Annual Report 2016
Belgian Building Research Institute

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Our sector is at a key point in its history
In 2016, the BBRI published its second vision report ‘HORIZON 2020’ translating the objectives of the Technical Committees. This document was presented in autumn 2016 at an event focused on the members of these Committees and their working groups. The aim was to review the progress of initiatives run by the Institute, as well as, and particularly, to look towards the future and examine the new challenges that lie ahead for us. For our sector, this future will certainly come with the four themes discussed briefly below. This new Annual Report will help you explore in more detail each of the themes as well as the various actions which have stood out in the year just gone.

While energy and environment remain relevant, the focus is now on the energy renovation of existing buildings. In 2016, the BBRI worked in close collaboration to implement a quality framework for thermal insulation from the inside. The environment is also, for its part, a focus of concern for the BBRI. The research conducted over several years on the use of recycled materials in construction is now integrated into the more general context of the circular economy. With this in mind, the Institute participates actively in the development of standards intended to encourage the rational use of materials.

Comfort, health and safety remain a key theme. Evidence of this can be seen in the publication of Technical Information Notes relating to fire safety of industrial buildings and the ventilation of housing. This latter document is also combined with a calculation tool allowing contractors to dimension their installations more easily and also to ensure optimum regulation.

Materials, building systems and technical installations have not been overlooked. Several projects have enabled us to increase our expertise in the subject area, leading to the publication of several documents such as Report no. 18 on the dimensioning of underfloor heating installations.

A fourth theme, entitled ‘Construction 4.0’ has also been covered. Our sector is indeed at a key point in its history. The development of digital technologies allows for better design, construction, management and maintenance of buildings. The Institute has taken on board the importance of the issue by creating the Technical Committee BIM & ICT, as well as launching several information initiatives and research projects on the subject. Only through this approach will the sector be able to fully commit itself on the path of industrial revolution 4.0.
Focus on a new theme: Construction 4.0

The annual work plans of the Technical Committees constitute more than ever the common thread of initiatives in which the Institute is involved. This approach allows us to stay in step with the needs of the sector in general and with the expectations of businesses in particular.

These initiatives do not prevent us in any way from developing a longer term vision of our mission. Quite the contrary, the compilation of the annual work plans of the 15 Technical Committees, on a thematic basis, allows us to highlight the fundamental changes that lie ahead. And these changes are substantial. To the themes already identified above (Energy and environment – Comfort, health, accessibility and safety – Building materials and systems – Technical installations) we would now add a digital theme. New technologies generate many applications that thus far have been the preserve of science fiction. But reality is catching up with fantasy, to such an extent that we now find ourselves at the dawn of a new era that the sector calls Construction 4.0.

This new theme encompasses everything related to digital technology, such as the Building Information Model, IT solutions facilitating the better management of the construction process but also technologies that will gradually appear on site. Here, we are thinking about drones which have multiple potential applications, virtual imagery, augmented reality, the Internet of Things, 3D printing, smart glasses, ...

Previously we broke down the actions related to the various themes into six areas. To these, which of course remain applicable, prefabrication and circular economy should also be added. As this approach, which aims to maintain the materials and raw materials for as long as possible in the chain, will undoubtedly help to develop new economic models based on local resources.

The various projects described in brief in the following pages are detailed in the ‘project’ sheets that can be consulted on www.bbri.be.
In 2016, the BBRI presented its second vision report HORIZON 2020 (downloadable from our website www.bbri.be). The document is intended to be a compilation of themes on which the Institute plans to work on over the coming years. These themes have been debated before an assembly of nearly 400 participants, at a special evening organised for all those involved in building the future and concerned about the actions of their Research Institute. The evening was enhanced with several films presenting various subject matters including energy renovation, wood construction, circular economy or prefabrication. The digital technology theme was tackled with a panel of four professionals who quickly demonstrated to the participants their enthusiasm for how the 4th industrial revolution offers new opportunities for innovation in the sector.

There are, however, a multitude of challenges. The first will consist of convincing the most reluctant. To achieve this, it will notably be necessary to concentrate on the creation of applications that will directly assist contractors in their daily tasks. In this context, the role of the Technical Committees will be instrumental, as it will fall to them to define the needs of their specific sectors of activity.
Theme 1
Energy and environment

The necessary energy

Several initiatives have been conducted on the theme of airtightness. The research project Luchtdicht bouwen van A tot Z has been finalised. This project made it possible to provide bespoke support to around twenty businesses, so that they can integrate airtight construction into their activities. A quantification process of air leaks of multiple construction details has been developed within this context.

Insulation works are essential if we are to reduce the energy needs of buildings. The revision to the Technical Information Note (TIN) 215 focusing on flat roofs continued, taking into account the most recent methods of implementation. Wall and roof insulation techniques applicable both in new build and renovation projects have also been subject of much research (see below).

The research project known as MEASURE continued in 2016. This project aims to verify the actual performances as well as the satisfaction of occupants of high-energy performance buildings notably through the remote monitoring of 25 dwellings.

The energy performance of buildings (EPB) is subject to regional regulations. In order to establish a shared calculation procedure, the BBRI is providing support to the three Regions via the Consortium PEB. Bringing together over a dozen teams, this consortium aims to develop the regulations. The BBRI also participates in the European concerted action ‘EPBD CA4’ that aims to implement the redrafted European Directive on the Energy Performance of Buildings, the basis of the EPB regulations. Still on the European scale, the research project QUALICheck continued. It aims to highlight the approaches enabling the promotion of quality work as well as the correct reporting of performances at regulatory level.
The technical details concentrate all the requirements and performances expected of a building in one location and are consequently particularly tricky to develop. The correct realisation thereof represents one of the challenges with which the building sector is confronted on a daily basis. Several initiatives that aimed to develop, validate, optimise and communicate the integrated technical details were run in 2016. The Standards Antenna Détails constructifs (Construction details) (Smart Connect) proposes hundreds of details via the BBRI’s website.

Among the multitude of constructional nodes, the integration of joinery into the rough structure requires the involvement of several trades. The development of technical details corresponding to this node is translated through several initiatives. Thus, the redrafting work to TIN 188 relating to the installation of outdoor joinery continued. Additionally, the prenormative study Fenêtres (Windows) was finalised.

The energy renovation of existing buildings is gaining significance and requires technical solutions making it possible to ensure correct, sustainable and affordable performances. This theme was the subject of the first CSTC-Contact of 2016 in which the articles each deal with a specific aspect.

Several initiatives have been conducted on the theme of thermal insulation of walls. We cite the research project Gevisol-ETICS studying the external thermal insulation systems with rendering, which are very popular on renovation work sites.

The RenoFase research, for its part, tackles the obstacles, technical or otherwise, related to the energy renovation of housing. The techniques for insulating existing façades from the inside were notably studied. The conditions for application, including construction details, are evaluated on the basis of full-scale tests.

Through the Vlaams Kennisplatform Woningrenovatie research, the BBRI coordinates an extensive initiative of demonstration projects devoted to housing renovations in the Flemish Region. Renovation projects that can be reproduced and applied on a large scale are monitored within this context. In the Brussels-Capital Region, Living Labs Brussels Retrofit organised the launch of a call for projects with the aim of developing, testing and implementing solutions for energy-efficient renovation that meet the specific challenges faced by the Brussels sector. The BBRI also contributes to the inclusion of energy aspects during the renovation of heritage buildings through the ‘Erfgoedenergieloket’ research project, led by the Flemish Region.
Information

This year again, the energy theme has been the focus of several initiatives providing information to the sector, through presentations and study days, but also through publications or videos issued by the BBRI. The Standards Antenna Energie et climat intérieur (Energy and indoor climate) releases information alongside the standards via the website www.normes.be. In 2016, one of the winter courses organised by the BBRI was devoted to the airtightness of buildings, following the publication of the TIN devoted to this subject area. The dissemination of information on the subject is supported by the actions of the European information platforms ‘Tightvent’ and ‘AIVC’ to which the BBRI contributes.

A series of information sessions and study days on the use of energy in buildings was organised in Brussels. The activities of the Institute in the field of energy were the subject of a video available on the BBRI’s website and presented in November at the ‘HORIZON 2020’ event.

Quality framework

Several initiatives continued in 2016 to promote quality in construction, notably through the implementation of quality frameworks. This is the case with regard to the realisation of pressurisation tests. The rules applicable in this context have been dealt with in a CSTC-Contact article.

In Flanders, a quality framework for ventilation specialists was launched by the BBRI and BCCA. It sets out to ensure the proper reporting of actual performances of as-built ventilation installations, so as to be able to exploit this information in EPB declarations for new housing. Reporters seeking to sign up to this quality framework must pursue a training programme and pass an exam. The quality of the reporting is also verified on a sample of installations, through an inspection of the validity of reporting on site.

Innovation

Innovation stimulation is carried out, for example, through initiatives such as Technological Advisory Services. In the Brussels-Capital Region, the Advisory Service Eco-construction et développement durable provided assistance to the sector, notably in the field of energy and environment in general.

The ‘ID-Innovation’ evaluation system (www.iidi.be) has enabled the technical evaluation of innovative material solutions, techniques or sustainable building concepts that often have a positive impact on the energy performance or the indoor climate of buildings.

Particular rules are in place for the handling of ventilation openings during a pressurisation test.
Innovative research projects have also been conducted. In Brussels, the HAMSTER project developed a test station to study in full scale the hygrothermal behaviour of building components subjected to two controlled atmospheres (indoor and outdoor). In 2016, we also saw the inauguration of a new BBRI location in Brussels at the Brussels Greenbizz premises. Housing offices and laboratories, this installation offers new opportunities to conduct research and publish the results of that work.

The environmental footprint of the building is primarily conditioned by the selection of materials during its life cycle and through the energy consumption during the use phase. The behaviour of occupants in terms of transport and consumption also impacts on the environment.

The URBANWISE project sets out to find a solution to the economic and environmental problems related to the provision of supplies to work sites in towns. To do this, the project attempts to develop an intelligent urban logistics management and communication platform, in order to improve and to simplify the organisation of goods transportation to building sites.

The renovation of existing buildings represents a major challenge, much more if one considers effective use of raw materials. The test benches and the ‘Vlaams Kennisplatform Woningrenovatie’ (VLAIO), as well as the ‘Living Labs Brussels Retrofit’ research projects (Innoviris), also take into account the environmental impact and sustainable construction. Indeed, these are evaluated at pilot sites for thorough energy renovation.
Quality framework

The impact of the use of materials on the environment is considered throughout their life cycle (extraction of raw materials, production and transport to the building site, use, maintenance, replacement and finally demolition and disposal or recycling of rubble).

A regulatory framework of standards is essential so that the sector players (materials producers, contractors, clients, owners, etc.) can access correct and clear information relating to these complex processes. Considered the sector operator for Belgian construction, the BBRI oversees this framework through active monitoring of the works by International (ISO TC 59 SC 17) and European (CEN TC 350 ‘Sustainability of construction works’) Standardisation Commissions.

It also closely follows the legislative initiatives intending to create a federal EPD (Environmental Product Declarations) database as well as those relating to the Belgian Royal Decree of 22 May 2014 laying down the minimum requirements for environmental labelling of construction products. Manufacturers wishing to affix an environmental message to their product must enter specific performances into the database, which enables the federal authorities to gather a general idea of the environmental impact of all construction products. With time, these will also be able to be evaluated at building level.

The BBRI also collaborates on several study missions relating to methods for calculating the environmental impact at building level. The Institute notably leads a prenormative study that aims to refine the methodological framework for life cycle analysis (LCA) in construction (see figure). This study looks at new environmental indicators and the environmental impact of recycling and reuse (module D). Particular attention is also paid to site activities and renovation.

The closing event for the Greenwin ‘LCip’ project took place in 2016. The results of the environmental impact reduction of several construction companies and materials producers were presented at the event. The environmental footprint of the management of these companies and their products was analysed in collaboration with the BBRI, which made it possible to establish several stages for optimisation.

Innovation

The BBRI is particularly invested in its role as catalyst to stimulate and guide the innovation process in the construction sector.

The Technological Advisory Service (TAS) ‘Eco-construction et développement durable’ in the Brussels-Capital Region offers support for innovation in sustainable materials and techniques. The sustainability evaluation systems, the Environmental Product Declarations (EPD) and the analysis of the environmental impact at building level are just some examples of the ways in which new requirements and needs of the market encourage contractors and construction industry operators to pursue innovation with the support of the Advisory Service. By playing its role as catalyst for innovation, this Advisory Service devotes a significant portion of its activities to the transition to circular economy and circular construction.
Since 2016, the Brussels Greenbizz offices of the BBRI are home to the Technological Advisory Service. Incubator for green construction and green businesses, Greenbizz, thanks to its technological network, enables the BBRI to disseminate innovative knowledge to dynamic start-ups.

Energy and environment constitute important drivers for innovation; it is the reason why the BBRI actively pursues the activities of C-Watch Inspiring Construction Technology. Integrated within the BBRI’s website, this platform brings together innovative ideas and products from the sector, that are either already on the market or in the process of development. This Technological Watch for construction has also inspired various articles on innovation.

Circular economy

Particular attention has been afforded to the use of raw materials and to short cycles, facilitating the promotion of the circular economy. Indeed, the scarcity of a large number of natural resources requires that we use such items in an ecological, economical and sustainable way.

Mindful of the issue for many years already, the sector concentrates its efforts on recycling but also on certain challenges relating to saving raw materials: circular design and construction, urban mining (reuse of materials contained in our buildings among others) and new economic models for functional or partial economy.

The FEDER BBSM project sets out to put these missions into practice using applied research. Within this framework, the project identifies the waste or raw material flows coming from demolished and renovated buildings as well as the technologies required to reintroduce this waste into the construction cycle.

Concluded in 2016, the ROADMAP RECYBET project also works on shortening the cycles. With the support of VLAIO and in collaboration with several industrial partners (recyclers, prefabricated concrete producers, demolition companies), it develops a short value chain for the recycling of concrete.

As with the Déchets de construction Bruxelles project, certain research projects also show the attention afforded to raw materials during construction works. In this way, they evaluate certain theoretical principles and new ways of recovery according to their relevance and practical feasibility.

Pioneer in the field of recycling, the Belgian construction sector is behind a good number of collaborations and ambitious projects. Thus, the conclusion of the NIB FUTURE CONCRETE project highlighted several applications for ‘ecological’ concrete (made from recycled aggregates). The prenormative study RecyBeton sets out to increase knowledge in this subject area, by determining the opportunities and conditions (environmental classes) of replacing natural aggregates with recycled aggregates. The results will make it possible to propose modifications to the Belgian standard NBN B 15-001. The current phase of the project (2016) consists of optimising the concrete formulations and conducting full-scale testing.

In 2016, the BBRI continued to provide its expertise with the aim of developing sustainable construction and the circular economy, notably by ensuring better coherence between the ongoing initiatives. Sustainable construction and the circular economy do not only have a significant impact on the market, they also provide a footing for quality frameworks and regulations. To this end, the BBRI has focused on the technical and scientific principles likely to be applied (at reasonable cost) both on building sites today and on those of the future.
Comfort, health, accessibility and safety

The principal requirements of building occupants are comfort, health, accessibility and safety. The BBRI attempts to address these challenges on a daily basis through its research work and the establishment of practical recommendations. Optimal acoustic protection and comfort, healthy indoor climate, fire-resistant environment and flexible built environment are just some of the themes tackled in 2016.

Energy construction

The context for ventilation has developed markedly since the publication of the standard NBN D 50-001:1991 and the entry into force of the EPB regulation (the requirements of which relating to ventilation of housing are based on the standard). Effective ventilation is vital for a good air quality. The PREVENT project principally aims to develop the necessary scientific basis for the drafting of new performance criteria and design rules for ventilation systems in dwellings. The first two-year period of this study was focused on the performance criteria in terms of required outputs and regulation strategies as well as on the design rules and conditions for operating basic systems and simple hybrid systems. The second two-year period handles the functioning of more complex hybrid systems, notably combining basic ventilation with intensive ventilation systems. It also looks at the operating conditions for all systems depending on the airtightness of the building envelope.

Constructing buildings with nearly zero-energy consumption in practice and achieving the minimum renewable energy quotas represent major challenges. Within this context, reservations were issued regarding the reliability of the working method and the declarations relating to the energy performance certificate (EPB). Continued in 2016, the QUALICHeCK project attempts to quell these concerns (http://qualicheck-platform.eu).

Concluded at the end of September 2016, the VIS DO-IT Houtbouw project made it possible to test in full scale the hygrothermal behaviour of wood-frame constructions. Close to 750 sensors analysed their hygrothermal behaviour, which made it possible to evaluate the hygrothermal comfort and the risks as regards the durability of certain solutions.

The VIS Instal2020 project aims to achieve energy-efficient installations for the production of domestic water and central heating. It aims to develop a general design and implementation method for these installations, both in new build and renovation. The project initiators would first like to establish the requirements that heating and domestic hot water installations should meet. In
addition to the heating and water needs, other parameters are also tackled (health, water quality and comfort). As far as the health aspect is concerned, a test station for legionella was developed in 2016.

The sanitary installations of buildings are often the source of unwanted noise. Directives enabling the reduction of noise nuisance in water distribution installations have been presented in Les Dossiers du CSTC 2015/3.16. On the basis of the observations formulated on this occasion, an article published in CSTC-Contact no. 51 looked into the impact of various design parameters on noise coming from water discharge installations.

The acoustic performances of two prototypes of structural sandwich panels were analysed within the context of the CemComStruct project. These are comprised of a very thick core in PUR foam and cement skins reinforced with fibres and textiles. The strong similarity noted between the acoustic calculation models and the airborne noise insulation measurements in the laboratory made it possible to study the impact of various parameters on the acoustic insulation afforded by these panels.

Technical details

The ‘DO-IT Houtbouw’ project delivered pioneering work: the innovative construction systems and the details of wood-frame constructions meet the thermal requirements, as well as the requirements relating to stability and fire, but also allow for markedly superior acoustic performances to be achieved. Acoustic measurements were carried out in 2016 within the context of various projects conducted in Belgium. It concluded a spectacular improvement in relation to the works realised according to traditional construction models and technical details (acoustic insulation between apartments, for example).

Energy renovation

The energy renovation of buildings was put into the spotlight from the beginning of 2016 thanks to the special edition of CSTC-Contact. Four articles directly related to the themes of comfort and health were able to be written up thanks to the knowledge acquired through the VIS Smart Geotherm, RenoFase, ‘Instal2020’ and Groen Licht Vlaanderen 2020 projects.

The article ‘Rénovation des systèmes de chauffage des locaux’ relates to the replacement of old boilers in favour of new heat generators. The energy renovation of domestic hot water installations is tackled in a second article. This article focuses clearly on the energy perspective, but these installations are no less important in terms of comfort, health and hygiene. A third article deals with lighting renovation. Projects such as ‘Groen Licht Vlaanderen 2020’, highlighting innovative and sustainable light
sources, and **SMART LED**, have made it possible to increase knowledge on the use of natural light and lighting in buildings.

Finally, the theme of energy renovation occupies a central place in all projects coming from the **Vlaams Kennisplatform Woningrenovatie**. This platform principally aims to promote innovation during energy renovation works in dwellings. The year 2016 notably saw the development of a new website for the platform and the publication of information sheets including all current research initiatives in progress as well as pilot projects and innovative technologies or practices. These sheets also comprise relevant background information, methodological frameworks, various examples of good practices as well as references and useful links.

The platform also organised a workshop on the theme of accessibility and adaptable housing. The care sector and that of renovation, which serve as test benches for the Flemish Region, have therefore been able to share their experiences in the fields which concern them. Public authorities have also had the opportunity to present their renovation and urban development projects.

The BBRI is involved in two pilot projects: **Ecoren** and **Mutatie+**. The former sets out to develop nearly zero-energy consumption renovation concepts applicable universally, both for single-family dwellings and apartment blocks, while enabling residents to continue their occupation of the building. The works are carried out in close collaboration with the end user. From a financing perspective, the advantages and disadvantages of the ESCO model are analysed. Thus, energy service companies make the investment rather than the owner and fund it themselves through the energy savings realised (three-way investment).

The first 2016 edition of **CSTC-Contact**, fully devoted to energy renovation, also looked at renovation solutions for ventilation. Good ventilation is a necessity for new buildings, but also for older premises in the process of renovation. Through six ventilation solutions, the authors highlight the importance of good design and proper installation, which guarantee energy efficiency and comfort, making it possible to avoid inconveniences such as noise nuisances and air stream.

This field was dealt with in depth in 2016 thanks to the publication of TIN 258 **‘Guide pratique des systèmes de ventilation de base des logements’**. This document, which covers both new build and renovation, is based on the collective research results from **‘OPTIVENT’**, led by the BBRI and financed by IWT (now VLAIO). The TIN proposes practical solutions and recommendations making it possible to realise efficient ventilation systems, both from an air quality perspective and in terms of energy consumption. It is supplemented by a calculation tool simplifying certain design stages and the commissioning of the systems. The tool can be downloaded from the BBRI’s website.

From a regulatory perspective and within the framework of the implementation of the European Directive on the Energy Performance of Buildings, the Walloon...
Government adopted on 28 January 2016 a decree establishing various requirements relating to heating, ventilation, air-conditioning and domestic hot water production systems. The three Regions of the country now have their own regulations. A summary of the requirements formulated in the various regulations is presented in *CSTC-Contact* no. 51. This regulatory context assumes importance for existing buildings, as the installation, replacement or modernisation of technical equipment represents the ideal opportunity to improve their energy performance.

Preliminary research conducted by the BBRI within the framework of the ‘Optimberquake’ project relating to seismic stresses on wood constructions led to the publication in the *CSTC-Contact* no. 51 of an article concerning the management of seismic risks in Belgium. While Belgium is not a country highly exposed to earthquakes, it is nevertheless located in a low but not inconsiderable seismic activity zone. Our country is divided into five zones according to the $a_{eg}$ acceleration values identified by the Belgian Royal Observatory. When a building is to be designed and dimensioned in a zone subject to earthquakes, certain basic principles need to be applied (simplicity, continuity, regularity of the structure, etc.), which allows for the additional costs related to seismic design to be reduced, but also to guarantee safety and to simplify the dimensioning.

**Quality framework**

With the publication of an *Infofiche*, a TIN and an article, 2016 could be considered a productive year for the Standards Antenna Prévention du feu (Fire prevention).

The TIN 256 ‘Conception et mise en œuvre de bâtiments industriels conformes aux exigences de sécurité contre l’incendie’ does not aim to substitute the standards or the regulatory texts, but rather to propose practical solutions and recommendations for good design and proper implementation making it possible to satisfy the requirements set out in annex 6 of the Belgian Royal Decree of 7 July 1994 establishing the basic standards in terms of fire and explosion prevention to which new buildings must comply. Notably, it deals with the compartmentation of industrial buildings, the fire resistance of the load-bearing and structural components, the design and installation of compartmentation walls and façades, the performance of the roof, the active safety measures against fire, the evacuation of occupants and the safety of emergency services.

In the extension of TIN 254, issued in 2015, installers were informed via an article in *CSTC-Contact* no. 51 of an important change relating to the stopping of pipes through fire-resistant walls. Indeed, as provided by legislation, on 1 December 2016 the four-year transition period expired, during which stopping systems benefiting from classification according to the Belgian standard were still permitted. Since 1 December 2016, only systems with a fire resistance certified according to the European standard may be installed.

The *Infofiche 73* published in September 2016 relates to fire-resistant doors within fire-resistant walls. It concentrates more specifically on the expected performances of doors in terms of fire resistance. Belgian regulations usually require a fire resistance equal to half of that required for the wall in which the doors are installed, with a minimum of 30 minutes. Some specific regulations may however establish more stringent requirements (care homes, hotels, etc.).
The BENOR-ATG technical approval for fire-resistant doors is now integrated into Belgian construction practice. If a BENOR-ATG approval is issued for a fire-resistant door, one can assume that the door meets all the requirements listed in the Belgian regulations with regard to fire-resistant doors and suitability for use.

The prenormative project In-Vent-Out sets out to characterise the dispersal of exhaust air and fume discharges close to buildings on the basis of measurements realised *in situ* using a CO$_2$ sensor and digital flow simulations. The objective of this project is to develop a method for positioning the air supply openings in relation to the exhaust air and fume discharge openings. Indeed, the impact of poor air quality on the health of building occupants has been shown many times over. This new method must take into account the evolution of heating and ventilation techniques and eventually replace the obsolete methods from the standards.

Innovation

Primarily focused on wood-frame construction, the ‘DO-IT Houtbouw’ project led us to become aware of the increasing popularity of Cross Laminated Timber (CLT) constructions for which the acoustic aspect was briefly tackled at the end of the project and in the A-LIGHT prenormative study. Unlike wood-frame construction, the flanking transmission of noise in CLT constructions represents a significant problem, that may be resolved through doubling walls (‘box inside the box’ concept), which involves however additional costs and a considerable loss of space. Moreover, for aesthetic reasons, CLT panels cannot remain visible. Thus, the Acoustic division of the BBRI has developed a new system integrating a special coupling that makes it possible to eliminate flanking sound transmission completely and which is more effective than the systems currently on the market (particularly at low frequencies). A European patent has consequently been filed.

The BBRI Patents unit (OCBC) offers a direct service to contractors and supports research projects relating to all sector fields. In recent years, however, an increase has been noted in issues concerning themes such as healthy environment and comfort. The databases of the Patents unit allow researchers to access a wealth of detailed information (rarely available in specialist literature) on inventions in relation to their project.

Circular economy

One of the aspects of the circular economy rests on the management of waste. In this context, knowing whether a material contains asbestos is of primary importance. This is precisely what the BBRI started by conducting a preliminary study in collaboration with Symbiose Biomaterials. This study made it possible to demonstrate the usefulness of certain peptides (GEPI, Genetically Engineered Peptides for Inorganics) in order to detect chrysotile asbestos fibres in free form (white asbestos from the serpentine family, the most common). Launched within the framework of this study, the ADEKIT research project continued in 2016. It aims to develop a simple and reliable method to detect asbestos fibres in materials *in situ*. With this method, it will be possible to detect the presence of asbestos with the naked eye with a change in the colour of the product put in contact with the material. The identification of biomolecules that can be linked to the six types of asbestos as well as the visualisation system (through reporter enzymes) have been successfully achieved. Moreover, two patents were filed in 2016.
The ‘Mutatie+’ project aims for adaptable renovation of dwellings (social housing) by converting them to nearly zero-energy consumption buildings through the use of experimental interchangeable modules. The objective is based on the innovative integration of social, technical and ecological/economic criteria. A ‘Mutatie+’ certificate may be granted when the building achieves a certain quality level.

In 2016, ‘Mutatie+’ presented its first pilot project in Flanders. The project partners are carrying out thorough renovation of social housing during tenant changes. A new bespoke outer wood-frame envelope is realised in advance and is then integrated into the building. The new wall which includes all the necessary elements (windows, ventilation ducts, electrical cables and outlets) is installed in less than an hour.

The project obviously includes a significant social component taking as full account as possible of the needs of future occupants. Everything is designed according to the principles of flexible housing. The knowledge centres involved in the project ensure that the operations are monitored and have a scientific basis. The objective is clearly to spread the knowledge acquired as widely as possible.

Industrialisation and prefabrication are also key elements of the ‘AIM-ES’ research project, which forms part of the Brussels Retrofit XL platform and also benefits from Innoviris’s support. After four years of research, the final research report ‘Retrofitting with AIM-ES (Architectural Industrialised Multifunctional Envelope Systems)’ was published in June 2016. The developments initiated in the field of industrial processes and computer-controlled machines make it possible to devise innovative techniques for the renovation of façades. Thus, old buildings can be fitted with new façades composed of large prefabricated components fixed to the outer envelope, making it possible to significantly reduce the renovation time and to lessen disturbance. In the best-case scenario, residents can continue to occupy the building. The same techniques also allow for buildings to be enlarged or for certain elements such as pipes or solar energy systems to be integrated in the new façades. The ‘AIM-ES’ project mainly relates to wood systems, but similar concepts are clearly possible with other materials. This is the reason why the Flemish cluster on industrialisation in construction considers a wide range of materials.
The research, development and dissemination of information concerning building materials and execution techniques remained one of the BBRI’s priorities in 2016.

Energy construction

Major advances have been achieved in the field of wood construction systems thanks to the projects OPTIDUBO and DO-IT Houtbouw. In addition to the hygrothermal behaviour study of many wood-frame system compositions (façades, roofs, floors), the research has enabled the development of wood façade configurations meeting the most stringent requirements in terms of acoustic performance and fire safety. New solutions for the junction between floors and walls in CLT (Cross Laminated Timber) have also been devised with the aim of markedly increasing the acoustic performance in situ.

The Groen Bouwen project has increased initiatives in order to promote living wall systems and to develop their construction aspects. The project brings together all the actors, both from the world of construction and from that of horticulture, with the aim of increasing technical knowledge. A test station bringing together eight living wall systems was developed on the BBRI’s site in order to assess the consumption and the quality of water.

CLT (Cross Laminated Timber) walls.
Technical details

Clear instructions are essential for the design and the installation of construction details. It is within this context that the BBRI created the Standards Antenna Détails constructifs (Construction details) (Smart Connect), with the support of the FPS Economy. This SA aims to help professionals interpret the standards and regulations at each phase of the building process of a construction detail.

The junctions between joined elements and the rough structure require particular attention. The prenormative study Fenêtres (subsidised by the FPS Economy) enabled the development of a test methodology intended to evaluate the long-term durability of the airtightness and watertightness performances of window junctions. A certain number of standard junctions were evaluated and optimised, contributing to the revision of TIN 188 ‘Menuiseries extérieures’.

Energy renovation

The FEDER Living Labs Brussels Retrofit project aims to launch living labs (pilot projects) to address the challenge of energy-efficient renovation of dwellings in Brussels. Innovative techniques and processes will be implemented in the actual renovation projects in order to test and to improve them. They will then be able to be applied on a wider scale with the aim of providing affordable renovation solutions, both in the private sector and in social housing.

Floating screeds (on an insulation layer) are currently undergoing significant development: the thickness of the insulation is continually increased and the construction times are decreased. The application of insulation in situ such as polyurethane (PUR) is now a frequently applied solution. However, pathology cases are observed following a compacting of the insulation. Given the numerous influencing factors, the causes of damage remain difficult to identify. The principal objective of the SOL-isPUR project, launched in 2016, is to identify the causes of any compacting encountered in order to reduce the number and the extent of the conditions.

Information

The ‘Betonic@’ platform (www.betonica.be) was developed with the aim of disseminating information concerning concrete. Videos presenting the projects, tests, courses or conferences – everything is included on the platform.

Raising awareness of innovations in the sector is the specific mission of the VIS IV Metselwerk project. In this context, an article on hooks for cavity walls was published in the CSTC-Contact 2016/2. The BBRI actively participated in a road show organised by the FEGC (Federation of General Construction Contractors) presenting all innovations relating to masonry products but also innovative installation techniques.
The expertise developed in the field of external thermal insulation systems with rendering translated into the publication of TIN 257. Much anticipated, this Note explains all the stages from design through to installation, including technical details. This work also formed the basis for training sessions organised in all Belgian provinces at which over 300 professionals were in attendance.

Finally, the Standards Antennas (SAs) of the BBRI remain an important relay for SMEs seeking to manage the use of standards. In this regard, we note that a completely new Standards Antenna is devoted to geotechnical works.

Quality framework

The BBRI is looking into the reliability of temporary or auxiliary structures (scaffolding or certain types of railings). The STEPWiSe project aims to draw out a common approach in order to determine the reliability of this type of structure. Tests have been conducted to determine the performances of anchorage points in the new masonry according to hardening conditions. For example, the wind tunnel measurements have made it possible to quantify the impact of a tarpaulin or net on the wind effect transferred to the temporary structure.

The indoor air quality is partly determined by the presence of VOCs, for which building materials represent an important source. The objective of the prenormative project PREDIVOC is to develop a new predictive and standardised measuring tool. The VOCs emissions of various paints are determined through existing methods available to the BBRI, before being tested with this new tool. It also relates to air quality (outdoor, this time) in the PHOTOCATALYSE project that looks at the durability of the self-cleaning and air purifying powers of photocatalytic cement-based building materials.

As far as synthetic fibre concrete is concerned, the POLYFIB project enabled the quantification of the creep effect in flexion and demonstrated a clear correlation with the creep of the fibres used, especially when synthetic. In 2016, a study relating to the impact of the proportion of fibres on the workability of the mix in fresh state was conducted and showed certain thresholds that should not be exceeded. In the field of industrial flooring, recent developments proposed to reduce the risks of delamination often involve problems obtaining wear resistance categories. The WEARFLOOR project therefore seeks to identify sufficiently durable compositions for environmental classes EE4 and EA3 that can be poured and finished easily, especially for concrete floors in car parks.

Innovation

The adoption of a new technology involves skills which companies, particularly SMEs, do not necessarily have and risks that they cannot always assume. Thanks to its Technological Advisory Service Eco-construction et développement durable, the BBRI brings support to Brussels companies in the areas of energy, renovation, restoration, acoustics, wood construction, etc.

The Institute is also active in projects intended to develop new building materials or elements. Notably we are referring to the project FAREBOIS that aims to create outdoor joined elements that are fire-resistant. In 2016, the project allowed to design an initial fire-resistant joinery concept. We also note the project Corrosie OB relating to innovative corrosion protection for underground structures.

We also have the 3D-Sturing project that brings together measuring, communication and management of future work sites. The 3D-Restauratie project has, for its part, demonstrated the opportunities to roll out artisanal
restoration using innovative and cost-effective tools, the objective being to accelerate restoration works and to make them more affordable.

Circular economy

It is no longer necessary to go on about the importance of sustainable development in all activities related to construction. The circular economy is integrated into this framework in order to operate continuously without producing waste.

Aerated concrete blocks now represent a considerable volume of elements used in masonry. Yet, aerated concrete waste recycling is not straightforward. Indeed, due to its low mechanical resistance and its high sulphate content, this waste, mixed with concrete and other masonry debris, reduces the quality of recycled aggregates and sand. It is therefore imperative that a method for recycling aerated concrete waste is developed so that quality aggregates and sand can be obtained. These can then be incorporated into suitable construction products such as screeds and insulating concrete blocks. The VALOCEL project aims to recycle and to reuse aerated concrete waste from demolition in Wallonia, where recycling is currently non-existent. Similarly, the OVERS©HOT project concentrates on criteria and methods allowing more effective recycling of wood waste.

Prefabrication

Increasing the productivity of construction companies remains a major commitment of the BBRI. In the field of building materials and systems, we note the collaboration of the Institute in the CIMEDE 2 project that aims to devise a building system that allows for the realisation of single-family dwellings and industrialised apartment blocks in wood that are adjustable and flexible, and which can be adapted to changes and developments in use over time.

Construction costs are the focus of the OPTICOST project. This project proposes a method and tools enabling to reduce construction costs for new dwellings for various building systems, without compromising on technical quality.

Finally, the BBRI has recently begun coordinating a cluster of businesses on the industrialisation of building systems and techniques (www.bouwindustrialisatie.be). This cluster will concentrate on the enhanced and systematic use of prefabricated building elements and automated solutions on site. Clearly, the aim is to accelerate the introduction and penetration of high-performance, prefabricated and profitable products and systems on the market.
Technical installations are necessary to the realisation of an optimal indoor climate making it possible to conduct activities in good conditions. These installations must be able to be adapted continuously to the characteristics of the building, the climatic conditions, the varied needs of users, the opportunities for local energy generation and storage, . . .

The continuous reinforcement of thermal insulation of buildings requires the constant adaptation of our technical installations (heating, cooling, ventilation, lighting and domestic water system). These installations are consequently becoming increasingly complex and high-performing.

The Smart Geotherm research (www.smartgeotherm.be) looks into the opportunities for using geothermal energy in building heating. In this context, the BBRI has notably conducted studies on heat and cold retention in the building structure, on the use of heat pumps and the advanced management of the supply and demand of heat. TIN 259 ‘Géothermie peu profonde’ was published within the context of this research project.

The regulation sensors for heating installations are the subject of the DeltaT research. This project studies hot water production installations in the tertiary sector and in high-density residential settings (apartment blocks) and aims more specifically to develop self-powered devices using thermoelectric effect.

Energy flexibility is a theme that is riding high due to the increasing use of renewable energy sources. To this end, the PEPSE project sets out to create a semi-virtual test station allowing to test energy generation, storage and distribution systems.

The VIS Instal2020 project aims to achieve energy-efficient installations for the production of domestic water (hot and cold) and central heating. This project aims to develop a global method for tackling design and realisation of these
installations both in new build and renovation projects. Optimal design encompassing the selection of the concept and the dimensioning, taking into account factors such as energy, comfort, the hygienic quality of water and the overall cost.

In the field of lighting, the arrival of LED technology has caused something of a revolution in recent years. This development has been very rapid and now extends to functional applications of interior lighting. The projects SMART LED and Groen Licht Vlaanderen 2020 (www.groenlichtvlaanderen.be) tackle different aspects relating to this type of lighting. They also deal with the use of natural lighting, the installation of advanced intelligent management systems for energy-efficient lighting and the maintenance of LED lights.

Energy renovation

Energy renovation programmes in existing buildings are no longer restricted to the envelope. Indeed, they often take into account the renovation of heating, ventilation and lighting installations. The RenoFase project (www.renofase.be) endeavours to find, for the various phases of renovation, solutions enabling the integration of techniques into the building envelope, amongst other things.

Information

TIN 258 ‘Guide pratique des systèmes de ventilation de base des logements’ represents the new reference document on the subject. It sets out to complement the standard NBN D 50-001 and the STS-P-73-1. A major new feature: the note is accompanied by a calculation tool (OPTIVENT) allowing easy dimensioning of the installation, as well as optimal regulation of the system. The TIN and its calculation module have been the subject of several training sessions organised in collaboration with regional professional bodies and the federation of installers (ICS).

The Standards Antennas Eau et toitures (Water and roofs), Energie et climat intérieur (Energy and indoor climate) and Eclairage (Lighting) have provided support to businesses in the application of standards. The collaboration with Tecnolec has enabled the SA ‘Eclairage’ (Lighting) to cover aspects relating to lighting products and applications.

Quality framework

In order that the performances of technical installations meet the expectations of users, the execution quality is crucial. For this reason, Construction Quality, BCCA and QUEST are working together to establish a quality framework on the subject: drafting STS concerning ventilation and renewable energy sources, creating a quality framework for ventilation specialists, issuing a quality label for recognised companies in the renewable energy sector and introducing a certification system (after training and exam) for installers of renewable energy systems. The latter (RESCert quality label) will be obligatory in the three Regions in order to obtain the subsidies for thermal solar systems and heat pumps.
The 4\textsuperscript{th} industrial revolution or ‘Industry 4.0’ is marked by the development of a series of technologies: artificial intelligence, robotics, the Internet of Things, BIM, augmented reality, 3D printing, etc. New opportunities are available to all companies that are looking to increase their competitiveness and the quality of their work. The fragmentation of construction trades disadvantages the exchange of information and the collaboration, thereby holding back greater industrialisation of the construction process. The digital era opens up new perspectives for building sites of the future that will likely be much more connected, industrialised and automated.

The BBRI stepped up to the challenge, by creating, in 2016, the new Technical Committee (TC) BIM & ICT, over 25 years after the creation of its predecessor. BIM stands for Building Information Model and ICT for Information and Communication Technologies. The former uses a digital model of the building, no longer comprising simple geometric elements, but real ‘intelligent’ objects. These digital objects reflect the materials and systems that will be installed on the actual site, and are connected to each other and associated to technical, geometric and even economic properties. Thus, we could obtain a virtual image that is a true representation of what there will be in the actual execution phase. As for the acronym ICT, it covers all technologies that deal with the exchange of information. Both BIM and ICT therefore relate to what is most important for the construction sector and what is at the heart of the 4\textsuperscript{th} industrial revolution: information sharing.

The Technical Committee BIM & ICT, within which all concerned parties are represented, operates in close collaboration with its counterparts, which are focused on sector trades. Two plenary meetings took place in 2016. Five working groups have been set up around five priority themes: classification, exchange protocols, e-products, legal aspects (section managed by the Confédération Construction) and finally, competency profiles and training. These working groups met monthly to deliver the first tangible results as
soon as possible, which are available on the website BIMportal.be. The Technical Committee has also been able to draw on the work conducted within the context of the VIS BIM project subsidised by the Flemish Region (VLAIO). Two new important projects were also launched in the autumn of 2016: the Cluster BIM and the prenormative study CODEC, subsidised respectively by VLAIO and by the FPS Economy. The Cluster is primarily comprised of BIM-ready companies. It aims to promote the use of BIM in practice and to encourage the adoption of innovative solutions. The CODEC project has an entirely different focus: notably it sets out to study the impact of BIM on existing or future standards, and to stipulate the way of using the digital model to carry out regulatory controls. This is simultaneously a challenge and an opportunity for the BBRI, which will be able to offer its own recommendations contextually and digitally, by linking them to objects that form the model. Alerts in relation to the composition of walls, construction details or the execution schedule may then be activated in this format. Within the context of the European standardisation activities, the BBRI also plays the role of sectorial operator and is responsible for the Mirror Committee for CEN TC 442 BIM. In 2016, it therefore took an active part in the decisions made in the various working groups implemented to facilitate the adoption of a harmonised exchange framework at European level.

An essential ‘trade’ approach

The act of building or renovating is, first and foremost, a question of workmanship and expertise. BIM and digital technology must be dedicated to helping those working in the field and assist them in their tasks. This, in the same way that ergonomics and the functionalities of current tools and site machinery have been designed specifically to meet the needs of users. Depending on the Level of Development (LOD), a digital model (of which the most visible part is the 3D representation of the project) contains all the necessary information to conduct all the desired investigations and regulatory controls (stability, acoustics, thermal energy, fire safety, etc.). The various construction professionals can also extract useful data from it to establish their quantity surveys and therefore their cost estimates, place material orders, prepare and execute their works. So that these ‘trade’ views and data meet their requirements (and are not needlessly overloaded), it is nevertheless necessary to specify what information is needed, when it should be extracted or communicated, and by whom and in which format. It falls to the BBRI’s Technical Committees to formulate the concrete responses to these questions. This exercise began in 2016 and will materialise in 2017 drawing on the work realised in that time for the development of ‘trade’ software such as Roof-IT for roofers or CaroLine for tilers. With the support of professionals from the Technical Committees, it will be a question of defining the desired ‘trade’ views and data and the information exchange protocols that are required.
The information that professionals require varies depending on the project objectives and phases (design, execution, as-built, ...). The principle consists of creating a database of objects or elements that will be fed into the geometric model. Even if it is possible to retranscribe this information manually for each application, this is a clearly particularly tedious task. The use of databases compatible with BIM may significantly speed up the process and avoid input errors. The technical information necessary must only be attributed or ‘linked’ to an object once and can then be used for all applications in the digital model (stability calculation, energy performance, etc.).

Different databases are necessary depending on the construction process. During submission and during the execution phase, technical databases of commercial products are to be used. However, in the design phase, it is preferable to use the generic data related to the technical performances of the elements. The question of knowing which information must be provided, at which stage of the project, in what format and with which level of reliability was the focus of the BBRI’s endeavours in 2016. The answers to these questions will undoubtedly lead to the creation of a harmonised framework favouring the greatest interoperability possible.

It should be noted that many actions have been undertaken and that different commercial systems exist in Europe. Thus, CEN TC 442 (WG4) aims to develop a methodology that sets out to describe reliable, harmonised and unequivocal technical information (as regards technical data...). Legal aspects must also be taken into account: who is responsible for the information proposed, how can technical information be retraced that may no longer be available in ten years’ time (‘historical link’)?

Finally, the BBRI has studied the possibility of developing, based on the TechCom tool (www.techcom.be), a database of BIM-ready building elements that would include current technical and commercial information, but also proven basic technical data such as the data contained in technical approvals or data measured according to a reference standard by an accredited laboratory (coefficients of thermal conductivity for insulating materials, for example). This tool would therefore be supplementary to the databases developed by manufacturers.
Prefabrication and automation are not really new features for the sector. The development of BIM and other digital applications may nevertheless work towards greater industrialisation of the construction process. Workshop production may even be directly ordered from a BIM model. Notably, it is to support and to frame greater industrialisation of the construction process that the Cluster ‘Bouwindustrialisatie’ was started at the end of 2016, with the help of the BBRI and financial support from VLAIO.

Other technologies are currently available and sufficiently mature to be able to enhance the competitiveness of those who use them. Whether it is 3D printing (which was the focus of the project 3D-restauratie), 3D high-definition survey techniques, virtual or augmented reality, the Internet of Things, connected construction machines or common IT applications, all these interconnected tools will also significantly impact the way of organising and executing site work.

As far as 3D scanning is concerned, the ‘AIM-ES’ project, subsidised by Innoviris, has made it possible to study the various applications for large-size prefabricated façade solutions used in renovation. The last phase of the project (AIM-ES-3D), which was completed in 2016, concentrated on studying high-definition geometric surveys and the opportunities opened up by the latest technological developments in the field (laser scanners, drones, etc.).

In parallel, the first ‘living labs’ came into being in Flanders, with a desire to put into practice highly industrialised solutions for renovation. Also in this context, the interest in 3D survey methods was quickly highlighted.

Information and training

The 4th industrial revolution affects all parties involved in the construction process. So that no one is left by the wayside, the BBRI and its partners have worked on disseminating information in 2016. In September, the first Summer University entirely devoted to the digital era was organised in Brussels, in collaboration with the Confédération Construction. With a number of workshops and demonstrations, this event brought together around 350 professionals. In Flanders and in Wallonia, several awareness and information sessions were scheduled, notably within the framework of the VIS project ‘BIM’. Close to 400 construction professionals took part in the information sessions and workshops that took place in Ghent, Leuven, Antwerp and Heusden-Zolder. An Internet portal entirely devoted to BIM has been developed in order to bring together everything one needs to know on the subject: BIMportal.be. With the aim of stimulating innovation and supporting and informing Brussels professionals, in September 2016 the BBRI created a specific section covering digital construction (BIM, 3D scanning, 3D printing, robotisation, LEAN) within the Technological Advisory Service ‘Eco-construction et développement durable’.
While digital communication has become essential in today’s environment, the BBRI has not overlooked the importance of personalised contact. Each year, the Institute organises several information sessions and thematic days and issues thousands of personalised advice notices to construction professionals. This reinforces the practical knowledge of our personnel and quickly and efficiently fills in any gaps in the distribution of information that cannot be compensated digitally.

The recent developments in the construction sector have a significant impact on the needs of professionals. Thus, the dissemination of information via the Internet now allows them to access reference documents more readily, which increases the difficulty of the technical questions. Moreover, the increase in expected performances of modern buildings intensifies the complexity of the construction, which more often requires bespoke solutions.

The ‘Technical Advice and Consultancy’ (TAC) department of the BBRI is available daily to those involved in construction to help them tackle these new obstacles. In addition, we would note that detailed planning, meticulous preparation and thorough controls make it possible to detect problems early on. Previously, damage files were often raised after the completion of works or even after the building was in use; now, our assistance is increasingly sought during the building process. In the future, any possible problems may even be detected before the works thanks to the use of BIM models that will make it possible for the various partners to anticipate issues. This positive development will certainly help to limit costs due to inefficiency. Indeed, a problem that is detected earlier will engender less costs to correct it.

The most appropriate solution for simple issues requiring a speedy response is to make contact with the engineers on the telephone helpline. For more complex problems, or where a written response is required, it is possible to use the assistance request form on the BBRI’s website, which also allows you to attach photos or explanatory sketches. The staff of the department will provide their response, depending on the complexity of the request, by e-mail, by phone or by mail, or will decide to visit the site and, where desired, to produce a report. Over 15,000 advice notices were issued in 2016!

The TAC department also strives to play the role of link between the research engineers and the construction professionals. The questions posed represent an important source of information that enables to identify recurrent problems encountered by the sector, as well as the gaps in information and techniques available. The ‘Interface and Consultancy’ (ICO) division tackles this task. This way of working makes it possible for the BBRI to publish articles consistent with practice.
The ‘Management and Quality’ division is tasked with raising awareness, training and supporting construction companies so that they can more efficiently manage the construction process. Increasing digitalisation and the importance of BIM have led to an increased need for a specific unit to support the sector. It is for this reason that the ‘BIM and Information Technology’ unit was created last year.

Following on from previous years, over one hundred training days were organised in 2016, bringing together technical knowledge and practical examples. They targeted all aspects of company organisation: cost price calculation, planning techniques, financial management, BIM, IT applications, etc.

A significant portion of the activities relates to supporting construction companies in various areas: cost price calculation, financial analysis, planning, resource management, organisation and quality.

In addition to this assistance, the division has taken responsibility for monitoring the following projects:

• **URBANWISE**: sourcing for building sites in cities has been problematic from an economic and environmental perspective for many years. The negative effects of freight transportation in an urban setting can partly be explained by certain organisational inefficiencies. To tackle this problem, the URBANWISE project sets out to design an IT platform intended to optimise the management of goods flow by connecting all urban logistics players

• **OPTICOST**: the costs of construction continuously increase, while household incomes tend to stagnate. Several factors, both contextual and techno-economic, influence the construction price. The OPTICOST research aims primarily to propose tools to help in the decision, making it possible to optimise the production cost of new dwellings through the analysis of technical and economic factors

• **BIM**: led with the support of VLAIO in collaboration with ORI, NAV, VCB and the BBRI, this project sets out to familiarise the professionals of the sector with BIM and to encourage them to use it in practice, through information sessions and workshops, which were attended by nearly 400 construction professionals

In order to be able to ensure quality assistance at any time, the ‘Technical Advice and Consultancy’ department conducted, in 2016, an extensive satisfaction survey of professionals within the framework of our ISO 9001 certification. From the responses obtained (16% return), it emerges that the service is particularly well regarded.

**Organisational assistance**

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  • ‘CRM-CSTC’: used for the first time in 2016, the CRM system allows the effective monitoring of questions and contacts in the construction sector. The division has conducted the analysis and the programming of this system

  • ‘cpro’ (web version): this fully online (Cloud) estimate calculation software was finalised in 2016. A new version will be launched during 2017.
The BBRI participates in the work of various associations related to construction and has even contributed in the establishment of some of them. Dedicated to a wide range of activities within the sector, these institutions aim to support companies as their continuous priority.

**Tradecowall**
The objective of this society is to look for solutions for the processing of inert waste and excavation soil from building sites and demolition sites ([www.tradecowall.be](http://www.tradecowall.be)). In 2016, new channels for recovering construction waste were examined: Tradecowall launched, with the BBRI, a research project relating to the recovery of aerated concrete debris.

**Belgian Construction Quality Society (BCQS)**
BCQS ([www.bcqs.be](http://www.bcqs.be)) trains and advises professionals involved in a labelling and/or certification process (quality management (ISO 9001), safety (VCA) and environment (ISO 14001), for example). Privileged partner of BCCA and Construction Quality, BCQS also supports companies signing up to quality frameworks put in place by these two associations.

**Belgian Construction Certification Association (BCCA)**
BCCA ([www.bcca.be](http://www.bcca.be)) is one of the leading Belgian certification bodies in the construction sector and has, thanks to this status, an accreditation from the BELAC office. The non-profit making association has supported the collective ‘Construction Quality’ label for several years and regularly performs production controls within the context of CE marking.

**Belgian Centre for Domotics and Immotics (BCDI)**
The BCDI ([www.bcdi.be](http://www.bcdi.be)) describes itself as a study and information centre in the field of automation integrated into the residential environment/building automation. Themes such as personal assistance, smart cities and intelligent buildings are also part of the BCDI’s area of expertise. In recent years, the centre has collaborated on various national and European research projects as well as various congresses, forums and workshops.

**Centrum Duurzaam Bouwen (CeDuBo)**
Thanks to the extension of its exhibition as well as the organisation of various study and training days, CeDuBo ([www.cedubo.be](http://www.cedubo.be)) remains the reference centre for sustainable construction for building professionals and the general public. Moreover, it oversees the Flemish transition network Duwobo ([www.duwobo.be](http://www.duwobo.be)) and is the base for the Dubolimburg support platform ([www.dubolimburg.be](http://www.dubolimburg.be)) and Duwolim (www.duwolim.be), a local body involved in eco-credits. Both centred on the systematic maintenance of buildings, the Sustainable Building Management Centre ([www.gebouwbeheerder.be](http://www.gebouwbeheerder.be)), a platform for building managers, and the coordination of the Vlisog cluster constitute new initiatives.

**Organisatie voor Duurzame Energie (ODE Vlaanderen)**
As a coordination body for sustainable energy in Flanders for 20 years, ODE ([www.ode.be](http://www.ode.be)) ensures dialogue between companies and organisations from the renewable energy sector and the public authorities through thematic platforms: heat pumps, photovoltaics, biomass, wind energy, heat networks, etc. Within this context, the BBRI is involved in the integration of renewable energy systems in buildings.

**Quality Centre for Sustainable Energy Technologies (QUEST)**
QUEST ([www.q4q.be](http://www.q4q.be)) develops, with the sector, Construction Quality and BCCA, quality procedures and technical reference documents for the application of small-scale renewable energy systems (heat pumps, thermal and photovoltaic solar installations). QUEST is also policy officer within RESCert for the certification of renewable energy system installers, essential for certain technologies in order to obtain subsidies.

**Vlaanderen Bouwt (Vlabo)**
Vlabo ([www.vlaanderenbouwt.be](http://www.vlaanderenbouwt.be)) aims to build quality housing at affordable prices. This non-profit making association aspires to an equilibrium between technical quality of housing, sustainability, architectural value and town-planning coherence. Land owners – as well as public authorities and private individuals – can call upon Vlabo as project manager.
The activities of the BBRI are guided by fifteen Technical Committees. While eleven of the Committees directly represent a construction trade and are composed primarily of contractors, the other focus on subjects of interest to several trades. In order to guarantee this bottom-up approach, each Committee defines the actions that will be carried out in the following year, via the work plans submitted to the Standing Committee of the BBRI for approval.
Glazing
Chairman: A. Sanchez
Vice-chairman: J. Jacobs
Engineer-leader: V. Detremmerie
Engineers TAC: F. Caluwaerts, G. De Raed, L. Lassoie

Sealing Works
Chairman: J. Coumans, R. Evens
Engineers-leaders: E. Mahieu, E. Noirfalisse
Engineers TAC: D. De Bock, E. Mahieu

Roof Coverings
Chairman: G. Pierrard
Engineers-leaders: F. Dobbels, D. Langendries, C. Mees
Engineers TAC: L. Geerts, O. Vandooren

Sanitary and Industrial Plumbing, Gas Installations
Chairman: A. Dooms
Engineers-leaders: B. Bleys, K. De Cuypere
Engineers TAC: I. De Pot, V. Jadinon

Joinery
Chairman: M. Collignon
Engineers-leaders: S. Charron, B. Michaux
Engineer TAC: G. De Raed

Stone and Marble
Chairman: H. Vanderlinden
Engineers-leaders: V. Bams, D. Nicaise
Engineers TAC: L. Firket, J. Van den Bossche
Plastering, Jointing and Façade Works

Chairman: J. Van den Putte
Engineers-leaders: I. Dirix, Y. Grégoire
Engineers TAC: J. Goovaerts, M. Lignian

Hygrothermy

Chairman: E. De Kempeneer
Engineers-leaders: X. Loncour, J. Van der Veken
Engineers TAC: A. Acke, R. Durvaux

Acoustics

Chairman: E. De Kempeneer
Engineer-leader: L. De Geetere
Engineers TAC: J. Goovaerts, M. Lignian

Architects

Chairman: M. Procès
Vice-chairman: R. De Lathouwer
Engineers-leaders: D. Langendries, P. Wouters

BIM & ICT

Chairman: T. Van den Berghen
Engineers-leaders: B. Ingelaere, O. Vandooren
Engineers TAC: V. Jadinon, S. Vercauteren
The accounts department aims to give a true picture of the financial situation of the Institute and to justify the management decisions made. Moreover, the BBRI counts on the expertise of over 250 employees from various disciplines to successfully carry out its mission. This synergy of professional skills, commitment and versatility contributes to making the Institute the authoritative body that it has become for the sector.

Finance

Affiliate members

As of 31 December 2016, the BBRI had 86,307 members, including 58,828 one-man businesses. The graph below shows that this number has increased by 25.73% over the course of the last ten years. If we take the indexation into account, the increase in fees collected for this period amounts to 16% in constant value.

Operating revenue and expenditure

The histograms represented at the top of the following page illustrate the evolution of various revenues and expenses in relation to the total over the course of the last three financial years. Thus, it can be noted that the fees of members represent some 53% of the total revenue. Personnel costs – the largest item in the expenditure – have fluctuated between 64 and 67% over the last three years.
Destination of expenditure

The diagram presented below shows the revenue and the expenditure which result from the activities of the BBRI, after distribution of structural costs. The latter represent not only the costs relating to the buildings and equipment, but also the administrative costs. This illustrates that all available resources benefit, directly or indirectly, construction companies.

Indeed, while 86% of the total budget is directly invested to the benefit of the sector, 14% of that is used for research activities under contract that, in the end, also benefit construction. Consequently, all our resources are devoted to improving the quality and the competitiveness of the sector, which is ultimately the founding mission of the Institute.
The BBRI endeavours to improve quality in construction and to strengthen the skills of professionals in the sector. This task is far from easy, given the fragmentation of the building process and the diversity of the partners involved.

To accomplish its mission and anticipate technological developments, the BBRI relies on a dynamic and multidisciplinary team. Our personnel ensure that the fruits of scientific and technical research conducted by the Institute are used to benefit building contractors, as well as other sector professionals (architects, consultancy offices, chartered surveyors, education, administrations, etc.).

The experience and pragmatism of some staff members, combined with the innovative vision of others make it possible to publish practical works, provide customized technical advice and even organise courses and training sessions corresponding to the actual needs of the sector.

Given the growing complexity of these needs and the increased interest in areas such as sustainable construction and renovation, finishing techniques, energy and indoor climate, BIM, IT applications in construction or even the accessibility of buildings, the BBRI has increased its personnel numbers over time and has gone from 215 to 253 employees in ten years.

Evolution of the workforce during the period 2006-2016 (situation as at 31 December)
During the meetings of the General Council of the BBRI on 26 April 2016 and 29 November 2016, the composition of the General Council and the Standing Committee was approved as follows:

**General Council**

**Chairman**
J. Willemen

**Vice-chairmen**
J. Coumans, E. Devos, C. Golinvaux

**Honorary chairmen**
J. Gheysens, R. Lenaers

**Members appointed by the Confédération Construction**

**Members coopted by the Confédération Construction**
A. De Bie, E. Devos, B. Gilliot, C. Peeters, Y. Planet, B. Zanardini

**Members appointed by the Bouwunie**
G. Baert, J. Debuf, B. DeMalsche, D. Hellemons, H. Masschelein, P. Suys, L.-J. Vancauwenbergh, S. Verhoeven, F. Verkest

**Member appointed by the FEB**
J. Coumans

**Members appointed by the Federal Public Service Economy**
F. Debuyst, D. Van Vaerenbergh

**Member appointed by the Walloon Region**
P. Villers

**Member appointed by the Brussels-Capital Region**
O. Eugene

**Members appointed by the Flemish Region**
S. Faignet, L. Van de Loock

**Members appointed by the workers’ organisations**
P. Cuppens, N. Deprets, J. Staal, J. Vandycke

**Auditors**
J. Lembrechts, B. Tasiaux

**Statutory auditor**
HLB Dodemont-Van Impe & C°

**Standing Committee**

**Chairman**
J. Willemen

**Vice-chairmen**
J. Coumans, E. Devos, C. Golinvaux

**Members**

**Observers**
L. Van de Loock, P. Villers
Annex

‘Projects’ database

3D-Restauratie – Nieuwe vormgevingstechnieken voor metal-, steen- en pleisterwerkrestauratie (3D Restoration – New execution techniques for the restauration of metal, stone and plastering) (VLAIO - Flanders)

3D-Sturing – Technologieën voor het meten, communiceren en sturen op de werfvan de toekomst (3D Management – Technologies for measuring, communicating and managing on the work sites of the future) (VLAIO - Flanders)

A-LIGHT – Integrating lightweight concepts in acoustical standardisation (FPS Economy and NBN)

AcustiCare (VLAIO - Flanders)

Ad usum navigantium (VLAIO - Flanders)

ADEKIT – Kit pour la détection rapide in situ de l’amiante dans les matériaux (Kit for rapid in situ detection of asbestos in materials) (SPW and DG06 - Wallonia)

AN Acoustique (SA Acoustics) (FPS Economy and NBN)

AN Béton-mortier-granulats (SA Concrete-mortar-aggregates) (FPS Economy and NBN)

AN Détails constructifs (Smart Connect) (SA Construction details) (FPS Economy and NBN)

AN Eau et toitures (SA Water and roofs) (FPS Economy and NBN)

AN Eclairage (SA Lighting) (FPS Economy and NBN)

AN Eléments de façades manuels et motorisés (SA Manual and motorized façade elements) (FPS Economy and NBN)

AN Energie et climat intérieur (SA Energy and indoor climate) (FPS Economy and NBN)

AN Eurocodes structuraux (SA Eurocodes for structural construction products) (FPS Economy and NBN)

AN Géotechnique (SA Geotechnics) (FPS Economy and NBN)

AN Parachèvement (SA Finishing) (FPS Economy and NBN)

AN Prévention du feu (SA Fire prevention) (FPS Economy and NBN)

AN Tolérances et aspect (Eye Precision) (SA Tolerances and aspect) (FPS Economy and NBN)

ATISOLCaC – Système membrane pare-vapeur et d’étanchéité à l’air. Isolant suivant Cradle to Cradle pour bâtiments neufs et la rénovation par l’intérieur des bâtiments existants (Vapour and air barrier membrane system. Cradle to Cradle insulation for new buildings and interior renovation of existing buildings) (Greenwin - Wallonia)

B-LCA – Cadre méthodologique pour la réalisation de LCA dans la construction. Modélisation belge et ajustement du cadre européen (Methodology framework for the execution of LCA in the construction sector. Belgian modelling and further development of the European framework) (FPS Economy and NBN)

BBSM – Le Bâti bruxellois : source de nouveaux matériaux (Brussels Buildings: a source of new materials) (FEDER - Brussels)

BIM – Building Information Model (VLAIO - Flanders)

BIO-BASED – Fire safe use of bio-based building products (European Union)

BruGeo – Valorisation du potentiel géothermique de la Région Bruxelles-Capitale (Exploiting the geothermal potential of the Brussels-Capital Region) (FEDER - Brussels)

CAPDESIGN – Encapsulation of polymeric healing agents in self-healing concrete (European Union)

CIAPASOL – Développement d’une sous-couche acoustique à base de granulats de caoutchouc recyclé (Development of a sound-insulating underlay from recycled rubber aggregates) (DG06 - Wallonia)

CemComStruct – Textile reinforced cementitious composites for a high-performance, fire-resistant, sustainable building system (VLAIO - Flanders)

CIMEDE 2 – Constructions industrielles de maisons évolutives durables et économiques (Industrial construction of flexible, durable and economical houses) (SPW and Greenwin - Wallonia)

CLUSTER BIM (VLAIO - Flanders)

CODEC – Communication framework for digital construction (FPS Economy and NBN)

Corrosion OB – Innovatieve Corrosiebescherming bij Ondergronds Bouwen (Corrosion UC – Innovative protection against corrosion in underground constructions) (VLAIO - Flanders)

Décêts de construction Bruxelles – Chantiers pilotes pour la Gestion des Décêts de construction à Bruxelles (Construction waste Brussels – Pilot projects for the management of construction waste in Brussels) (Bruxelles Environnement - Brussels)

DeltAT – Dispositif d’autoalimentation électrique d’installations thermiques par effet thermoélectrique (Electrical self-supply system for thermal installations using thermoelectric effect) (Innoviris - Brussels)

DO-IT Houtbouw – Duurzame innovatie op het vlak van technologie en leefcomfort voor houttoepassingen in de bouw (Sustainable innovation in the area of technology and living comfort for wooden structures) (VLAIO - Flanders)

DuroObet – Duurzaam Ontwerpen van Beton: chloride-indringing en carbonatatie (Sustainable design of concrete: penetration of chlorides and carbonatation) (VLAIO - Flanders)

Ecoren – Energetische renovatie van Vlaamse representatieven eengezinswoningen en appartementsgebouwen (Energy renovation of representative Flemish single-family dwellings and apartment buildings) (VLAIO - Flanders)

EMERISDA – Effectiveness of methods against rising damp in buildings: European practice and perspective (BELSPO)

Entretien menuiseries – Entretien des menuiseries extérieures en bois (Joinery maintenance – Outdoor joinery maintenance) (FPS Economy and NBN)

FAREBOIS – FAçades et menuiseries extérieures RÉsistant au feu en BOIS (Fire-resistant wood façades and outdoor joinery) (SPW and DG06 - Wallonia)

Futures – Evaluation des performances et de la durabilité de fenêtres à hautes performances et raccord au gros œuvre (Windows – Evaluation of the performances and the durability of high-performance windows and their junction with the rough structure) (FPS Economy and NBN)

FUTURE CONCRETE – Stortklaar beton voor de toekomst (Ready-to-use concrete for the future) (VLAIO and NIB - Flanders)

GABI – European network for shallow Geothermal energy Applications in Buildings and Infrastructures (European Union)

Gela Via – Critères de résistance des bétons de routes au gel/dégel en présence de sel de déverglaçage (Freeze/thaw resistance criteria for road concrete in the presence of de-icing salt) (FPS Economy and NBN)

GEOCONSTRUCT – Etat limite de service de structures géotechniques: Méthodes de déduction des paramètres de déformation du sol, de calcul des déformations de structures
géotechniques et directives relatives aux déformations admissibles (Service limit state of geotechnical structures: Methods for the deduction of the ground deformation parameters, the calculation of the deformations of geotechnical structures and directives on the admissible deformations) (FPS Economy and NBN)

Gevisol-ETICS – Buitengevelisolatie met ETICS (External insulation for façades with ETICS) (VLAIO - Flanders)

Groen bouwen – Groene gevels voor duurzame gebouwen en steden (Green construction – Green façades for sustainable buildings and cities) (VLAIO - Flanders)

Groen licht Vlaanderen 2020 – Innovatieve en duurzame lichtbronnen (Innovative and sustainable lighting) (VLAIO - Flanders)

GT COM-MAT – Matériaux et techniques de construction durables (TAS COM-MAT – Sustainable construction materials and techniques) (SPW and DG06 - Wallonia)

GT Construction durable – Eco-construction et Développement Durable en Région de Bruxelles-Capitale (TAS Sustainable construction – Eco-construction and Sustainable Development in the Brussels-Capital Region) (Innoviris - Brussels)

GT SUREMAT – Traitements de surface et revêtements actifs multi-matériaux (TAS SUREMAT – Surface treatments and active multi-material coverings) (SPW and DG06 - Wallonia)

GT Valowall – Valorisation des déchets industriels et sols & sites contaminés en Wallonie (TAS Valowall – Recovery of industrial waste and contaminated soils and sites in Wallonia) (SPW and DG06 - Wallonia)

HAMSTER – Heat, Air and Moisture real scale Test facility for building elements (FEDER - Brussels)

IDEA – Innovatieve details in de binnenaanwerking (Innovative details in interior finishings) (VLAIO - Flanders)

In-Vent-Out – Positionnement relatif des ouvertures d’aménée d ’air par rapport aux évacuations d’air et de fumée des bâtiments (Relative positioning of air supply openings in relation to the exhaust air and fume discharge openings) (FPS Economy and NBN)

Instal2020 – Integral ontwerp van installaties voor sanitair en verwarming (Integral design of heating and domestic hot water installations) (VLAIO - Flanders)

KMO RENO – Renovatiescenario’s voor KMO-gebouwen (SMEs RENO – Renovation scenarios for SMEs’ buildings) (VLAIO - Flanders)

Living Labs Brussels Retrofit (FEDER - Brussels)

Luchtdicht bouwen van A tot Z (Airtight construction from A to Z) (VLAIO and NIB - Flanders)

MEASURE – Mesure de performances réelles et de satisfaction des occupants dans les bâtiments résidentiels à hautes performances énergétiques (Measurement of the real performances and the satisfaction of the occupants in high-performance residential buildings) (SPW and DG04 - Wallonia)

Metselwerk – Innovaties in de metselwerksector: implementering door innovatieoogers (Masonry – Innovations in the masonry sector: implementation through innovation monitoring) (VLAIO - Flanders)

MICROPILES – Développement d’une méthode de dimensionnement belge intégrée (MICROPILES – Development of a Belgian integrated dimensioning method) (FPS Economy and NBN)

Mutatie+ – Mutatiewoningen harmonieuws geïmpeleed met modulaire technieken in functie van levensloop, leefcomfort en energiebesparing (Homes undergoing transformation harmoniously upgraded with modular techniques according to life cycle, living comfort and energy savings) (VLAIO - Flanders)

NEPBC – Next generation building energy assessment methods towards a carbon neutral building stock (VLAIO - Flanders)

OPTICOST – Optimisation technico-économique des coûts de la construction (Technical and economical optimisation of construction costs) (SPW and DG06 - Wallonia)

OPTIDUBO – Développement et optimisation de toitures et parois à base de bois innovantes et durables dans le temps (Development and optimisation of innovative and long-lasting wood-based roofs and walls) (SPW and DG06 - Wallonia)

OVERS®HOT – Optimiseren (chimisch) verontreinigd sloop hout (Optimisation of (chemically) contaminated wood from demolition sites) (MiP and i-Cleantech - Flanders)

PEPSE – Conception, développement, validation et mise en service d’un poste d’essai semi-virtuel pour le test de systèmes de production, de stockage et de distribution d’énergie (Design, development, validation and commissioning of a semi-virtual test station for the testing of energy production, storage and distribution systems) (FEDER - Wallonia)

PHOTOCATALYSE – Durabilité des matériaux de construction photocatalytiques à base de ciment (Durability of photocatalytic cement-based construction materials) (FPS Economy and NBN)

POLYFIB – Evaluation de l’utilisation structurelle de macrofibres synthétiques (Evaluation of the structural use of synthetic macrofibres) (FPS Economy and NBN)

PREDIVOC – Développement d’un outil prédicatif, rapide et simple d’évaluation des émissions de composés organiques volatils (Development of a predictive, quick and simple tool to evaluate the emissions of volatile organic compounds) (FPS Economy and NBN)

PREMANAT – Performances requises pour les pavages de voirie en pierre naturelle (Required performances for road paving in natural stone) (FPS Economy and NBN)

PREVENT – Ventilation des logements : critères de performance et règles de conception des systèmes (Ventilation of dwellings: performance criteria and rules for the design of ventilation systems) (FPS Economy and NBN)

PREVENT II – Ventilation des logements : critères de performance et règles de conception des systèmes (Ventilation of dwellings: performance criteria and rules for the design of ventilation systems) (FPS Economy and NBN)

PRO+ – Prefab-Renovatie-Oplossingen voor de tertiaire gebouwsector (Prefab-Renovation-Solutions for the tertiary building sector) (VLAIO - Flanders)

QUALICheCK – Towards improved compliance and quality of the works for better performing buildings (European Union)

RadSII – Robust Acoustic Details Standard II (FPS Economy and NBN)

RAINROOF – Cadre normatif pour l’étanchéité aux pluies battantes des toitures inclinées (Standard framework for pitched roofs resistance to driving rain) (FPS Economy and NBN)

RecyBeton – Utilisation de granulats recyclés dans le béton prêt à l’emploi (Use of recycled aggregates in ready-to-use concrete) (FPS Economy and NBN)

RecyBeton II – Utilisation de granulats recyclés dans le béton prêt à l’emploi. Ouvrabilité et granulats mixtes (Use of recycled aggregates in ready-to-use concrete. Workability and mixed aggregates) (FPS Economy and NBN)

REDMONEST – Monitoring dynamic network for existing structures of concrete Cultural Patrimony (BELSPO)
In order to meet the requirements of the sector, the BBRI collaborates on various research projects and awareness initiatives. These projects are supported by the following bodies:
Researches • Develops • Informs

Primarily financed through the membership fees of some 85,000 Belgian companies, representing almost all of the construction trades, the BBRI has been considered the leading scientific and technical institute for over 55 years, contributing directly to the improvement of quality and productivity.

Research and innovation

The introduction of innovative techniques is vital for the survival of an industry. Oriented by the construction professionals, contractors and experts sitting on the Technical Committees, the Institute’s research activities are closely aligned to the day-to-day needs of the sector.

With the help of various official bodies, the BBRI encourages companies to innovate, by offering advice in various fields that is tailored to the current challenges.

Development, standardisation, certification and approval

At the request of public or private players, the BBRI also works on various development projects under contract. Actively collaborating in the activities of the standardisation institutes – on the national (NBN), European (CEN) and international (ISO) levels – as well as in those of bodies such as the Belgian Union for Technical Approval in Construction (UBAtc), the Institute is ideally placed to gain insight into the construction sector, and thus to respond to the future needs of the various construction trades.

Dissemination of knowledge and support to companies

The BBRI makes extensive use of information technology in order to efficiently share the results of its work with all companies of the sector. Its website, adapted to the diverse needs of construction professionals, contains the publications of the Institute as well as more than 1,000 construction standards.

Personalised training and technical assistance contribute to the Institute’s commitment to disseminating information. Alongside some 650 information sessions and thematic conferences involving the BBRI’s engineers, over 18,000 advice notices are issued each year by the Technical Advice division.