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Digital progress increases the opportunities for our sector
The world is undergoing constant changes and this evolution is also visible in the construction sector. In fact, our sector is one of the most affected by the recent technological progress and this will only increase in the years to come. The Institute is monitoring matters closely and tries to anticipate to trends, in order to better support professionals in their daily work and especially to help them improve the services provided to their clients as well as the quality of the works undertaken. We daily apply ourselves to this mission in close collaboration with professional organisations within the sector. It is in this context that the Standing Committee of the BBRI took the decision in 2017 to create a new Technical Committee: Smart & Sustainable Constructions. This Technical Committee sets out to develop the buildings and towns of the future.

Everybody agrees that digital progress already offers numerous opportunities in the construction sector. The main advantage is that these developments contribute to a more comprehensive preparation of the work site, which results in shorter execution periods, better budget control and an improved quality of the works. They also contribute to a more effective communication between the various parties involved, with the benefit of less misunderstandings and therefore less time wasted. However it remains a challenge to coordinate this progress and make it accessible and profitable for everybody, in order to be beneficial for both small and large businesses. The Technical Committee BIM & ICT focuses on this challenge, through its research, information and standardisation activities related to ‘Construction 4.0’. The first publications on this subject were released in 2017 and more are still to come, along with information sessions and training courses organised in collaboration with all the Belgian professional organisations.

However, we are not losing sight of our other primary activities relating to other equally important themes like energy and environment, comfort, health, accessibility and safety, building materials and systems as well as technical installations. In the following pages you will observe that the Institute remains very active on all these subject areas. Furthermore, we do our utmost to improve the services to our members and provide them with the most efficient personalised assistance, both technical or organisational.
The year 2017 was marked by a significant increase in the number of training sessions to which the BBRI staff participated. Indeed, there have been no less than 900 sessions, representing a significant increase compared to previous years.

These courses and conferences make it possible to disperse the research information and to support businesses in the daily management of their projects.

The chart below illustrates the thematic division of trainings provided in 2017. Compared to previous years, a re-orientation can be noted within the training sessions relating to energy and environment. The majority of the sessions deal with the energy renovation of existing buildings and with more innovative themes such as the circular economy or the life cycle analysis of materials.

The training sessions regarding the technical installations have mainly been dedicated to ventilation and heating systems, but also to sanitary installations. The courses on building materials and systems continue to be in the majority. They often concern future technologies, such as capillary active insulation or the Internet of Things, as well as more traditional subjects such as structural or exposed concrete, masonry, the junctions between the joinery and the rough structure or the execution of roofs.

### Thematical repartition of training sessions 2017

- **Company management, BIM & ICT**: 33%
- **Comfort, health, accessibility and safety**: 29%
- **Technical installations**: 16%
- **Energy and environment**: 12%
- **Building materials and systems**: 10%
After the tragic fire at the Grenfell Tower in London in June 2017, the BBRI wanted to enlist the potential risks to which high-rise buildings are exposed to in our country.

The objectives were notably:
• to give an overview of the applicable regulatory framework and standards in the field of fire safety in Belgium, particularly with regard to the risk of fire spreading via façades
• to present the first proposed approaches for the revision of the current regulations
• to present the main concerns and the constructional measures making it possible to guarantee a correct design and proper installation of the most up-to-date façade systems, taking into account current and future requirements.

This document was drafted and published at record speed, in order to anticipate to the actual situation at the time. The monograph was received with unparalleled success, with over 4,500 downloads in the first week and close to 10,000 over the entire year!
Theme 1
Energy and environment

The energy and environmental impact of buildings represents a major concern in any renovation or construction project. The regulatory requirements are regularly becoming more stringent and represent one of the main levers in order to reduce this impact. The BBRI is committed to offering simple and effective solutions to meet these expectations, taking into account the constraints of the various trades. Once again this year, the Institute has increased its initiatives with the aim of addressing the challenges in this field.

The necessary energy

The energy efficiency of buildings has improved significantly in recent years. Particular attention has been given to actual performances. The ‘MEASURE’ project has therefore evaluated the satisfaction of occupants of energy-efficient buildings over several years. Overheating and comfort in summer have proven to be critical factors and are the subject of an article in the CSTC-Contact 2017/4.

In 2017 the study CoDyNi was launched, within the framework of the international project ‘EBC Annex 71’. The study sets out to develop techniques to measure the actual on-site energy performances of the building’s envelope, using the least intrusive methods possible. In this context, all stages for the performance of measurements using the co-heating technique are evaluated. Various initiatives were also launched in order to find solutions to improve the energy efficiency of buildings. The revision to Technical Information Note (TIN) 215 focusing on flat roofs also continued. Two TINs were also published, one note focuses on solar panels and the other note on cavity walls.

Additionally, emphasis has also been put on the hygrothermal design of walls, which is often at the source of building pathologies. The Hygrimpact study started in 2017 with the aim of evaluating the impact of humidity on the energy performance of materials, walls and the building itself.

By coordinating the Consortium PEB, the BBRI is working to develop regional EPB regulations in a coherent way. Furthermore, the Institute 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. Launched in 2017, the NEPBC research project explores new routes to incorporate emerging technologies that are not yet included in current EPB regulations.
Technical details

All technical constraints and requirements are united in the construction details. The execution of these details additionally implies the involvement from various building trades. For several years, the BBRI has been developing integrated details in order to respond to the current requirements and needs of all involved parties. The Institute notably published the Technical Information Note 264 bringing together all technical reference details for cavity walls.

The Standards Antenna Détails constructifs (Construction details) (Smart Connect), devoted to constructional nodes, has also made it possible to make the technical details available on the BBRI’s website. Technical solutions are proposed which can be applied to renovations for the junctions between sloped roofs and façades, for example.

Several initiatives were taken for the energy renovation of buildings. The RenoFase project, amongst others, was concluded. This project sets out to tackle obstacles, technical or otherwise, related to the energy renovation of housing. It led to the development of the Reno-Pro tool, which aims to optimise the design of the energy renovation of a building. Within the context of insulation techniques for existing internal walls, various systems were assessed through both laboratory tests and on-site testing. This technique is also the focus of the project ATISOL C2C. The central sections as well as the technical details are considered, as this is the case for wooden beams incorporated in the façade. The execution details regarding interior insulation were examined in an article of the CSTC-Contact 2017/3. The Institute also contributed to the implementation of a training programme on this subject area in the Flemish Region.

The energy renovation of heritage buildings is the core focus of the P-Renewal project, which evaluates adapted technical solutions, and of the Erfgoedenergielokket, which aims to develop a network of energy advisers specialising in heritage buildings.

Through the Vlaams Kennisplatform Woningrenovatie research, the BBRI coordinates an extensive initiative of demonstration projects for the renovation of housing units in the Flemish region. The Mutatie + and EcoRen projects set out to develop market-orientated and socially accepted energy renovation concepts for single family dwellings and apartment blocks, representing the residential stock in Flanders. The TypoReno project focuses on construction details for the energy renovation of houses in Wallonia according to type.

Energy renovation

Example of an integrated detail applicable in renovations.
In the Walloon region, the BBRI also participated to the implementation of the ‘PAE 2’ voluntary energy advice procedure applicable to existing homes, and the use of an energy certification system for existing buildings.

In the Brussels-Capital region, several renovation projects were selected following a call for projects by Living Labs Brussels Retrofit. These projects leave room for research, experimentation and innovation in the organisation and execution of renovation activities; the main objective being the creation of a larger market for energy renovation.

Information

The energy theme has been the object of several information initiatives within the sector, via presentations and study days, but also via various publications, including the TIN 263 devoted to the installation of solar panels on roofs and TIN 264 on the reference details for cavity walls.

The Standards Antenna Energie et climat intérieur (Energy and Internal Climate) keeps the sector informed about the evolution of the relevant standards in this field, mainly via the website www.normes.be or through conferences.

A series of information sessions and seminars specifically dedicated to energy were organised throughout the year.

Quality framework

The BBRI continued its activities relating to quality frameworks that were implemented in recent years. The subject areas covered included, amongst others: post-insulation of cavity walls and the performance reporting of ventilation systems. Revision work on STS-P 71-3, which form the basis of the quality framework for measuring airtightness, took up a large portion of the year.

Innovation

Other research projects looking at innovation stimulation were also continued in 2017. In the Brussels-Capital region, the HAMSTER project will allow the BBRI to dispose of a full-scale testing station to study the hygrothermal behaviour of building components subjected to two controlled atmospheres (indoors and outdoors). The CLEARPOWER project focuses on the development of transparent or semi-transparent paints which have electrical energy storage properties and which can be applied on construction materials such as glass. In addition, the Institute mobilised resources to tackle the subject of smart buildings, which will undoubtedly become more important in the years to come. The preparatory work to create a new Technical Committee dedicated to this subject was also completed.

Innovation stimulation also introduced initiatives such as the Technological Advisory Services. In the Brussels-Capital Region, the Technological Advisory Service Eco-construction et développement durable provides significant support to the sector regarding energy and environment in general.
The environment

The environmental impact of a building mainly depends on the choice of materials during the building’s life cycle and on the energy consumption during the use phase. The behaviour of the occupants in terms of transport and consumption also has an impact on the environment.

The URBANWISE project sets out to find solutions for the economic and environmental problems related to the provision of supplies to work sites in towns. To do this, the project has developed an intelligent urban logistics management and communication platform, in order to improve and to simplify the organisation of goods transportation to building sites. The results of the project were presented during a workshop organised in cooperation with the partners of the European project ‘SUCCESS’.

A number of valuable insights were acquired in the areas of technology and organisation for high-energy performance buildings, at least for new buildings. The environmental footprint of materials – and their end of life – will constitute the next challenge for the sector. The applied research in the construction sector relates consequently to nearly zero-energy buildings with a low environmental impact.

The environmental impact of building processes or materials is systematically evaluated in research projects such as Groen Bouwen, CemComStruct, CIMEDE 2, HETREFORT, ‘OPTICOST’ and ‘Careno’. In the process of finding innovative solutions, this analysis effectively allows for decisions to be taken from a life cycle perspective (from quarry extraction through to recycling).

Within the context of the ‘Groen bouwen’ project, knowledge growth has allowed the development of a series of parameters that aim to promote and to develop green façades. The recommendations issued relating to material selection, composition and maintenance are brought together in a guide. The results of the research also form a basis for the continued development and optimisation of innovative systems.

The Material World project looks at the environmental impact analysis of finishing materials frequently used within the context of retail outlets. Additionally, it examines the experience-based characteristics of these materials. The results of the research will be used to develop an educational tool enabling a more experience-based and more durable selection of construction materials intended for commercial interiors.

Energy renovation

The renovation of existing buildings represents a major challenge, and much more if one targets the effective use of raw materials. The test bench projects and the ‘Vlaams Kennisplatform Woningrenovatie’, as well as the ‘Living Labs Brussels Retrofit’ research projects, also take into account the environmental impact and sustainable construction during experiments concerning thorough energy renovation.
The impact of the use of materials on the environment is examined throughout their life cycle (extraction of raw materials, production and transport to the building site, use, maintenance, replacement and finally disposal or recycling of rubble). A regulatory framework of standards is essential so that the sector players have access to correct and clear information about 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 Standardisation Commissions (CEN TC 350 ‘Sustainability of construction works’).

In particular in relation to the evaluation of the environmental impact at building level, the BBRI is conducting a prenormative study aiming at the methodological framework for the implementation of the life cycle analysis (LCA) within the construction sector. This study looks at new environmental indicators and the environmental impact of recycling and length of use (module D).

Several LCA studies at building level have shown the importance of the different life cycle phases (including the site phase) and the different building components. Some results were directly integrated into the standard NBN DTD B 08-001, a national supplement to the European standard NBN EN 15804 established within the context of Environmental Product Declarations (EPD). This normative document includes the Belgian calculation rules for EPD (including standard scenarios for the transportation of construction materials and waste and for waste management), guidance relating to module D, as well as a proposed approach relating to biogenic CO₂ and energy recovery through combustion.

TOTEM, a user-friendly online tool to evaluate and optimise the environmental impact of buildings, was developed by the three Regions with support from the BBRI. The Institute developed 460 representative building elements which were integrated in the tool’s library and on which designers/contractors can base themselves for (the optimisation of) the design of the building.

As the environmental performances of a building are integrated in the ‘Building Information Modelling’ (BIM), the BBRI conducted the CODEC study to develop a harmonised information exchange protocol during construction projects. More specifically in the field of the environment, this project looks at how BIM could help to forecast the building performances and link this to environmental objectives.

At the industry’s request, the BBRI also conducts studies to analyse the environmental impact of building materials, according to the methods set out in European standards. The BBRI thus contributes to the drafting of environmental product declarations (EPD) which will serve as calculation bases in the short term to evaluate the environmental impact of buildings or even districts.

Innovation

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.

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, an online platform bringing together innovative products and ideas from the construction sector.
Circular Economy

Particular attention has been paid to the use of raw materials and 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 this 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 or cities) and new economic models for the functional or the partial economy.

The 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.

The attention paid to raw materials during construction work is demonstrated in certain research projects, which evaluate certain theoretical principles and new ways of recovery according to their practical relevance and feasibility.

A first example is the project Déchets de construction Bruxelles (Brussels Construction Waste). The aim of this project is the implementation and testing by contractors of innovative waste management practices on 12 construction and renovation sites in Brussels through intensive follow-up.

A second example is the ‘Careno’ project looking into the optimisation of the reuse of ceramic tiles in the construction sector. Improving the cleaning process, the packaging and marketing of the product, the technical documentation and the sales potential are just some of the aspects tackled within the project.

A third example is the Overs©hot project which analyses the optimisation of scrap wood contaminated with chemical agents. This project sets out the criteria and method for a more efficient selection of post-consumer scrap wood.

A final example is the Sand2Sand project that looks at high-quality applications for recycled sand from concrete constructions, with the aim of creating added value for an already existing recycling stream (in particular recycled crusher sand), and to remedy the shortage of construction sand in Flanders.

In 2017, the BBRI continued to provide its expertise with the aim of developing sustainable construction and circular economy, while notably monitoring better coherence between the initiatives under way. Sustainable construction and 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 in current and future building sites.
Of the four central themes from this category, fire safety was undoubtedly an unavoidable topic in 2017. The tragic Grenfell Tower blaze last June in London, drew the entire world’s attention and confirmed the importance of the fire safety of buildings. The BBRI has been actively involved for many years in this field, notably through research, standardisation and the dissemination of knowledge in this area.

Energy construction

The energy construction of buildings starts with good insulation. The fire in the London apartment block has nevertheless demonstrated that insulation can contribute to major problems regarding fire safety. Indeed, directly after the tragedy the press blamed the insulation materials as the likely cause. It will fall to the courts to ascertain their actual role. In view of the number of fires in high-rise buildings in 2017, the BBRI drafted a document addressing the fire safety status of this type of constructions during the summer of the same year.

This monograph entitled ‘Sécurité incendie des façades des bâtiments multiétages’ (Fire safety of multi-storey building façades) gives an overview of the Belgian normative and regulatory context both in force and under revision, highlighting the risk of fire spreading via façades (which is what effectively took place in London). Using an inventory of the most common façade systems, the document gives an overview of the aspects which must be taken into account to ensure a correct design and a good implementation, taking into account current and future requirements.
Technical details

We know that the building’s performances are also determined by the details. It is a question of knowing how to realise them in practical terms. The same issue applies to the accessibility of buildings for all persons: young or old, healthy or disabled, etc. What many people do not realise is that accessibility goes hand in hand with the demand for sufficient visual contrast in buildings. The latter is particularly important for visually impaired people, as it increases the readability of the building and it facilitates wayfinding.

The problem is however that several bodies develop standards for which the contrast formulae and the acceptance criteria are often very different. For this reason, a calculation tool was developed within the framework of the VIS project ‘Groen Licht Vlaanderen 2020’, concluded in 2017, in order to specify the colours that are sufficiently contrasting. This calculation tool can help to indicate colours in the specifications and measurements and to determine the minimum font size (e.g. signage inside buildings and on or next to doors, etc.).

User tests were also performed within the context of this project, in collaboration with UHasselt. A dynamic lighting system marking out the route in the UZBrussel hospital was also tested to see whether it actually provided assistance. A second series of experiments studied the illumination of staircases. Fall incidents, particularly on stairs, can have serious implications, and can even represent an important cause of death for the elderly. All too often overlooked, this type of lighting is likely to improve the perspective and the contrast between the individual steps.

The article ‘Outil de calcul pour l’évaluation des contrastes de couleur et le dimensionnement de la signalisation’, that appeared in the CSTC-Contact 2017/2, presented a brief overview of the spreadsheet (available under the section ‘Outils de calcul’ (Calculation tools) on www.cstc.be), as well as the applicable standards and reference documents.

Carefully studied details are also essential to ensure an effective acoustic protection and to optimise the acoustic comfort. Lightweight construction systems such as CLT panels (see ‘Innovation’ section, p. 17), are very commonly applied for the finishing of office buildings, schools and hospitals, etc. In these situations they are primarily used as technical compartimentation or as flooring during renovations. However, the complexity of these systems hinders the prediction of acoustic performance between premises.

The study project A-LIGHT sets out to develop a calculation model for this type of construction, in order to propose execution details that meet...
the current acoustic requirements. To do this, the dynamic properties that have an influence on the acoustic performances need to be identified, measured in laboratory conditions and subjected to a parametric analysis. This will facilitate the development of empirical or analytical calculation tools that will be integrated into a predictive software for acoustics intended for lightweight construction systems. In 2017, the MODA laboratory of the Acoustic division studied the weakening of structural transfers at junctions on a large scale model.

Comfort and accessibility research sometimes implies constructional-technical challenges. This was also the conclusion of an article in the CTSC-Contact 2017/2 on the water tightness of walk-in showers in single family homes. The quality and durability of the water tightness is determined by the execution details. Insufficient attention for these execution details will lead to damage and frustrated users in the long term, even though it will result in comfortable and easily accessible showers (for wheelchair users for example) in the short term.

Energy renovation

Concluded in October 2017, the RenoFase project wanted to bridge the gap between theory and reality. Its objective was to tackle the extensive and phased energy renovation of dwellings in a structured way, in order to achieve an efficient high-quality project. The encountered problems and challenges were tackled with a comprehensive approach, taking into account the different stages of the renovation process: diagnostics (diagnostic tool), design (overall plan and costs/benefits), execution (post-insulation of façades, coordination, innovative solutions) and customer support (information, advice, collaboration and financing). Other events and training courses have enabled the project to reach a wide audience (about a thousand businesses in total).

The most important results were compiled in a brochure, addressing the following aspects:

• analysis of the actual situation: a tool has been developed in the form of check lists to assist designers, contractors, experts, etc. when analysing the actual situation of a building that needs to be renovated. By means of specific questions, attention is paid to the constructional-technical and construction-physical preconditions. The main aim is to provide a systematic and structured overview of the building that can be used as the basis for renovation choices and possibilities.
• design guide in order to make well-considered choices: this guide must allow architects and contractors to draw up a well thought-out and practical renovation plan. It is composed of two complimentary sections: an ‘approach plan’ offering support when making important decisions, and ‘scorecards’ to help with the choice for certain renovation works
• execution (details and organisation): the quality of the interior insulation of external walls significantly depends on the design and execution of the details (floor, walls, carpentry, etc.). The ‘RenoFase’ project brought together the main solutions, insights and points of interests in the first version of a practical guide on the details of interior insulation
• financially sound renovations (www.reno-pro.be): developed by contractors and architects, this digital tool allows to determine the cost-optimal combination of renovation measures
• customer support (www.renovatietstart.be): from the very start of the project, the client needs to be properly informed and needs to be made aware of the importance, the possibilities and the limits of an extensive phased energy renovation. During the renovation project one not only needs to select an adequate solution for an element, but one also has to take into account the measures that need to be executed later. Designed with this in mind, the ‘Renovatietstarter’ is a tool that gives a clear overview of the possibilities, the points requiring special attention, etc.
• financing of energy renovations (RenoSave/ReCalculator): with this module a realistic energy savings calculation can be made based on certain building data before and after the renovation. The owner can take this saving into account when determining his repayment possibilities for the renovation loan. A pilot version is available at www.renofase.be/renosave.

Inform

It is the task of the BBRI to transfer the during the research acquired knowledge to the sector. This transfer is usually done via conferences, publications and the BBRI-website, and in particular via the Standard Antennas (SA Acoustique, Energie et climat intérieur, Eclairage and Prévention au feu) which cover amongst other the issues of comfort, health, accessibility and safety. Some of this information has been adopted in student courses, specialized press, professional trainings and publications of the industry. This year again, there has been a wealth of conferences and publications dedicated to these different themes.

The first edition of the CSTC-Contact in 2017 focused on digitisation in the construction sector, and more specifically on the use of the BIM technology (Building Information Model) which has an impact on all areas of the construction sector and of course also on the aspects of comfort, health, accessibility and safety. It is common knowledge that when the same project is built twice, the second build can be done with far fewer errors and consequently optimising the costs and making the most of the experience acquired during the first build. Thanks to the BIM technology, this principle has almost become a reality, the virtual construction of the project effectively allows a similar optimisation. The BBRI hopes to focus in the future on the development of different applications linked to BIM in order to optimise the aspects of comfort, health, accessibility and safety.

The issue of fire safety was also addressed in the CSTC-Contact of 2017, which confirms the attention paid to this subject for many years.

The first article about the fire safety requirements for sloped roofs (CSTC-Contact 2017/2.4) forms a supplement to the TIN 251. The article is based on the requirements from the Royal Decree on ‘Normes de prévention de base’ which are not applicable to roofs of single-family dwellings (since these are not subject to fire safety requirements).

A second article deals with the fire safety of wooden terraces on flat roofs (CSTC-Contact 2017/2.6). It reports on the current require-
ments regarding external fire safety for roof coverings, and more specifically wooden terraces on roofs. The trials conducted as part of the “DO-IT Houtbouw” research project (now concluded) were a source of inspiration. This project also made it possible to present validated solutions that allow to comply with the requirements.

In a third and final article (CSTC-Contact 2017/2.8) a short summary is given of the current fire safety requirements for façades. It focuses further on the requirements and the supplementary constructional measures to reduce the risk of fire propagation via the façades in the particular case of external façade insulation systems, commonly known as ETICS.

Other issues that were addressed in 2017:
• Legionella: Legionella is a persistent problem in water facilities. The problem is clearly explained in the CSTC-Contact 2017/2.12, with special attention for elements in the installation that can contribute to the development of bacteria and for ways to resolve this potentially fatal infection
• flooding: backflow from public drains can jeopardize both comfort and security. While such situations do not usually affect the life of the occupants, floodings can nonetheless cause significant damage to buildings and their contents. The third issue of the CSTC-Contact explains how to stay safe
• situations involving a health risk: these can particularly appear when the acoustic insulation does not provide effective protection against noise made by the installation, the environment or the neighbours. Acoustic insulation should allow us to turn up the volume of our devices (TV, hi-fi, etc.) without disturbing the neighbours. This aspect needs special attention, particularly for new types of construction. The CSTC-Contact 2017/2 addresses the issue of acoustic insulation for CLT (Cross Laminated Timber) structures and proposes a patented solution developed by the BBRI (see ‘Innovation’ section, p. 17). Wooden floors in old buildings are also known for their lack of acoustic protection. The fourth and last CSTC-Contact of 2017 proposes a number of solutions for the acoustic renovation of these wooden floors.

Quality framework

The finishing stage of a building often represents almost half of the construction costs. In the case of large projects, the majority of the specifications mention increasingly diverse performance requirements, generally relating to the assembly of components and to how they are held in place, without specifying how to fulfil these requirements. For SME finishing companies, this is an extremely difficult and risky task from a technical point of view.

The IDEA project aims to improve the quality framework for the interior finishing sector:
• by helping small producers of construction elements to improve their products by means of recently established innovative solutions. This means that the sector can have access to improved elements allowing easier junctions with and a better integration in other construction elements
• by developing optimised details that will simultaneously comply with several technical requirements
• by broadly disseminating knowledge and proven innovations within the sector (via publications, conferences, workshops, websites, individual support, etc.).
Innovation

The hot water installations are at the heart of the DeltaT project. The Brussels project DeltaT is studying the hot water production installations in the tertiary sector and large residential complexes. Its intention is to develop devices that power themselves with thermoelectric energy. In short, the aim of this project is to design, produce and test devices that use the heat from a hot water installation to supply electricity to switches and sensors regulating this system, to make them autonomous. Since the functioning of these devices is based on the thermoelectric effect, the project focuses on three types of needs:

• improved energy performance of buildings in the tertiary sector and high-density residential complexes, which are prevalent in the Brussels-Capital region
• a better thermal comfort by means of better monitoring and better adjustments for large buildings in particular
• the reduction of the operating and maintenance costs.

With regard to ventilation systems, installers can have difficulties to ensure the acoustic performance of the systems. To limit noise pollution, users reduce the ventilation rate to a very low level, which results in insufficient indoor air quality and negative health consequences. The aim of the innovation project SILENCEVENT is therefore to make the acoustic performances of residential ventilation systems more predictable and more controllable, thanks to a thorough understanding of the acoustic flow and the ventilation components.

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• the reduction of the operating and maintenance costs.

Building structures using CLT panels is a relatively recent innovation, allowing the realisation of multi-storey buildings. The possibilities of this construction system are however restricted by the acoustic comfort and the fire safety requirements. Building with large laminated panels can prove significantly more risky when a wooden structure is being used, for example, and this is due to the lateral transmission of noise. The problem can be often solved by placing acoustic double walls made of plasterboard. However this is an expensive and cumbersome technique, which does not allow the wood to be left visible. Fortunately the ‘DO-IT Houtbouw’ research resulted in a new construction system, which almost entirely prevents the lateral transmission of noise and allows improved levels of acoustic insulation compared to traditional constructions systems.
Floating screeds (on an insulation layer) are currently undergoing significant developments. In order to meet the energy performance requirements, the thickness of the insulation is continually increasing and the construction time is becoming shorter, which means it is necessary to find fast and straightforward solutions. Insulation materials such as polyurethane (PUR) can be sprayed quickly and easily in sufficient thicknesses (several layers) without discontinuities for the pipework. This application thus represents an interesting and widely used solution. The prenormative study SOL-isPUR looks at the causes of the compacting of sprayed insulation to reduce the occurrence and the extent.

Following the green roofs, the presence of green façades is slowly but steadily increasing in our streets. These façades not only make our cities and towns more attractive, they also present many other potential benefits: biodiversity, absorption of fine particles, reduction of the urban heat island effect, etc. The project Groen bouwen brings together the key players from the construction and horticultural sector. These parties have conducted research in order to further expand the technical knowledge of the sector. Apart from the life cycle, the BBRI has paid special attention to the analysis of the quality and the consumption of water used to irrigate several types of vegetated façades. Green façades with vegetation growing from the ground are also being improved, especially with regard to the supports for the plants.
Concluded in 2017, the Wash study looked at, amongst other things, the efficiency of different systems ensuring the impermeability of concrete structures. Thanks to the results of this study the phenomena of damage recovery could be determined and the most efficient impermeability system could be identified for the junctions of different parts of a structure (slab/shell, for example). Moreover, the short-term relaxation of the concrete experiencing restricted drying shrinkage was measured using an innovative testing device (dog bone test). Finally, a statistical methodology was developed to objectively evaluate the on-site cracking.

Energy renovation

Launched in 2017, the P-RENEWAL project aims to develop a methodological tool for sustainable energy renovation in order to meet the demand of the heritage building renovation sector. The REDMONEST project also focuses on protected buildings. The conservation of old concrete in heritage buildings often represents a significant challenge. In this context, the BBRI has evaluated the possibilities and limits of protective treatments with water-repellent and transparent paints. These new treatments protect against the corrosion of the reinforcements due to the carbonatation of the concrete and also meet the requirements relating to the preservation of the appearance of heritage buildings.

The FEDER Living Labs Brussels Retrofit project aims to support pilot projects to respond to the challenges of the energy-efficient renovation of dwellings in Brussels. Innovative techniques and processes will be implemented in actual renovation projects in order to test and 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 as well as in social housing. In 2017, five Living Lab Projects were selected which focused both on the economic feasibility as well as on the technical design of prefabricated modules for the renovation of façades or the optimisation of ventilation strategies.

Inform

The Technical Information Notes (TINs) remain, of course, the driving force of the Institute and the fruit of the efforts of the Technical Committees. In particular, the publication in 2017 of the TIN 259 on shallow geothermics, the revision of the TIN on concrete reinforcements (TIN 260) and the TIN devoted to the reference details for cavity walls (TIN 264).

Finally, the Standards Antennae (SAs) of the BBRI remain an important relay for SMEs seeking to manage the use of standards.
The indoor air quality is partly determined by the presence of volatile organic compounds (VOCs), for which building materials represent an important source. The PREDIVOC project has made it possible to develop a new predictive and standardised measuring tool for VOC emissions.

The prenormative study UNCOUPLED FLOOR deals with uncoupling systems of floor coverings composed of mats or membranes, placed between the covering and the support. This project aims to establish a standardised framework for the performance evaluation of these systems.

Other prenormative studies were also set out to develop a standardised framework, which can be particularly useful for contractors. For example, the projects Entretien Menuiseries (maintenance of water-based finishings on outdoor wooden joinery), RAINROOF (driving rain impermeability of sloped roofs), Revêtement chape (moisture control for screeds for the installation of resilient floor coverings) and PREMANAT (required performances for road pavings in natural stone), the latter in collaboration with the CRR.

The BBRI continued the studies on the reliability of temporary or auxiliary structures (scaffolding or certain types of guardrails). Completed in 2017, the STEPWiSe project demonstrated that the impact of the presence of a tarpaulin or net on the wind loads of a scaffolding is considerable. The study also identified the parameters relating to the configuration of the building which impact the stresses on the structure’s anchorage points as well as the effect of weather conditions on the strength of these anchorage points in new masonry.

In 2017 special attention was given to the durability of concretes. The prenormative study Gela Via was continued in collaboration with the CRIC and CRR, and focused on the resistance of road coverings against road salts. The three partners conducted several frost/thaw cycles in the presence of road salts during the first year of the project. The composition of the concrete, the type of surface and the hardening conditions are just some of the parameters studied. The DurOBet study lead to the establishment a prenormative framework based on a more quantitative/statistical approach of the durability of concrete.

Still within the field of concrete, the WEARFLOOR project concentrates on the parameters that (negatively) influence the finishing of industrial floors. By means of laboratory testing, we have demonstrated that the compositions with a less complex execution can also be sufficiently durable, provided that the curing is carried out correctly.

The geotechnical sector is giving particular attention to the ultimate limit states of structures. The research on deformations is often incomplete and the correlation with geotechnical tests in order to define the relevant properties of the terrain is rather small. This issue has been examined within the context of the GEOCONSTRUCT study. With regard to the application of Eurocode 7 and its national annex, the BBRI report no. 19 can be supplemented on the basis of several tests.
The Institute is also active in projects intended to develop new materials or construction elements. The FAREBOIS project has made it possible to develop fire-resistant outdoor wooden joinery, while still adhering to the other essential requirements (air- and watertightness, wind resistance and acoustic insulation). The CAPIASOL project focused on the development of an acoustic underlayer made from recycled rubber aggregates. The research has led to the development of an organic glue for the setting of the rubber aggregates. The HETREFORT project was launched at the end of 2017 and strives to develop small-sized prefabricated elements composed of CLT panels (Cross Laminated Timber) in beech with an insulating coating.

Circular Economy

Given the volume of aerated concrete blocks used today, the development of a recycling method for the resulting waste was necessary. This aim was accomplished during the ‘VALOCEL’ study which demonstrated several times that it is possible to reuse aerated concrete. The research on the production of blocks made from recycled aerated concrete shows that even blocks that are mainly composed of recycled aerated concrete present satisfactory properties for indoor applications.

As part of this current theme the Sand2Sand project strives for a high-quality application of recycled construction sand in concrete in order to create added value to an already existing recycling stream, in particular recycled crusher sand, to remedy the shortage of construction sand in Flanders. Within the same context the OVERS©HOT project, which is currently being tackled by the BBRI, focuses on the optimisation of chemically contaminated scrap wood. This project sets out the criteria for a more efficient sorting of wood waste at the end of its life cycle.

Prefabrication

Increasing the productivity of construction companies remains a major commitment of the BBRI. Increased prefabrication becomes all the more important in this context. The PRO3 project is centred on prefabricated renovation solutions, mainly from wood, enabling a rapid and reproducible renovation of the envelope of an existing building. A guide pays special attention to the aspects for the execution of these innovative solutions.

The classical composition of walls is continually called into question due to increasingly strict requirements in the field of insulation and airtightness. The CeComStruct project (www.cecomstruct.be) studies an alternative structural load-bearing wall system. The full scale testing campaigns, conducted during the first three years of this project, have demonstrated that lightweight wall systems can bear the equivalent weight of four floors.

Finally, the CIMEDE 2 project also continued in 2017 in collaboration with several research partners. The first objective is to extend and improve the evolving nature of a construction, by facilitating a change in the overall size of a dwelling to adapt to the family needs. On the basis of a wood-frame structure, several BBRI-teams have worked to optimise the evolutive nature of a building (including the foundations), whilst maintaining its energy performances.
Technical installations are necessary for the realisation of an optimal indoor climate, making it possible to conduct activities in the right conditions. The installations must be able to be adapted continuously to the characteristics of the building, the climatic conditions, the changing needs of users, the possibilities of local energy production and storage, etc.

In recent years, the Smart Geotherm project (www.smartgeotherm.be) has focused on the opportunities for using geothermal energy for the heating and cooling of buildings. Subject to a good design and the right balancing, the summer heat can be stored in the soil to be used in wintertime. This highly effective and comfortable air conditioning system nevertheless requires geothermal drilling, heat pumps and adapted emission and control systems. The final results of the project as well as the winner of the Geothermal Award were presented at the final symposium organised in partnership with the heat pump platform. Available on the project’s website, the results as well as the developed analysis tools were the inspiration behind several BBRI publications such as the Technical Information Note 259 and the test report on energy piles.

Energy flexibility 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 production, storage and distribution systems.

A good air quality in a ventilation system is essential for a good ventilation. Within this framework, the In-Vent-Out study sets out to develop a method for the correct positioning of air supply openings in relation to the exhaust air and fume discharge openings.
Ventilation remained an important subject area in 2017. The additional training sessions on TIN 258 ‘Guide pratique des systèmes de ventilation de base des logements’ and on the OPTIVENT calculation tool were also organised during the year.

The VIS Instal2020 project is aimed at designing energy-efficient installations for the production of sanitary water (both hot and cold) and (central) heating systems. A better understanding of the water demand allows a more accurate dimensioning of the installations without loss of comfort, and stimulates the rational consumption of drinking water and energy. In 2017, a laboratory test was performed on a full-scale installation, that lead to a better understanding of the conditions for the development of the Legionella sp. bacteria in our sanitary hot water installations. The initial results for this test have been included in the revision of the code of good practice ‘Best Beschikbare Technieken (BBT) voor Legionella-beheersing in nieuwe sanitaire systemen’ published at the end of 2017. The evacuation of waste water and rainwater as well as the efficiency of the different types of water softeners have been the subject of several publications.

Photovoltaic and thermal solar panels constitute a renewable energy source for the local energy production within buildings. The majority of the future scenarios provide for an extensive use of these installations to contribute to the reduction of greenhouse gas emissions. TIN 263 ‘Montage des capteurs solaires sur les toitures à versants’ (Installation of solar panels on sloped roofs) provides the necessary information to install solar panels on the roof of a building without compromising its integrity.

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

New projects relating to ventilation were approved in 2017. Prio-Climat aims to optimise specific ventilation strategies suitable for social housing renovation. Silenthalpic sets out to improve performances, mainly in the field of acoustics, of a decentralised ventilation unit with heat recovery developed by a Belgian manufacturer.

The introduction of LED technology to the market has been revolutionary on a number of fronts. In terms of light adjustments, new opportunities were created thanks to increased possibilities and greater flexibility in the regulation of luminous flux and colour temperature. Problems related to the interaction with existing installations have however been noted and the existing methods for the evaluation of the performances have often proven to be inadequate or outdated.

The Groen Licht Vlaanderen 2020 project (www.groenlichtvlaanderen.be) analyses and demonstrates, on the one hand, the possible compatibility issues and on the other, the new designs and opportunities for regulating natural daylight. The ‘SMART LED’ project evaluated the criteria for visual comfort when using LED lighting in a space. The Standards Antenna ‘Eclairage’ (Lighting) enables the close monitoring of the developments regarding the evaluation methods in the standards and facilitates the implementation.
The concept of industry 4.0 has become common knowledge. Rapid digital developments have already had a major impact on the economy. Not adapting to these developments may mean losing ground on competitors who have the appropriate know-how. In the construction sector, we talk about ‘construction 4.0’, which includes concepts such as BIM technology, drones, smart buildings and smart cities, artificial intelligence, big data analysis, the Internet of Things, 3D printing, robotisation, etc. The BBRI mobilised additional resources in 2017 in order to support its members with this new technological challenge.

The BBRI’s BIM building site

The BIM (Building Information Model) technology is an essential part of the new industrial revolution. Created in 2015, the new Technical Committee BIM & ICT manages and monitors various actions relating to construction 4.0 through a number of working groups and projects. In 2017 the Technical Committee had access to the actions and results of the Cluster BIM, the CODEC study project and activities that form part of a technological guidance project in the Brussels-Capital region.

Bringing together over 70 companies, the main objectives of the ‘Cluster BIM’ are the remediation of a series of problems that interfere with the BIM implementation, the creation of new opportunities and, more specifically, the promotion of the collaboration between the members (the BIM business club). The Cluster calls on the BBRI and the VCB (Vlaamse Confederatie Bouw) as host organisations and is also subsidised by VLAIO. The working groups of this cluster fine-tune solutions (based on the know-how acquired particularly in the context of the ‘CODEC’ study project) and then communicate these solutions to the relevant working groups of the Technical Committee BIM & ICT, which approves or amends them, after which they are implemented as standards or best practice documents for the whole country. The ‘CODEC’ study project and the ‘Cluster BIM’ working groups operate as ‘knowledge factories’ which transmit their know-how to the working groups of the Technical Committee. Around 25 working group meetings took place in 2017, which lead to substantial results.
If a contractor had to rebuild a structure identically, for a second time, the second build would surely be more efficient, more technologically optimised, faster and with less errors. The second project would also be more profitable from an economic point of view. By using BIM technology, the structure will first be digitally built, optimising all aspects. This digitisation offers practically the same technical and economic advantages as if the building had actually been built twice. Contractors mastering this technology therefore gain a real competitive advantage. The fact that they have correct and detailed information in the BIM model also greatly benefits the owner and his facility management when it comes to using the building or operating the infrastructure.

The BIM model is created by all actors involved in the project (architects, consultants, contractors, etc.) and therefore requires a new form of collaboration compared to the traditional construction process. Developing this cooperation and anticipating all its legal consequences was a considerable challenge for the working groups of the TC BIM & ICT and the cluster. The BBRI could fortunately rely on the ‘CODEC’ study project for support with this task.

Correlation between the model and the manufacturer’s information

Assigning information to the composing items of a BIM model allows for the development of a wide range of optimisation tools. We can now talk about an intelligent BIM model. The problem of assigning data originating from manufacturers or generic data was also addressed in 2017.

A number of requirements were established:

• the data provided by the manufacturers must be constantly updated
• the information provided and the databases must comply with the requirements of the standard CEN/TC 442
• the elaboration of an intelligent system of product data models is necessary.

The basic algorithms of a new data exchange system have been developed and a successful subsidy application was submitted to VLAIO.

The intelligent BIM model at the heart of construction 4.0

The development of smart buildings and smart cities goes hand in hand with the development of BIM models. This evolution requires the use of intelligent optimisation tools. The carried out projects will also send large amounts of data via sensors to the BIM model, that will store and analyse them. The BIM models will accompany the constructions more often throughout their full life cycle. The sensors with which the smart constructions are equipped, will in some ways serve as the sensory organs of the BIM model and will function as a link between the real construction and the virtual model. At the present time, there are few applications of this kind on an international scale, but it is clear that in future they will become increasingly more common. In 2017 the BBRI has prepared itself for this by setting up a research group that will focus on smart buildings. In December 2017 a first major event on this subject took place.
Sensors are not the only sensory organs in the intelligent BIM model. Information obtained via high-definition laser scans and photographs is also sent to the BIM model to improve the link between the virtual model and the reality. Drones are also an important tool for automated data collection. At the end of 2017, a project for collecting data via drones and linking it to a BIM model was also introduced by VLAIO.

Furthermore BIM makes it possible to view the future building in a hyperrealistic form (virtual reality). This is, of course, a particular asset in the communication between the various partners, and particularly with the customer. Another step forward is the so-called augmented reality, where virtual reality is projected onto an existing situation. There are a multitude of advantages: simulating future situations, clarifying which series of technical interventions are required (construction of components, machinery maintenance), etc.

Lastly, the BIM model can also be used in the context of the industrialisation of the construction sector. For this particular aspect, the Cluster ‘Bouwindustrialisatie’ was set up in 2017, with the BBRI as host organisation and in collaboration with WOOD.BE.

These technologies are rapidly approaching the construction sector. The BBRI successfully introduced an ERDF project in 2017, with the intention of building a demonstration centre to test all these innovations and present them to the sector.

**BIM technology accessible to all**

Although the use of BIM offers a number of technological and competitive advantages, it also goes hand in hand with a certain financial commitment. The commercial modelling software comes at a considerable price and staff training also requires an investment. These costs could be a problem for small contractors, who therefore risk to miss out on BIM and its technical and financial advantages. Given that a growing number of customers will
dispose of a BIM model in the future, this problem could be a potential threat for small businesses.

To remedy this, the BBRI continued working on easy BIM in 2017. The principle is similar to that of a smartphone: the technology and software are particularly complex, but almost everyone knows how to use it, regardless of their level of study or their resources. Easy BIM has the same objective. The BIM model, developed with the assistance of commercial software, is imported in IFC format into an easy BIM platform. This imported model can then be filtered by criteria (Model View Definitions), allowing only certain data to be shown. The aim is to reduce the profusion of information in the BIM model to easily understandable data and 3D views in function of the job of the user and his wishes (e.g., quick generation of quantity surveys). For small companies, this means easy access to the BIM technology and all related advantages, requiring little or no training and a much smaller investment. The development of easy BIM is a key action area for the BBRI and requires a detailed study to solve various related problems (modelling protocols, consistency checks to obtain a correctly imported model, etc.).

Information and training

The numerous training courses and conferences organised in 2017 highlight the importance that the BBRI places on the implementation of BIM in the construction sector.

In October 2017, the Confédération Construction organised in collaboration with the BBRI, the first major trade fair for BIM technology and ‘construction 4.0’ applications. The aim is to organise an annual ‘Digital Construction Brussels’ fair, to create a central meeting place for professionals involved in digital construction. The first edition offered a multitude of conferences, both for members of the public who are far from familiar with the technology as for experienced users. The 1,500 attendees were able to visit over 65 exhibitor stands.

Numerous documents on this subject have been published. In addition to the first CSTC-Contact of 2017 ‘Digitalisation for everybody’, entirely dedicated to construction 4.0 and more specifically to the BIM technology, the other three editions of that year also featured an article on the same subject, ranging from the use of drones and 3D scans at the service of the contractor, to the implementation of BIM within companies, but also the BIM classification systems to structure data from the digital model.
While digital communication has become essential, the BBRI has not overlooked the importance of personal contact. Each year, the Institute organises numerous information sessions and theme days and issues thousands of personalised advice notices to professionals in the sector. This reinforces the practical knowledge of our collaborators and quickly and efficiently fills in any gaps in the dissemination of information that cannot be compensated digitally.

The recent developments in the construction sector have a significant impact on the needs of the 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 note that detailed planning, meticulous preparation and thorough control make it possible to detect problems early on. Previously, damage cases were often submitted to us after the completion of works or even after the building was in use; now, our input 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 problems. This 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 possible to use the assistance request form on the BBRI’s website, which also allows you to attach photos, explanatory sketches. The staff of the department will provide their response, depending on the complexity of the request, by email, by phone or by letter or will decide to visit the site and, where desired, to produce a report. In 2017, about 15,000 advice notices were issued. A CRM system allows to channel these advices efficiently.

The department also strives to play the role of link between the research engineers and the construction professionals. The questions asked by construction professionals represent an important source of information that enables us to identify the recurrent problems encountered by the sector. 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.

Technical assistance
The department created two Standards Antennas (Détails constructifs (Construction details) and Tolérances et aspect (Tolerances and aspect)) the objective of which is to present as clearly and practically as possible the standards and regulations in force in these fields. A database has also been developed and facilitates quick access to the technical details available to the BBRI. The engineers of the ‘Technical advice and Consultancy’ department are also represented within various Technical Committees and working groups and participate in various research projects such as RenoFase, ‘OPTICOST’ and KMO Reno. They also provide support to the Brussels Technological Advisory Service, to the ‘Erfgoedenergieloket’ (or ‘Heritage energy desk’) and to the cluster ‘Entretien’ (‘Maintenance’).

In order to be able to ensure quality assistance at any time, the ‘Technical advice and Consultancy’ department conducted, in 2017, an extensive satisfaction survey of professionals within the framework of our ISO 9001 certification. The digitalisation of this survey resulted in an increase in the response rate (20 % of the total). This illustrates that the services provided by the BBRI are highly valued.

Organisational assistance

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. The ‘BIM and Information Technology’ department, created in 2016, has increased its number of BIM experts in 2017. This department is primarily devoted to supporting the various working groups of the Technical Committee BIM & ICT.

Like in previous years, training represents a key action area for the division. These training sessions were aimed at all aspects of company organisation: cost price calculation, planning techniques, resource management, financial management, BIM, IT applications, etc. The content of these courses is a mix of technical knowledge and practical examples, which are highly valued by the sector.

In view of the increasing interest of the construction sector for LEAN, several initiatives have also been taken on board: a Summer University about LEAN has been organised with the assistance of a professional organisation, and LEAN training sessions were programmed. A road show on the digitalisation of construction companies has also been set up in partnership with French-speaking professional organisations.

Many construction companies have again relied on our multidisciplinary team for personalised support in cost price calculation, financial analysis, planning, resource management, organisational management and quality.

Various information sessions have been organised to assist companies with the transition to the new version of the standard NBN EN ISO 9001 (2015).

The CRM system that was adopted in 2016 has been further developed and improved for the efficient follow-up of questions and contacts within the construction sector.

In 2017 a new version of ‘cpro’ was launched, the BBRI calculation module, now available fully on-line (Cloud). At the request of contractors and thanks to their feedback, this programme has been adapted further and several practical training courses have been organised in partnership with the professional organisations.

Our staff members were also actively involved in research projects such as ‘OPTICOST’, Urbanwise, etc.
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). In 2017, new channels for recovering construction waste were examined: Tradecowall continued, together with the BBRI, a research project relating to the recovery of aerated concrete waste.

**Belgian Construction Quality Society (BCQS)**
BCQS (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) is one of the leading Belgian certification bodies in the construction sector and has, thanks to this status, an accreditation from the BELAC office. This 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)**
BCDI (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 BCDI’s area of expertise. In recent years, the centre has collaborated on various national and European research projects as well as various conferences, forums and workshops.

**Centrum Duurzaam Bouwen (CeDuBo)**
Thanks to extension of its exhibition as well as the organisation of various study and training days, CeDuBo (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) and is the base for the Dubolimburg support platform (www.dubolimburg.be) and Duwolim (www.dubolimburg.be), a local body involved in eco-credits. Both centred on the systematic maintenance of buildings, the Sustainable Building Management Centre (www.gebouwbeheerder.be), a platform for building managers and the coordination of the Vlisog cluster constitute new initiatives (www.onderhoudvangebouwen.be).

**Organisatie voor Duurzame Energie (ODE Vlaanderen)**
As a coordination body for sustainable energy in Flanders for 20 years, ODE (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.questforquality.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) aims to build quality housing at affordable prices with an architecture that forms an enrichment for the environment in less evident places (e.g. town and city centres). Furthermore it also strives for an optimal technical quality, sustainability and town-planning coherence. Land owners – as well as public bodies and 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.

**Rough Structure and General Contractors**

**Chairman:** X. Braet  
**Engineers-leaders:** N. Huybrechts, B. Parmentier  
**Engineers TAC:** A. Van der Auwera, S. Vercauteren, J. Wijnants

**Heating and Climate Control**

**Chairman:** D. Peytier  
**Engineers-leaders:** C. Delmotte, P. Van den Bossche  
**Engineers TAC:** I. De Pot, V. Jadinon

**Painting, Flexible Wall and Floor Coverings**

**Chairman:** S. Magnee  
**Engineers-leaders:** E. Cailleux, E. Nguyen  
**Engineers TAC:** M. Ghislain, H. Vercoutere

**Hard Wall and Floors Coverings**

**Chairmen:** P. Goegebeur (until end of April), M. De Bes (from May)  
**Observers:** P. Holderick, T. Verstaen  
**Engineer-leader:** T. Vangheele  
**Engineers TAC:** L. Firket, J. Van den Bossche
Glazing

Chairman: A. Sanchez
Vice-chairman: J. Jacobs
Engineer-leader: V. Detremmerie
Engineers TAC: F. Caluwerts, G. De Raed, L. Lassoie

Sealing Works

Chairman: J. Coumans (until 7 March), R. Evens (since 7 March)
Engineers-leaders: E. Mahieu, E. Noirfalisse
Engineers TAC: D. De Bock, E. Mahieu

Roof Coverings

Chairman: G. Pierrard (until autumn), C. Vandermosten (since autumn)
Engineers-leaders: F. Dobbels, D. Langendries, C. Mees
Engineers TAC: L. Geerts, O. Vandooren

Sanitary and Industrial Plumbing, Gas Installations

Chairman: P. Deweer
Engineers-leaders: B. Bleys, K. De Cuypers
Engineers TAC: I. De Pot, V. Jadinon

Joinery

Chairman: W. Simoens
Engineers-leaders: V. Detremmerie, E. Kinnaert, Y. Martin
Engineer TAC: F. Caluwerts

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 (until October), D. Verhaegen (since November)
Engineers-leaders: I. Dirkx, 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: S. Eeckhout, D. Langendries, P. Wouters

BIM & ICT

Chairman: T. Vandenbergh
Engineers-leaders: B. Ingelaere, O. Vandooren
Engineers TAC: V. Jadimon, S. Vercauteren
The accounts department aims to give a true picture of the financial situation of the Institute and 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 2017, the BBRI had 88,031 members, including 62,295 one-men businesses. The graph below shows that this number has increased by 20.28 % 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 15.74 % 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 on average some 54 % of the total revenue. Personnel costs – the largest item in the expenditure – have fluctuated between 64 and 68 % 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 87% of the total budget is directly invested to the benefit of the sector, 13% 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 competitiveness of the sector, which is ultimately the founding mission of the Institute.
Staff

The BBRI endeavours to improve quality in construction and 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, administration, etc.).

The experience and pragmatism of some staff members, combined with the innovative vision of others makes 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 and smart construction, industrialisation and BIM & ICT, a further increase in personnel numbers is expected in the coming years.
During the meetings of the General Council of the BBRI on 25 April 2017 and 28 November 2017, the composition of the General Council and the Standing Committee was approved as follows:

**General Council**

**Chairman**
J. Willemen

**Vice-chairmen**
J. Coumans, P. Depreter, E. Devos

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

**Members appointed by the Confédération Construction**

**Members coopted by the Confédération Construction**
J. Bosschem, A. De Bie, E. Devos, B. Heiderscheidt, C. Peeters, B. Zanardini

**Members appointed by the Bouwunie**
G. Baert, J. Debuf, B. De Malsche, D. Hellemans, 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

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

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

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

**Members appointed by the workers’ organisations**
P. Cuppens, N. De Meyere, B. Hilami, J. Staal, J. Vandycke

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

**Company auditor**
HLB Dodémont-Van Impe & C°

**Standing Committee**

**Chairman**
J. Willemen

**Vice-chairmen**
J. Coumans, P. Depreter, E. Devos

**Members**

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

‘Projects’ database

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

AcustiCare (VLAIO - Flanders)

Ad usum navigantium (VLAIO - Flanders)

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 & Toitures (SA Water and roofs) (FPS Economy and NBN)

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

AN Élments 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)

ATISOL CaC – Système constructif membrane pare-vapeur et d’étanchéité à l’air couplée à une isolation pour les bâtiments neufs à ossature en bois et pour la rénovation par l’intérieur, en suivant la démarche Cradle to Cradle (Vapour barrier and airtight membrane construction system paired with insulation for new wood-frame structures and interior renovation, following the Cradle to Cradle initiative) (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)

BE REEL – Belgium Renovates for Energy Efficient Living (European Union)

BIM – Building Information Model (VLAIO - Flanders)

BIM4SUB – Développement d’une interface de collaboration basée sur l’open BIM en vue d’optimiser la collaboration avec la sous-traitance (Development of a cooperation interface based on open BIM with the aim of optimising the cooperation with subcontractors) (DG06 - Wallonia)

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

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

CAPIASOL – Développement d’une sous-couche acoustique à base de granulats de caoutchouc recyclé (Development of an acoustic under layer 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)

CLEARPOWER – Coatings for the stockage d’énergie issue de productions renouvelables (Coatings for energy storage from renewable sources) (SPW and European Union)

Cluster BIM (VLAIO - Flanders)

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

CoDyNi – Détermination in situ des performances énergétiques réelles des bâtiments à l’aide de tests de coheating dynamiques et de mesures non intrusives (On-site determination of the real energy performances of buildings using dynamic co-heating tests and non-intrusive measures) (FPS Economy and NBN)

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

Déchets de construction Bruxelles – Chantiers pilotes pour la Gestion des Déchets de construction à Bruxelles (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)

DurOBet – Duurzaam Ontwerpen van Beton: chloëde-indringing en carbonatie (Sustainable design of concrete: penetration of chlorides and carbonatation) (VLAIO - Flanders)

EcoRen – Energetische renovatie van Vlaamse representatieve 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 finitions des menuiseries extérieures en bois (Joinery maintenance – Outdoor joinery maintenance) (FPS Economy and NBN)

Erfgoedenergieloket – Gespecialiseerde energieconsulenten voor onroerend erfgoed (Heritage desk – Energy advisers specialising in heritage buildings) (Flanders)

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

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

Gela Via – Critères de résistances des bâtons de routes au gel/ dégel en présence de sels de dégivrage (Freeze/thaw resistance criteria for road concrete fine the presence of de-icing salt) (FPS Economy and NBN)

GEOCHAPES – Chapes isolantes en géopolymères (Geopolymer insulating screeds) (BEL and SME - Wallonia and Flanders)

GEOCONSTRUCT – Etat limite de service de structures géotechniques : Méthodes de déduction des paramètres de déformation du sol, de calcul des déformations de structures géotechniques (FPS Economy and NBN)
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)

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

**Groen licht Vlaanderen** – Samenwerken rond digitalisering van verlichting (Collaboration on light digitalisation) (VLAIO - Flanders)

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

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

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

**HETREFORT** – Développer des éléments préfabriqués de petites et moyennes dimensions pour construction bois composés de panneaux contrecollés CLT (Cross Laminated Timber) en hêtre muni d’une couche extérieure isolante et d’une couche intérieure en argile (Developing small and medium-sized prefabricated elements for wooden constructions made from CLT (Cross Laminated Timber) panels in beech with an external insulating layer and an internal clay layer) (SPW - Wallonia)

**Hygrimpact** – Impact des caractéristiques hygrothermiques des matériaux sur la performance thermique et le confort des bâtiments (Impact of hygrothermal properties of materials on the thermal performance and the comfort of buildings) (FPS Economy and NBN)

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

**In-Vent-Out** – Positionnement relatif des ouvertures d’amenée 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** – Integraal 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)

**LCC ECOOP** – Life Cycle Costs als economische succesfactor (Life cycle costs as a factor of economic success) (VLAIO - Flanders)

**LEAN plannen en LEAN bouwen met BIM als versterkende factor** (LEAN Planning and LEAN construction with BIM as a strengthening factor) (VLAIO - Flanders)

**Living Labs Brussels Retrofit** (FEDER & Innoviris - Brussels)

**Material world** – Sensorische ervaring en duurzaamheid als strategie bij materiaalkeuzes voor winkelinterieur (Sensoric experience and sustainability as a strategy when selecting materials for commercial interiors) (VLIO - Flanders)

**Modul’Air** – Module de façade préfabriqué pour la rénovation accélérée de l’enveloppe et des systèmes de ventilation (Prefabricated façade module for a faster renovation of the envelope and the ventilation systems) (Living Labs - Brussels)

**Mutati+** – Mutatiewoningen harmonieus geüpgraded 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)

**Off-Site Construction** (VLAIO - Flanders)

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

**P-RENEWAL** – Rénovation énergétique du bâti wallon d’avant-guerre à valeur patrimoniale (Energy renovation of prewar Walloon heritage buildings) (DG04 - Wallonia)

**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)

**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)

**Prio-Climat** – Priorisation et optimisation des stratégies de rénovation dans le logement social : vers un meilleurs climat intérieur (Prioritisation and optimisation of renovation strategies in social housing: towards a better indoor climate) (Living Labs - Brussels)

**PRO** – Prefab-Renovation-Opplossingen voor de tertiaire gebouwsector (Prefab-Renovation-Solutions for the tertiary building sector) (VLAIO - Flanders)

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

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

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

**REDMONEST** – Monitoring dynamic network for existing structures of concrete Cultural Patrimony (BELSPO and DG06)

**RenoFase** – Stappenplan voor een kwaliteitsvolle energetische renovatie (Structured action plan for high-quality and efficient energy renovation) (VLAIO - Flanders)

**Revêtement chape** – Pose de revêtement de sol résilients : maîtrise de l’humidité des chapes (Screed covering – Installation of resilient floor coverings: managing screed humidity) (FPS Economy and NBN)

**Sand2Sand** – Hoogwaardige toepassingen voor gerecycleerde zanden in beton (High-quality applications for recycled sands in concrete) (MIP - Flanders)

**SILENEVENT** – Voorspelbare stromingsaakkoestische prestaties van ventilatiesystemen in woongebouw (Expected acoustic-flow...
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:
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 better 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.