma and insecurity to people's surroundings. In this populist era we need to strike a balance, also acknowledging that abstraction



– when not applied too liberally – can provide freedom of interpretation, itself a very democratic ability. On the other hand, a design with immediately recognisable forms creates recognition. For example, including anthropomorphic qualities or predetermined forms in a building means that people will know for example that it's a church, that it corresponds to their image of a church.

Turning to a final reference, our design of the Brakel Police Station involves a building made of huge mega-bricks carried by 13 androgynous police officers. The statues look a bit like the terracotta army of the first emperor of China, though the impression here is welcoming. We played with proportion – huge bricks supported by huge officers – and the result is appreciated by visitors because it engages with them. The emergence of recent techniques like 3D printing allows us to do these kinds

of design exercises in an affordable way. The effort of incorporating design elevates our daily experiences, such as visiting a police building.

To conclude, the intention underlying resilient city transformation lies in our ability to reconnect society through the built environment, to create practical ways in which a building or space can extend itself to the user and embrace different social classes. A severely disconnected society cannot support the necessary innovations set to see us into the next age. Designing for a cohesive society is a constant and practical effort, not a disconnected or idealist practice. There are tangible, realisable efforts we can make to create legible territories, to engage stakeholders in the shaping of their spaces, to build places of connection and exchange, and to design uplifting spaces that engage society.



## 4. Forum discussion points

**Wim Straetmans and Cécile Goffaux,  
Yves Martin, Lisa Wastiels and Filip Dobbels**

### 4.1. Introduction

**One week after Luk Peeters's keynote speech, a roundtable panel discussion brought together 20 people in Limelette. Seventeen people attended in person and three virtually.**

Introduced by Tom Willemen, chairman of the Vision Committee, this session was chaired by Wim Straetmans (KARIOS) and Cecille Gouffaux (Cenareo). Other participants were Alain Waha, Stefan Boeykens (D-Studio), Françoise Elaerts (Thomas-Piron Bâtiment), Dieter Froyen (Willemen Construct), Bart Janssens (Willemen Groep), Jean-Pierre Liebaert (Confederatie bouw), Marisa Moens (BAM), Bruno Schroder (Microsoft), Oztürk Taspinar (KPMG Belgium), Wilfried Verachttert (IMEC), François Lederer (BESIX) and Shirley Elprama (VUB).

The discussion was captured on video and transmitted live over the internet, allowing some 20 further people to follow the debate and engage in the question time and the polls. Addressing two scenarios, the discussion was followed by a poll organised live over the internet for both the panel experts and the external attendees. The first scenario stated that by 2030 we will have evolved to 'Everything as a service', while the second asked the question "What strategies and spatial measures should we take against climate change? How should we build our cities and buildings to make them climate-proof?". The session as a whole allowed the audience to give their opinions on the likelihood and impact of future evolutions. We report below on the debates and the results of the polls.

### 4.2. Discussion: Theme 1 - Urbanisation

There is a clear trend towards 'more living in the city'. We need to be closer to each other and, above all, take up less space. Are high-rise buildings the only solution? At the same time, we are increasingly living in a sharing economy, sharing homes, cars, workplaces, materials, services, etc. What impact does this trend have on our way of building and living?

Luk Peeters from ORG briefly summarised his *'City and buildings transformation'* speech for the panel. In his view, *"the world faces a number of systemic threats to which urban projects can provide a response. But in order for an urban project to be successful, certain obstacles have to be overcome. In addition to the technical and financial obstacles, spatial and social factors also play a role today. In our daily lives we experience four challenges to which we need to find an answer. We must learn to read our environment better, asking ourselves where and how we are going to build next. New developments must go hand in hand with high-quality accessibility. We can no longer develop places that are barely accessible and we have to think about how to combine transport systems between urban and rural areas in a quality way, with nodes offering many development opportunities. We also need to improve the image quality. We will only be able to redesign our environment together with users and residents. Moreover, our cities need to become more versatile again. In addition to consumption, we must make room for production. If we want to integrate a productive city into our urban fabric, we need to learn to build more flexibly, designing buildings in such a way that we can integrate different functions in the same building. This ties in with the forms of circular economy that are on the way. Finally, we must also learn to attach greater importance to design. Concept development and design should be given a more prominent place in the construction process and not be reduced to an aesthetic exercise. Endowed with the responsibility to think about design, designers are now being given that opportunity thanks to new technologies."*

#### Hypothesis 1: Building density

Leo Van Broeck, former Vlaams Bouwmeester [Flemish Building Master], called for "building high where necessary, low where possible". Van Broeck believes that giving back space to nature is almost even more urgent than reducing our CO<sub>2</sub> emissions.

*"It is in our nature to look for technical solutions. We need to focus more on the phase that precedes it, responding to social changes. Only then can we think about technological solutions. We should stop renovating poorly located*

*buildings. Remote homes must be demolished as soon as they are given up. Land and exchange rights should provide owners with new housing options in better-situated places. We cannot continue with a model of eternal growth, because that will not achieve our goals. We think that the world is a resource and that we should take as much as possible of what we can get. We need to change that image."*

Jacques Teller (University of Liège) responded: *"The increasing building density and the protection of our natural reserves are two opposites. But habitability and access to housing also play an important role. In addition to the climate crisis, there is also a housing crisis. Above all, the construction sector must move away from its linear economy and evolve more towards a circular economy. From now on, we must do everything to reuse land that has already been urbanised or built on. We can upgrade such land through densification, e.g. via high-rise buildings. But we can also partition buildings differently and better: more functional, more compact, etc. Reusing or recycling material is also an option. But whatever we do, these new forms of construction only stand a chance if a lot of attention is paid to green spaces. Green, open spaces provide the necessary quality of life, have a climate-regulating effect, provide space for water and cool the city. Citizens and residents today are calling for such green lungs."*

#### Mixed building forms

Statement: *"In the future we will have to move towards mixed building forms, where different functions come together. Ideas and concepts to densify, to make a city greener and more habitable must guide new developments and constructions. But they must also be extended to the post-construction phase through such concepts as co-ownership, cohabitation, etc. The construction sector must integrate nature in a refined but direct manner."*

**The statement provoked several reactions from the panel:**

Thomas Scorier (TS Construct) gave an example of an innovative technical and financial concept to renovate, upgrade and densify urban buildings: *"They sell the roof and then add a few floors. Through the proceeds gained from selling the space on the new floors, the rest of the building is renovated to meet today's standards."*

Gilles Vanvolsem (Befimmo) and Wanda Debauche (OCW) suggested a more rational use of the available space.

Vanvolsem: *"For example, an office building's carpark can be used by others in the evening. In addition to the use of space, the use of materials and waste processing also have a very high environmental impact."*

Debauche: *"Public space can also be used flexibly. For example, a traffic lane used during the day can become a parking lane in the evening. By focusing on more shared mobility with electric vehicles, bicycles, scooters, etc., a city's parking facilities can be partitioned differently, resulting in spatial gains. Construction projects must be viewed in an integrated manner, with their location and construction process fully geared to mobility and accessibility. Neighbourhoods may only be developed if they are sufficiently accessible and do not depend solely on car-based mobility."*

#### Hypothesis 2: The environmental quality in cities

Kristiaan Borret, Brussels Bouwmeester, was asked whether the corona crisis had led to new insights.

*"Corona teaches us that more open space should be created when we densify. You don't build a city for a crisis or for a war. You build a city forever. In a city we share things, do things together. We have to strengthen that. Cut off from all those open spaces during the Covid crisis, we noticed all the more how important they are to us. If we want to make our cities more robust, we should increasingly invest in open and green spaces, in letting water filter into the ground ... Making cities better for the climate also makes them better for a crisis like this."*

Luk Peeters (ORG): *"If we want to densify, high-rise buildings are not the only solution. High-rise buildings especially deserve a place at the junctions, where we want to link living and working with mobility. We want to densify in the growth city, but we often have to ventilate the core city and its historic centre. We must dare to cut back density there in order to improve the quality of life. The fact that we continue to use up space on all those empty plots on a daily basis is a very urgent problem."*

#### Compromise

Loïc de Moffarts (Thomas & Piron): *"In some neighbourhoods, a good compromise can be achieved between densification and greening. Everything starts with the design. You have to think in advance about the whole picture and develop a concept supported by both citizens and governments."*

Dirk Boydens (Boydens engineering): *"City planning is often viewed on a relatively small scale, but it always has a much wider-ranging impact. Policy and design should therefore be tackled on a much larger scale."*



Leo Van Broeck: *“Long before we start building, we have to determine what can be done where and what density and quality we are aiming for. If this is anchored in time, then the developer’s return is immediately clicked into place.”*

### Hypothesis 3: Multifunctional cities

Sarah De Boeck (Researcher for urban economic development and planning, VUB): *“As a post-industrial city, Brussels is losing a lot of production space at an almost unnoticed rapid pace. Between 2000 and 2018, the region lost 16% or 106 hectares of production space. Low-value users, such as production, nature and parks, are having to make way for high-value users, such as residential development. This financial logic is driven by the real estate market. We have to look for other forms of logic, such as the ecosystem that a city needs for its inhabitants: utilities, care, education, public transport, food, ... These are the sectors that we have come to know during the lockdown as the essential economy. The construction industry is building itself out of the city. If we opt for a multifunctional city that includes production, we need to question our financial values.”*

Bart Ingelaere (BBRI): *“When functions are condensed and mixed, we wonder what that means for the business model and technological knowledge in the sector. We quickly spot problems in terms of fire safety, noise, air quality, etc. So, we need to apply adapted technology to facilitate these mixed functions.”*

Gilles Vanvolsem (Befimmo): *“The idea of bringing production back to the city is appealing. The management of recycled materials is a great opportunity to embark on the path to a circular economy.”*

### Hypothesis 4: The choice of materials

Wanda Debauche (OCW): *“Mixed functions are essential for the future of our cities. The city is displacing production, transport and logistics with dramatic consequences for urban mobility. Deliveries are getting more difficult. The government must give these functions a new place in the urban fabric. The choice of materials is also becoming very important, now that we see more and more different users in the streets: electric scooters, one-wheelers, etc. The design of public space faces new challenges.”*

Luk Peeters (ORG): *“We can give (craft) workshops and small manufacturing industry a place in the city, but keeping or re-acquiring larger production units in the city is a major challenge.”*

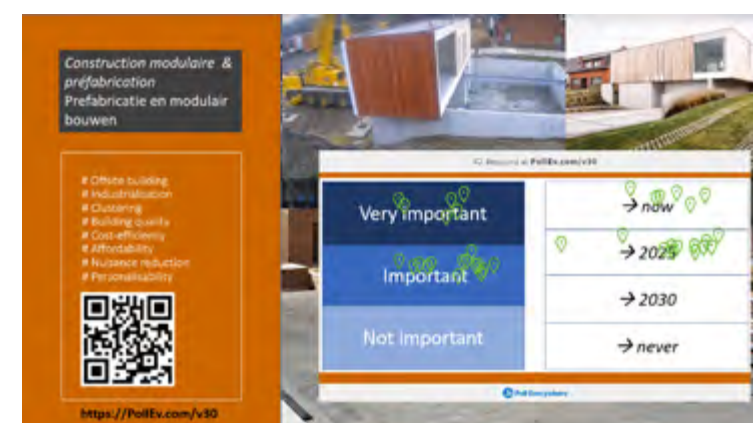
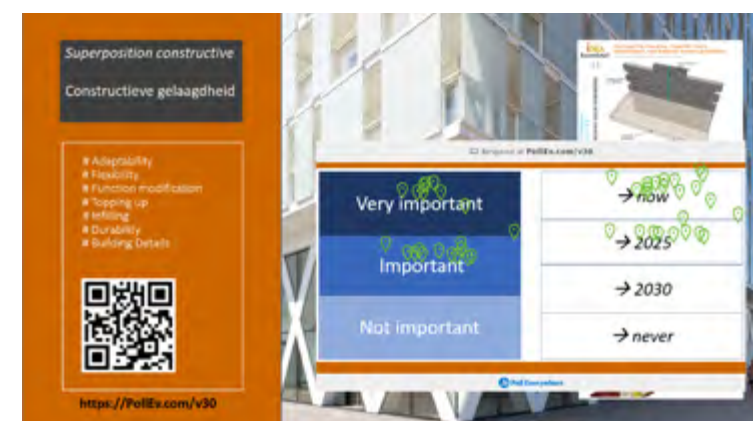
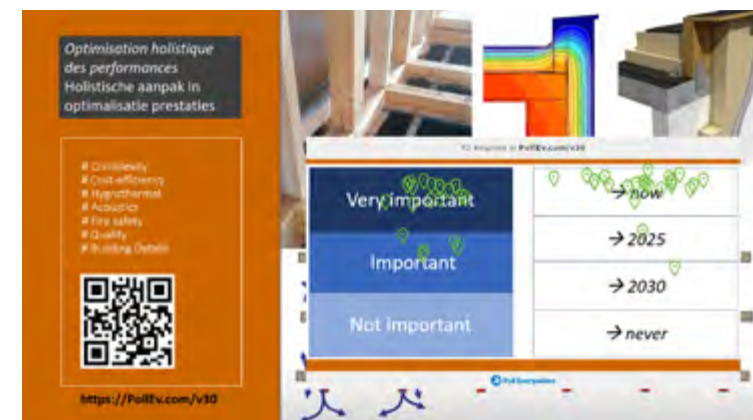
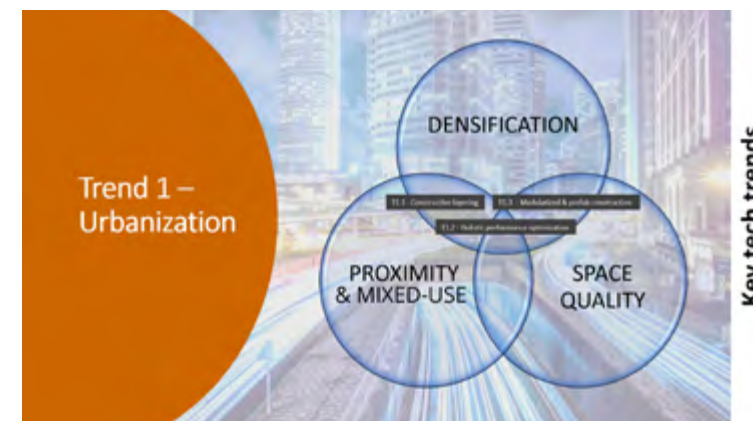
### 4.3. Live Survey: Theme 1 - Urbanisation

To gain more insights into different trends affecting the construction sector and participants’ shared vision for 2030, an online survey was conducted after the debate. The objective was to identify how the sector could be impacted by current urbanisation trends and climate change, what challenges and opportunities the sector faced, and what concrete action the BBRI could take in the next few years to support the evolution. All the experts on the panel participated in this survey, as did the audience (approx. 40 responses). Both experts and audience are referred to below as ‘participants’. About 40% of participants had a research or education background, while 20% were real estate representatives. Building contractors and architects each constituted around 15%.

The main objective of the survey was to prioritise some concrete key technological trends, linked to the megatrends discussed in the debate (densification, mixed-use buildings, quality, etc.). They had been identified and selected by BBRI in a preparatory internal research and discussion process.

The participants were asked about their vision on both the importance and urgency of those trends, using a time horizon between now and 2030. The responses varied, depending on the expertise and background of each participant. However, the main trends in the answers were quite clear, with little overall divergence.

The poll on the first theme ‘Urbanisation’ shows that, looking to 2030, the construction sector considers ‘holistic performance optimisation’ to be the most important trend in terms of both importance and urgency, followed by ‘upward extensions’ and then ‘modularised & prefab construction’. However, there is little difference in their prioritisation, with all three themes considered to be important and urgent (actions/results needed between now and 2025).



Upward extension and holistic performance optimisation are both important aspects addressed in the construction sector on the road towards more flexible and multifunctional buildings, as discussed during the debate. Indeed, they imply a higher level of complexity (mixed use, mix of renovation and extension, adding floors to existing buildings, etc.), a situation exacerbated by the quite difficult post-Covid context of material shortages and problems finding sufficient skilled workers. BBRI should support the building sector in coping with this increased complexity.

A higher degree of modularised and prefab construction could be a tool for the sector to achieve the expected high levels of comfort in a rational and cost-effective manner. However, application of these principles in our very diverse Belgian building scene remains a challenge.

### What could/should BBRI do?

The participants were also given the opportunity to make suggestions for concrete actions by BBRI for each trend. As the responses sometimes overlapped, they were summarised in a single list, prioritised by the number of entries:

#### Focus on building details

- Development & sharing of robust or integrated details, taking into account all relevant aspects: hygrothermal, acoustics, fire safety, environmental impact, ...as well as practical execution and cost-effectiveness. They should be BIM-proof and if possible also consider the concept of circularity. The Pareto principle should be borne in mind, with a focus put on pragmatic solutions
- New construction, as well as renovation and extension. Focus on mixed-use constructions (characterised by a higher level of complexity)
- Improve interoperability between modules from different manufacturers. Help the sector to develop standards
- Digital compliance checks could be a supplementary added value
- Training of architects and contractors to find the right details for project-specific connections between building elements

#### Share best practices

- Accompany companies in concrete cases, support pilot projects
- Collect and share best practices
- Support new collaboration models for the contractor



## Explore, strengthen and promote the digital toolbox for the building sector

- Develop simulation tools and digital twin platforms for collecting, unlocking and visualising data on the built environment as a support to rational (systemic) thinking
- Strengthen digital interoperability

## Support upscaling and prefab construction

- Clustering and upscaling are needed to provide enough critical mass to make prefab cost-effective

## Be a valuable knowledge platform, embedded in practice

- Be a sharing platform in a multidisciplinary context
- Focus more on real engineering instead of prescriptive normalisation
- Maintain the dialogue with the public authorities

The responses constitute valuable input for the Vision Committee, helping it to ensure that the BBRI 2030 vision corresponds to the sector's actual needs. While most suggestions match the well-established role played by BBRI in helping the sector establish frameworks to support contractors and other stakeholders, it's interesting to see the clear main mission emerging in the entries: the urgent need for support in dealing with the significantly higher level of complexity in building construction, due to the higher level of density and mixed-use considerations.

In concrete terms, the results show that the construction sector expects pragmatic, cost-optimised solutions from BBRI for the increased complexity and performance levels in construction, with attention paid to comfort, durability, circularity and adaptability. The development of integrated, robust and BIM-oriented construction details for both new construction and renovation/extensions (or combinations thereof) should be a key focus for BBRI on its journey to 2030.

## 4.4. Discussion: Theme 2 - Climate change and a resilient city

### Hypothesis 1: Demolish or renovate?

Maarten Dubois (OECD, directorate for the environment): *"By 2050 we want to be a climate-neutral continent, and construction plays an important role in this. The*

*European ambition in terms of energy savings alone is 90% by 2050. Belgium has a very old building stock and our renovations are marginal and fragmented. Drastic improvements can only be achieved by demolishing and rebuilding. However, the policy does not provide the right incentives to achieve these goals. For demolition, for example, the VAT rate is 21%. For renovation it is 6%. This policy must change so that we can modernise our old building stock more quickly, not only in terms of energy, but also in terms of spatial planning. We need to demolish more and renovate more and get away from small-scale renovation."*

Dirk Boydens (Boydens engineering): *"Energy generation should stop being fossil-based, while demolishing our built heritage requires political courage. We also tend to build for several generations. In countries where one builds for one or at most two generations, it is easier to adapt buildings to new quality and environmental requirements."*

Jacques Teller (University of Liege): *"Our building stock is indeed old, but no older than in some other countries. The poorer energy situation is mainly due to the policies and regulations of recent decades. As demolition and reconstruction usually lead to densification, they are only desirable in well-located places easily accessible by frequent public transport, mobility hubs or places with sufficient facilities such as child- and eldercare, stores, services, etc. Densification in remote areas is out of the question."*

Sven Marievoet (Transport Mobility Leuven): *"We cannot have this debate without knowing what the policy has in mind. Densification has a very important function. Mobility is a derivative of living, working, etc. The policy must make the spatial choices and indicate the direction. I don't hear that voice enough today."*

Wanda Debauche (OCW): *"As adaptations in spatial planning do indeed require many years, you have to be able to start from a vision offering long-term coherence. Such a vision is lacking in this country. At public transport hubs, we need to plan precisely those activities that can make full use of public transport. No more permits should be issued for office buildings that can only be reached by car."*

Bart Ingelaere (BBRI): *"The decision to demolish or renovate a building involves various criteria. In addition to climate objectives, quality or city recognition, we must also take into account the financial impact. The BBRI has to provide decision-makers with the necessary maps to enable them to make the right choice between new construction and renovation. But we also have to look at ways of making certain renovations more efficient and*

*less expensive. We have new techniques for this, such as digitalisation, BIM, scanning, building industrialisation, etc. And let's not forget that demolition also has an environmental impact."*

Some of the panellists shared their views on environmental impact and the use of existing technology in buildings.

Gilles Vanvolsem (Befimmo): *"The biggest environmental loss in a building arises from not using the foreseen technologies correctly. Simplifying the use of technology is a challenge."*

Leo Van Broeck: *"Building labels say nothing about what one does with that building afterwards. We need to move towards a CO2 tax, based on a building's actual consumption."*

Dirk Boydens (Boydens engineering): *"We are trying to 'detechologise' buildings. Technology should not be visible. The comfort that a building provides should be the benchmark."*

Wim Straetmans (Kairos): *"Smart doesn't mean just installing technology. Smart is not looking for a new solution for every problem. If you don't design in an integrated way, you're not being smart."*

### Hypothesis 2: Smart buildings and cities

Jan Adriaenssens (imec): *"We have to get away from the idea that technology happens to us and guides us. We have to use the technology ourselves. People are moving out of the city today with their children. Why would you want to live in the city if you can easily get to your employer via telecommuting? Telecommuting takes us away from the city. We relax through apps and technology. Where is the surprise, the bustle of the city, if we program everything in advance through apps? So technology changes how we experience a city. The resilience of a city and climate change also require technological choices. After all, technology offers opportunities to use public space, mobility, etc. in a flexible and modular way. I don't think you should have to depend on a smartphone to interact with your city."*

Bart Ingelaere (BBRI): *"We must not become slaves to technology. It should be the other way around: we have the tools to learn a lot. The BBRI could collect data that we can use to improve our future buildings, without focusing too much on technology."*

Wanda Debauche: *"Technology excludes certain populations, such as the elderly. On the other hand, technology allows a user to become a provider himself. We see this in partial mobility, for example. And finally: today, specifications are an obstacle to true innovation. Price still rules everything in tenders, but Green Public Procurement is being planned by the European Union, where specifications will incorporate sustainable solutions and open perspectives for innovation."*

Thomas Scorier (TS Construct): *"We are currently looking for technological solutions for what our cities should look like tomorrow in the view to our sociologists, psychologists and philosophers. The human aspect remains an important element."*

### Hypothesis 3: Towards green blue cities

Bruno Gobin (PCS – 'Proefcentrum voor de Sierteelt' – Research Centre for horticulture): *"The need to green our densely built-up living and working environment is greater than ever. Greening can be done anywhere, including in cities. Greenery creates more biodiversity, can slow down water drainage, cool down, purify grey water or create pleasant places to rest. We must also dare to integrate green into facades and roofs. And we must incorporate greening into our plans from the very first moment, creating an attractive environment with the necessary mobility and communal facilities. Densification and greening are not contradictory. Green has a certain cost, but it provides direct financial added value for the owners, better health, better social interaction, less absenteeism, less crime, etc. Incorporating green in the design is the best way of ensuring that it is also realised when the building is delivered."*

Leo Van Broeck: *"There is a sequence for greening. First, old dilapidated environments must make way for open space. Next, all unnecessary paving and tarmac must be broken out. The next step is to reduce the amount of sealed surfaces in the cities. The maintenance of patches of wild greenery is up to 90% cheaper than previous methods."*



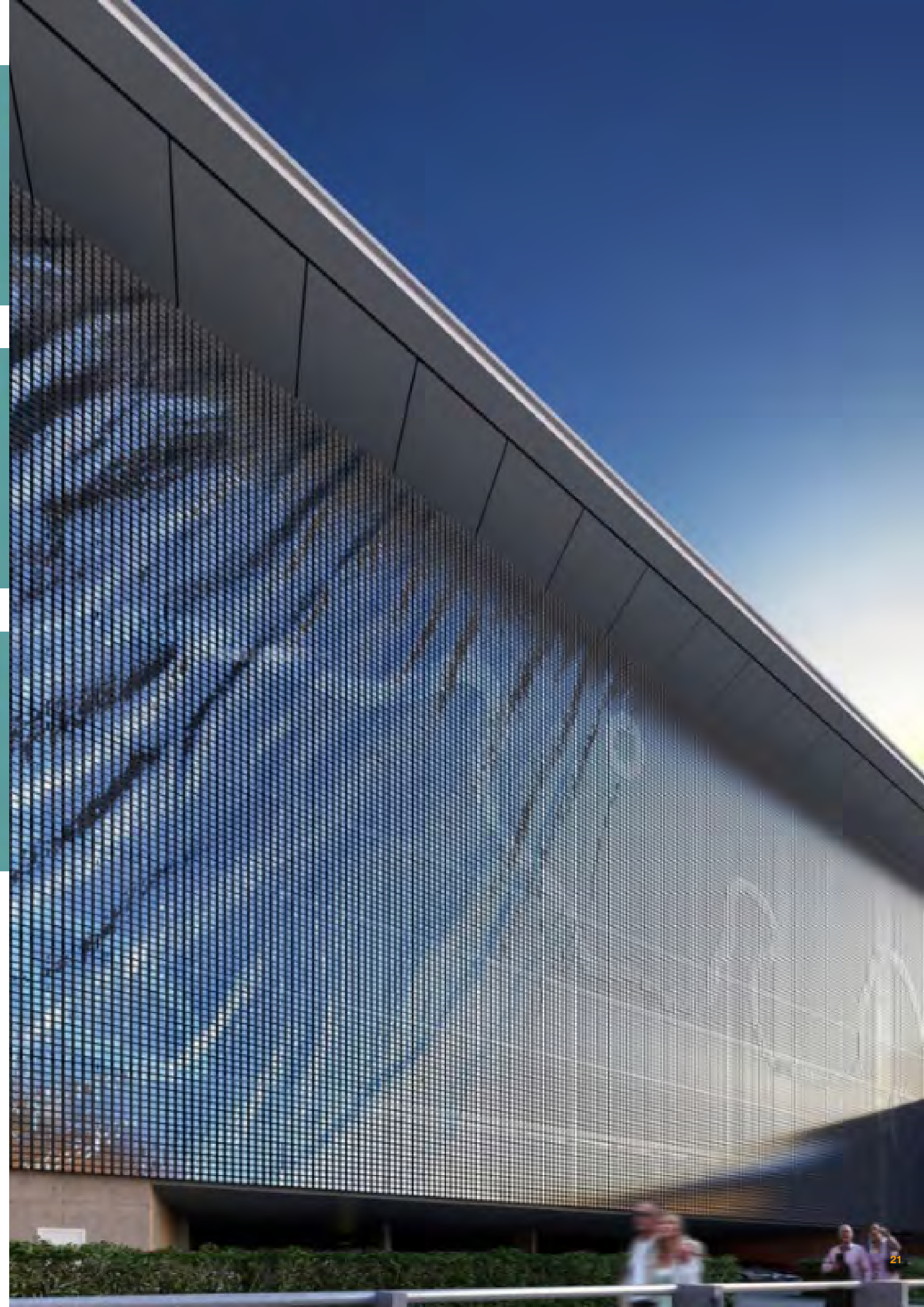
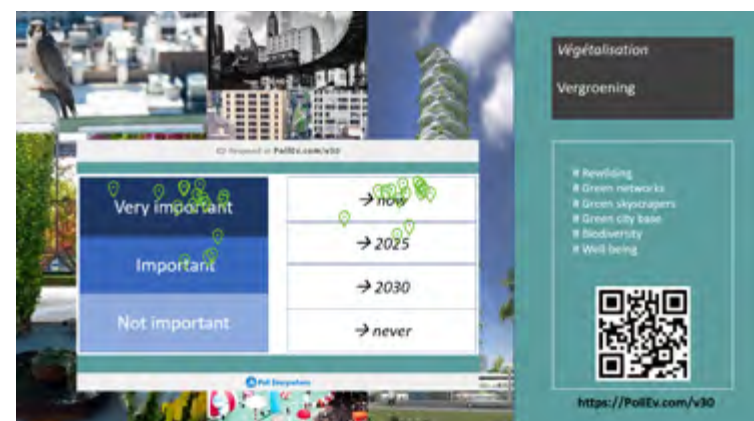
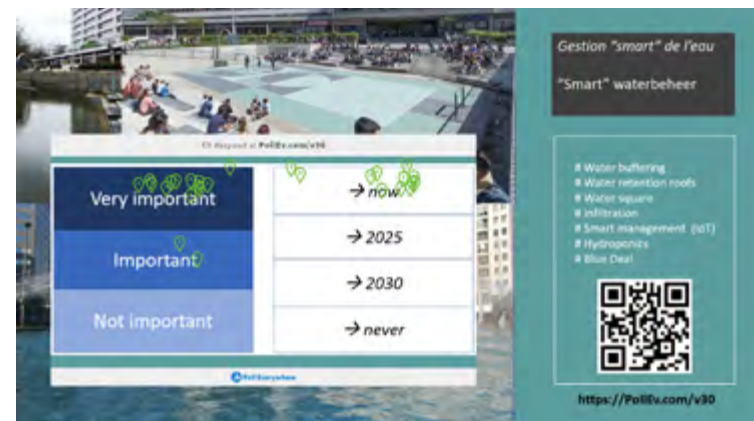
## 4.5. Live Survey: Theme 2 - Climate change and a resilient city

The poll on 'climate change' showed that, on our journey towards 2030, 'smart water management' was perceived as very important and urgent by the construction industry. 'Greening' and the 'transformation of the existing building stock' are also important, but appear to be addressable on a slightly longer time horizon in the view of the construction industry.

### Some concrete suggestions suggested by poll participants are:

- Support the development of multifunctional and green-blue buildings as an answer to climate change (more extreme rain events, more periods of drought). Help resolve the technical challenges by conducting research and standardisation work. Support rewilding and (grey) water recovery
- Conduct research into the link between green and blue at building and city level, to support policy and prevent technical problems
- Pay special attention to the integration of green-blue elements into existing buildings (specific challenges).
- Bring together the main stakeholders and suggest technical solutions
- Develop technical specifications for integrating vegetation into the built environment
- Publish best practices
- Develop Technical Guidelines (TV – 'Technische Voorlichting') to support green-blue construction:
  - 'Green facades'
  - 'Blue roofs' (roofs designed to retain water)
- Digitalisation as a tool: support the development and use of tools and models for data capture of existing buildings

The results of the live survey for the second main theme 'Climate change and a resilient city' also revealed a clear wish of the construction sector to receive pragmatic, cost-optimised solutions from BBRI to cope with the technical challenges of tomorrow's green-blue buildings. The development of green-blue construction specifications for both new construction and renovations/extensions (or combinations thereof) should be a central focus for BBRI on its journey to 2030. Put in concrete terms, Technical Guidelines for green facades and the integration of infrastructure for better managing (extreme) rainwater events would be welcomed by the building sector.





# 5. General conclusion and future perspectives

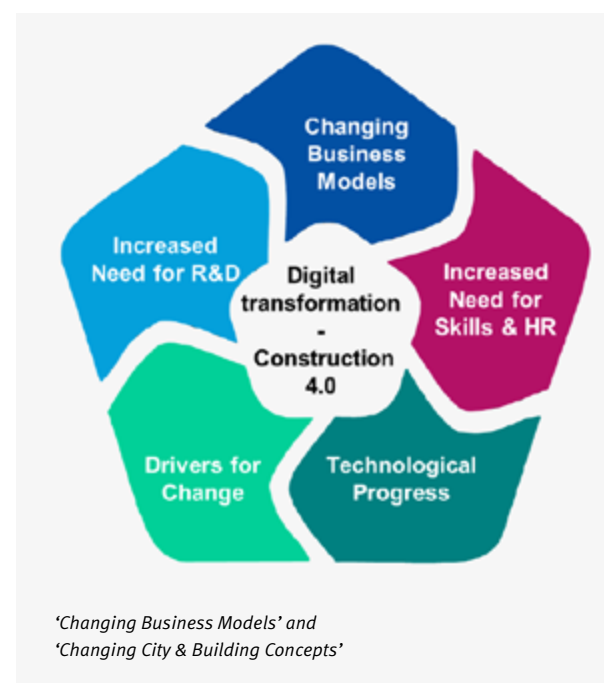
Tom Willemen, Wim Straetmans, Kevin Dethier, Yves Martin, Lisa Wastiels, Filip Dobbels

## Introduction

**Societal, economic, environmental, political and legal aspects influence how things evolve. Hence technological evolution in the sector is not the only driver: the availability of skilled labour, affordability, challenges to society, changing client needs and many other aspects will all determine how the construction sector evolves.**



In this second part of the BBRI 2030 Vision, we focus on how the global megatrends towards urbanisation and climate resilience can impact the construction industry in the next 10 years. Climate change and demographic evolutions are worldwide considered as the epic challenges of our era. Our little ‘plat pays’ (flat country) by the sea, this prosperous, crowded economic and transportation hub in the heart of Europe, feels the huge shadow of these megatrends on a daily basis. The Belgian building sector is strongly interconnected within an international network. Belgians have been involved in building the world’s tallest buildings in the Emirates. We are dredging waters all over the planet. At the same time, we increasingly depend on foreign labour in Belgium and are quickly hit by price developments on the international market. How will climate change and demographic evolutions influence the world of our building companies in the next decade? What are the prospects for 2030? And what should be the role of BBRI?



## Drivers of change

### Non-tech trends affecting the construction sector

Players along the construction industry’s value chain – architects, designers, engineers, building material suppliers, contractors, and operations and maintenance companies – need to prepare strategically and make the right moves to thrive amid the potential disruptions caused by new technologies and trends. However, the myriad potential changes in society and industry make it difficult to predict the future. To help achieve this, BBRI has studied some future scenarios with a view to preparing the building sector for a broad range of possible futures.

While it is difficult to make predictions, understanding the possibly disruptive character of trends is important. To be prepared for future evolutions in good time, we need to map and analyse upcoming trends, trying to look as clearly as possible into the foggy future. With an open mind and a sense of history, we can avoid hollow futurism. Just 100 years ago, certain human achievements which we now take for granted – such as satellites, drones, nuclear power, the internet, smartphones, BIM – were virtually unimaginable. One can expect technology and the resulting business changes to be driven by the need to overcome challenges and future market developments.

In addition to new technologies, several global megatrends are forcing players in the construction industry to rethink long-established practices. Among those with the highest impact are the steady demographic evolution, rapid urbanisation and climate change<sup>1</sup>.

### Climate change

*“Extreme weather events, such as unusually high or low temperatures, severe winds and heavy precipitation, pose a threat to people and property in cities, and are expected to become more frequent and intense as a result of climate change. Managing this risk requires effective climate adaptation policies – strategic courses of action designed to strengthen urban resilience to climate-related stress.”<sup>2</sup>*

As a society we try to cope with climate change through mitigation and adaptation policies, both of which have a major impact on the construction sector.

<sup>1</sup> <https://www.weforum.org/agenda/2018/03/how-construction-industry-can-build-its-future/>  
<sup>2</sup> <http://futuretodayinstitute.com/trends/>

To achieve the Paris Agreement goals, the United Nations Framework Convention on Climate Change’s Marrakech Partnership for Global Climate Action Human Settlements Pathway, co-led by GlobalABC and also adopted by the #BuildingToCOP26 Coalition, has set the following goal: “By 2030, the built environment should halve its emissions, whereby 100 per cent of new buildings must be net-zero carbon in operation, with widespread energy efficiency retrofit of existing assets well underway, and embodied carbon must be reduced by at least 40 per cent, with leading projects achieving at least 50 per cent reductions in embodied carbon. By 2050, at the latest, all new and existing assets must be net zero across the whole life cycle, including operational and embodied emissions.”<sup>3</sup> The Fit for 55 plan and EU Green Deal are clearly in line with this goal.

### Demographic evolution

Fast global population increase, ageing and migration waves<sup>4</sup> are putting pressure on our environment and creating tensions worldwide. The Belgian population is growing by an annual average of 0.5% (40,000 persons/year), almost entirely due to migration<sup>5</sup>. Although mitigation (birth control and migration management) has been known to be part of the solution for a long time<sup>6</sup>, our society focuses almost exclusively on adaptation<sup>7</sup>, leading to densification and widespread urbanisation.

### Urbanisation

Climate and demographic evolutions are putting permanent and still-growing pressure on our environment, especially on the existing built environment.

An often-cited UN projection is that, by 2050, two-thirds of the world’s population will live in cities. That’s just one generation away. Today, some 55% already live in urban areas. These figures underline the importance of cities to people: their quality of life, experience of living and working, as well as potential for growth, are inevitably influenced by what cities offer and provide.

More interesting, however, are socioeconomic figures, like the number of professionals, or wages, GDP or a city’s

<sup>3</sup> Executive Summary of the 2021 Global Status Report for Buildings and Construction, UN environment programme, Global Alliance for Buildings and Construction <https://globalabc.org/sites/default/files/2021-10/2021%20Buildings-GSR%20-%20Executive%20Summary%20ENG.pdf>  
<sup>4</sup> [https://population.un.org/wpp/Publications/Files/WPP2019\\_Highlights.pdf](https://population.un.org/wpp/Publications/Files/WPP2019_Highlights.pdf)  
<sup>5</sup> <https://statbel.fgov.be/nl/themas/bevolking/structuur-van-de-bevolking>  
<sup>6</sup> “De ogen van de panda. Een milieufilosofisch essay.” Etienne Vermeersch, 1988  
<sup>7</sup> Global warming policy: Is population left out in the cold?, Bongaarts J., O’Neill B., Science, Vol. 361, pp. 650-652, 2018, <https://www.science.org/doi/10.1126/science.aat8680>



crime rate, where increases exceed 100%. For example, a doubling of a city’s population leads to an increase of about 115% in the number of patents achieved by it. Similarly, agglomeration leads to a ‘superlinear’ increase in socioeconomic output.

It is clear that city masterplans are multi-faceted. They are complex and multi-disciplinary. To be meaningful, their planning and implementation need to be integrated across many jurisdictions and benchmarked against other cities and the future<sup>8</sup>.

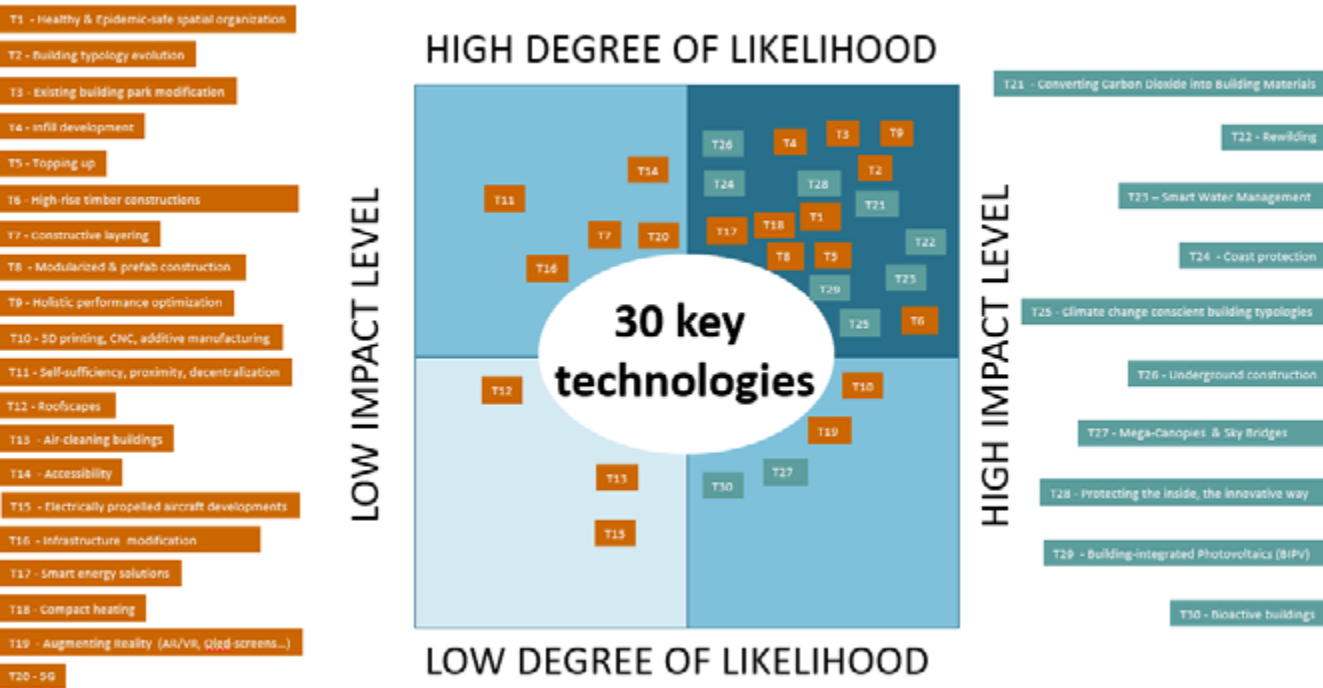
## Technological advances

### Tech trends affecting the construction sector

Ongoing and upcoming technological evolutions are being intensely followed by the building sector, as they have the potential to overcome typical construction problems and help cope with societal and environmental changes. At the same time, tech trends can also be drivers of change.

Inspired by the Future Today Institute methodology<sup>9</sup>, in its preparations for the workshop, BBRI selected 30 tech trends set to grow in importance between 2020 and 2030, driven by urbanisation and climate change. They were studied with regard to their likelihood and potential impact on the construction sector.

8 <https://www.arup.com/perspectives/integrated-planning-for-complex-cities>  
9 <https://futuretodayinstitute.com/>



Overview of 30 tech trends concerning urbanisation and climate change and their impact on the building sector (estimate based on literature review, BBRI, 2020)

Based on internal discussions, 7 tech trends were finally selected as the basis for the online survey during the workshop. In these conclusions, we would like to emphasise 3 main trends, closely linked to the BBRI Ambitions 2025 ‘Green Deal’ and ‘Construction 4.0’.

Buildings are responsible for about 40% of worldwide CO<sub>2</sub> emissions<sup>10</sup>. To achieve the Paris Agreement, buildings throughout the world and the construction sector need to be almost completely decarbonised by 2050<sup>11</sup>. A building’s emissions will need to be reduced over its lifecycle through a triple strategy, namely a combination of reducing energy demand (behaviour change and energy efficiency), decarbonising the power supply (e.g., electrification through renewable sources and increased use of other zero-carbon heating technologies) and addressing embodied carbon stored in building materials. The first two measures (the energy transition) are expected to enable virtually all carbon emissions to be eliminated from building operations by 2050<sup>12</sup>.

However, while the ambitions are very high, the results of past decades are sobering. In the residential sector, fuel consumption actually increased by 17.4% between 1990 and 2003, mainly due to the increasing number of buildings (+26% between 1991 and 2001)<sup>13</sup> and a clear

10 Executive Summary of the 2020 Global Status Report for Buildings and Construction, UN environment programme. Global Alliance for Buildings and Construction <https://drive.google.com/file/d/1kzXooASPI-RU5igoRdKLMkrBfalv29yW/view>  
11 Executive Summary of the 2021 Global Status Report for Buildings and Construction, UN environment programme. Global Alliance for Buildings and Construction <https://globalabc.org/sites/default/files/2021-10/2021%20Buildings-GSR%20-%20Executive%20Summary%20ENG.pdf>  
12 Ibid.  
13 <https://klimaat.be/in-belgie/klimaat-en-uitstoot/uitstoot-van-broeikasgassen/uitstoot-per-sector>



illustration of the huge and often underexposed impact of the demographic evolution on climate mitigation efforts.

Technological advances give us new possibilities to tackle the challenges of our time, but the influence of the human factor remains a key determinant of the final result.

### Energy transition

**“Energy generation should no longer be fossil-based.”**  
[D. Boydens]

To tackle climate change, energy delivery is moving towards electrification at both urban and building levels. This transition is leading to a period of uncertainty, as old technologies are being phased out and restricted, while new technologies are not yet entirely mature. While the principles of a CO<sub>2</sub>-neutral society have since been widely adopted, implementation of clean energy sources such as wind or solar energy remains in development. This phasing could lead to problems in energy delivery (blackouts) and make it much more complex to choose the ‘right’ technical installations at building level, especially in renovation projects.

### Building materials transition

Emissions from materials and construction processes must also be addressed to ensure that the buildings being built today are optimised for low-carbon solutions across the full lifecycle. This involves maximising the refurbishment of existing buildings, evaluating each design choice using a full lifecycle approach and seeking to minimise upfront carbon impacts (e.g., lean construction, low-carbon materials and construction processes, etc.), as well as taking steps to avoid future embodied carbon during and at the end of life (e.g., maximise the potential for renovation, future adaptation, circularity, etc.).

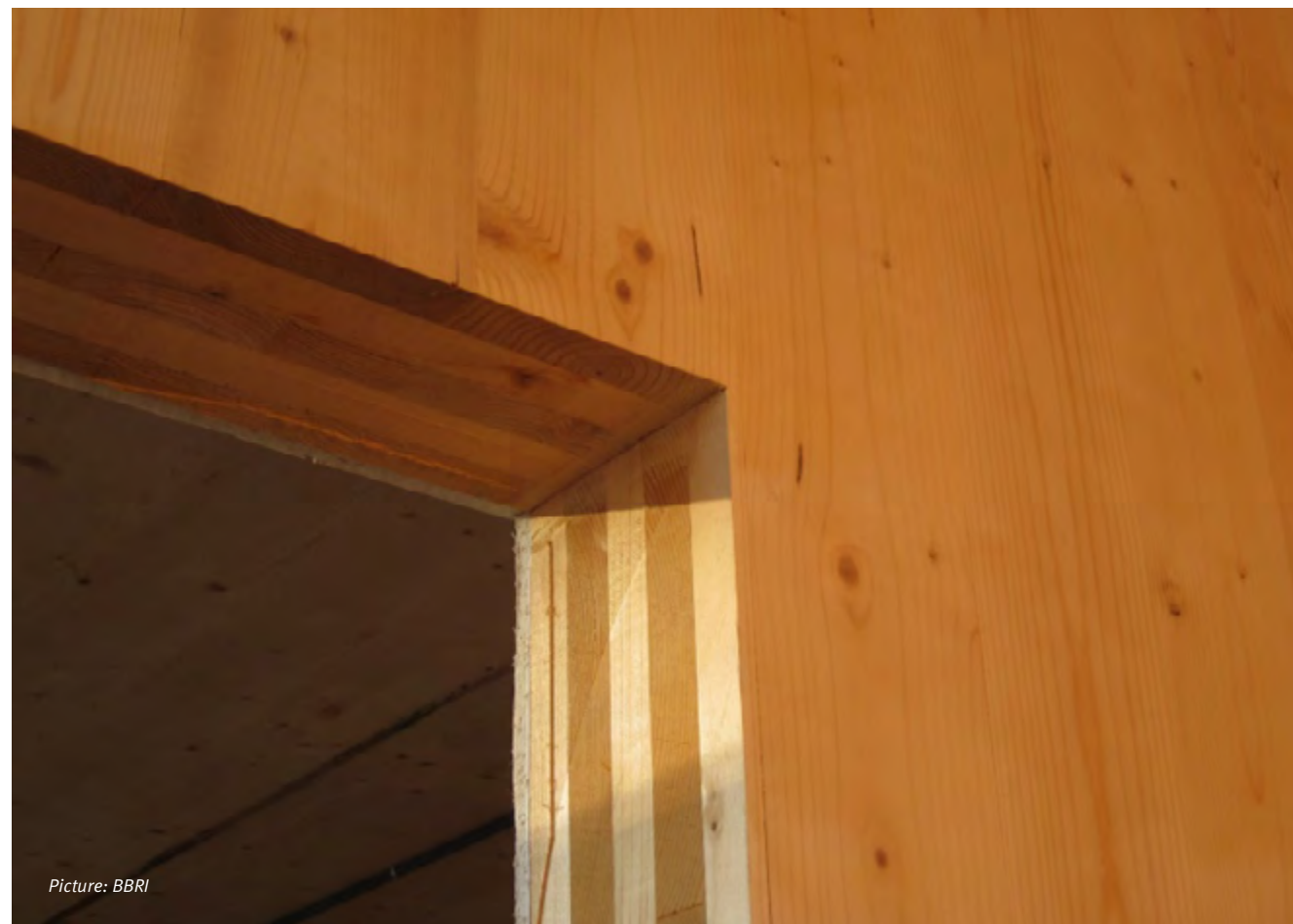
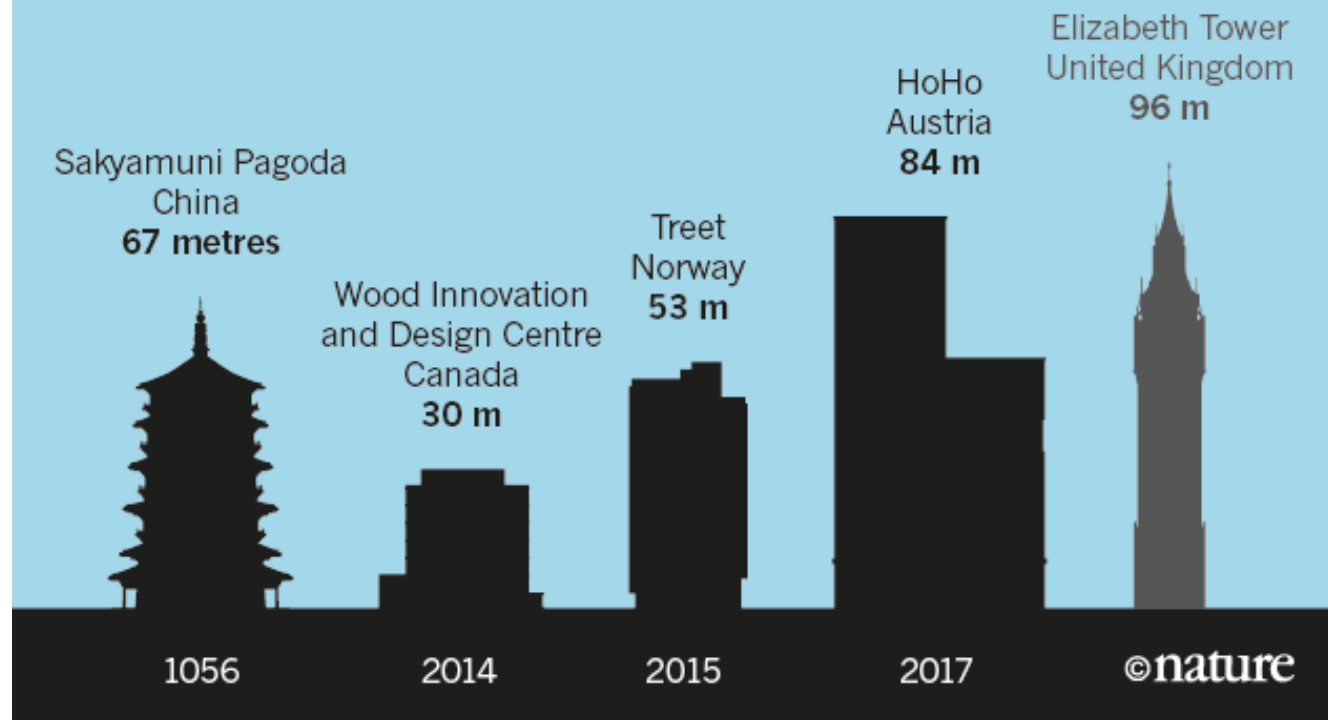
As the only building material capturing CO<sub>2</sub> instead of emitting it during its production phase, the use of timber is extremely promising. The market for timber construction is growing in Belgium year after year<sup>14</sup>. Eye-catching is the construction of Europe’s largest wooden building as part of the renovation of the Gare Maritime in Brussels. There is a growing interest worldwide in wooden buildings, even skyscrapers. Recently developed materials such as CLT (Cross Laminated Timber) make it possible to build qualitatively and quickly, storing lots of CO<sub>2</sub> for the next few decades, the crucial period for limiting global warming to below 1.5°C.

14 TIEN JAAR HOUTBOUW IN BELGIË: WAT IS ER VERANDERD? Enquête Hout Info Bois, oktober 2021



## THE WOODEN RENAISSANCE

As advanced timber technologies enable wooden buildings to approach the heights of more conventional landmarks such as Elizabeth Tower, they promise to lock up carbon dioxide and reduce the emissions associated with steel and concrete construction.



## Digital transformation

The ongoing spectacular progress in digital techniques offers the construction sector new possibilities and perspectives never seen before. BIM, digital twins, drones, ... and other digital tools belonging to Construction 4.0 can help the sector cope with the challenges of climate change and urbanisation. The first BBRI Vision 2030 document on digitalisation provides an overview of the possibilities and challenges of these promising new tools.

## Changing city and building models

### Design & planning trends affecting the construction sector

*“Simplifying the use of technology is a challenge.”*  
[Gilles Vanvolsem (Befimmo)]

One clear and interesting conclusion of the workshop was that technology alone will not ‘save the world’, nor the construction sector more specifically. While tech tools can obviously deliver added value, (integrated) design and planning are even more important to make the transition happen. Consequently, their role is growing as we move towards 2030, as they are crucial for tackling the challenges of our epoch. A smart design can make the use of tech tools unnecessary. On the other hand, tech tools such as BIM and digital twins can help resolve complex design problems. There is an interaction between technology and design, which should be kept in mind. Tech tools – often quite expensive and not directly feasible for SMEs, especially in the early years of development and application – should be implemented in a smart way, not as gadgets or marketing tools, but thoughtfully and focused on achieving maximal impact with limited resources.

*“We should try to ‘detechologise’ buildings. Technology should not be visible. The comfort that a building provides should be the benchmark.”* [Dirk Boydens (Boydens engineering)]

## Climate-resilient urban planning

*“We need to make cities more robust and resilient. In a city we share things and do things together. We have to strengthen that. If we want to make our cities more robust, we must invest more in open and green space, in letting water filter into the ground.”* [K. Borret]

## Densification

The current demographic evolution is leading to widespread urbanisation and the densification of urban regions. Densification can be achieved by a combination of high-rise buildings, upward extensions of existing buildings, infilling, the compartmentalisation of old buildings and replacing dilapidated buildings by new, denser and compact buildings.

*“High-rise buildings especially deserve a place at the junctions, where we want to link living and working with mobility. We want to densify in the growth city, but we often have to ventilate the core city and its historic centre. We must dare to cut back density there in order to improve the quality of life.”* [L. Peeters, ORG]

*“Building high where necessary, low where possible.”*  
[Van Broeck]

One interesting global trend is the appearance of high-rise timber (or mixed) buildings, a very promising development in the decarbonisation of our building stock. Capturing CO<sub>2</sub> in the atmosphere through trees and then storing it for decades in timber buildings is a very smart way to fight global warming.







The upward extension of existing buildings is an innovative way of upgrading urban buildings: *“They sell the roof and then add a few floors. Through the proceeds gained from selling the space on the new floors, the rest of the building is renovated to meet today’s standards”* [Thomas Scorier (TS Construct)].

Lightweight construction methods are most suitable for such upward extensions, again presenting new opportunities for timber construction.



Making the most of the ‘fifth façade’ similarly presents opportunities to bring more green to city centres. Rooftops provide interesting potential for a wide variety of functions, set to be increasingly unlocked over the next decade.

#### Rational & circular land use

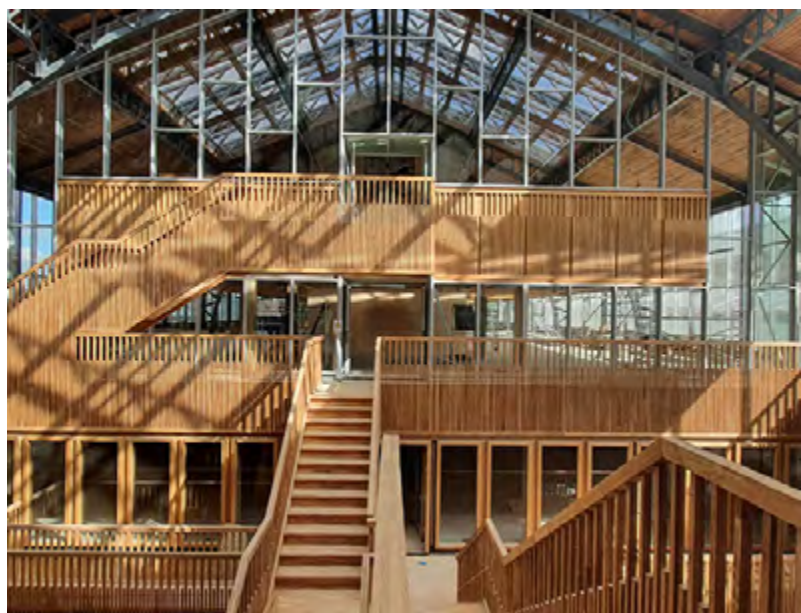
To achieve densification in a qualitative and structured way, we need to use available space more rationally, while at the same time finding the right balance between densification and greening. Interestingly, the concept of circularity can also be applied at urban level.



*“The construction sector must move away from its linear economy and evolve more towards a circular economy. From now on, we must do everything to reuse land that has already been urbanised or built on.”* [J. Teller]

*“We can upgrade such land through densification, e.g. via high-rise buildings. But we can also partition buildings differently and better: more functional, more compact, etc. Reusing or recycling material is also an option. But whatever we do, these new forms of construction only stand a chance if a lot of attention is paid to green spaces. Green, open spaces provide the necessary quality of life, have a climate-regulating effect, provide space for water and cool the city. Citizens and residents today are calling for such green lungs.”* [J. Teller]

To give (new) life to abandoned parcels or old buildings in city centres, timber construction can be an interesting technical solution, as relatively light building components can be prefabricated and assembled (and possibly dismantled at a later date) on site.





Mobility

Rational land use and spatial quality go hand in hand with mobility.

We should note that there is great potential in collaboration between the real estate development sector and mobility providers. Public-private partnerships or other subsidy mechanisms are needed to allow all stakeholders to benefit from and enhance an area's overall quality. [Luc Peeters]

By activating selected sites as multi-modal hubs, we can facilitate a decentralised mobility system based primarily on recent technological innovations. In turn, this new network of mobility offerings provides enhanced real estate development opportunities, both around the stations and also within the area through upzoning incentives and densification programs. This encourages a higher utilisation of the land surrounding existing and new mobility hubs.

Flexibility – Versatility - Mixity

*“Our cities need to become more versatile again. Cities can gain from urban manufacturing.”* [Luc Peeters]

*“The idea of bringing production back to the city is appealing. The management of recycled materials is a great opportunity to embark on the path towards a circular economy.”* Gilles Vanvolsem (Befimmo):

*“Mixed functions are essential for the future of our cities. The city is displacing production, transport and logistics, with dramatic consequences for urban mobility. Deliveries are becoming more difficult. The government must give these functions a new place in the urban fabric.”* [Wanda Debauche (OCW)]

*“We can give (craft) workshops and small manufacturing industry a place in the city, but keeping or re-acquiring larger production units in the city is a major challenge.”* [Luk Peeters (ORG)]

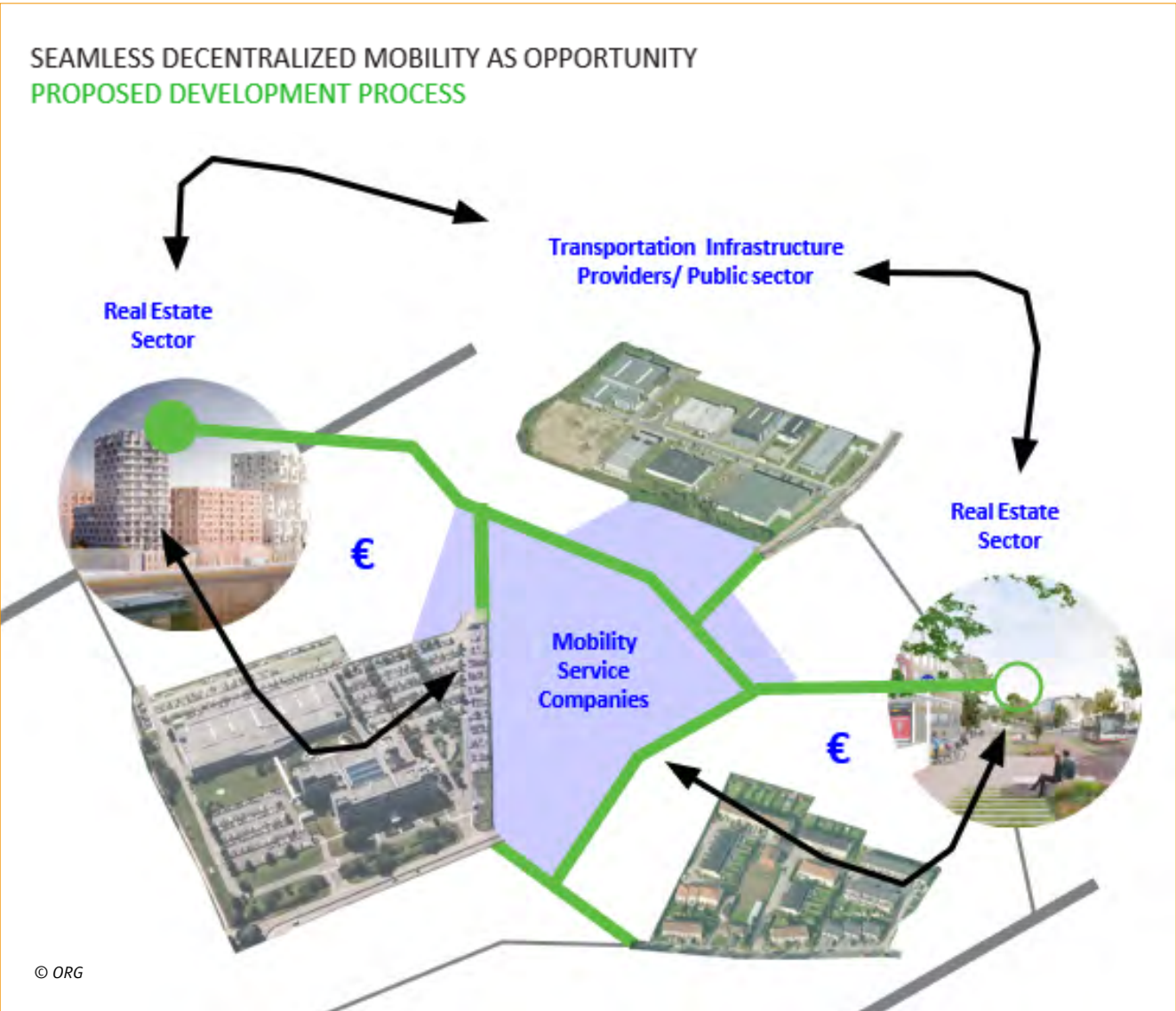
In the future we will have to move towards mixed building forms, where different functions come together.

Demolish or renovate?

*“We need to demolish more and renovate more and get away from small-scale renovation.”* [L. Van Broeck]

*“Demolition and reconstruction usually lead to densification and is therefore only desirable in well-located places easily accessible by frequent public transport.”* [J. Teller, ULiège]

*“The decision to demolish or renovate a building involves various criteria. In addition to climate objectives, quality or city recognition, we must also take into account the financial impact. The BBRI has to provide decision-makers with the necessary maps to enable them to make the right choice between new construction and renovation, but we also have to look at how we can make some renovations more efficient and less expensive. We have new techniques for this, such as digitalisation, BIM, scanning, building industrialisation, etc. And let's not forget that demolition also has an environmental impact.”* [B. Ingelaere]







### Water management

In the light of climate change, causing periods of extreme drought or frequent precipitation, water management becomes an extremely important part of urban planning. Good spatial design can prevent flooding, in a better way than even the use of tech solutions such as green roofs.

### Toward blue-green cities

*“Giving back space to nature is more urgent than reducing our CO<sub>2</sub> emissions.”* [Van Broeck]

Rewilding or renaturing our dense city centres is an important point of attention to guarantee or improve the quality of life. Greening can go hand in hand with water management and should ideally be planned together.

*“The need to green our densely built-up living and working environment is greater than ever. Greening can be done anywhere, including in cities. Greenery creates more biodiversity, can slow down water drainage, cool down, purify grey water or create pleasant places to rest. We must also dare to integrate green into facades and roofs. And we must incorporate greening into our plans from the*

*very first moment, creating an attractive environment with the necessary mobility and communal facilities. Densification and greening are not contradictory.”* [B. Gobin, PCS]

*“First reduce the amount of sealing in cities. Create a green roof or facade where necessary, a park, a forest, a green road or square or gardens where possible.”*  
[L. Van Broeck]



Example of successful rewilding:  
the High Line, New York



[Picture by Ghent Municipality for  
BBRI project (VIS Groen Bouwen) –

### Smart cities?

*“Technology offers opportunities to use public space, mobility, etc. in a flexible and modular way.”*  
[Jan Adriaenssens (imec)]

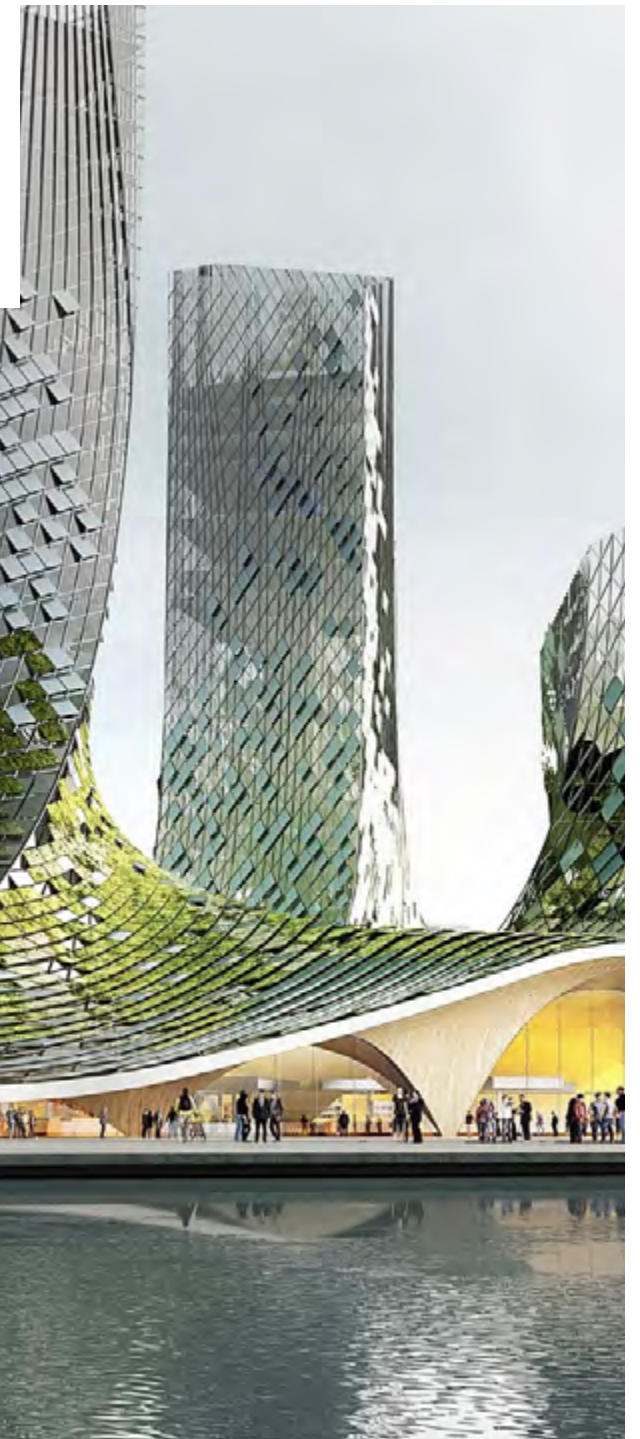
*“We have the tools to learn a lot. The BBRI could collect data that we can use to improve our future buildings, without focusing too much on technology.”* [B. Ingelaere]

*“Smart doesn’t mean just installing technology. Smart is not looking for a new solution for every problem. If you don’t design in an integrated way, you’re not being smart.”* [Wim Straetmans (Kairos)]

2020: greening (algae formation) on facade/roofs  
mostly perceived as a problem

2030: algae formation could also be used positively  
in so-called ‘bioadaptive facades’<sup>15</sup>

<sup>15</sup> <https://www.divercitymag.be/nl/de-lucht-reinigen-met-gebouwen-gemaakt-van-algen/>







### Synthesis: what could the city of 2030 look like?

Realistically speaking (avoiding hollow futurism), our spatial environment in 2030 will not differ that much from what surrounds us in 2021... However, influenced by the observed drivers for change and the technological advances, a certain percentage of our buildings and infrastructure will be transformed. What could it look like? Based on the observed trends, we venture to predict the image of our cities of tomorrow.

The challenge for 2030 is to transform the present urban environment into a more concentrated and well-defined green-blue city, optimising the physical and psychological

well-being of people. Starting out from the 2021 situation, the 'Garden City 2.0' could become a network of optimally interconnected functions, enhancing the quality of life by improving greenery and wildlife in the city. A network of (very diverse) clustered cells, lockable and interconnected. Provided with a connection to the real world (mobility) and the virtual world (internet), closely linked to our evolutionary and psychological roots (nature) and cultural roots (heritage). The 'City of the Future' could be a 'smart mix' of various technological and conceptual solutions, a mosaic based on the extensive palette of actual possibilities. To get there, planning, alignment & integration will be at least as important as the technological solutions themselves.

### Learning from Singapore?

Singapore, a partner city in the Biophilic Cities Network, is a shining example of how to incorporate 'nature' into building and city designs. The Parkroyal on Pickering Hotel, for instance, is shrouded in thickly forested terraces and sky gardens inhabited by local insects and birds. While the situation there is obviously very different to ours (climate, politics, culture, etc.), the image it presents reflects many of the ingredients detected as possible characteristics or elements of our future urban environment. In this way, it can give us an impression of a possible future.



### Designing climate-resilient buildings

To transform our current urban 'goo' into more climate-resilient spatial networks, we should renovate in-depth or replace the most energy-hungry buildings by high environmental quality constructions, possibly very diverse in form and composition. Nevertheless, we can make out some clear upcoming trends, characteristics often cited as ingredients of buildings of the future and therefore receiving a lot of attention nowadays:

- Smart water management (e.g. reuse of grey water)
- Building materials with a low environmental impact, and especially with a low carbon footprint (e.g. timber, CLT,...)
- Flexible, circular primary structures (characterised by a long lifespan, able to take on different functions in a qualitative manner), combined with secondary layers (which can be replaced and recycled to integrate other functions). The ability to transform buildings in the future limits the need to demolish them
- Special attention to natural ventilation, daylight and dimensions (e.g. floor height)

- Climate-resilient building skin (to achieve a good indoor climate, even in periods of extreme weather)
- Nature-inclusivity (integration of vegetation, animal-friendly, insofar as there are few or no opportunities for fauna or flora in the direct surroundings of the building)
- Specific for big city-centre buildings: dense and versatile structures with partitions between substructures (taking account of the risk of flooding, made of stone-based materials, including mobility and circular economy functions) and a superstructure (consisting of lightweight, low-carbon materials like wood, taking on more residential functions). Combinations of street-level production and offices and residential space above

Under the influence of climate change and urbanisation, we are evolving in the direction of smart blue-green buildings. The construction sector must integrate nature in a refined but direct manner in the built environment. We should pursue an optimal intertwining of nature, culture and technology.



The recently built circular office building of Triodos Bank in Zeist, the Netherlands, a nice synthesis of most of the ingredients of building for the future (wood construction, circular, green, ...)  
[https://architectura.be/nl/architube/11730/het-circulaire-kantoorgebouw-van-triodos-bank?utm\\_source=newsletter&utm\\_campaign=20200528\\_NL](https://architectura.be/nl/architube/11730/het-circulaire-kantoorgebouw-van-triodos-bank?utm_source=newsletter&utm_campaign=20200528_NL)







## Integrated design is key

To realise climate-resilient buildings in a dense, urbanised environment, qualitative design is more important than ever, requiring close collaboration between builders and designers.

### Complexity

*“When functions are condensed and mixed, we wonder what that means for the business model and technological knowledge in the sector. We quickly spot problems in terms of fire safety, noise, air quality, etc. So we need a lot of new background for mixed functions.”*

[Bart Ingelaere (BBRI)]

The above-described buildings for the future are characterised by a significantly higher degree of complexity, creating new challenges for building companies. Luckily, they can count on BBRI for support.

## Integrated design

*“Everything starts with the design. You have to think in advance about the whole picture and develop a concept supported by both citizens and governments.”*

[Loïc de Moffarts (Thomas & Piron)]

Constructing flexible buildings, multifunctional structures, integrating nature, achieving smart water management, all in a cost-effective and realistic way, make design more important than ever. Construction and spatial problems can often be resolved by qualitative architecture<sup>16</sup>.

*“An intelligent design can resolve problems before they exist. We should look further than technological solutions alone, as they come in second place.”*

BIM offers us the opportunity to properly prepare each stage of the construction process and to detect problems earlier in the building process.

*“The most sustainable building is the building that doesn’t need to be rebuilt. We should enhance the spatial and image quality of our urban environment.”*

[Luc Peeters]

Concept development and design should be given a more prominent place in the building process and not be reduced to an aesthetic exercise.

16 De groene stad : hedendaagse stedelijke natuur & de nieuwe beplante ruimte, Anna Yudina, 2018



Innovative building skin & piece of art



The organic, curvilinear designs of an Avatar universe may be closer than we think. Indian agroecologist Amlankusum and Paris-based Vincent Callebaut Architectures have released plans for a vertical ‘eco-neighbourhood’ called the Jaypee Green Sports City. The compound, which would theoretically be built outside of New Delhi, is named ‘Hyperions’ and consists of a set of six 36-story towers connected by common green spaces, walkways, and shared eco-conscious utilities. A more futuristic vision of a city of the future, but also a nice synthesis of most of the ingredients of building for the future (superstructure/substructure, versatility, flexibility, wood construction, circular, green, ...)



Functional & beautiful



## Digital twins

New tools such as BIM and new ways of collaboration as the ‘building team’ can help us cope with complex design processes. The use of BIM shifts the effort of all building partners concerned towards the early phase of the design & construction process, making it possible to integrate all relevant aspects in a smart way into relatively simple, cleverly invented architectural solutions. Projects will have to cope with heightened health and safety performance targets, sustainability requirements and climate change considerations, introducing the concept of the ‘twin transformation’ merging ‘green’ and ‘digital’ goals.

## Building details

The complexity of buildings for 2030 will obviously lead to more complex building execution details. Execution details are the design tools par excellence to cope with complexity. The way details are designed is very determining for the quality of the building, both in a negative sense (avoiding building damage) and in a positive sense (achieving architectural quality). BIM can help us tackle building details in an effective, rational way. As a consequence of the evolution towards the buildings for 2030, attention to building details is set to further increase over the next few years.

## Increase research and development

**The exponential evolutions expected within the sector, the new normal in 2030, could be strongly influenced by disruptive innovations. With R&D set to become a strategic activity, R&D efforts should be focused on facilitating integrated design.**

We expect to see disruptive action leading to innovations solving some of the sector’s current problems. As McKinsey & Company points out:

*“All of the players in the construction value chain will need to develop their strategies for dealing with or leading disruption. This is especially true for engineering and design, materials distribution and logistics, general contracting, and specialised subcontracting, all of which are likely to face commoditisation and decline shares of value for parts of their activities”.<sup>17</sup>*

<sup>17</sup> McKinsey & Company, ‘The next normal in construction: How disruption is reshaping the world’s largest ecosystem’

New technology know-how and insights can provide a disruptive advantage. Major challenges to our society like climate change, sustainability and changing customer requirements will boost research and the development of new knowledge. Together with existing know-how, these will be encoded in advanced, sometimes disruptive software improving our existing knowledge of design, construction efficiency and expected customer needs. Software and data acquisition will be able to capture accumulated know-how from project to project, applying it so we can learn from it and optimise future projects.

R&D will thus be essential to competition in the construction industry. Even if larger companies have more resources to invest in R&D, they will have to work with other, smaller companies. Cocreation will be a necessary way of optimising their collaboration. BBRI has a major role to play in reinforcing larger companies’ individual research efforts, and in facilitating and empowering this cocreation. Last but not least, our collective research centre faces a major challenge: assisting smaller companies with the transformation through research, training, the development of tools and new climate-resilient ecosystems.

## The decisive human factor

Research and design can help us achieve the constructions targeted for 2030, to cope with climate change and urbanisation. However, we should be careful in our predictions, especially for the near future. Tech trends are (no more than) possibilities for the future. Whether they achieve a breakthrough to become readily available or remain exceptions confirming the rule (as nowadays), largely depends on the human factor. Some (promising) tech trends are not new at all, having been around for several years. Better than just listing possibilities, it’s interesting and important to study why certain trends are growing

while others seem to stagnate. How can we make them happen? How can we convert good ideas into action? What are the obstacles and are there ways to get round them? What will remain futuristic and what can we effectively realise through strategically chosen, focused efforts?

Finally, human behaviour is decisive. We should be aware of the consequences of the choices we make. The future is shaped by the choices we make today, the choices we want to make, we can make. Affordability plays a crucial role, as does the availability of a skilled workforce, now one of the biggest problems in the Belgian construction sector.

## The search for skilled workers

The scarcity of skilled workers at all levels is causing major problems for the traditional construction process and should be taken into account as a determining factor for future change. Prefabrication and industrialisation could be part of the solution, but they too have limits, especially in relation to our - very diverse - existing building stock. Where in-depth renovation turns out to be financially unrealistic, demolishing & rebuilding could be presented as a possibility, though, in practice, this option is often not realistic for a lot of people, for practical and/or financial reasons. If we really want to renovate the existing building stock to improve energy performance, we need enough people able to insulate a roof, (simply) install a gutter and connect it up to the sewer system, make small modifications to existing wooden frames, install wall insulation, clad walls around windows, etc., i.e. workers able to work onsite on small-scale building details... Expecting too much from new construction methods – however valuable they may be for certain situations – could lead to wishful thinking and hollow futurism.

In the down-to-earth reality of day-to-day building sites, the skilled trades remain necessary.

## Affordability

Project and operating costs must be contained, as this is set to become an increasing concern for customers and owners. This is certainly the case for housing and for public investment, where budgets are tight.

*“Is the affordability of housing under threat? How affordability will determine what and how we build”.*

[ING report, 2019 ]<sup>18</sup>

Available budgets play a decisive role in construction projects – an aspect not set to change by 2030. The Covid-19 pandemic led to a major rise in material costs. Combined with ever-stricter building rules, building or even renovating is tending to increasingly become a privilege. To avoid hollow futurism, the impact of affordability should be a central point of attention in predictions for the future.

## Human behaviour

*“Building labels say nothing about what one does with that building afterwards.”* [Leo Van Broeck]

At the end of the day, the only things that count are a building’s real energy consumption and real CO<sub>2</sub> emissions, both of which depend to a great extent on human behaviour. It’s possible to live quite economically in a non-insulated house, while at the same time it is not impossible to emit more CO<sub>2</sub> per person in a very well insulated building. Real energy consumption mainly depends on available floorspace, the ‘feel-good’ level of comfort and the number of inhabitants. Neither buildings nor urbanisation contribute to climate change. People do.

*“Human behaviour and spatial organisation have an enormous impact on energy consumption and durability. Technological solutions could and should help to change human behaviour and in turn change our spatial organisation. BBRI can help us move forward on this topic over the next few years.”* [Wim Straetmans]

<sup>18</sup> <https://www.ing.be/nl/business/my-business/innovation/affordable-real-estate>





# 6. Executive summary

## English version Executive summary

***By 2030, the construction of buildings able to withstand climate change and focused on the human aspect of building will have become the new norm. Integrated (holistic) designs and greater collaboration between designers, developers, suppliers and the authorities will all help the sector face up to this new reality and the enhanced level of complexity that goes with it. Driven by climate warming and demographic pressures, our towns, cities and buildings are currently being transformed at an unprecedented speed. Working with specialists from the construction sector, the BBRI has focused on the strategic actions ahead of us that will provide for the transformation of our cities and buildings between now and 2030.***

Advances in technology are now offering the construction sector new tools and spectacular opportunities. Evolving into dense ‘green and blue’ grids, cities themselves and the buildings in them have to become low-carbon, as well as circular, flexible and polyvalent. This is leading to greater complexity, especially when combined with the current building stock, highlighting the need for integrated design and collaboration, from the initial design phase through to the final implementation details. The driving forces of change will create opportunities for new aspects and technologies with high added value. New players are redefining the shape of the construction industry and taking their place in the value chain. All of them, including the new tech players, will have to constantly adjust and reinvent themselves. Emphasis will be placed more on industrialising the sector, as well as on maintenance and service. The internationalisation of companies, the impact of new business models and the high cost of investing in technology, installations and qualified labour will push company strategies towards consolidation, specialisation and/or sustainable integration.

### 1. Using land rationally and handing back space to nature

To facilitate the process of densifying cities in a high-quality and structured manner, a more rational use of the land available is required. The concept of circularity can also be applied on an urban level. The construction sector needs to abandon its linear approach and move towards a circular economy. Preference needs to be given to the recycling and reuse of land that is already urbanised or built on. These plots of land can be put to good use by focusing on urban densification through the construction of high-rise buildings or by the careful (re-)designing of the existing building stock. In all cases, the attention paid to open spaces, greenery and water are crucial points in the transition towards the circular use of land. These spaces offer the quality of life sought by those who live there. They also

regulate the climate by purifying the air and refreshing the city. City-dwellers and other inhabitants expect such ‘green and blue’ lungs in their city. Reconverting our dense city centres is an important lever for guaranteeing and improving the quality of life. Bringing in vegetation goes hand in hand with water management and is expressed ideally in a process qualified by some people as ‘urban flora and fauna’. The need to bring back nature to the surroundings we live and work in, densely built on as they are, is greater than ever. Action needs to be taken to reach this stage, especially in our cities. Greening our spaces enables us to create more biodiversity, to decelerate the discharge of water, to refresh the environment, to purify grey water and create places for us to live and relax in that are pleasant for everyone. We need to dare to plant, even more than today, the facades and roofs of our buildings. Making the most of the ‘fifth wall’ creates opportunities for introducing more greenery in city centres. Roofs offer a very interesting potential for a wide variety of functions, requiring consideration over the coming decade. To create an attractive environment, planting needs to be included from the outset. We should also stress that densification and planting need not necessarily be opposites. They can be mutually reinforcing. Thanks to densification, we can reduce the amount of impermeable surfaces in cities. And the space freed up can be restored to nature by building roofs and walls that are planted, parks, ponds, forests, green paths, squares or gardens.

### 2. Building high if necessary, low if possible

High-rise buildings deserve a place at intersections where we want to connect where we live and work with mobility. We want densification in the new ‘growing city’. However, in many cases, we also have to bring fresh air into cities and their historic centres. We need to find a balance between ‘open space’ on the one hand and ‘built space’ on the other. Demolition and reconstruction generally

go with densification. It is vital for the quality of life that this densification should only be in appropriately located spaces: places easy to access by frequent public transport. There is great potential for collaboration between the property development sector and providers of mobility services. Private-public partnership structures or subsidy mechanisms should be encouraged and implemented in such a way that they benefit all stakeholders while improving the overall quality of the built environment. By activating selected locations as multimodal hubs, we can develop a decentralised system of mobility, based mainly on recent technological innovations. In turn, this new mobility network will create a base for more property development opportunities, based around urban hubs, but also in more extensive zones thanks to levelling-up incentives and densification programmes. These developments encourage a more compact use of the land close to new and existing mobility hubs. And in doing so, they preserve those scarce free spaces. Lightweight timber construction may offer an attractive technical solution for breathing new life into the old structures of city centres. As a result of the industrialisation of buildings, relatively lightweight construction components can be prefabricated in the factory, assembled on site and dismantled at the end of a building’s service life so that they can be reused, thus helping to achieve circularity. One interesting global trend is the emergence of high-rise buildings with a timber or mixed structure (structural works in concrete and outer skin in wood). This trend would appear to be very interesting when it comes to reducing the carbon footprint of our buildings. The repurposing of existing buildings with lightweight constructions can provide an innovative way of enhancing existing urban buildings: for example by selling the roof to add a few floors, with the remainder of the building being renovated to meet present-day requirements.

### 3. Building on the idea of the multi-functional city for making our cities resilient and agile again

Over the years, manufacturing has quit our cities, with dramatic consequences in terms of urban mobility, due to transport and logistics requirements. Deliveries have become increasingly difficult and the idea of again factoring manufacturing into the city – at least in part – is a recent and attractive one. We are currently seeing the re-emergence of logistics hubs with deliveries arriving by waterways, for example. This will enable cities to flourish and benefit from urban industrial production. A blend of functions is essential for the future of our cities. We are able to accommodate craft workshops and small production facilities, as well as small manufacturing industries in ur-

ban areas. But maintaining or buying up larger production units in the city remains a major challenge. In the future we will evolve towards forms of mixed construction, combining a range of different functions. Essential and flexible networks, not only for transport, but also for power, water, data communication, etc., will have to be planned to this effect. Condensing and blending functions will involve modifying existing business models and require the use of technological knowledge in the sector. Clearly this poses challenges in terms of fire safety, noise, air quality, sustainability, building costs, etc. Mixed functions require new general knowledge about service requirements. By 2030, we predict that the complexity of buildings will lead to more complicated construction details. Holistically well-executed and properly designed details are essential for meeting complex and strict requirements. The way in which the details are thought through is to a large extent decisive for enabling a circular approach to be taken and for the overall quality of the building, both in a negative sense (preventing damage caused by building) and in a positive sense (implementation of architectural quality). Using BIM can help us tackle the design, construction details, building process, operation and eventual demolition (materials database) in an efficient and rational way.

### 4. Focusing on an integrated construction process through intensive collaboration

Cities are places of exchanges and life that we need to maintain and develop. If we want to future-proof our cities, we need to invest more in open, green spaces and in water infiltration. Current demographic developments are pointing to widespread urbanisation and the densification of urban regions. As mentioned in the three points above, densification can be achieved by combining high-rise buildings, making (better) use of existing buildings, using empty plots of land, compartmentalising old buildings and replacing dilapidated structures with new buildings that are more dense and compact. Viably and realistically creating buildings that are multifunctional and resilient to climate change, in a densely populated urban environment, more than ever requires close collaboration between the various parties involved (developers, study bureaus, designers, suppliers and the authorities). A high-quality and integrated design process is needed. This process needs to bring together all disciplines concerned at an early stage to ensure that unexpected problems or issues do not need to be adjusted afterwards and that no costly solution is necessary. New R&D efforts should focus on facilitating integrated designs and on ensuring close collaboration between all providers involved in the construction value chain. In parallel with existing savoir-faire,



new forms of knowledge need to be incorporated into advanced software, some of which will be disruptive but will improve our understanding of a building's design and efficiency and the expected needs of customers. As a result of software and the collection and processing of data, we are able to apply the knowledge and expertise built up as part of a specific project to new projects. New technological processes, such as BIM and collaboration as the building team can help us to manage complex design processes. These forms of collaboration will allow us to focus the efforts of all stakeholders on the early stages of the process, in turn enabling all relevant aspects to be incorporated effectively into relative simple and intelligently designed architectural solutions.

### 5. Simplifying the use of technology in buildings

Projects will be faced with growing performance targets in terms of health, comfort, safety, sustainability and considerations associated with climate change. Technology can help us meet these challenges, but we need to make sure that technology does not become an aim in itself. Technology should not be visible, so to speak. The aim is

the comfort and convenience provided by a building and it needs to stay that way. Of course, technical tools can offer added value, but they also need to sustain the process of designing and planning (integrated) and the experience of the built environment. 'Smart' does not mean that we put more and more technology into our buildings, but rather that we examine those areas where technology brings added value. 'Smart' does not mean looking for a new solution for every problem, but preventing problems by having an integral design. There is an interaction between technology and design that needs to be taken into account. Technical tools – which are often rather expensive and difficult to access for small and medium-sized enterprises, especially during the early years of their development and application – must be used in an intelligent and considered way, and not merely as gadgets or marketing tools. They need to achieve maximum impact with limited resources. And we mustn't forget that buildings, as such, contribute neither to climate change nor to urbanisation. It's people who do this. Human behaviour and the way space is organised have a major impact on the consumption of energy and sustainability. Technological solutions can and must contribute towards changing human behaviour and therefore modifying the way we organise space.

## POINTS TO REMEMBER

### Principal 'points of interest' for the BBRI and its Technical Committees.

The study reveals a number of important points requiring the attention of the BBRI's 'vertical' Technical Committees (TCs). To ensure that everything is properly understood, it is of course recommended that TC members read the full report of the Vision Committee in order to discover other important aspects for their trades. Many of the observations about future trends are also extremely relevant for the 'horizontal' technical committees and for the 'Digital Construction' and 'Smart & Sustainable Constructions' TCs. One important point to remember is certainly the blend of functions in buildings, both at a specific time and in subsequent phases. Understanding the implications of this 'blend' in terms of the requirements and constraints of (re-) design, the required technical performance and the way they are incorporated is of great importance. The complexity needed to fulfil the multidisciplinary requirements is enormous, covering many technical issues: acoustics, fire safety, stability, sustainability, modular requirements, etc. Flexible solutions and (re-)design guides are needed to enable functional changes over time, converting office buildings into apartments or even hospitals.

Construction techniques and processes geared to the renovation and enhancement of the existing building stock require additional guidance. These relate to the development and application of solutions that are modular, flexible and prefabricated, and often involve lightweight constructions in wood and steel, albeit complying with safety, energy needs, carbon footprint or environmental requirements. Design codes need to be supplemented by redesign requirements and examples of good practices. Technical specifications are also required for integrated 'green and blue' solutions. Attention also needs to be paid to a whole range of aspects, including social aspects, biodiversity, risk

management, maintenance, safety and security. This not only concerns water and mobility networks, but also the design and integration of other 'lifelines', such as electricity and communications.

Many of these subjects are new for the BBRI and also require extensive collaboration with designers and planners to tackle sustainability in all its aspects. Integrated concepts are an essential element for dealing with this increased complexity. Special attention is required with regard to simple construction details, taking all relevant parameters into account, as well as multidisciplinary, circularity and modularity.

Design guides indicating the 'do's and don'ts' would be welcome for understanding the options and risks associated with specific solutions. Existing construction details may have to be reassessed to include how dismantling and circularity can be made possible. The introduction of registers linked to the construction materials used and the specifications for the required maintenance of a building also need to be considered. When further developing the initiatives already undertaken by the BBRI as part of the 'Smart & Sustainable Constructions' Technical Committee, it became apparent that attention had to be paid not only to the development of new technical aspects, but also to making existing knowledge and tools more widely available, for example in relation to LCC (Life-Cycle Cost) / LCA (Life-Cycle Assessment).

This is important for helping stakeholders find their own way in the world of data and smart solutions. It means that not only do we have to concentrate on technological solutions, but that we also need to ensure that we avoid problems by identifying them and dealing with them from the outset.



## Nederlandse versie Executive summary

***Tegen 2030 zal klimaatbestendig en mensgericht bouwen de nieuwe norm zijn. Geïntegreerd (holistisch) ontwerpen en meer samenwerking tussen ontwerpers, aannemers, de toeleveringsindustrie en de autoriteiten zullen de sector helpen om met deze nieuwe realiteit en toegenomen complexiteit om te gaan. Onder invloed van de opwarming van de aarde en de demografische druk transformeren onze steden en gebouwen momenteel in een ongekend tempo. In samenwerking met deskundigen uit de bouwsector heeft het WTCB onderzocht welke strategische acties moeten worden ondernomen met het oog op de transformatie van onze steden en gebouwen tegen 2030.***

De technologische vooruitgang biedt de bouwsector nieuwe instrumenten en spectaculaire mogelijkheden. Steden ontwikkelen zich tot dichte ‘groene en blauwe’ rasters. Steden en gebouwen moeten koolstofarm worden en bovendien circulair, flexibel en veelzijdig. Dit leidt tot een grotere complexiteit, vooral in combinatie met het bestaande gebouwenbestand. Deze complexiteit brengt de noodzaak naar voren van integraal ontwerpen en samenwerken, van de eerste ontwerpfase tot de uiteindelijke uitvoeringsdetails. De drijvende krachten achter verandering zullen kansen creëren voor nieuwe aspecten en technologieën met een hoge toegevoegde waarde. Nieuwe spelers zijn de contouren van de bouwsector aan het hertekenen en nemen hun plaats in de waardeketen in. Allen, ook de nieuwe technologische spelers, zullen zich voortdurend moeten aanpassen en heruitvinden. De nadruk zal meer komen te liggen op de industrialisatie van de sector, alsmede op onderhoud en service. De internationalisering van ondernemingen, de impact van nieuwe bedrijfsmodellen en de hoge kosten van investeringen in technologie, faciliteiten en geschoolde arbeidskrachten zullen de bedrijfsstrategieën in de richting van consolidatie, specialisatie en/of duurzame integratie duwen.

### 1. Rationeel gebruik van land en teruggave van ruimte aan de natuur

Om de verdichting in de steden op een kwalitatieve en gestructureerde manier te bevorderen, is een rationeler gebruik van de beschikbare grond noodzakelijk. Het concept van circulariteit kan ook op stedelijk niveau worden toegepast. De bouwsector moet zijn lineaire aanpak laten varen en overschakelen op een circulaire economie. De valorisatie en het hergebruik van reeds verstedelijkte of reeds bebouwde grond moeten worden bevorderd. Dit kan gebeuren door stedelijke verdichting met hoogbouw of door een doordacht (her)ontwerp van bestaande gebouwen. In alle gevallen is aandacht voor open ruimte, groen en water cruciaal bij de overgang naar een circulair landgebruik. Deze ruimten bieden de levenskwaliteit die de bewoners zoeken en reguleren het klimaat door de lucht te zuiveren en de stad af te koelen. Burgers en inwoners verwachten deze ‘groene en blauwe’ longen in hun stad

aan te treffen. De omschakeling van onze dichtbevolkte stadscentra is een belangrijke hefboom om de levenskwaliteit te garanderen en te verbeteren. Vergroening gaat hand in hand met waterbeheer en is ideaal verwoord in een aanpak die door sommigen wordt omschreven als ‘stadsflora en -fauna’. De noodzaak om onze dichtbebouwde woon- en werkomgeving te renaturaliseren is groter dan ooit. Er moet actie worden ondernomen om dit te bereiken, met name in onze steden. Vergroening stelt ons in staat meer biodiversiteit te creëren, de waterafvoer te vertragen, de omgeving te verfrissen, grijs water te zuiveren en aangename plaatsen te creëren om te rusten en te leven. We moeten de gevels en daken van onze gebouwen nog meer durven te vergroenen dan we nu al doen. De ontwikkeling van de ‘vijfde gevel’ schept mogelijkheden om meer groen in de stadscentra te introduceren. Rooftops hebben een zeer interessant potentieel met een grote verscheidenheid aan functionaliteiten die in het komende decennium moeten worden overwogen. Om een aantrekkelijke omgeving te creëren, moet vanaf het begin rekening worden gehouden met groenvoorzieningen. Benadrukt moet worden dat verdichting en begroeiing niet noodzakelijk tegenover elkaar hoeven te staan. Ze kunnen elkaar versterken. Door verdichting kunnen we de hoeveelheid ondoordringbare oppervlakken in steden verminderen. De vrijgekomen ruimte kan worden teruggegeven aan de natuur door de aanleg van groene daken en gevels, parken, vijvers, bossen, groenwegen, pleinen of tuinen.

### 2. Bouw hoog als het moet, laag als het kan

Hoogbouw verdient een plaats op knooppunten waar we onze woon- en werkplekken willen verbinden met mobiliteit. We willen verdichting in de nieuwe ‘groeistad’, maar in veel gevallen moeten we ook het stadscentrum en de historische stad verluchten. Er moet een evenwicht worden gevonden tussen ‘open ruimte’ enerzijds en ‘bebouwde ruimte’ anderzijds. Sloop en wederopbouw gaan gewoonlijk hand in hand met verdichting. Voor de levenskwaliteit is het van essentieel belang dat deze verdichting alleen plaatsvindt op plaatsen die goed gelegen zijn: plaatsen die gemakkelijk bereikbaar zijn met frequent openbaar vervoer. Er is een groot potentieel in de samenwerking

tussen de vastgoedontwikkelingssector en aanbieders van mobiliteitsdiensten. Publiek-private partnerschapsstructuren of subsidiemechanismen moeten worden aangemoedigd en geïmplementeerd op een manier die alle belanghebbenden ten goede komt en tegelijkertijd de algehele kwaliteit van de gebouwde omgeving verbetert. Door geselecteerde plaatsen te activeren voor multimodale transitie, ontwikkelen we een gedecentraliseerd mobiliteitssysteem, hoofdzakelijk gebaseerd op recente technologische innovaties. Dit nieuwe mobiliteitsnetwerk creëert op zijn beurt een basis voor meer vastgoedontwikkelingsmogelijkheden, rond stedelijke knooppunten maar ook in ruimere gebieden door middel van opwaarderingssstimulansen en verdichtingsprogramma’s. Deze ontwikkelingen stimuleren een compacter gebruik van land in de buurt van bestaande en nieuwe mobiliteitsknooppunten, waardoor schaarse open ruimte behouden blijft. Lichtgewicht houtbouw kan een interessante technische oplossing bieden om oude gebouwen in stadscentra nieuw leven in te blazen. Dankzij de industrialisering van de bouw kunnen relatief lichte bouwcomponenten in de werkplaats worden geprefabriceerd, op de bouwplaats worden geassembleerd en aan het einde van de levenscyclus van het gebouw worden afgebroken voor hergebruik, waardoor circulariteit wordt bereikt. Een interessante wereldwijde trend is de opkomst van hoogbouw met een houten of gemengde structuur (betonnen casco en houten omhulsel). Deze trend lijkt zeer interessant om de koolstofvoetafdruk van onze gebouwen te verkleinen. Het opwaarderen van bestaande gebouwen met lichtgewicht constructies kan een innovatieve manier zijn om bestaande stedelijke gebouwen op te waarderen: door bijvoorbeeld het dak te verkopen om er verschillende verdiepingen op te bouwen, kan de rest van het gebouw worden gerenoveerd om aan de eisen van vandaag te voldoen.

### 3. Focus op de multifunctionele stad om onze steden weer veerkrachtig en wendbaar te maken

In de loop der jaren is de productie geleidelijk uit onze steden verdwenen. De gevolgen zijn dramatisch voor de stedelijke mobiliteit als gevolg van de behoefte aan vervoer en logistiek. Leveringen worden steeds moeilijker. Het idee om opnieuw voor een deel in de stad te produceren, is recent en aantrekkelijk. We zien nu de heropleving van logistieke hubs met, bijvoorbeeld, leveringen over water. Steden kunnen zo tot bloei komen en profiteren van de stedelijke industriële productie. De mix van functies is essentieel voor de toekomst van onze steden. Wij zijn in staat kleinschalige productie- en fabricage-eenheden in steden te huisvesten. De instandhouding of verwerv-

ing van grotere productie-eenheden in de stad blijft een grote uitdaging. In de toekomst zullen we naar gemengde bouwvormen gaan, waarin verschillende functies samenkomen. In dit verband zal moeten worden voorzien in essentiële en flexibele netwerken, niet alleen voor vervoer, maar ook voor energie, water, datacommunicatie, enz. De verdichting en vermenging van functies impliceert een wijziging van de bestaande bedrijfsmodellen en vereist het gebruik van technologische kennis in de sector. Het is duidelijk dat dit uitdagingen met zich meebrengt op het gebied van brandveiligheid, lawaai, luchtkwaliteit, duurzaamheid, bouwkosten, enz. Gemengde functies vereisen nieuwe algemene kennis over de dienstveristen. Tegen 2030 verwachten wij dat de complexiteit van gebouwen zal leiden tot meer ingewikkelde bouwdetails. Holistisch goed uitgevoerde en goed ontworpen details zijn essentieel om aan de complexe en strenge eisen te voldoen. De wijze waarop details worden vormgegeven is in hoge mate bepalend voor het mogelijk maken van een circulaire aanpak en voor de algehele kwaliteit van het gebouw, zowel in negatieve zin (voorkomen van bouwschade) als in positieve zin (bereiken van architectonische kwaliteit). BIM kan ons helpen om het ontwerp, de constructiedetails, het bouwproces, de exploitatie en de uiteindelijke sloop (materialendatabase) op een efficiënte en rationele manier aan te pakken.

### 4. Focus op een geïntegreerd bouwproces door intensieve samenwerking

Steden zijn plaatsen van uitwisseling en leven die we moeten onderhouden en ontwikkelen. Als we onze steden veerkrachtiger willen maken voor de toekomst, moeten we meer investeren in open en groene ruimten en in waterinfiltratie. De huidige demografische ontwikkelingen leiden tot een meer verspreide verstedelijking en een grotere verdichting van de stedelijke gebieden. Zoals in de vorige drie punten is gezegd, kan verdichting worden bereikt door het combineren van hoogbouw, het in gebruik nemen van bestaande gebouwen, het benutten van rustpercelen, het compartimenteren van oude gebouwen en het vervangen van oude gebouwen door nieuwe, dichtere en compactere gebouwen. Om multifunctionele en klimaatbestendige gebouwen in een dichtbevolkte stedelijke omgeving op een kosteneffectieve en realistische manier tot stand te brengen, is meer dan ooit een intensieve samenwerking tussen de verschillende actoren (aannemers, ingenieursbureaus, ontwerpers, toeleveringsindustrie en autoriteiten) vereist. Er is een kwalitatief en geïntegreerd ontwerpproces nodig. Dit proces moet alle disciplines in een vroeg stadium bijeenbrengen, zodat onvoorziene of veroorzaakte problemen later niet hoeven te worden bijgestuurd en er geen



kostbare oplossingen nodig zijn. Nieuwe O&O-inspanningen moeten gericht zijn op het vergemakkelijken van geïntegreerd ontwerp en nauwe samenwerking tussen alle actoren in de bouwketen. Naast de bestaande knowhow moet nieuwe kennis worden geïntegreerd in geavanceerde, soms disruptieve, software die het inzicht in het ontwerp, de efficiëntie van de bouw en de verwachte behoeften van de klant verbetert. Met behulp van software en gegevensverzameling en -verwerking kunnen wij de in een specifiek project opgedane kennis later op een ander project toepassen. Nieuwe technologische processen, zoals BIM en samenwerking als een ‘bouwteam’, kunnen ons helpen complexe ontwerpprocessen te beheren. Door deze vormen van samenwerking kunnen wij de inspanningen van alle belanghebbenden naar de eerste fasen van het proces verschuiven, zodat alle relevante aspecten effectief kunnen worden geïntegreerd in relatief eenvoudige en intelligent ontworpen architectonische oplossingen.

## 5. Vereenvoudiging van het gebruik van technologie in gebouwen

Projecten zullen te maken krijgen met steeds hogere prestatiedoelstellingen op het gebied van gezondheid, comfort, veiligheid, duurzaamheid en klimaatverandering. Technologie kan helpen om deze uitdagingen aan te gaan,

maar we moeten ervoor zorgen dat technologie geen doel op zich wordt. Technologie mag bij wijze van spreken niet zichtbaar zijn. Het doel is het comfort dat een gebouw biedt en dat moet zo blijven. Technische instrumenten kunnen uiteraard een toegevoegde waarde bieden, maar moeten het (geïntegreerde) ontwerp- en planningsproces en de beleving van de gebouwde omgeving ondersteunen. ‘Slim’ betekent dus niet dat we steeds meer technologie in onze gebouwen stoppen, maar dat we kijken waar technologie een toegevoegde waarde heeft. ‘Slim’ betekent niet voor elk probleem een nieuwe oplossing zoeken, maar problemen voorkomen door integraal te ontwerpen. Er is een wisselwerking tussen technologie en design waarmee rekening moet worden gehouden. Technische instrumenten - die vaak vrij duur en niet gemakkelijk toegankelijk zijn voor kleine en middelgrote ondernemingen, vooral in de eerste jaren van hun ontwikkeling en toepassing - moeten op een intelligente en doordachte manier worden gebruikt, niet alleen als gadget of marketingtool. Zij moeten streven naar een maximaal effect met beperkte middelen. Ze moeten er aan herinnerd worden dat gebouwen als zodanig niet bijdragen tot klimaatverandering of verstedelijking. Het zijn mensen die dat doen. Menselijk gedrag en ruimtelijke organisatie hebben een grote invloed op het energieverbruik en de duurzaamheid. Technologische oplossingen kunnen en moeten helpen om het menselijk gedrag te veranderen en zo onze ruimtelijke organisatie te veranderen.

# TAKE AWAYS

## Belangrijkste ‘aandachtspunten’ voor het WTCB en zijn technische comités.

Uit het onderzoek komen een aantal belangrijke aandachtspunten naar voren met betrekking tot de ‘verticale’ technische comités van het WTCB. Voor een goed begrip wordt de TC-leden uiteraard aangeraden het volledige rapport van het Visiecomité te lezen om andere belangrijke aspecten voor hun vakgebied te ontdekken. Veel opmerkingen over toekomstige trends zijn ook uiterst relevant voor de zogenoemde horizontale technische comités, de TC’s ‘Digital Construction’ en ‘Smart & Sustainable Constructions’. Een belangrijk aandachtspunt is zeker de vermenging van functies in gebouwen, zowel op een bepaald moment als in opeenvolgende fasen. Inzicht in de implicaties van deze ‘mix’ in termen van (her)ontwerpeisen en -beperkingen, technische prestatie-eisen en de integratie daarvan is van groot belang. De complexiteit om aan multidisciplinaire eisen te voldoen is enorm en omvat vele technische kwesties: akoestiek, brandveiligheid, stabiliteit, duurzaamheid, modulaire eisen, .... Flexibele oplossingen en (her)ontwerpgidsen zijn nodig om in de loop van de tijd functionele veranderingen mogelijk te maken, waarbij kantoorgebouwen in appartementen of zelfs ziekenhuizen kunnen worden veranderd.

Er is extra steun nodig voor bouwtechnieken en benaderingen die zijn aangepast aan de renovatie en opwaardering van de bestaande voorraad. Deze betreffen de ontwikkeling en toepassing van modulaire, flexibele, geïndustrialiseerde oplossingen met lichte constructies van hout en staal, met betrekking tot de veiligheid, de energiebehoeften, de koolstofvoetafdruk of het milieueffect, ... Ontwerpcodes moeten worden aangevuld met herontwerpeisen en voorbeelden van goede praktijken. Voor geïntegreerde ‘groene en blauwe’ oplossingen zijn technische specificaties vereist. Ook moet aandacht worden besteed aan tal van aspecten: sociale aspecten, biodiversiteit, risicobeheer, onderhoud, veiligheid en beveiliging. Dit betreft niet alleen waternetwerken en mobiliteit, maar ook het

ontwerp en de integratie van andere ‘levensaders’ zoals elektriciteit en communicatie.

Veel van deze onderwerpen zijn nieuw voor het WTCB en vereisen ook uitgebreide samenwerking met ontwerpers en planners om duurzaamheid in al zijn aspecten aan te pakken. Geïntegreerd ontwerpen is een onmisbaar element om de genomen complexiteit het hoofd te bieden. Bijzondere aandacht moet worden besteed aan eenvoudige constructieve details, waarbij rekening moet worden gehouden met alle relevante parameters en onder meer met multidisciplinariteit, circulariteit en modulariteit.

Ontwerpgidsen met ‘do’s and don’ts’ zouden welkom zijn om inzicht te krijgen in de mogelijkheden en risico’s van specifieke oplossingen. Bestaande constructieve details moeten wellicht opnieuw worden geëvalueerd, waarbij wordt nagegaan hoe demontage en circulariteit mogelijk kunnen worden gemaakt. Ook moet aandacht worden besteed aan de uitvoering van de administratie met betrekking tot de gebruikte bouwmaterialen en de specificaties voor het vereiste onderhoud van het gebouw. Bij de ontwikkeling van de initiatieven die het WTCB reeds heeft genomen in het kader van de Technische Commissie Smart & Sustainable Constructions, is gebleken dat niet alleen aandacht moet worden besteed aan de ontwikkeling van nieuwe technische aspecten, maar ook aan de popularisering van bestaande kennis en instrumenten, bijvoorbeeld rond LCC (Life-Cycle Cost) / LCA (Life-Cycle Assessment).

Dit is belangrijk om belanghebbenden te helpen hun eigen weg te vinden in de wereld van gegevens en slimme oplossingen. We moeten ons daarom niet alleen richten op technologische oplossingen, maar er ook voor zorgen dat problemen worden vermeden door ze vanaf het begin te onderkennen en aan te pakken.



## Version française du résumé analytique

***D'ici à 2030, la construction de bâtiments résilients face au changement climatique et centrés sur l'humain sera la nouvelle norme. Une conception intégrée (holistique) et une collaboration accrue entre les concepteurs, les entrepreneurs, l'industrie de l'approvisionnement et les autorités aideront le secteur à faire face à cette nouvelle réalité et complexité accrue. Poussées par le réchauffement climatique et la pression démographique, nos villes et nos bâtiments se transforment actuellement à une vitesse sans précédent. En collaboration avec des experts du secteur de la construction, le CSTC s'est penché sur les actions stratégiques à venir face à la transformation de nos villes et nos bâtiments à l'horizon 2030.***

Les avancées technologiques offrent au secteur de la construction de nouveaux outils et des opportunités spectaculaires. Les villes évoluent en maillages « vert et bleu » denses. Les villes et les bâtiments doivent devenir bas carbone et, de surcroît, circulaires, flexibles et polyvalents. Cela conduit à une complexité accrue, du surcroît en combinaison avec le parc de bâtiment existant. Cette complexité place au premier plan le besoin d'une conception et d'une collaboration intégrales, de la phase de conception initiale aux détails de mise en œuvre finaux. Les moteurs de changement créeront des opportunités pour de nouveaux aspects et technologies à haute valeur ajoutée. De nouveaux acteurs redéfinissent les contours de l'industrie de la construction et prennent leur place dans la chaîne de valeur. Tous, y compris les nouveaux acteurs technologiques, devront constamment s'adapter et se réinventer. L'accent sera davantage mis sur l'industrialisation du secteur ainsi que sur la maintenance et le service. L'internationalisation des entreprises, l'impact des nouveaux modèles d'entreprises et le coût élevé des investissements dans la technologie, les installations et la main-d'œuvre qualifiée pousseront les stratégies des entreprises vers la consolidation, la spécialisation et/ou l'intégration durable.

### 1. Occuper rationnellement le territoire et redonner de l'espace à la nature

Afin de faciliter la densification dans les villes de manière qualitative et structurée, une utilisation plus rationnelle des terrains disponibles est nécessaire. Le concept de circularité peut également être appliqué au niveau urbain. Le secteur de la construction doit abandonner son approche linéaire et évoluer vers une économie circulaire. La valorisation et la réutilisation de terrains déjà urbanisés ou déjà bâtis est à privilégier. On peut valoriser ces terrains en misant sur une densification urbaine par des immeubles de grande hauteur ou par une (re)conception réfléchie du bâti existant. Dans tous les cas, l'attention portée aux espaces ouverts, à la verdure et à l'eau sont des points cruciaux dans la transition vers une occupation circulaire du territoire. Ces espaces offrent la qualité de vie recherchée par les habitants et régulent le climat en

purifiant l'air et en rafraichissant la ville. Les citoyens et les habitants s'attendent à trouver ces poumons « vert et bleu » dans leur ville. La reconversion de nos centres-villes denses est un levier important pour garantir et améliorer la qualité de vie. La végétalisation va de pair avec la gestion de l'eau et s'articule idéalement dans une démarche qualifiée par certains de « faune et flore urbaine ». La nécessité de renaturaliser nos environnements de vie et de travail, densément bâti, est plus grande que jamais. Des actions doivent être prises pour y parvenir, en particulier dans nos villes. Le verdissement nous permet de créer plus de biodiversité, de ralentir l'évacuation d'eau, de rafraîchir l'environnement, de purifier les eaux grises et de créer des lieux de repos et de vie agréables. Il faut oser végétaliser, encore davantage qu'aujourd'hui, les façades et les toitures de nos bâtiments. La valorisation de la « cinquième façade » crée des opportunités pour introduire plus de verdure dans les centres-villes. Les toits ont un potentiel très intéressant avec une grande variété de fonctionnalités à envisager au cours de la prochaine décennie. Pour créer un environnement attrayant, la végétalisation doit être incluse dès le départ. Soulignons que la densification et la végétalisation ne doivent pas nécessairement être opposées. Elles peuvent se renforcer mutuellement. Grâce à la densification, nous pouvons réduire la quantité de surfaces imperméables dans les villes. L'espace libéré peut en effet être restitué à la nature en construisant des toits et des façades végétalisés, des parcs, des étangs, des forêts, des voies vertes, des places ou des jardins.

### 2. Construire en hauteur si nécessaire, bas si possible

Les immeubles de grande hauteur méritent une place aux carrefours où nous voulons relier nos lieux de vie et de travail à la mobilité. Nous voulons une densification dans la nouvelle « ville de croissance », mais dans de nombreux cas, nous devons aussi aérer le centre-ville et la ville historique. Il faut trouver un équilibre entre « espace ouvert » d'une part et « espace bâti » d'autre part. Démolition et reconstruction vont généralement de pair avec la densification. Il est indispensable pour la qualité de vie que cette densification ne se fasse que dans des lieux bien situés

: des lieux facilement accessibles par des transports en commun fréquents. Un grand potentiel réside dans la collaboration entre le secteur de la promotion immobilière et les fournisseurs de services de mobilité. Des structures de partenariat public-privé ou des mécanismes de subvention devraient être encouragés et mis en place de manière à bénéficier à toutes les parties prenantes tout en améliorant la qualité globale de l'environnement bâti. En activant des lieux sélectionnés pour la transition multimodale, nous développons un système de mobilité décentralisé, principalement basé sur les innovations technologiques récentes. Ce nouveau réseau de mobilité crée à son tour une assise pour davantage d'opportunités de développement immobilier, autour des nœuds urbains mais aussi dans des zones plus larges grâce à des incitations à la mise à niveau et à des programmes de densification. Ces développements encouragent une utilisation plus compacte du territoire à proximité des pôles de mobilité existants et nouveaux, préservant ainsi les rares espaces libres. La construction légère en bois peut offrir une solution technique intéressante pour insuffler un nouveau souffle aux constructions anciennes des centres-villes. Grâce à l'industrialisation du bâtiment, les composants de construction relativement légers peuvent être préfabriqués en atelier, assemblés sur site et démontés à la fin du cycle de vie du bâtiment pour être réutilisés, réalisant ainsi la circularité. Une tendance mondiale intéressante est l'émergence d'immeubles de grande hauteur avec une structure en bois ou mixte (gros-œuvre en béton et enveloppe en bois). Cette tendance semble très intéressante pour réduire l'empreinte carbone de nos bâtiments. La valorisation des bâtiments existants avec des constructions légères peut être une valorisation innovante des bâtiments urbains existants : par exemple, en vendant le toit pour construire plusieurs étages, le reste du bâtiment peut être rénové pour répondre aux exigences d'aujourd'hui.

### 3. Miser sur la ville multifonctionnelle pour rendre nos villes à nouveau résilientes et agiles

Au fil des années, la production a progressivement quitté nos villes. Les conséquences sont dramatiques en terme de mobilité urbaine en raison des besoins de transport et de logistique. Les livraisons sont rendues de plus en plus difficiles. L'idée de prévoir à nouveau, en partie, la production dans la ville est récente et séduisante. On assiste aujourd'hui à la réémergence de hubs logistiques avec, par exemple, des livraisons par voies navigables. Les villes peuvent ainsi s'épanouir et bénéficier de la production urbaine industrielle. La mixité des fonctions

est essentielle pour l'avenir de nos villes. Nous sommes en mesure d'accueillir des unités artisanales et de petites productions et des petites industries manufacturières en ville. Maintenir ou racheter des unités de production plus importantes en ville reste un enjeu majeur. À l'avenir, nous évoluerons vers des formes de construction mixtes, où différentes fonctions se rejoignent. Des réseaux essentiels et flexibles, non seulement pour le transport mais aussi pour l'énergie, l'eau, la communication de données, etc. devront être prévus à cet égard. La condensation et la mixité des fonctions impliquent une modification des modèles d'entreprises existants et nécessitent l'utilisation de connaissances technologiques dans le secteur. Il est clair que cela pose des défis en termes de sécurité incendie, de bruit, de qualité de l'air, de durabilité, de coût de construction, etc. Les fonctions mixtes nécessitent de nouvelles connaissances générales sur les exigences de service. Pour 2030, nous prévoyons que la complexité des bâtiments conduira à des détails de construction plus compliqués. Des détails holistiquement bien exécutés et bien conçus sont essentiels pour répondre aux exigences complexes et sévères. La manière dont les détails sont conçus est dans une large mesure décisive pour permettre une approche circulaire et pour la qualité globale du bâtiment, tant dans un sens négatif (prévention des dommages de construction) que dans un sens positif (réalisation de la qualité architecturale). Le BIM peut nous aider à aborder la conception, les détails de construction, le processus de construction, l'exploitation et la démolition éventuelle (base de données des matériaux) de manière efficace et rationnelle.

### 4. Se concentrer sur un processus de construction intégré grâce à une collaboration intense

Les villes sont des lieux d'échanges et de vie que nous devons entretenir et développer. Si nous voulons rendre nos villes plus résilientes pour l'avenir, nous devons investir davantage dans les espaces ouverts et verts et dans l'infiltration de l'eau. Les évolutions démographiques actuelles conduisent à une urbanisation plus généralisée et à une densification des régions urbaines. Comme mentionné dans les trois points précédents, la densification peut être réalisée en combinant des immeubles de grande hauteur, en occupant des bâtiments existants, en utilisant des parcelles vides, en compartimentant des bâtiments anciens et en remplaçant les bâtiments vétustes par de nouveaux bâtiments plus denses et compacts. Réaliser des bâtiments multifonctionnels et résilients au changement climatique, dans un environnement urbain densément peuplé, de surcroît de manière rentable et réaliste,



nécessite plus que jamais une collaboration intense entre les différents acteurs (les entrepreneurs, les bureaux d'études, les concepteurs, l'industrie de l'approvisionnement et les autorités). Un processus de conception qualitatif et intégré est nécessaire. Ce processus doit réunir toutes les disciplines à un stade précoce, de sorte que les problèmes imprévus ou provoqués n'aient pas à être ajustés par la suite et qu'aucune solution coûteuse ne soit nécessaire. Les nouveaux efforts de R&D devraient se concentrer sur la facilitation de la conception intégrée et sur une collaboration étroite entre tous les acteurs de la chaîne de valeur de la construction. Parallèlement au savoir-faire existant, de nouvelles connaissances doivent être intégrées dans des logiciels avancés, parfois disruptifs, qui améliorent la compréhension de la conception, de l'efficacité de la construction et des besoins attendus des clients. Grâce aux logiciels et à la récolte et au traitement des données, nous pouvons appliquer le savoir-faire accumulé au sein d'un projet spécifique à un autre projet ultérieur. Les nouveaux processus technologiques, tels que le BIM et la collaboration en tant que « bouwteam » (équipe de construction), peuvent nous aider à gérer des processus de conception complexes. Ces formes de collaboration nous permettent de déplacer l'effort de toutes les parties prenantes vers les premières étapes du processus, ce qui permet d'intégrer efficacement tous les aspects pertinents dans des solutions architecturales relativement simples et intelligemment conçues.

## 5. Simplifier l'utilisation de la technologie dans les bâtiments

Les projets seront confrontés à des objectifs croissants de performance en matière de santé, de confort, de sécurité, de durabilité et à des considérations liées au changement climatique. La technologie peut aider à relever ces défis, mais nous devons veiller à ce que la technologie ne devienne pas un but en soi. La technologie ne devrait, pour ainsi dire, pas être visible. L'objectif est le confort offert par un bâtiment et doit le rester. Des outils techniques peuvent bien sûr offrir une valeur ajoutée, mais doivent soutenir le processus de conception et de planification (intégré) et l'expérience de l'environnement bâti. « Smart » ne signifie donc pas que nous mettons de plus en plus de technologies dans nos bâtiments, mais que nous regardons où la technologie apporte de la valeur ajoutée. « Smart » ne signifie pas rechercher une nouvelle solution pour chaque problème, mais prévenir les problèmes grâce à une conception intégrale. Il existe une interaction entre la technologie et la conception, qui doit être prise en compte. Les outils techniques - qui sont souvent assez coûteux et difficilement accessibles pour les petites et moyennes entreprises, en particulier dans les premières années de leur développement et de leur application - doivent être utilisés de manière intelligente et réfléchie, et pas seulement comme un gadget ou un outil de marketing. Ils doivent viser un impact maximal avec des ressources limitées. Il ne faut pas oublier que les bâtiments en tant que tels ne contribuent pas au changement climatique ni à l'urbanisation. Ce sont les gens qui s'en occupent. Le comportement humain et l'organisation spatiale ont un impact majeur sur la consommation d'énergie et la durabilité. Les solutions technologiques peuvent et doivent contribuer à modifier les comportements humains et ainsi modifier notre organisation spatiale.

# À RETENIR

## Principaux « points d'intérêt » pour le CSTC et ses Comités Techniques.

L'étude révèle un certain nombre de points d'attention importants concernant les Comités Techniques « verticaux » du CSTC. Pour une bonne compréhension, il est bien sûr recommandé aux membres du CT de lire le rapport complet du Comité vision afin de découvrir d'autres aspects importants pour leur métier. De nombreuses observations sur les tendances futures sont également extrêmement pertinentes pour les Comités Techniques dits horizontaux, les CT « Digital Construction » et « Smart & Sustainable Constructions ». Un point d'attention important est certainement la mixité des fonctions dans les bâtiments, à la fois à un moment précis et par étapes successives. Comprendre les implications de cette « mixité » en termes d'exigences et de contraintes de (re)conception, de performances techniques requises et de leur intégration est d'une grande importance. La complexité pour répondre aux exigences multidisciplinaires est énorme et comprend de nombreux enjeux techniques : acoustique, sécurité incendie, stabilité, durabilité, exigences modulaires, .... Des solutions flexibles et des guides de (re)conception sont nécessaires pour permettre des changements fonctionnels au fil du temps, transformant les immeubles de bureaux en appartements ou même en hôpitaux.

Des techniques et démarches constructives adaptées à la rénovation et à la valorisation du parc existant nécessitent des accompagnements complémentaires. Ces derniers concernent le développement et l'application de solutions modulaires, flexibles, industrialisées avec des constructions légères en bois et en acier, dans le respect de la sécurité, des besoins énergétiques, de l'empreinte carbone ou de l'impact environnemental, ... Les codes de conception devraient être complétés par des exigences de reconception et des exemples de bonnes pratiques. En ce qui concerne les solutions intégrées « vertes et bleues », des spécifications techniques sont requises. Il faut également prêter attention à de nombreux aspects : les aspects sociaux, la biodiversité, la gestion des

risques, la maintenance, la sûreté et la sécurité. Cela ne concerne pas seulement les réseaux d'eau et la mobilité, mais aussi la conception et l'intégration d'autres « lignes de vie » telles que l'électricité et la communication.

Beaucoup de ces sujets sont nouveaux pour le CSTC et nécessitent également une large collaboration avec les concepteurs et les urbanistes pour aborder la durabilité sous tous ses aspects. Une conception intégrée est un élément indispensable pour faire face à la complexité accrue. Une attention particulière est nécessaire en ce qui concerne les détails constructifs simples, en tenant compte de tous les paramètres pertinents et, entre autres, de la multidisciplinarité, de la circularité et de la modularité.

Des guides de conception indiquant «les choses à faire et à ne pas faire» seraient les bienvenus pour comprendre les possibilités et les risques de solutions spécifiques. Les détails constructifs existants peuvent devoir être réévalués, en intégrant comment le démontage et la circularité peuvent être rendus possibles. La mise en œuvre des registres associés aux matériaux de construction utilisés et les spécifications pour l'entretien requis du bâtiment doivent également être abordées. Lors du développement des initiatives que le CSTC a déjà prises dans le cadre du Comité Technique « Smart & Sustainable Constructions », il est apparu qu'il ne faut pas uniquement prêter attention à l'élaboration de nouveaux aspects techniques, mais également à la vulgarisation des connaissances et outils existants, par exemple autour de LCC (Life-Cycle Cost) / LCA (Life-Cycle Assessment).

Ceci est important pour aider les parties prenantes à trouver leur propre chemin dans le monde des « data » et des solutions « smart ». Nous ne devons donc pas seulement nous concentrer sur les solutions technologiques, mais également veiller à éviter les problèmes en les identifiant et en les traitant dès le départ.



# 7. Appendix

## Tom Willemen Willemen Groep

PRESIDENT, VISION COMMITTEE



Tom graduated in 1998 from KU Leuven as civil engineer in structural engineering and is today CEO of the Willemen Groep, a Belgian family-owned construction group familiar with numerous segments of the construction market, such as buildings, civil engineering, road construction, special techniques, foundations and real estate development. The Willemen Groep is active in Belgium, neighbouring countries and Morocco. The company has 2,200 employees and has an annual turnover of approximately €800 million. Tom also sits on a number of advisory boards and boards of directors, including those of COPRO, Federale Verzekering/Assurance and ADEB-VBA. He also chairs the BBRI Vision Committee. In addition to his operational tasks, he is mainly concerned with innovation in the construction industry and how digitalisation and new technologies such as drones, wearables, virtual and augmented reality and AI can help people in the construction industry carry out construction projects better and more efficiently.

## Cécile Goffaux Cenaero

CO-CHAIR



Responsible for business development and innovation at Cenaero. Her mission is to develop R&D activities and collaboration projects with innovative companies, bringing simulation and related digital technologies into the design and business phases of a new product, process or service.

## Wim Straetmans BAM-Kairos

CHAIR



Wim Straetmans graduated as an ir-architect from KU Leuven. In 2008, he joined Immo BAM, later becoming a board member of that company and BAM Contractors for several years. Today Wim Straetmans is a director of BAM Interbuild and managing director of Kairos, BAM's real estate developer in Belgium. Together with an ambitious and dynamic management team, Wim is developing an urban renewal strategy and optimising the Kairos portfolio.

## Luk Peeters Orgpermod

INVITED SPEAKER - KEYNOTE



Luk Peeters is co-founder of ORG Permanent Modernity, a multi-disciplinary design office for urban planning and architecture with offices in Brussels and New York. Starting in 2007, he has developed a firm with 50 employees that has produced high-profile designs in Belgium and abroad. He leads the architecture department, which operates both in Belgium and in Africa (Malawi, Kinshasa, Ghana). Luk holds a Master of Science in Architecture (KU Leuven) and a Master of Urban Design and Spatial Planning (KU Leuven & UGent). Since 2000 he has gained extensive international experience in designing sustainable production buildings and sites. With ORG he is going one step further, bringing production to the city and shaping it within timeless, flexible structures. He designed the master plan for the Abattoir site in Anderlecht, as well as the Foodmet, an iconic market building where production (with the largest aquaponic urban roof farm in Europe), meat processing and sales come together in one building. He also carried out research work with ORG in the highly mixed-use production / residential buildings currently under construction in Brussels. Recently, ORG presented the Broeklin site, the largest circular economy site in Belgium.

## Jan Adriaenssens IMEC – City of Things

PANEL



Jan Adriaenssens is director of City of Things at Imec. He is fascinated by the role and impact of technology in and on society, especially the public space. Jan studied mathematics in Antwerp and philosophy in London. He gained experience with innovation policy and technology working with the Flemish government and the iMinds research centre.

## Birgit Clottens Orgpermod

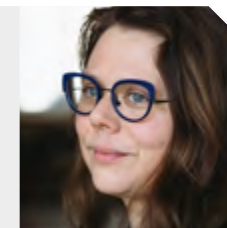
PANEL



Birgit Clottens, Civil Eng/Arch, is an Associate Director in Architecture. She is a design critic and studio teacher at KU Leuven. Birgit has been working at ORG since 2014, where she led the civic centre for Beveren (B) from concept to implementation. She also led the research for the redesign of the Europalaan in Genk (B). She has more than 14 years of experience in designing and implementing large-scale buildings and infrastructure projects. Before joining ORG, she was an Associate Partner at the leading architectural firm Foster + Partners in London and Singapore, where she worked on high-profile projects in Europe, Asia and the USA. Birgit Clottens obtained her Master's degree in Civil Engineering-Architecture from the University of Leuven, Belgium.

## Sarah De Boeck Brussels Gewest

PANEL



Sarah De Boeck is Director of the Territorial Knowledge Department at Perspective, the Brussels regional planning agency. She holds a PhD in Interdisciplinary Sciences (urban planning, economic geography and urban economic development) and is a member of the Foundational Economy Collective. In the spring of 2021, she gave the Paul Verbracken Lecture 'Let's Massively Intervene in the Economy. A plea for the essential economy'.

## Dirk Boydens Studiebureau Boydens NV

PANEL



Dirk Boydens has been CEO of Boydens Engineering since 1994. They operate as a construction and sustainable engineering firm for small to large construction projects in the public and private sectors. Today, they have grown into one of the most important independent engineering firms in Belgium for technical equipment in the building sector.

## Wanda Debauche BRRC

PANEL



As a transport economist, Wanda DEBAUCHE worked for many years in a consultancy firm specialised in the fields of mobility and land planning. After a spell with the directorate of the Belgian railways as consultant at the office of one of the managing directors, Wanda DEBAUCHE joined the Belgian Road Research Centre (BRRC) to develop the 'Mobility' unit. She is currently in charge of the BRRC's 'Mobility, Road Safety and Road Management' division and a member of its management team. In this capacity, she performs team management tasks, while retaining research, training and expertise activities in the specific area of mobility.

## Loïc de Moffarts Thomas & Piron Bâtiment

PANEL



Loïc de Moffarts is Business Support Manager at Thomas & Piron Bâtiment. In this position, he is responsible for the following 3 units: the Digital Transformation Unit, Research & Development Unit and Information Technology and Telecommunications Unit. He studied at the ECAM Brussels Engineering School where he obtained his engineering diploma with distinction. He has worked abroad for long periods, in countries such as Dubai, Abu Dhabi, Doha (Qatar), and has been Business Support Manager for the last 5 years.



## Maarten Dubois

OECD  
PANEL



Maarten Dubois is Circular Economy and Plastics Lead at the OECD. By providing in-depth insights and concrete guidance, he is helping governments to realise their circular economy aspirations. Previously, Maarten managed consulting and research teams working on sustainability at EY and KU Leuven. Maarten holds a PhD in environmental economics from KU Leuven and Masters degrees in Business Engineering, Environmental Engineering and Advanced Economics.

## Sven Maerivoet

TML  
PANEL



Sven Maerivoet holds a PhD degree in traffic engineering. Within TML he is a member of the Data Enrichment Group. His expertise mainly lies in transportation planning models, traffic flow theory, giving courses and lectures, numerical and statistical analysis of various big data, travel time loss functions, multi-agent systems, sustainability effects in cities, external costs of road congestion, the related parking problems and innovative technological solutions, (cooperative) intelligent transportation systems (C-ITS), road user charging, connected, cooperative and automated vehicles, Open Data, Mobility-as-a-Service, Smart Cities, and Telraam. He is co-ordinator of the international nuMIDAS Horizon 2020 project, and regularly acts as reviewer for the European calls.

## Jacques Teller

LEMA  
PANEL



Jacques Teller is Director of LEMA (Local Environment Management and Analysis) and Professor of Urban Planning at the University of Liège. He graduated as an Architectural Engineer from the University of Liège in 1992 and obtained a PhD in Civil Engineering in 2001. His research areas are urban planning and architecture, spatial planning and urban development. He is focused on sustainable urban development combining urban modelling with qualitative approaches to governance and decision making.

## Bruno Gobin

Horticultural research centre  
PANEL



Bruno Gobin (PhD KU Leuven 1997) is director of the Research Centre for Ornamental Plants and Greenery (PCS) in Destelbergen. On the basis of its tree nursery expertise, his team set up a department dedicated to the technical challenges facing professional green managers in 2008. PCS works closely with entrepreneurs to translate knowledge into pragmatic solutions. Major lines of research are high-quality planting (healthy plants), climate mitigation (plants for cooling, but also for water storage), promoting biodiversity as the basis for a natural balance, low-maintenance greenery, and specifically vertical greenery for a built environment.

## Thomas Scorier

TS Construct  
PANEL



Founder of TS Construct, a general construction company specialising in timber frame construction, structural panels laminated into passive and low energy houses. The company builds new houses, extensions, apartment buildings and industrial buildings. Thomas also has experience as a volunteer administrator at the Construction Federation of Walloon Brabant, vice-president of the Cap Construction cluster and president of the National Construction Confederation.

## Leo Van Broeck

Van Broeck Architecten bur.  
PANEL



Leo Van Broeck graduated in 1981 as an engineer-architect from KU Leuven. On 1 September 2016, he took up the position of Flemish Government Architect. Leo Van Broeck is a civil engineer-architect and co-founder of the Brussels architectural firm BOGDAN & VAN BROECK. He has been working there since 1995 as a practice assistant and since 2006 as a professor of architectural and urban design. He is also involved as a guest lecturer in various architectural programmes and public organisations. In addition, Van Broeck was president of the Royal Federation of Architectural Associations of Belgium (FAB) from 2013 to 2016.

## Gilles Vanvolsem

Befimmo  
PANEL



Gilles has worked for more than 15 years as project manager for NGOs, public and private companies. His methodological approach has been shaped by years of consulting experience. He is passionate about the transition period we live in. In recent years, he has helped organisations on their innovations, CSR, sustainability and digitalisation initiatives. He's currently managing Befimmo's digital transformation programme. He's also co-founder and president of New6s (an association working on the social responsibility of the media) and teaches CSR at the Haute Ecole Provinciale of Liège.

## Yves Martin

PANEL HOST



A civil engineer in construction, Yves Martin joined the BBRI in 2000. He is coordinator of the Technical Committees and coordinator of Strategy and Innovation at BBRI. To ensure our bottom-up approach, our activities are led by 14 Technical Committees. While 11 Technical Committees directly represent a specific building trade and are composed of contractors and experts, the others focus on topics of interest to different trades (fire safety, smart and sustainable, BIM, etc.). Yves Martin was previously Head of Division of Facades, Roofs and Joinery. His specialty is Fire Safety Engineering. He is a member of the High Council for Fire Safety of the Ministry of the Interior as a representative of the Confederation of Construction and external expert Fire Safety at the Deviation Committee.

## Bart Ingelaere

BBRI  
PANEL



A civil engineer by trade, he obtained his diploma at UGent and has been working at BBRI for 31 years, where he is Director of Information and Management Techniques and Deputy Director-General.

## Filip Dobbels

RAPPORTEUR



Filip Dobbels is a civil engineer-architect (UGent, 1997) and has worked at BBRI since 1998. He is co-chair of the Roofing TC and associated with the Insulation, Sealing and Roofing Laboratory (TDI). Since 2002 he has been a member of the Expert Group 'Building Physics, Building Technology and Architecture' of ie-net. His interest and research activities focus on the building envelope, with special attention to energy and environmental impact. Specifically, he is advancing knowledge on roofs, wood structures, airtightness, energy-related renovation/restoration and green building. Convinced of the importance of knowledge management, he was a forerunner in BIM (designs via BIM modelling since 2009, co-chair WG 'Classification' of the TC BIM&ICT, 2016-2019). For years he was technology advisor for companies in the field of roofs & facades. From his practical experience as an architect, engineer and energy expert, he is constantly looking for pragmatic and cost-efficient solutions to realise the great ambitions for tomorrow and to prevent building defects. Integrated design is central to this, with great respect for craftsmanship and a great passion for construction details.

## Lisa Wastiels

RAPPORTEUR



Lisa Wastiels studied at the Vrije Universiteit Brussel and Harvard University and obtained the title of Doctor of Engineering: Architecture in 2010. She joined the BBRI in 2011 and is currently leading the team working on the environmental performance of buildings. Her research and interests concentrate around social and environmental aspects of sustainable construction, with a focus on topics such as life cycle assessment (LCA), CO<sub>2</sub> emissions, material efficiency, ageing, adaptability, innovative systems, ....



