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One of the most striking changes is undoubtedly the drastic reduction in the environmental footprint of buildings.
One of the most striking changes is undoubtedly the drastic reduction in the environmental footprint of buildings while maintaining, or even increasing, the required quality level, whether with regard to watertightness, acoustical insulation, fire safety or accessibility. Thus the constructive elements composing our buildings are today optimised to achieve very high performance levels. The challenge then lies in putting them all together in the best possible way. The difficulties, whether they be technical or organisational, are therefore concentrated at the constructional node, because these zones are the site of numerous interactions between different specialised trades. Several studies and research projects, publications and training courses were devoted to this problematic in 2012.

The airtightness of buildings is certainly a very good example of the constructional nodes problematic. Various studies in progress led to the publication of a thematic issue of CSTC-Contact devoted exclusively to this subject. This was certainly one of the year’s high points: distributed in over 100,000 copies and downloaded nearly 10,000 times, this edition constitutes, for the companies and professionals of the sector, a first basic document that will be followed by the publication of a Technical Information Note and technical execution details. Moreover, the themes of airtightness and constructional nodes in general formed the object of several theoretical and practical training sessions organised in collaboration with actors in the field. Researchers and engineers have travelled all over the country to spread the good word.

It goes without saying that the future will bring us at least as many challenges and possibilities for development, and we must prepare ourselves so that we can successfully deal with them!

Jan Venstermans, ir.  
Director General

Jacques Gheysens, ir.  
Chairman
Faithful to its tradition, the BBRI strove during 2012 to support the professionals of the sector in order to improve their performances and deepen their knowledge.

The rational use of energy, the importance of constructional nodes as well as the integration of digital technologies within companies are all themes that we focused on and around which a series of events were organised, often in collaboration with the professional organisations. In total, no fewer than 711 training courses were given in 2012.

**The airtightness of buildings: 2012 was a pivotal year**

The regional regulations on the energy performances of buildings (EPB) are being reinforced every year. A good airtightness can improve the energy performance of a building significantly.

In the long run, this criterion will become inevitable and obligatory, similarly to what has been imposed for passive buildings. Such a change will not be without consequence for all practitioners, and especially for contractors.

Since the BBRI has been active on this subject for more than 20 years, it has accumulated solid expertise that, now more than ever, needs to be applied to the benefit of the sector.

In addition, we have been determined not to limit ourselves to purely theoretical aspects. Besides practice-based training courses, several demonstrations of pressurisation tests were conducted in existing buildings. We found that the sector has not underestimated the importance of the upcoming changes, since nearly 2,000 participants took a training course on the subject.

To this training strand are added the widespread distribution of the thematic issue of CSTC-Contact and over 2,500 downloads of a teaching video. But our efforts on this thematic don’t stop there: on the contrary, we are continuing, through research, to develop our knowledge, which will then form the object of future training and information campaigns.

**Information and communication technologies (ICT)**

Convinced of the necessity for optimising collaboration amongst the players, the BBRI has made the integration of digital technologies within companies one of its top priorities. The engineers of the ‘Management, Quality and Information Technologies’ Division therefore gave no fewer than 300 training courses over the past year.

The sessions devoted to the use of decentralised hard disks (cloud computing) undoubtedly opened up new possibilities to contractors looking for space to store their computer data.

**The importance of constructional nodes**

Following the success of the preceding seminars, the FEGC (Fédération des entrepreneurs généraux de la construction – Federation of General Construction Contractors) and the BBRI’s ‘Rough Structure’ Technical Committee took a fresh look at the subject of structures. This time the public could discover how to design and execute constructional nodes in buildings, while at the same time integrating other functionalities such as accessibility, fire safety, ... without neglecting the watertightness of the structure. These highly successful events made it possible to raise the awareness of nearly 450 participants about the profound upcoming changes.

**Impermeable concrete structures**

2012 was also the year for drawing attention to the design and the creation of impermeable concrete structures. Indeed, it is not enough to prescribe that a wall needs to be of a given thickness in order to make it impermeable — far from it! The dimensioning of the reinforcements and, above all, the management of the connections and feedthroughs are essential for limiting leakage rates.

These concepts, which are addressed in detail in the TIN 247, also formed the subject of a training course. In total, more than 500 participants were able to refine their knowledge on the subject.

**Sustainable construction and renovation**

The concept of sustainable construction and renovation is becoming omnipresent. And with good reason, since it integrates a large number of topical themes such as the environmental impact of buildings, acoustical comfort, accessibility, safety, health and the rational use of drinking water, while also covering an undeniable economic and social dimension.

There is no doubt that this theme has a ‘sustainable’ future and that we must progressively assimilate it into our building habits. We thus invested ourselves in several training courses on the subject.
The construction sector is constantly evolving in order to meet not only today’s challenges, but also those of future generations. Contractors must deal with new stakes, adapt the way they work and manage their company. In order to accompany them in these changes, the BBRI focuses on its three basic missions: scientific and technical research, innovation and development, as well as information, assistance and advice.

Collective research, innovation and development

Oriented by its Technical Committees, the research conducted by the Institute benefits all of its members and, more broadly, the society as a whole, which is directly affected by the topics addressed. These Committees bring together the various actors of the building sector in order to examine technical problems and discuss new opportunities. This approach makes it possible to orient the research projects and guarantee that they meet the real needs as experienced out in the field.

To carry out this mission successfully, the BBRI can rely on a network of partners in addition to its own infrastructures and qualified laboratories, which are recognised far beyond our borders. Amongst the tests conducted by the latter, more than 150 have been accredited by the BELAC office of the FPS ‘Economy’.

The Institute also contributes, with the support of the Regions, to encourage the development of innovative worksite processes via a range of services: Technological Advisory Services, technology cheques, VIS-Trajects, ... Another important source of innovation is the way the experience acquired on the worksite is fed back to the research world. This mechanism makes it possible to focus on widely-encountered problems for which new solutions must be developed, possibly with other industrial partners. It also frequently leads to proposing adaptations in the building principles and/or the coordination of the works in order to avoid difficulties.

Standardisation, patents, certification and approval

Via the activities of its Standards Antennas, the BBRI strives to guide Belgian companies, and primarily SMEs, through the maze of standards and regulations. We also strive to ensure that the greatest possible number of persons has access to essential normative documents. The Patents Unit informs companies about patented products and technologies as well as about how to go about developing and protecting their own inventions.

The BBRI is recognised as the sectorial operator in more than thirty standardisation committees responsible for developing draft standards and ensuring their follow-up. It thus enables building professionals to be represented in those committees and to make their voices heard from the very start of the decision-making process.

For many years, the Institute has been engaged in the approval of innovative products and systems as well as in the certification of companies. In 2012 a close symbiosis was created between the approval of products and systems, the certification of companies and the obtaining of certain premiums allocated by the Regions with a view to the energy rehabilitation of buildings. This principle makes it possible to even more solidly establish the quality of the sector, to the benefit of all its actors. The first successfully-conducted experiment concerns the post-insulation of hollow walls: a total of no fewer than 400 people have taken the training course. This generated the certification of 60 companies and the approval of 13 systems.

Information, training and support to companies

What would research and development be without information? It is evident that the fruits of several years of study must be evaluated in the field and, to do this, one must translate the information into a language that can be understood by as many people as possible.

Our communication strategy is composed of three strands. The first is the publication of technical documents. Nearly 1,200 pages were placed online in 2012 alone. The themes addressed varied widely and concerned all of the specialised trades and themes.

The second strand of our communication is based on personalised assistance. Companies have to become constantly more profitable and efficient; and to achieve this, they have at their disposal ever more sophisticated management and communication tools. New IT modules have thus been developed and made available to companies. Technical assistance properly speaking has certainly not been neglected, since it is necessary to help companies resolve problems they might encounter before, during or after the works.

The third and final strand, the direct training of professionals, logically complements the information communicated via publications, the website and the personalised assistance. In total, no fewer than 711 training courses were given by the BBRI staff during the past year.

SME portfolio: fast and easy support for innovation

Via the SME portfolio, entrepreneurs can receive each year up to 15,000 euros in subsidies in several areas. This way of working gives the SMEs the opportunity to expand their knowledge and their innovative skills. The BBRI can also assist the SMEs in the area of technology exploration.
The stability and resistance of infrastructures and superstructures are areas in which considerable efforts are being made in order to enable faster processing, render systems more reliable, increase their resistance, equip them with related properties that make them ‘intelligent’, but also to improve their energy performances within a context of sustainable development.

Furthermore, the networked activities within various Belgian and European associations — the GBMS (Groupement belge de mécanique des sols et de géotechnique), ABTUS (Association belge des techniques et de l’urbanisme souterrains), FABI (Fédération des associations francophones d’ingénieurs), AIV (Association de l’ingénierie du vent), EL-GIP (European Large Geotechnical Institutes Platform) — ensure that the Belgian Building Research Institute constitutes a privileged forum for the exchange of information and experiences.

Geotechnics

The results of the studies that have been conducted for several years now by the ‘Geotechnics’ and ‘Structures’ Divisions constitute a genuine goldmine of information for the drafting of the National Annexes to the Eurocodes 2 (Concrete Structures), 5 (Wood Structures) and 7 (Geotechnical Design), which are coordinated by the BBRI.

The programme of the ‘Geotechnics’ Division includes research on the following topics:

- the technique of ‘soil mix’ walls. Within the framework of this innovative research, subsidised by the IWT (the Flemish Government’s Agency for Innovation through Science and Technology), the vast experimental programme for characterising mixed materials was largely completed. Steps were taken with a view to developing a calculation method proper to this type of materials which takes into account the functional requirements (temporary, permanent, load-bearing functions, etc.). A BBRI-CUR commission was also launched in 2012 and it will draft a joint manual entitled ‘Design and implementation of soil mix walls’
- sheet piling and micropiles technology. These prenormative studies, carried out thanks to the financial support of the NBN and the FPS Economy, made it possible to continue drafting new Data Sheets on foundation techniques. Within the framework of these projects, the BBRI collaborated with the sector in order to be able to monitor real geotechnical structures. For example, measurements were performed on walls created by jet grouting in Anderlecht and during the building of the Waasland lock. It is important to note that the latter made it possible to develop and use new measurement techniques (on the basis of optical fibres, for example). The knowledge acquired thanks to these monitoring projects will serve to develop future standards
- energy problematics (revision of the European EPB Directive concerning buildings with nearly-zero energy consumption by 2021). In 2012, within the framework of the ‘Smart-Geotherm’ project, financed by the IWT, the ‘Geotechnics’ Division primarily analysed the current international situation and the information gathered concerning shallow geothermics, the parameters of thermal comfort, flexible thermal buffers, heat emission systems, thermal and electrical energy sources, etc. These were summarised and published in

Finally some clarity on impermeable concrete

Those of you who always wanted to know how to achieve an impermeable concrete but were afraid to ask will be especially satisfied: the TIN 247 ‘Design and execution of impermeable concrete structures’, on line at www.cstc.be, was published at the end of 2012.

From the single-family home, where cellars are increasingly being used as living space, to municipal water treatment plants, the TIN focuses on the principal use of reinforced concrete as an impermeable primary structural barrier (concrete cast on site or prefabricated elements). It will be followed next year by a Technical Report that will develop the calculation methods aimed at controlling crack formation.

Published at the initiative of the BBRI’s ‘Rough Structure’ Technical Committee, the new reference document is intended as a tool for designers and contractors, who must join forces to ensure the functionality of a structure and avoid the harmful consequences that notably occur when cracks develop.
various technical reports and/or reference works. Moreover, the Institute drew up a list of obstacles to the proper application of shallow geothermics. Most of this information is available on the project site www.smartgeotherm.be.

**Metal structures**

Speed of construction is an indisputable advantage of light structures. The metal solutions of this type of structure are demonstrating technical innovations thanks to increased quality combined with easy processing. The Technological Advisory Service 'MIDUC -- Innovative and sustainable metal solutions for construction' was initiated with the CRM in 2012 to accompany the SMEs in the effective use of these new technologies (hybrid steel-concrete floors, new surface coatings, solutions for better thermal and acoustical comfort, photovoltaic systems integrated into facades or roofs, etc.).

**Self-compacting concretes**

In 2012, the prenormative research on self-compacting concrete concentrated on particular areas of application. Specifically, the resistance to shear stresses and the bending behaviour of self-compacting fibre-reinforced concrete were studied. Prestressed self-compacting concrete also formed the object of an important testing programme on which three Belgian prefabricators collaborated. Within this framework, 24 prestressed beams were tested. These tests notably concerned adhesion length, prestressing losses, bending behaviour, ... This research also focused on aspects relating to the processing of self-compacting concrete whose results were published in CSTC-Contact (see publications).

**Lateral stability of multi-floor wooden buildings**

Few multi-floor buildings have yet seen the light of day in Belgium - and this despite many interesting examples having already been put up abroad. Within the framework of the 'Optimberquake' project, most of the testing campaign on floor diaphragms and connections was carried out in 2012. The tests on floor diaphragms made it possible to highlight the influence of the processing technique of wooden floors on resistance and rigidity when the latter are subject to cyclical horizontal stresses.

**Effects of wind and conditioning of the indoor climate**

Since 2009, the BBRI has put its experience concerning the effects of wind on structures at the service of the 'SIMBA' project (www.project-simba.eu) whose objective is to develop an approach for a digital simulation of the evolution of the climate inside a building. Thanks to the experimental rotating house, the 'Structures' Division developed a set of measurement data for certain scenarios relating to the indoor climate. These measurements (external pressure, local temperature, air flows, etc.) serve as benchmarks to validate the different digital simulation models used by the partners of the consortium.

**What's new in the laboratories?**

A new flexion testing station for large concrete elements was developed and installed in the big test hall of the 'Structures' Division. This made it possible to test, in collaboration with several prefabricators, prestressed beams made of ultra-high-resistance concrete within the framework of a project subsidised by the IWT. The 'Structures' laboratory now has six testing stations for creep in flexion to test the performances of fibre concretes (notably concretes based on synthetic fibres).

In 2012, the 'Geotechnics' laboratory performed, at regular intervals, characterisation tests on soils, granulates and mixtures of soil binding agent as well as various load tests on new piling systems. It also strove for improvements in monitoring applications based e.g. on optical fibre technology.

**Standardisation — ATG and BENOR quality declarations**

Since the BBRI is concerned to keep its members well-informed about the evolution of standards, but also to further incorporate their feedback into the Belgian normative documents, the Institute focused more than ever on coordinating the various standardisation committees for which it has been recognised as sectorial operator (SO):

- NBN E250 Eurocodes (in collaboration with SECO)
- NBN E288 Execution of special geotechnical works
- NBN GEO Geotechnical investigation & testing of geotechnical structures
- NBN E396 Earthworks (in collaboration with the CRR).

The Belgian Building Research Institute is also actively involved in other national or European committees: preparation of the National Annexes of various Eurocodes, and of a document of National Application for the new standard on the execution of concrete structures, followed by the standardisation of infrastructural and structural products in collaboration with PROBETON, and the participation in the drafting of Technical Approvals (ATG) relating to buildings and civil engineering.

Finally, we would like to draw attention to the fact that the 'Eurocodes' Standards Antenna notably made a number of free calculation modules available on line, on its website www.normes.be/eurocodes, one those modules makes it possible to determine wind pressures (WInt™) and the choice of the ‘roughness class’ on the basis of a new calculation software (CInt™), see www.cstc.be/gb/cint.

**Publications of the BBRI ‘Geotechnics and Structures’**

2012 was marked by the search for solutions to problems that are frequently encountered on work sites, as attested to by studies on the delamination of industrial floors and the frost resistance of concrete. Naturally, innovation and the environment two themes that cannot be ignored in the construction sector have not been forgotten either.

Most of the projects are conducted in collaboration with other research centres or universities. Below we review a number of current topics.

The concerns of contractors are at the heart of our research

Delamination of concrete industrial floors
In recent years, the BBRI's 'Technical Advice' Division has been confronted with a large number of cases regarding the deterioration of concrete industrial floors. This involves a detachment of the upper layer (delamination) of concrete floors whose finishing is performed mechanically, sometimes associated with inadequate wear resistances. The research initiated at the BBRI continued in 2012. Delamination can be caused by bleed water or by air bubbles trapped under a surface of polished and denser mortar. If the concrete is viscous as a result e.g. of a high filler content (cement and additives) or an excess of fine sand, the air bubbles and the water will have more difficulty to escape. The air content of the concrete also plays an important role: concretes containing more than 3 % of air are sensitive to delamination. The timing of the execution of the finishing is also of crucial importance. However, slow setting or crusting of the concrete makes it difficult to determine the optimal moment for the finishing.

These findings are currently being implemented within the framework of the works on revising the TIN 204 on cement-based industrial floors. Specific recommendations for the composition of concretes that are resistant to delamination, the verification of the quality of the delivered concrete and the performance of surface finishing operations (floating, levelling) will be given. Since this problem affects the whole of Europe, a RILEM committee on this thematic will be established in 2013.

The frost resistance of concrete
After the corrosion of reinforcements, frost damage is the second major cause of deterioration of concrete structures. The research in progress mainly aims to establish a classification of resistance against the frost/thaw cycles of structural concretes manufactured out of different types of cement on the Belgian market. Two types of operating methods are considered : firstly, the measurement of the losses of mass due to scaling on the surface of the concrete due to de-icing salts (comparison between the 'Slab-Test' of the CEN/TS 12390-9 and the ISO-DIS 4846-2 method, which is more widely used in Belgium) and, secondly, the measurement of the losses of mechanical properties as a function of the number of freeze/thaw cycles (CEN/TR 15177). Additional prescriptions and performance criteria will be formulated for the curing and the composition of concrete that is subject to severe frost degradation.

Innovation, a key element for the development of the construction sector
In 2012, the BBRI continued its research efforts on the so-called ‘special concretes’, such as metal or synthetic fibre-reinforced concrete, self-compacting concrete (SCC), ultra-high performance concrete (UHPC) as well as exposed or decorative concrete. The works in progress are seeking to provide recommendations for both the design and the implementation of these new types of concrete.

Ultra-high performance concrete (UHPC)
Thanks to an extensive mastery of the concrete technology, the BBRI has developed several formulations of UHPC based on materials available in Belgium. These materials are characterised by an excellent durability and a compression strength in the order of 150 N/mm², i.e. 4 to 5 times greater than ordinary concrete. The ductility and bending strength of the concrete are improved by the addition of metal microfibres. With regard to durability, the UHPC demonstrates exceptional performances thanks to its very low porosity, which prevents the intrusion of aggressive substances.

The project on the UHPC's was concluded at the end of 2012 with a collaboration with FEBELCEM, Infobeton.be, the GBB and the BBRI seek to propel concrete technology into the digital age thanks to the development of didactic tools (learning platforms, ‘e-learning’ modules, etc.) including more than twenty webinars that are freely accessible online (www.betonica.be), as well as thanks to the creation of a genuine digital library dedicated to concrete. The website will be regularly updated with publications, presentations of seminars, short videos, as well as an “FAQ” section.

Betonic® : THE concrete information centre

By creating the “Betonic®” project, FEBELCEM, Infobeton.be, the GBB and the BBRI seek to propel concrete technology into the digital age thanks to the development of didactic tools (learning platforms, ‘e-learning’ modules, etc.) including more than twenty webinars that are freely accessible online (www.betonica.be), as well as thanks to the creation of a genuine digital library dedicated to concrete. The website will be regularly updated with publications, presentations of seminars, short videos, as well as an “FAQ” section.
prefabrication factories. In order to complete the research works in the laboratory and to evaluate the potential of this new concrete for the Belgian market, a final study consisted in the creation of prestressed beams in UHPC on in industrial scale with a span of nearly 10 metres. An extensive testing campaign made it possible to characterise the structural behaviour of these UHPC elements, with a view to a comparison with the calculation rules of Eurocode 2. The excellent durability of UHPC was also confirmed by measurements of porosity and resistance to carbonation and chlorides.

**Exposed or decorative concrete**

Concrete now offers the possibility of meeting both structural and aesthetic requirements. The architect can cast the concrete as he wishes, play with colours, forms, volumes, light, ... Demands for exposed concrete structures (cast on site) or decorative ones (prefabricated) are constantly on the rise, as indicated by numerous projects carried out in recent years. At present, however, there are no established aesthetic criteria that could be objectively evaluated with regard to the texture of the concrete, air bubbles, nuances of tone and geometrical tolerances. In addition, the description of tolerances. In addition, the description of realistic requirements in the specifications and various difficulties encountered during the execution, are provoking increasingly frequent discussions about the quality of the final result. To remedy this, the BBRI is actively participating in the preparation of the publication of a new TIN and a Belgian standard on exposed concrete.

**The environment as an incentive for innovation**

On the environmental level, the laboratory is continuing its study of refractory concretes that do not require prior baking, which saves substantial amounts of energy. The use of construction wastes and industrial by-products in concrete also constitutes one of the BBRI’s major interests. Within this framework, the sector is implementing constructive solutions in order to meet the current challenges of sustainable construction. For example, the ‘CemCalc’ project focuses on the development of new ternary cements with a reduced clinker content for the preparation of durable and environmentally-friendly concretes. The initial promising results should lead to these cements being considered in future standardisation works.

**What’s new on the equipment front?**

The Concrete Technology laboratory owns a wide range of equipment that can create and preserve samples of mortar and concrete, as well as characterise them in both green and hardened condition. Recently, the laboratory acquired equipment making it possible to quantify the air content in the mass of the hardened concrete by analysing images on the microscopic level. This tool is used for identifying a posteriori the cause of delamination of concrete industrial floors.

**Standards Antenna**

**Concretes, mortars and granulates**

Several years ago, the BBRI set up a series of Standards Antennas (SA) intended to raise awareness and inform SMEs about the national and European standards that either already exist or are under preparation. 2012 was marked by the publication of two essential standards for any provider or user of concrete in Belgium. Firstly, the SA worked on drafting the National Annex (prNBN B 15-400) to the new European standard NBN EN 13670 ‘Execution of concrete structures’, with the support of a working group composed of contractors, SECO, SPW, MOW and the concrete and concrete products federations. Based on the state-of-the-art practices in our country, this annex notably contains requirements for curing concrete and casting concrete the winter. The winter courses organised by the BBRI in 2012 were devoted to this thematic. In addition, a revision of the standard NBN B 15-001, the national supplement to the standard NBN EN 206-1, has just been published. The most important changes were announced on the website (www.normes.be) which was complemented with several articles and informational sections in 2012.

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**Publications of the BBRI ‘Concrete and Concrete Structures’**

With regard to masonry, our efforts have concentrated, firstly, on drafting and publishing the TIN 246 relating to the post-insulation of hollow walls by filling up the cavity, and, secondly, on the laboratory evaluation of the mechanical behaviour of masonry fasteners in the context of the EPB regulation (design and execution). Behaviour in response to freeze/thaw cycles was also an important subject in 2012, since the research programme conducted in recent years made it possible to formulate specific proposals for submission to the Belgian and European standardisation bodies.

In the specific area of facades, the research also resulted in proposals to the standardisation committees that are establishing the future standards on ETICS’s. The revision of the TIN 209 on this specific subject made rapid progress. Moreover, numerous research actions were undertaken in order to work out specifications and recommendations for the implementation of hard coatings glued on site directly onto external insulation.

These actions, which were conducted at the request of the ‘Rough Structure’ and ‘Plastering and Jointing’ Technical Committees, concern research, development, standardisation and quality certificates as well as direct services to companies via technical advice, the ultimate objective always being to provide objective and verified information to the contractors.

Post-insulation of hollow walls
The new TIN 246, published at the initiative of the ‘Plastering and Jointing’ Technical Committee, seeks to be a best practice code and proposes recommendations to contractors responsible for the post-insulation of hollow walls by filling up the cavity. This reference text consists of the following chapters: architectonic conditions and constructive aspects, prior inspection of the building, insulating materials, processing instructions and monitoring of the works. This TIN was drafted on the basis of the STS 71.1 which contains all of the specifications to which the materials must comply.

Impact of the EPB on masonry
Several actions were taken under the aegis of the ‘Rough Structure’ Technical Committee as a result of questions from the sector. A ‘Details’ working group was created in order to update constructive details. An experimental programme was also conducted at the BBRI as a part of a dissertation in order to evaluate the mechanical behaviour of the fasteners linking the two walls of the double wall (hollow wall — cavity wall). These actions are ongoing and will form the object of future publications.

Facade masonry
The BBRI is continuing its activities aimed at giving facing walls the desired effectiveness regarding durability and appearance. The frost resistance of facade bricks formed the object of a study conducted in collaboration with the CRIB (Centre de recherche de l’industrie belge de la céramique - the Research Centre of the Belgian Ceramics Industry).

This project clearly demonstrates that the tried-and-tested Belgian methodology (which has been ratified in addendum 2 of the standard NBN B 27-009) is stricter than the one currently being proposed on the European level (CEN TS 772-22). Within the framework of the second research biennial, the BBRI and the CRIBC worked together to optimise the European method and to propose amendments to establish a harmonised method recognised throughout Europe that is both tried-and-tested and sufficiently strict.

We therefore believe that we can still recommend that the national prescriptions should continue to be favoured and that one should use bricks that have been tested according to the ‘Belgian’ method, i.e. accompanied by a technical data sheet clearly stating ‘high resistance to frost’ or ‘normal resistance to frost’ according to the standard NBN B 27-009/A2. This recommendation

Standards Antennas

‘Eurocodes’, ‘Concretes, Mortars and Granulates’ and ‘Finishing’

The transfer of information gathered through the monitoring of European standardisation in the field of masonry and facades is handled by the ‘Eurocodes’, ‘Concretes, Mortars and Granulates’ and ‘Finishing’ Standards Antennas, all three subsidised by the Federal Public Service Economy. Thanks to the permanent contact they maintain with the various standardisation committees and institutes, on the one hand, and the building contractors, on the other, these Standards Antennas are able to explore and define the needs of the Belgian SMEs from the sector and fulfil those needs in the best possible way.
This Advisory Service, supported by the Walloon Region via financing from the DG06, was set up to respond to the growing demand for renovation works and to support small and medium-sized businesses struggling with the rapid evolution of products, techniques and legislations. It is aimed at all Walloon companies in the construction sector, i.e. both building contractors and upstream actors. The Advisory Service also makes it possible to accompany the optimisation of products and systems through laboratory tests or studies, for which the companies can benefit from technological cheques issued by the AST. In addition, the advisors help these SMEs to work out research programmes within the framework of different calls of the Walloon Region and regularly participate actively in events.

was sent to the BCCA (Belgian Construction Certification Association) which is applying it within the framework of the certification of bricks (BENOR mark).

**Finishing on external insulation**
In the area of plasters on external insulation (External Thermal Insulation Composite Systems (ETICS) with Rendering), the BBRI continues to conduct actions focused both on research and support to information or training and on laboratory tests in favour of the European Technical Approvals (ETAs issued by the EOTA) and Belgian Technical Approvals (ATGs issued by the UBAtc). They are supplemented by direct services to contractors who ask the BBRI for technical advice as well as by information sessions and courses. These actions as well as the various articles published recently are serving as a basis for the current revision of the Tn 209 on this specific subject.

Made of hard coatings glued on site onto external insulation (terracotta bricks, ceramic tiles, natural stone or agglomerated stone), these composite systems derived from plasters on insulation are increasingly common and raise questions from the entire construction sector. Research actions were quickly launched and still continue thanks to the implementation of a prenormative project ‘Glueing hard finishings on thermal insulation : performance criteria for the selection of materials, durability of the system and use prescriptions (‘Vêtures’).

This technique, which is very interesting when the aesthetic choices of the owner or urban-planning constraints require it, meets the great interest around thermal insulation applied on the exterior of existing buildings and new structures, while preserving the aesthetic appearance of facade masonries.

These building techniques, whose monitoring is performed under the aegis of the ‘Plastering and Jointing’ Technical Committee, will benefit from the BBRI’s full attention, since new actions devoted to innovative systems (‘InnovETICS’ research in the Brussels-Capital Region) and to dissemination (‘key’ technology transfer ‘Gevisol-ETICS’ in the Flemish Region) were launched parallel to the actions in progress (‘Vêtures’ research — FPS Economy and Technological Advisory Service ‘RENO-2D’).

**Structural and Finishing Materials laboratory**
Parallel to the above-mentioned actions, the laboratories of the BBRI are conducting tests at the direct request of professionals from the sector, with a view to obtaining European and Belgian Technical Approvals as well as campaigns of on-site or laboratory tests as a result of pathology cases or in order to optimise construction products and systems.

The BBRI has great expertise in evaluating the durability of construction materials, especially against climatic agents. This expertise, acquired for the benefit of contractors, was constituted thanks to stations for accelerated ageing that make it possible to assess the longevity of all kinds of construction materials.

These laboratory tests are performed within the framework of technical advice, research projects, Technical Approvals and CE marking.

Besides the experimental research and study activities, our staff participates in the standardisation works of:
- the NBN mirror committee CEN CT 250 C 6 ‘Eurocode 6. Masonry’ within which European standardisation is monitored and the national annexes of Eurocode 6 are drafted
- the NBN mirror committee CEN CT 125 C 64 ‘Masonry products’.

The BBRI is also closely following the activities related to the ATG and BENOR Quality Declarations within the BENOR Brand Committee and the BENC consulting boards of the BCCA (bricks), CRIC (masonry mortars) and PROBETON (concrete, silico-calcarous and cellular concrete blocks). External plasterers are also subject to the standardisation works of:
- the NBN mirror committee CEN CT 88 WG18 ‘ETICS’, within which European standardisation is monitored and the Belgian position on the development of standards on the subject is established
- the EOTA concerning the CE marking of the ETICS via the UBAtc.

**Publications of the BBRI ‘Masonry and Facades’**

High energy-performance construction is more than ever the magic word in both new construction and renovation. To achieve this objective, a careful choice of the materials composing the roof and meticulous implementation are indispensable. This problematic, combined with a desire to build strong and durable structures, is at the core of our activities in the roofing area.

Under the aegis of the Technical Committees and with the support of the laboratories, the BBRI’s engineers and technicians are carrying out a large number of actions that make it possible to support roofing professionals in the construction of high-performance solutions.

Activities conducted in the ‘Sealing Works’ TC

Connecting structures of flat roofs
The TIN 244 ‘Connecting structures of flat roofs, general principles’ was published in 2012 and replaces the TIN 191, which was essentially devoted to bituminous membranes. Since then, new materials and techniques have been developed and new requirements have been imposed on buildings (thermal insulation and airtightness of the envelope). This TIN thus addresses both the new materials and the new performances that must be attained. It is available in both paper and digital versions. The online version will be supplemented by sheets on the performance details. These sheets will be broken down according to the four most common families of sealing membranes.

Compact roofs
In so-called ‘compact’ flat roofs, the insulation is placed between the structural elements.

Resistance of flat roofs to wind action
The research concerning the evaluation of the effects of wind on flat roofs was completed at the end of 2012. It established the laboratory and on-site test procedures for membranes that are glued, welded or fastened mechanically. The on-site tests made it possible to validate and monitor the installation on the worksite, as well as to assess the state of impermeability for the renovation of a roof or for the installation of a supplementary layer.

Mechanical fixation of flat roof sealing systems
Since the document of national application relating to the Eurocode ‘Wind’ had undergone a series of modifications, the TIN 239 ‘Mechanical fixation of insulations and sealings on profiled steel sheets’ had to follow suit, since the latter is based, for the wind calculations, on the former Belgian standard and on the European standard NBN EN 1991-1-4. A corrective was therefore published in July 2012. This three-page supplement also made it possible to clarify certain points of the TIN.

Roof car parks
The TIN currently being drafted is composed of two volumes: the first part concerns the design of roof car parks and the stresses to which they are subjected; the second will be devoted to the constructive details, access ramps, maintenance and renovation considerations, ...

The first volume is being finalised and will be published in 2013. An article describing the general principles of design and implementation of this type of roof was already published in 2012.

Activities conducted in the ‘Roof Coverings’ TC

Insulation of sloped roofs
Several working group meetings were held in 2012 to finalise the drafting of the TIN devoted to the insulation of inclined roofs. The latter primarily concerns the design and the proper selection of the elements of the ‘roof complex’ (vapour barrier, insulation, sub-roof, etc.). It is being drafted in consul-

Technological Advisory Service

‘Eco-construction and sustainable development’ in the Brussels-Capital Region

Conducted in collaboration with the Construction Confederation of Brussels-Capital and financed by Innoviris, this Advisory Service is designed to support building companies in introducing innovative techniques in different themes, including energy in buildings and acoustical comfort, the use of sustainable and healthy materials, sustainable wooden constructions and green roofs.
The first stage of this project concerned the drafting of information sheets describing the performances required from insulating materials in order to be implemented in flat and sloped roofs. These sheets help orient the manufacturers in the development of innovative products that can be used for the insulation of roofs.

**Eracobuild STAR**

Launched in 2012, the European project ‘Eracobuild STAR’ is being led by the BBRI in collaboration with the ‘Passive House’ Platform and partners from Sweden and the United Kingdom.

Its objective is the development of sheets of sustainable execution details which can be applied within the renovation context. This project concentrates notably on thermal and acoustical insulation.

**Laboratory tests**

Several BBRI laboratories are participating in the assessment of the performances of roof complexes. These tests make it possible to characterise the roofing materials (slates, tiles, metal strips, etc.), the membranes, the insulations, but also the various additional products (domes, roof brackets, etc.) according to the European standards and the technical approval guidelines.

The laboratories also contribute to innovation through direct collaborations with companies specialised in the roofing field.

The tests also make it possible to evaluate and improve the performances and characteristics of new products: liquid impermeability products, the insulation/roof sealing complex, flexible, semi-rigid or rigid photovoltaic panels fixed in a particular way, domes with solar functions, etc.

**Standardisation activities**

Besides their activities linked to the UBAtc for granting Belgian and European Technical Approvals, the BBRI staff also participates in the BENOR consulting boards.

In addition, the BBRI sits in various working groups and European Technical Committees, as well as in the corresponding Belgian mirror committees: it chairs and provides the secretariat services for the CEN TC 128 ‘Roof covering products for discontinuous laying and siding products’ and is sectorial operator of several national standardisation committees (follow-up of CEN CT 088 'Thermal insulating materials and products, 128 and 254 'Flexible sheets for waterproofing').

**Standards Antennas**

Seven Standards Antennas provide roofing professionals with the necessary normative support. With respect to fire prevention, 2012 was marked by the modification of the Royal Decree by integrating new requirements for green roofs. Within this context, an article was published at the end of 2011 and training courses were organised in 2012. Furthermore the ‘H₂O and Roofs’ Standards Antenna, carried out numerous actions for the benefit of SMEs.
Scientific research and technical innovations were at the base of the activities in the field of joinery and glazing in 2012. These applied research projects and developments are shared with the sector concerned by means of direct support to the companies, such as the Technological Advisory Services, the Standards Antennas and other forms of technical advice.

In order to adapt themselves to the new techniques and requirements (or even anticipating them), the construction companies need the collective research and the personalised supports offered by the BBRI now more than ever. The evolutions with regard to thermal insulation of new buildings, energy renovations of facades, acaustical insulation, durability of wooden structures, fire performances, resistance to breaking and entering, aesthetics, ... have a direct influence on the construction companies in the area of joinery and glazing.

Based on numerous works such as applied research, developments of technical innovations, Technological Advisory Services, Standards Antennas and technical advice, the BBRI was especially proactive in all of these subjects and could, with its publications and training courses, make the sector benefit directly from these works.

Applied research and the development of technological innovations

Performances of wooden parquets on top of floor heating systems

The different pathology cases relating to parquet floors laid on top of floor heating systems and the increasing popularity of this type of heating prompted the BBRI to continue its research in the area of wooden parquets. The above-mentioned research, initiated and monitored by professionals from the sector via the ‘Joinery’ Technical Committee and its ‘Parquets’ working group, made it possible to characterise the compatibility between the applied wooden floor coverings and the floor heating systems.

Performances and durability of the junction with the rough structure of windows

Windows and their junctions with the rough structure have a substantial impact on the performances of the building’s envelope. Given that these components have a long expected service life, the durability of their performances is just as essential. The objective of this prenormative research, which continued in 2012, is to develop a normative framework making it possible to assess the performances and the durability of the junctions of the outdoor joineries and their junctions with the building’s envelope.

Durability of the performances of more energy-efficient joined elements

It is of paramount importance to be able to guarantee the durability of the properties of more energy-efficient joineries. The goal of this research, continued in 2012 in direct collaboration with Belgian joineries, is to design and develop optimised joined elements with improved energy efficiency offering reliable and long-lasting performances. The results of the project will be disseminated to the sector by establishing good practice rules for the design and the execution of such joineries, in order to guarantee the durability of their performances.

Performance and durability of the airtightness of products, walls and junctions

The airtightness of a building represents a major challenge for all of the specialised trades. These days it has become an almost inevitable performance. Still, one has to ensure that it maintains its high performance over the years, and that is precisely the goal of this research : to evaluate and improve the durability of the airtightness of buildings. Tests quantifying the airtightness performances of different materials and of walls (including wood-frame walls) were conducted before and after ageing. This research will conclude in 2013 and will produce interesting elements that will ideally be transferred to the sector via a TIN which is currently being drafted.

Research on technological innovations in the area of wooden structures

Wooden structures represent a high-performance building system that is really evolving. Professionals and private individuals are showing great interest in such structures and hold them in high esteem, both for tertiary and residential (even multi-residence) buildings. The Institute is involved via several research studies in the area, notably : research on the acaustical performances of wooden structures (see ‘Acoustical comfort’ section, p. 26), research on the stability of wooden buildings vis-à-vis horizontal actions (see ‘Geotechnics and Structures’ section, p. 8), prenormative research on the deformation of insulations (notably in wood-frame structures) and the development of a construction panel consisting of insulating structural wood, making use of indigenous tree species. In addition, the BBRI participates as the
Technological Advisory Services

‘Durable wooden structures’ and ‘Sustainable renovation and construction’

The Technological Advisory Service ‘Durable wooden structures’ subsidised by the Walloon Region has as its principal objective to assist the sector to assimilate and utilise new products and emerging technologies. It focuses on wooden materials (panels, etc.), elements of wooden structures (joined wooden facade elements, indoor joineries, wooden parquets, etc.) and wooden structures. The laboratories ‘Facade and roof elements’, ‘Wood and coating’, ‘Acoustics’ and ‘Structures’ strive to support building professionals, and more particularly joiners, in the development of new products and the evaluation of their essential performances.

The Technological Advisory Service ‘Sustainable renovation and construction’ is intended to disseminate relevant technical information to Walloon companies concerned by sustainable development in such a way as to encourage innovation. The laboratory ‘Facade and roof elements’ focused on aspects relating to the development of processes, materials and equipment seeking to optimise the energy performances of buildings with regard to joineries, glazings, roofs, ... and to safety aspects (joineries, glazings, guardrails, etc.).

Valorisation to the sector and support to companies

The scientific and technical research and studies conducted by the Institute need to be valorised directly by the construction sector. This involves not only training courses and publications, such as the TIN, but also the activities of the Technological Advisory Services and the Standards Antennas — without of course forgetting the numerous pieces of technical advice (see ‘Technical Assistance’ section, p. 30) furnished to building professionals. This advice is based on the results of research and laboratory tests, thanks to the excellent collaboration of the personnel working within the Institute's different departments.

Everything is coordinated by the ‘Joinery’ and ‘Glazing’ Technical Committees, which ensure that the BBRI's activities match the needs that are being perceived in the world of practice.

Technological Advisory Services

The Technological Advisory Services enable construction companies, in particular the SMEs, to stay informed of the development of new techniques and to obtain concrete technical assistance in the development of innovative ideas.

The various possibilities of financial aids given to SMEs in connection with innovation were used within the framework of specific development tests performed by the laboratories.

Standards Antennas and Standardisation

The Standards Antennas constitute an excellent way of valorising the results of prescriptive studies with a view to encouraging innovation within companies. The ‘Manual and Motorised Facade Elements’ Standards Antenna continued its activities of awareness-raising and normative and technical support to the sector during the past year. The ‘Finishing’ Standards Antenna focused especially on wooden floor coverings, light partitions, suspended ceilings and raised floors, all important subjects for joiners. Other Standards Antennas with a more horizontal scope (‘Fire Prevention’, ‘Acoustics’, ‘Energy and Indoor Climate) provide the normative support necessary for joiners and glaziers.

The studies and deliveries of ATGs concerning windows, coated glasses, joinery profiles, mastics and facade coverings continued in 2012.

Publications and training courses

Training courses were organised — both at our own premises and throughout the country — that addressed a wide range of subjects : wood-frame structures, renovations of existing windows, wood parquet, sidings, external joinery (windows), preservation of wood, fire-resistant perforation of walls, personal safety, etc.

New publications were also made available to the sector. They were particularly numerous in the field of joinery and glazing in 2012 and covered the following topics : renovation of existing windows, glazing and thermal breakage, acoustics and wooden parquet, consequences of wooden joineries without finishing, pathology of wooden terraces, processing of shop windows, air-tightness of wooden structures, installation of external joinery, instructions prior to the installation of fire-resistant doors, ...

In addition, the BBRI continued to work, in collaboration with its Technical Committees and the sector concerned, on the drafting of Technical Information Notes in the area : revision of the TIN 218 ‘Wooden floor coverings : floors, parquets and veneer floor coverings' and of the TIN 188 ‘The installation of outdoor joineries. Furthermore a TIN on feedthroughs in fire-resistant walls, a TIN relating to particular glass structures and a Technical Information Note on curtain walls and the risk of fire propagation are under preparation.

Publications of the BBRI ‘Joinery and Glazing’

The finishing sector is represented by four Technical Committees: ‘Plastering and Jointing’, ‘Hard Wall and Floor Coverings’, ‘Paintwork, Flexible Wall and Floor Coverings’ and ‘Stone and Marble’. The ‘Joinery’ Technical Committee also contributes to what relates to light partitions and suspended ceilings.

‘Finishing’ Standards Antenna
Set up in 2010 by the BBRI with the support of the FPS Economy, the ‘Finishing’ Standards Antenna is at the sector’s disposal for all information concerning European standardisation with respect to the finishing of walls and floors (paintworks, internal and external plastering systems, light partitions, suspended ceilings and hard coverings). In addition, the SA provides technical assistance enabling professionals to better understand and make better use of these standards (www.normes.be).

Ceramic tiles and tiling adhesives
With regard to the dissemination of information, the principal activity placed under the aegis of the ‘Hard Wall and Floor Coverings’ and ‘Stone and Marble’ Technical Committees was the continued drafting of the TIN on the subject of external floor coverings. Thanks to a dynamic working group, this work is advancing rapidly and the document may be finalised by the end of 2013.

In 2012, the prenormative research financed by the FPS Economy concerning hard coverings adhesively bonded to facade insulation yielded its first results. It will contribute to the development of this technique which, for both technical and aesthetic reasons, is flourishing. The objective is to expand our knowledge about the climate-related durability, to establish a normative framework unifying the specifications of the products (selection criteria) and installations (hygrothermal and mechanical behaviour) and to define the rules of use as well as the execution recommendations.

The ‘Tetra’ project, subsidised by the IWT and conducted by the HoGent and the UGent in collaboration with the BBRI, concluded at the end of August 2012. It sought to identify the optimal time scheme for installing coverings on cement-based supports. The results were presented to the ‘Hard Wall and Floor Coverings’ Technical Committee, which was able to measure the complexity of the phenomena of drying and curling of screeds and to derive from this certain practical recommendations.

Parallel to carrying out research projects, the ‘Structural and Finishing Materials’ laboratory continues to perform large numbers of tests for various producers seeking the classification and CE marking of their products. This laboratory is accredited by BELAC for performing adhesion tests on adhesives and adhesive mortars for tiling.

With regard to standardisation, the engineers of the BBRI serve as the relay between the CEN TC 67, on the one hand, and the Belgian federation of tilers and mosaicists (FECAMO) and the importers, on the other hand. They also act as sectorial operator for the standardisation of screeds (CEN TC 303), as well as for the important problem of the slipperiness of floor coverings (CEN TC 339).

Natural stone
In terms of research, the ‘Stone and Marble’ Technical Committee wishes to deepen its knowledge both from the perspective of the technical parameters of the material and its processing, and with regard to the aesthetic aspects, which are a frequent source of disputes with owners.

Within this framework and in order to remedy the various shortcomings that exist in the standards and technical reference documents, the BBRI continued in 2012 the prenormative research on measuring the appearance of construction materials and on the associated acceptable variations. This study, conducted in collaboration with the CoRI, the KU Leuven and the ULg, is being monitored by a working group composed of representatives from the different Technical Committees concerned by the problematic.

In addition to the active participation of the ‘Stone and Marble’ Committee in the ‘External floors’ working group, one can highlight amongst the different publications of 2012 the online launch of more than twenty additional technical data sheets within the framework of the TIN 228 ‘Natural stones’. This considerably strengthens the content of the note, which, with more than 50,000 annual consultations on the BBRI internet site, has already became the reference document of the sector.

Furthermore (and as already mentioned), the BBRI is continuing its activities as sectorial operator of standardisation with the committee CEN TC 246 and remains very active in this area.

Flexible floor coverings and paints
The working group responsible for revising the TIN 159 ‘Best practice code for paintworks’ completed its work in 2012. Many changes were integrated into the note. Greater importance was given to paint selection criteria. These take into account the support and the desired surface finish, but also the previous layers of paint. Compatibility tables between paints were established. Easy tests that can be performed on the worksite are described in this document so as to help painters identify these earlier types of paints.
Summary tables containing the stages necessary to obtain a desired surface finish in function of the type of support were also incorporated. Generally, three degrees of execution (basic finishing, standard finishing, high-quality finishing) are provided. These tables will make it possible to clarify the scope of the work expected from the painter. Finally, an entire section is devoted to the description of the increasingly strict labels and environmental requirements for paints.

The ‘Paints, flexible coverings for walls and floors’ Technical Committee also wished to revise the part of the former TIN devoted to textile coverings. A bibliographical analysis and initial contacts with manufacturers took place in order to permit the working group created for this purpose to begin drafting this new document in 2013.

Given the growing importance of the ‘wood’ and ‘paints’ activities in the construction sector, a new laboratory was created at the BBRI in 2012. Besides the tests on protective coverings of concretes (aptitude tests for their capacity to bridge cracks, for example), this laboratory set up testing stations notably making it possible to characterise the permeability of paints and to characterise their durability on wooden supports.

**Interior coatings**

Two important studies demanded by the ‘Plastering and Jointing’ Technical Committee were performed in 2012. The first study concerns the development of realistic technical details for plastering connections where the continuity of airtightness must be ensured. These details, validated by a series of laboratory tests intended to verify the adhesion of the plastering to its support in the presence of a membrane, will be sent to the ‘Airtightness’ working group of the ‘Hygrothermy’ TC.

The second study that also required numerous laboratory tests concerns the adhesion of interior coatings to masonry block supports, notably in the presence of efflorescences. The conclusions of this study will form the object of an upcoming publication and will also serve to propose amendments to the standards concerned.

In addition, the LMA laboratory of the BBRI tested on behalf of different manufacturers innovative coating systems with diverse functionalities (floor coverings, impermeability in wet rooms, etc.).

With regard to standardisation, the BBRI continued its activities as sectoral operator for the committee NBN E 241 and participated in the revision of the ATG technical approvals for plaster coatings.

**Light partitions, suspended ceilings and raised floors**

In the wake of the publication of the TINs 230, 232 and 233, a working group continued to draft a TIN on feedthroughs and other weak points of vertical and horizontal walls for which fire resistance performances are required. One must admit that at present there are many practical problems with respect to both design and processing. The objective of the future TIN is to draw the attention of installers to important points on how to create a feedthrough in such a manner as to be fire-resistant.

The working group, led by the BBRI’s ‘Fire Prevention’ SA, brings together representatives of all the affected players: installers (finishing companies, plumbers, heating engineers, etc.), manufacturers of passive protections against fire (fire-proof sealing systems, partitions, etc.), inspection bureaus and fire experts.

In addition, the working group on acoustics in residential structures continued its activities in 2012, also following the publication of the above-mentioned TINs, with the objective of drafting a new TIN on the subject.
Sustainable construction

The concept of ‘sustainable construction’ is especially extensive, encompassing energy savings and reduction in CO₂ emissions, environmentally-friendly materials, rational water use, comfort, accessibility and the cost of projects. The range of research actions is thus very broad and multidisciplinary.

The BBRI is closely involved in works seeking to give an interpretation of the term ‘sustainable construction’, with regard to both its content and its technicity. By collaborating with the international (ISO TC 59 SC 17) or European (CEN TC 350) standardisation committees and by participating in the activities of the mirror committees, the BBRI ensures the transfer of knowledge and adapts the future international and European normative framework that will structure the field.

Besides the environmental aspect, the economic and social dimensions of sustainable construction are also being examined. For example, the European research project ‘Superbuildings’ analysed a series of sustainability indicators, which enabled the development of relevant and reliable methods. An international seminar held in the BBRI’s own buildings concluded the research project at the end of 2012.

On the Belgian and regional levels, the Institute monitors the coherence of initiatives for evaluating the sustainability of the construction elements and buildings. Within this framework, particular attention was paid to the technical and scientific principles of sustainable construction capable of being applied on both today’s worksites and those of tomorrow.

Life cycle grows in importance

Within a sustainable construction context, it is essential to consider the life cycle of a building in its entirety. It is recommended to use the following instruments: analysis of the inherent Life Cycle Costs (LCC) and evaluation of the environmental impact using the Life Cycle Analysis (LCA).

In 2012, the LCC project ‘analysis of the costs inherent to the life cycle for evaluating the economic performances of sustainable buildings’, financed by the Bureau de Normalisation (NBN – Belgian Standardisation Office) and the FPS Economy, made it possible to elaborate a methodological framework and a calculation tool. This tool enables the contractor to easily evaluate the costs and determine the expenditures that will have to be made later for the maintenance and replacement of sustainable buildings.

The methodological knowledge acquired is then transposed into more practical research projects where the life cycle principles are integrated into different case studies (‘RENO 2020’ and ‘BTP 1000’).

Detailed information on a building and its history is of great importance within the life cycle framework. ‘Spatiobdata’, an innovative research project, financed by the Walloon research network WIST, developed an IT platform that makes it possible to link a wide range of information on the building and its components (installations, pipes, construction elements, etc.) with their location within the structure. This database centralises the various pieces of useful information (photos, plans, descriptions, etc.) which can be consulted and updated by the intervening parties.

Recycling and recycled concrete

The problematic of the recycling of construction and demolition wastes and C2C (cradle to cradle) were at the centre of discussions in 2012. The galloping complexity of the construction process, its impact on the environment and the increasing strictness of the environmental regulations are prompting the sector to adopt new practices and search for innovative solutions.

Here again, an integrated management of the chain offers a sustainable solution. From the pre-demolition study and the actual demolition to the recycling and reuse in new materials, the chain is entirely designed to optimise the process and guarantee the quality of the final recycled products.

Accessible construction

The challenges posed by demographic ageing have driven a whole series of studies on the accessibility and adaptability of structures. The Flemish Network for Accessible Construction, conducted with the support of the European Regional Development Fund (ERDF), seeks to integrate the theme of accessibility as much as possible into the day-to-day practice of building worksites. The implications of the new Flemish regulation on accessibility constitute elements of high-priority research that the BBRI will include in a technical report on accessibility. The latter will focus more specifically on sanitary installations and joinery.

In 2012, the project VIS-Traject ‘Omkerd Thuis Wonen’ financed by the IWT was launched. This project supports health care companies, service companies and technology suppliers with a view to creating the technological framework necessary for healthcare professionals, local intervening...
The Technological Advisory Service, set up in 2006 by the BBRI and supported by InnovIRIS (Institut bruxellois de recherche et d’innovation), strives to increase the knowledge and innovation potential of Brussels-based building professionals within the framework of new technologies and principles of sustainable construction.

Besides the traditional multidisciplinary technological support, the dissemination of information, collective training and market recognition, the 2012-2014 biennial will focus on supporting companies for the introduction of (inter)national research projects. Moreover, this Advisory Service was enlarged by the addition of the themes of sustainable wooden construction and roofs.

Other important actions of this TAS concern the technology watch and innovative prospecting. New market and social trends are identified in order to offer the sector investment opportunities, both on the technological level and with regard to management. The impact of the Brussels City Boom (spectacular increase in the population and accessibility to housing units) on the opportunities for the construction sector is a central topic of discussion.

Sustainable renovation techniques
In light of the European challenges to achieve a low-carbon society and the European objectives for 2020 (20 % less greenhouse gases and 20 % more energy yield), the renovation of existing buildings constitutes an enormous challenge. This theme ideally fits within the context of sustainable development: low energy and material consumption, preservation of the social fabric and of the identity of the built-up environment.

The number of initiatives that kicked off in 2012 illustrates how seriously the BBRI is taking these challenges. For example, the Institute launched, in collaboration with InnovIRIS (Institut bruxellois de recherche et d’innovation), the strategic research platform ‘Renovation of the built-up environment’. This platform includes 11 research projects on renovation and dwellings applicable within the urban context. The latter is executed by Brussels-based academic research centres and the BBRI.

Sustainable renovation also forms part of the projects in progress. The Walloon project ‘RENO 2020’ (conducted with the support of the DG06 in the Walloon Region) researches an integrated sustainable renovation entailing interactions between the owner, the architect and the consultancy office, the contractor, the manufacturers of materials and the research consortia. The combined analyses of the costs inherent to the life cycle and of the environmental impact are applied in two real renovation projects defined and executed within the framework of ‘RENO 2020’. An important monitoring campaign of one of the renovation projects with interior insulation will enable us to expand our knowledge in this area.

The Eracobuild ‘One Stop Shop’ project (financed by the IWT in the Flemish Region) envisages very high-performance renovations with nearly-zero energy consumption. This project laid the foundation for the development of technological solutions for ‘very-low-energy’ renovation and, with the aid of case studies, and also analysed the financial and environmental impact of these high-performance renovations. This project is notably generating a better knowledge of the forms of collaboration and the interactions necessary between the different players in the building sector for such intensive energy renovation projects.

In addition, one also finds a sustainable evolution on the construction products market. The formulations containing organic solvents are systematically being replaced by aqueous solutions in order to limit olfactory discomfort and the health risks resulting from releases of VOCs. In 2012, the ‘HUMIBAT’ research project (conducted with the aid of the DG06) developed innovative test procedures for the development and characterisation of products for the treatment of rising damp.

All of these innovative research projects make it possible to transfer the results of the technological studies and innovations to the sector thanks to the Technological Advisory Services ‘RENO-2D’ (subsidised by the Walloon Region) and ‘Sustainable Construction and Development’ (financed by the Brussels-Capital Region) (see boxed text).
2012 was marked by numerous actions concerning the airtightness performance of buildings: thematic CSTC-Contact, winter courses, training courses, lectures and the continuation of research projects. The other elements influencing the energy performance of a building's envelope were also at the centre of the Institute's activities. Finally, the BBRI also focused on the performance of the building's technical installations.

**Energy performances**

The requirements of the regulations on the energy performance of buildings (EPB) have evolved vigorously in recent years and will be further strengthened in the future, both for new buildings and for renovations. Indeed, by 2021 Europe will impose nearly-zero levels of energy consumption for new buildings. In Belgium, the Brussels-Capital Region announces that it is picking up the pace by setting 2015 as the year when ambitious new requirements enter into force. The objective is therefore to minimise energy needs and to cover the remaining demand by calling upon renewable energies produced at the local level.

Improving the airtightness performance of buildings with a view to attaining this objective thus constitutes an important theme. The BBRI undertook numerous information actions addressed to all of the building trades. A 24-page thematic issue of CSTC-Contact devoted to the airtightness of buildings was published and constitutes a first reference document for the professionals, with a TIN currently in preparation. The 2012 winter courses were also very successful, even requiring several dates to be reprogrammed in different provinces of the country. A multitude of seminars, information sessions and lectures were also organised. This dissemination of information is directly fed by the results of research projects in progress in this area (the ‘Etanch’air’ and ‘DREAM’ projects), as well as by the actions of the thematic information platforms ‘TightVent’ and ‘AIVC’ to which the BBRI contributes. Finally, the Institute led, for the account of the Flemish energy agency (VEA), a sectoral consultation in order to evaluate how in the future airtightness performance should be taken into account in the EPB regulation.

The regulatory calculation methods and the calculation tools integrating them are constantly being worked on by the regional authorities. The BBRI lends them its support via the EPB platform bringing together the three Regions. Active since 2007, the latter is designed to encourage a coherent development of the regional EPB regulations.

In addition, the BBRI participates in the concerted European action dealing with the implementation of the reformulated European Directive on the energy performance of buildings which is at the origin of these EPB regulations. We also took part in a study seeking to compare different calculation methods of the energy performance of buildings, including the statutory EPB method.

Within the framework of the ‘Build-Up Skills Belgium’ project, the BBRI initiated in 2012 a consultation of the actors concerned aimed at identifying the steps to be taken so that the construction sector is ready to meet the energy targets set for 2020.

In the Walloon Region, the BBRI worked to introduce (scheduled for 2013) the second version of the voluntary energy advice procedure (EAP) applicable to existing housing.

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**Technological Advisory Service 'RENO-2D' in the Walloon Region**

The Technological Advisory Service ‘Sustainable renovation and construction in Wallonia’ serves to promote technological innovation in companies. It is subsidised by the Walloon Region via the Public Service of Wallonia (DGO6).

The Advisory Service focuses on five top-priority themes: glass and joinery, acoustics, energy, materials and renovation.

The Advisory Service acts via:
- missions of support for assimilating new technologies
- direct assistance on worksites, in offices, workshops as well as factories
- training or information sessions and publications
- aid to the organisation and implementation of specific studies or research projects.

This Technological Advisory Service is addressed to all Walloon companies in the construction sector (contractors, manufacturers, distributors, designers, etc.).
It notably helped in the development of the software, the preparation of the training courses for the auditors and the work on the communication media. In recent years, support was also provided for the application of the energy certification system for existing housing.

Training sessions concerning the implementation of the EPB regulation were continued, particularly with regard to the impact that these regulations will have on the various specialised trades.

In addition, the BBRI was designated to coordinate the establishment of the new ‘Exemplary Buildings Wallonia’ competition. An exemplary building is one that is remarkable in the way it responds to a series of sustainable construction criteria which thus are no longer limited solely to the energy question. Finally, the Institute continued to coordinate the voluntary action ‘Building with energy ... naturally’ which since 2004 has sought to construct exemplary housing units whose energy efficiency surpasses the regulatory prescriptions.

The envelope of a building

Improving the performance of a building’s envelope, whether in new construction and renovation, is one of the BBRI’s major areas of activity. A TIN and an STS devoted to the post-insulation of hollow walls by filling the interspace were published in 2012. Several seminars devoted to this technique and to the more general thematic of the energy renovation of existing walls were also organised. At the request of the VEA, the BBRI, in collaboration with the KU Leuven, also drafted a brochure on the technique of insulation via the interior of existing walls.

Several seminars devoted to constructional nodes were organised in the country’s three Regions. Moreover, the ‘STAR’ research designed to work out constructive details applicable to renovation, while simultaneously taking into account acoustical and thermal performances started up in 2012.

A prenormative research project named ‘PERFECT’ devoted to on-site evaluation of the real energy performance of the envelope of buildings began in 2012. This research is being conducted parallel to Annex 58 of the International Energy Agency (IEA). In addition, the BBRI participates in demonstration projects of housing renovations in the Walloon Region or of construction of high-performance office buildings at limited costs.

Several Technological Advisory Service actions were conducted in 2012. In the Walloon Region, the Technological Advisory Service ‘RENO-2D’ (see p. 22) supports the actors of the construction sector in order to encourage innovation, primarily in the area of technologies aimed at optimising the energy performance of buildings. In the Brussels-Capital Region, the ‘Eco-construction and sustainable development’ Advisory Service (see p. 23) assisted the sector, particularly in the field of energy.

Finally, the ‘Energy and indoor climate’ Standards Antenna (see p. 24) disseminates, via the site www.normes.be or through lectures, information about the standards and regulations on energy performances, heating, climate control, ventilation, insulation, shading devices, ...

Light and building

The BBRI has a cutting-edge laboratory for the study of natural and artificial lighting. The range of measurement infrastructures available at the experimental station in Limelette is unique in Europe.

The thematic of the lighting of buildings is especially important, since lighting-related electrical consumption in tertiary buildings represents around one-third of the total primary energy consumption of this type of building. In addition, natural lighting plays a major role in the comfort of the occupants.

In 2012, BBRI researchers continued the development of the calculation methods for the energy certification of existing tertiary buildings, and more particularly with respect to the energy consumptions associated with artificial lighting.

They are also working on the drafting of technical specifications relating to energy-efficient lighting with a view to improving the quality of technical specifications.

In the area of the visual comfort of occupants and the prevention of overheating, the ‘PROSOLIS’ research project devoted to the energy characterisation of shading devices and their impact on the visual perception of users continued. The METRICS project, conducted in collaboration with the UCL, focuses on the dimensions that make it possible to characterise visual comfort.

The thematic innovation stimulation actions ‘Groen Licht Vlaanderen’ (TIS) and ‘Groen Licht Vlaanderen 2020’ (TRAJECT), supported by the IWT (see p. 25) made it possible to maintain close contacts with the lighting sector. Assistance was also provided to the VEA for drafting the technical content of the ‘lighting’ part of its internet site.

Finally, the BBRI remains very active within the IBE-BIV (Institut belge de l’éclairage — Belgian Lighting Institute), the Technical Committee 169 ‘Light and Lighting’ of the European Committee for Standardization (CEN) and participates in the International Commission on Illumination (CIE).
Technical installations

High-performance climate control and ventilation installations in energy terms

To guarantee a healthy and comfortable indoor climate, a low-energy building must be equipped with high-performance technical installations. For example, a ventilation system (natural or mechanical) is necessary in order to ensure a supply of fresh air and evacuate the used air (loaded with humidity and various pollutants). Insofar as ventilation is inevitably accompanied by a certain energy consumption, during the heating season it must be used in a sound and controlled manner, for example, by combining it with a heat recovery system or a system in which the flow is regulated as a function of demand.

‘OPTIVENT’, a collective research project financed by the IWT, drafts directives and creates calculation tools intended to optimise ventilation, emphasising the following aspects: measurements prior to acceptance (flow, airtightness of conduits, pressure losses, etc.), dimensioning of the conduits, regulation of the flow, acoustical recommendations, clogging and maintenance (dusts, molds, etc.), pressure losses of various types of conduits. The work programme includes a synthesis of current knowledge as well as the performance of both laboratory and on-site tests. The BBRI published an article concerning the measurement of ventilation flows when commissioning an installation. Several pieces of practical advice are given there in order to be able to perform a reliable measurement, an operation that is far from simple. In addition, a video on the creation of ventilation systems was launched at the end of 2012. The latter runs for 13 minutes and makes it possible to clearly visualise the various aspects that must be taken into account (from the design to the maintenance of an installation).

A high-performance installation also requires the use of high-performance products. The list on the site www.epbd.be was substantially augmented, primarily for fans with heat recovery. Thus, the contractor disposes e.g. of outputs in compliance with the EPB, which makes it possible for him to clearly compare the devices and avoid any later discussion about the data.

Launched in September 2011, the ‘Smart-Geotherm’ project concentrates on the application of shallow geothermics combined with heat storage. This technique can contribute significantly to the development of buildings with nearly-zero energy consumption. The project has in the meantime reached its cruising speed: the site www.smartgeotherm.be is filled with useful information and an extensive testing campaign on energy posts was set up (for more information, see p. 8).

The resounding success of the techniques for using renewable energies, such as solar water heaters, systems for producing photovoltaic electricity, heat pumps, pellet-burning stoves and boilers, etc., must not allow us to lose sight of the necessity of proper quality control, even if the regulation on the subject is not yet finalised.

The BBRI is an important partner of the non-profit association QUEST (Quality Centre for Sustainable Energy Technologies) which, in collaboration with Construction Quality, grants quality labels to companies and fitters of renewable energy systems. This approach was also expanded to cover various types of ventilation systems. Articles devoted to the integration of solar panels in roofs and to wind resistance were published in CSTC-Contact.

Amongst the standardisation activities, one can mention the revision of important Belgian standards relating to new prescriptions concerning the installation of heat generators in boiler rooms and the evacuation of combustion gases. The revision of the standard for installations rated at 70 kW or higher is in the process of being finalised. Certain adaptations still have to be provided for lower-power installations.

A working group completed the revision of report no. 1 ‘Dimensioning of central hot-water heating installations’. Once published, this document will serve as the basis for training sessions to be held in different cities throughout the country.

The BBRI participates in the activities of the Air Infiltration and Ventilation Centre (AIVC). This allows the Belgian building sector to access the publications and the database of this international body created by the IEA. The latter’s objective is to disseminate information about the ventilation of buildings, air infiltrations and indoor air quality within a context of rational energy use.

The European project ‘CLEAR-UP’ developed and demonstrated, for both new construction

Standards Antenna

‘Energy and Indoor Climate’

Energy performance, thermal insulation, heating and cooling, lighting and visual comfort as well as ventilation and air quality are the five main areas of the ‘Energy and Indoor Climate’ Standards Antenna which is supported by the FPS Economy and whose objective is to inform the professional public about the standardisation on these issues. The actors addressed are essentially:

- advisors and designers (architects, consultancy offices, etc.)
- installers (heating engineers, electricians, lighting specialists, companies specialised in indoor climate regulation or in charge of thermal insulation works, etc.)
- producers and distributors of insulating materials, equipment for heating, cooling, lighting, glazings, shading devices, etc.

The information is transmitted collectively via the site www.normes.be as well as through articles, technical reports and seminars. The internet site features a link to a database permitting users to access the object of different standards. Furthermore, most of these standards can be downloaded from the BBRI internet site (www.cstc.be).

Information is also disseminated individually by telephone, e-mail or work meetings.
A partnership amongst many actors (the BBRI, the lighting technology laboratory of the Katholieke Hogeschool Sint-Lieven (KaHo), the Organisation professionelle des bureaux d’ingénierie et de consultation (ORI), the Provinciale Hogeschool Limburg (PHL) and the Vlaams Elektro-Innovatiecentrum (VEI)), the ‘Green Licht Vlaanderen 2020’ project is designed to support Flemish companies in the lighting sector, given the very rapid development of technologies in this field (LED, OLED, etc.).

Within the ‘Light and Building’ laboratory, research focuses on the impact of management systems (natural lighting, presence, etc.) on visual comfort and energy consumption.

The ‘Light and Building’ laboratory concentrates on three developments:

- the classification of management systems and sources of lighting on the basis of their interactions (in collaboration with the VEI);
- the development of an algorithm/calculation program to determine the relative impact of the choice of a management system and/or of certain of its initial parameters;
- the creation of a test space to study how users react under the impact of the management of their visual environment.

In the ‘Sustainable Development’ laboratory, the actions are focused on visual perception and interpretation (of spaces and signals) by visually-impaired persons, these spaces being visually structured by their coloration or their lighting installations.

and renovation, innovative technologies such as electrochromic films (for controlling solar inputs), photocatalytic paints (purification of the air), air quality sensors and strategies for ventilation and heating on demand, vacuum insulation systems and the accumulation of heat by phase change materials. Within this context, the BBRI facilitated the interactions with the market players by organising seminars and publishing a newsletter.

Sanitary Installations
The ‘H₂O and roofs’ Standards Antenna (formerly ‘Water evacuation and adduction in buildings’) provides information about the standards and regulations relating to the distribution and evacuation of water inside and around buildings.

The TIN 245, a revision of the TIN 154, proposing recommendations for the use of copper pipes, was published. This revision takes into account a number of standards and documents, published in the recent past, which prove to be less restrictive with regard to water softening. The revision of the TIN 200, whose updating was deemed necessary by the Technical Committee and which bears on the evacuation of waste waters from buildings, was dealt with in the working group.

In 2012, we finalised the new TIN on rainwater evacuation. This Note applies a normative dimensioning method and proposes a simplified approach and a more detailed method. In 2013, this new TIN will be published and the thematic will be enlarged to include the use of rainwater in buildings: collection and storage, possible treatment and distribution within the building.

In addition, research on peak flows in water distribution systems within buildings was performed at the request of the ‘Sanitary’ Technical Committee. Various on-site measurements were performed in 2012 on cold water, hot water and rainfall. This research is intended to establish a publication describing a method for dimensioning water distribution systems in buildings. A ‘TETRA’ study devoted to the production and distribution of sanitary hot water began in October 2012. This research covers around 25 % of the high-priority subjects defined by the Technical Committee.

The BBRI staff also examined, at the request of this same Committee, the possibilities for application to the Belgian context of a French typological study devoted to collective networks for evacuating combustion gases within apartment buildings. A working group was formed to study the current situation and warn those affected about the potential dangers of using collective chimneys. The ultimate objective is to formulate technical solutions capable of being reasonably implemented within the framework of replacing older atmospheric gas heat generators connected to collective chimneys with modern (condensation) equipment.

The global position of the ‘Acoustics’ Division was strengthened in 2012 thanks to its participation in numerous international research groups and the commissioning of the new acoustics laboratory in Limelette. The latter is currently regarded as one of the reference laboratories in Europe.

‘Acoustics’ Standards Antenna

The activities of the Standards Antenna once again concentrated on the organisation of training courses and publications, and more particularly on the transposition of the acoustical comfort criteria of the standards NBN S 01-400-1 for residential buildings (2008) and NBN S 01-400-2 for school buildings (2012) into practical instructions. The Internet site enables Belgian SMEs to access the relevant sound standards thanks to summaries, presentations, practical calculation modules and databases. Regular updating of this information should permit Belgian manufacturers, contractors, architects or engineering students to develop products and services that comply with the acoustical standards in effect.

Development activities, in the laboratory and on site

In 2012, the activities of the ‘Acoustics’ laboratory primarily concerned the validation of the new measurement stations within the framework of the BELAC accreditation. Construction elements such as glazings, windows, panels, masonry walls, partition systems, doors, sliding windows, ventilation grills and roller blind boxes can from now on be evaluated acoustically according to the series of EN ISO 10140 standards in effect in one of the seven available testing stations. The acoustical performances of floors, roofs and floating screeds can also be determined according to the EN ISO standards in the new laboratory. Within this framework, the BBRI participated in a European inter-laboratory test with a view to assessing a new method for measuring footstep sounds on floor coverings. In 2012, the ‘Acoustics’ Division received accreditation for the measurements of the dynamic stiffness of products used under floating screeds according to the standard ISO 9052-1. In order to bring the measurement procedure into conformity with the latter, an innovative testing station was developed within the ‘MODA’ laboratory, which made it possible to substantially reduce the measurement uncertainty linked to the dynamic stress.

In addition to numerous validation works, over one hundred commercial measures were performed notably on windows, glazings, partition systems, masonry walls, anti-noise screens, floating screeds and floor coverings. Among these, six files benefited from the support of the Flemish Region (SME portfolio) or the Walloon Region (technology cheques). In addition, measurement campaigns were also organised within the ‘Acoustics’ laboratory stimulated by research activities and Technological Advisory Service files. Finally, acoustical measurements were performed on over forty worksites in collaboration with the ‘Technical Advice’ Division, most of them in order to monitor the requirements of the specifications and/or the standard.

Acoustical comfort and ventilation systems

A study of the noise produced by mechanical and natural ventilation systems in residential buildings or school buildings with low energy consumption was conducted in 2012 within the framework of the ‘Clean Air Low Energy’ project. The latter was launched at the request of the department Leefmilieu, Natuur en Energie (‘Environment, Nature and Energy’, Ministry of the Flemish Community) and the Flemish Administration responsible for energy. A major on-site measurement campaign made it possible to analyse the link between air quality, ventilation flows, the airtightness of the building and the sound levels produced in the classrooms, living rooms and rooms equipped with a mechanical or natural air supply. The conclusions of the study will form the basis of future directives on the preservation of acoustical comfort in low energy consumption buildings.

Within the framework of the VISCO IWT ‘Optivent’ project, acoustical measurements were performed in the spring of 2012 in dwellings having a mechanical ventilation system. The analysis of the 2011-2012 measurement results will make it possible to formulate directives and concrete recommendations in order to limit the noise pollution of mechanical ventilation systems (design, installation, maintenance).

Prenormative research on non-residential buildings

In May 2012, the definitive version of the draft standard NBN S 01-400-2 on school buildings was presented and unanimously adopted by the NBN E 126 ‘Buildings Acoustics’ committee. These new requirements demand that the parties intervening in the construction take certain building principles into account. Training courses and lectures enabled them to discover the various aspects of this standard.

Moreover, the research was primarily devoted to studying the criteria to be applied to other types of buildings (offices, hospitals, hotels, etc.), the readjustment of our acoustical criteria in accordance with the European standards, low frequencies and the real perception of discomfort. The theme of psychoacoustics was thus integrated into the world of building acoustics in 2012. In this context, the BBRI took part in the international working group ‘COST TU0901’
These two Technological Advisory Services continued the work of the preceding years. They firstly emphasised acoustical insulation against impact noises, notably by assisting in the development of new technical solutions for floating screeds on solid floors. These solutions enabled them to jointly respond to the thermal criteria of the EPB and to acoustical comfort criteria higher than the standard NBN S 01-400-1. The work performed in the area of insulation against external noises was then continued with the optimisation of a combined wood and aluminium frame. Secondly, the Advisory Services also concentrated on the acoustical comfort of indoor spaces by assisting with in the design of sound absorbing chandeliers.

In addition to the usual acoustical activities, the ‘Acoustics Division’ was also called upon to deal with particular vibroacoustic problems: infrasonic fields of unknown origin, differentiation of pure air or pure solid conduction paths, classical cases of discomfort relating to vibrations generated by road traffic, but also case of complaints relating to vibrations generated by rail traffic, notably with the opening of the four-track Brussels-Ottignies line. Finally, the laboratory highlighted the problematic of structural noises deriving from the differential expansion of materials or of hyperstatic structural elements.

In Wallonia, the attention was focused on applications in renovation market, while in the Brussels-Capital Region, the accent was placed both on new constructions and on the renovation of older buildings. Around 100 interventions were carried out in the Walloon Region in 2012, covering diverse activities such as the writing of articles, organizing lectures for building professionals or support in resolving problems. We did around 90 interventions in the Brussels-Capital Region, primarily individual actions concerning the problematic of acoustical comfort in apartment buildings, as well as the organisation of workshops and collaboration on publications and thematic presentations. Finally, the Advisory Services gave the necessary acoustical support to the other Technological Advisory Services (CDuBois, Smiduc, etc.). Flanders recorded in 2012 a very clear demand for Technological Support. This Region no longer provides specific Technological Advisory Service actions, but furnishes resources within the research actions. The Technological Advisory Service dedicated to building acoustics was reinforced in 2012 within the framework of the ‘STAR’ and ‘AH+’ projects.

whose objective is a better harmonisation of the assessment criteria for acoustical insulation.

Finally, the development of prediction calculations defined in the standard NBN EN 12354 for complex systems composed of viscoelastic materials was finalised. In general, it was demonstrated that the performance of all these systems could be evaluated on the basis of general complex formulas. However, we showed that simpler empirical prediction formulas could, in some cases, give a first approximation of the improvements. The research also made it possible to obtain a more precise prediction of the insulation to impact noises of a floating screed based on the dynamic stiffness of the under-layers.

Innovative research on wood-frame structures

The research concerning the elaboration of building directives for wood-frame structures was finalised within the framework of the VISCO IWT ‘AH+’ project. This research was intended to elaborate construction details allowing one to comply with the requirements of the standard NBN S 01-400-1.

Large-scale measurement campaigns performed in the laboratory, on a full-scale ‘three rooms’ model and on various worksites, demonstrated interesting developments. The latter notably led to an innovative solution for wood-frame walls separating two housing units with a very high acoustical insulation. However, it is necessary to continue to conduct new research in order to improve the insulation against impact noises. In 2013, this necessity will be incorporated in the the new project Trajet IWT ‘DO-IT Wood construction’.

Within this framework, the international working group ‘COST FP0702’ continued the testing and experimental verification of the theoretical prediction models (mock-up). The most important finished product is an e-book available on line that describes numerous performance details and practical solutions.

Robust solutions for the rapidly-expanding renovation market

The European project ‘Eracobuild STAR’ was launched in 2012. Its main objective is the development of integrated Robust Retrofit Details. The latter include checklists intended for designers and implementers that contain focal points for the various stages of the construction process. Interdisciplinary working groups (designers, manufacturers, experts, etc.) were organised to study the concrete assembly details between the different types of construction elements during a renovation. Measurement programmes were proposed in order to check or continue the development of higher-performance renovation systems in case that certain performance data should be missing.

Publications of the BBRI ‘Acoustical Comfort’

Several awareness-raising actions for companies
The contribution of Cloud Computing for building companies was one of the flagship themes of 2012.

Cloud Computing makes it possible to delocalise the data and/or software usually stored on a computer or smartphone. In this way, the contractor can access his data and his computer solutions via the internet at any time. The Cloud is regarded as a major IT evolution.

The event ‘IT and Construction — Which online tools for contractors? ’ attracted over 130 people. The participants were able to attend a range of presentations by the BBRI and the CETIC (Centre of Excellence in Information and Communication Technologies), listen to the testimonial of contractors and meet providers of Cloud solutions.

A Data Sheet on the various phases for the elaboration of a planning was also published in 2012. This publication deals with the design of a planning, the use of software for scheduling and the implementation and the monitoring of a planning.

Secondly, the Data Sheet 36 ‘Which support for my planning?’, dealing with the necessity of a planning for the management of a project, was updated in order to clarify the differences between a project management software and an intervention management software.

Training activities
Hundreds of training days were also organised in 2012, targeting all different aspects of the way how companies are organised: cost price calculation, planning techniques and software, document management, internet for construction, ...

These training courses are a mix of technical knowledge and practical examples to stimulate the building professionals to work more efficiently and encourage them to make more intensive use of IT methods and tools. The final objective is to make the management of their company more effective in the future.

In 2012, new training courses were developed and tested. One of the courses focuses on the financial management of a construction company. These training courses will be offered to the building professionals in 2013.

Tools to assist companies
Within the framework of ‘ConstrucTic’ or ‘ABC DigiBouw’, more than 600 companies received valuable advice on how to optimise their IT environment, their organisation and their management. They were also able to discover various user-friendly and accessible computer applications.

The individual guidance actions primarily related to the computerised calculation of cost prices, the digitisation of the company planning as well as the electronic management of data and documents.

Management tools adapted to SMEs
The BBRI offers various supports that make it possible to move easily from theory to practice. These learning modules are Excel applications that are compatible with MS Office (2007 and 2010 versions).

The application C PRO was created to calculate the cost price and prepare estimates. The approach, developed on the basis of direct costs, allows small and medium-sized enterprises not only to calculate the flat cost and the selling price of the various items of a job, but also to work out the overall estimate.

The application C DATA enables a company to calculate or verify the average hourly rate, to calculate the distribution of its overhead costs and to assess the equipment costs.

The application C FACT assists companies with the calculation of the progress reports and the preparation of the invoices. These applications can be downloaded from www.cstc.be/go/cpro.

These applications were downloaded more than 1,500 times in 2012.

Quality management system
Through the activities of the BCCA, the employees of the BBRI’s ‘Management’ Division are also very active in the certification of company management systems.

In 2012, the staff of the ‘Management, Quality and Information Technologies’ Division worked to raise awareness, train and accompany building companies in the use of IT tools for the purpose of improving their management and optimizing the processes. These actions enabled numerous SMEs to identify high-performance solutions adapted to their company. In addition, different learning modules were developed that enable greater efficiency in cost price calculation and invoicing.
Despite the globalisation, the interaction between the owner and the public authorities is often a local event based on regional SMEs, traditions and smooth communications. Nevertheless, the construction sector continues to be confronted with European initiatives, notably with respect to cross-border commerce in construction materials, environmental requirements, European standardisation, the critical trades, etc.

To keep Belgian companies informed about the European developments and defend the interests of the Belgian building sector (notably the SMEs), the BBRI sits in numerous bodies and actively participates in European and international initiatives.

**European regulation**

2012 was a transitional year for the Construction Products Regulation no. 305/2011 that will replace the Construction Products Directive (89/106/EEG) as of 1 July 2013. The Official Journal of the European Union published a new Regulation concerning the European standardisation system. A new directive on energy yield was also published in November and will have an impact on the construction sector.

**European Committee for Standardization (CEN)**

The publication of a new Regulation on European standardisation entails the coming into force of new requirements. To deal with them, the CEN (www.cen.eu) and CENELEC joined forces and took the necessary measures. A broader commitment from the persons involved and a greater effectiveness constitute the main challenges. The fact that the construction sector became the second principal sector of the CEN illustrates the importance of standardisation. To maintain its knowledge in this field, the BBRI chairs and handles the secretariat for these two organisations. The actions of the Institute enabled the UEAtc to renew its articles of association and internal rules in order to improve their services to the sector. The UBAtc is also a member of the European Organisation for Technical Approvals (EOTA, www.eota.eu), which is also preparing for the arrival of the Construction Products Regulation.

**Activities in networks**

In 2012, the BBRI collaborated actively in various European networks.

**European Construction Industry Federation (FIEC)**

The FIEC (www.fiec.org) informs contractors about European activities. The federation joined the ‘Renovate Europe’ campaign in September 2012. This project envisages tripling the annual renewal rate of buildings, bringing it from 1 % to 3 % by 2020. Our country is represented within the FIEC by the Confédération Construction, which relies on the BBRI for the technical aspects. Our Institute chairs and handles the secretariat for the Technical Committee ‘FIEC 1’.

**European Network of Building Research Institutes (ENBRI)**

For more than 25 years, the BBRI has been in charge of the secretariat for the ENBRI (www.enbri.org), a network of 23 major research centres. In 2012, it organised various seminars on topics such as geothermics, fire, low energy consumption buildings, … The participation of the Institute in the ‘Building Up’ project, which is seeking to create a research and innovation roadmap in order to improve the energy yield of buildings, made it possible to spend a great deal of effort establishing a strategic vision for ‘Horizon 2020’, the continuation of FP7. A video report on the closing event of ‘Building Up’ organised in Louvain can be consulted on ENBRI’s Internet site.

**European Council for Construction Research, Development and Innovation (ECCREDI)**

This network (www.eccredi.org) conducts a wide range of actions to secure European funding for research and development in the sector. The BBRI has also been in charge of the secretariat of the ECCREDI since it was created in 1996. The network sometimes collaborates with major decision-makers of the European Commission for supporting ‘Research and Innovation’. Recently, the European Association for External Thermal Insulation Composite Systems (EAE) became a member of the organisation.

**European Construction Technology Platform (ECTP)**

The ECTP (www.ectp.org) and the E2B initiative (www.e2b-jti.eu), which concentrate specifically on energy challenges, are two construction research coordination platforms on the European level. These two initiatives can count on the support of the BBRI staff within their steering group and various working groups. The ‘refINE’ initiative has also taken form within the framework of the ECTP. This project focuses on research for the future infrastructure networks in Europe. An inaugural event for ‘refINE’ is scheduled for the spring of 2013.
The ‘Technical Advice and Consultancy’ department (TAC) is composed of the ‘Technical Advice’ Division (better known under the abbreviation ATA) and the ‘Interface and Consultancy’ Division (ICO). It plays a vital role in the interaction between the research projects and construction activities in the field. Firstly, the experience on worksites acquired by the TAC engineers has an important influence on the selection of subjects in the various Technical Committees, and moreover constitutes a terrain that is favourable for innovations. Secondly, the personalised technical assistance allows us to stimulate the construction sector to introduce innovative techniques and systems, which will improve the quality of structures as well as the competitiveness and productivity of the construction companies.

Similar to the two ventricles of a human heart, the ATA and ICO divisions are two linked pumps that feed the research projects and translate their results into practice.

In this perspective, the tasks of the department were expanded in 2012: for decades, the pieces of technical advice were drafted exclusively by the ATA, but, since 2012, the department increasingly collaborates with colleagues from the ‘Research and Innovation’ department via the ICO division. In this way, the contribution of subjects deriving from the day-to-day world of practice increased significantly in 2012. For example, the TAC department collaborated on the ‘Le Grand-Hornu’ renovation file within the framework of the UNESCO world heritage sites, to the perfection of performance details within the framework of the constructional nodes problematic, to projects such as Floorcrete, Betonic®, Smart Geotherm, Build Up Skills Belgium, ...

Providing technical advice to building professionals and above all to construction companies still constitutes the main task of the TAC department. In 2012 for example, around 13,000 questions were handled by telephone and more than 9,000 e-mails were recorded (an increase of 10% compared to 2011), of which 82% is related to a technical file. In nearly 750 cases, the engineers decided to make an on-site visit. These interventions are reserved for files necessitating findings and/or on-site tests in order to be able to formulate a well-founded piece of advice.

This increase can also be attributed to the current electronic resources. Indeed, the electronic request form available on our Internet site, to which one can easily attach documents (excerpts from plans and/or specifications, digital photos, technical sheets and reports, etc.), enables construction companies to contact us in a quick and easy way.

The person making the request must understand that a substantiated piece of advice can only be provided if our staff has all of the relevant and available information. This will allow them to devote themselves entirely to processing this request. The quality of the advice and the speed of follow-up will only improve!

The diagram shows the breakdown per construction elements of the written advices that were given over the course of the last five years. The main subjects of these pieces of technical advice are the following: humidity problems, damage caused by detachments, cracking of the rough structure and finishings and, finally, aesthetic complaints.

In this context, one must not lose sight of the different actions taken within the department to prevent building pathologies as much as possible. Indeed, 110 lectures were given over the past year and we collaborated on a substantial number of publications and trade fairs in the construction sector, according to the motto: ‘An ounce of prevention is worth a pound of cure!’
The BBRI participates in the works of numerous associations linked to construction and even contributed to the founding of some of them. Dedicated to the most wide-ranging activities of the sector, the priority of these institutions is always to provide support for companies.

Recywall

The mission of Recywall is to help companies to valorise and recycle their wastes (www.recywall.be). In 2012, the close collaboration continued via the dissemination of information on construction waste recycling notably via the Recywall newsletter.

Tradecowall

The objective of this company consists in finding solutions for the treatment of inert wastes and excavation soils coming from construction and demolition worksites (www.tradecowall.be). 2012 was marked by the move of the registered office to Fernelmont and the difficulties with the acceptance of recycled granulates, even when provided with the CE2+ certification.

Belgian Construction Quality Society (BCQS)

BCQS (www.bcqs.be) trains and accompanies companies with a view to creating an effective system of management of quality, safety and the environment. Depending on its needs, the company may seek to obtain a ‘Construction Quality’ label or a certification (ISO 9001, ISO 14001 or VCA).

Belgian Construction Certification Association (BCCA)

BCCA (www.bcca.be) is one of the Belgian leaders with regard to certification in construction. Thanks to this status, it benefits from an accreditation from the BELAC office. For several years now this non-profit association has been supporting the collective ‘Construction Quality’ label and regularly performs production inspections within the context of the CE marking.

Belgian Centre for Domotics and Immotics (BCDI)

The BCDI (www.bcdi.be) defines itself as a centre of study and information in the field of home and building automation. Themes such as personal assistance, smart cities and intelligent buildings also form part of the BCDI’s expertise. In recent years, this centre has collaborated on many national and European research projects as well as a wide range of congresses, forums and workshops.

Centrum Duurzaam Bouwen (CeDuBo)

Thanks to a renewal of its exhibition as well as the organisation of various seminars and training courses, CeDuBo (www.cedubo.be) remains the reference centre for sustainable construction. It also plays a leading role in the creation of the Belgian Sustainable Building Council. This organisation is conducting a feasibility study with a view to establishing a platform for management and certification in the field of sustainable construction. CeDuBo won the Gouden Baksteen 2012.

Quality Centre for Sustainable Energy Technologies (QUEST)

QUEST (www.q4q.be) prepares, with the assistance of the building sector and in close collaboration with Construction Quality, quality procedures and technical reference documents for the application of small renewable energy systems (heat pumps, thermal and photovoltaic solar installations, ventilation with heat recovery, etc.).

Vlaanderen Bouwt (VLABO)

VLABO (www.vlaanderenbouwt.be) sets up, with the technical support of the BBRI, construction projects to create durable, high-quality housing for local authorities while monitoring the urbanistic, architectural and technical qualities of the design and its cost.

Organisatie voor Duurzame Energie (ODEVlaanderen)

As a coordinating body for sustainable energy in Flanders for more than 15 years, ODE (www.ode.be) handles the consultation between companies, organisations active in the renewable energy field and the public authorities through thematic platforms: heat pumps, photovoltaics, biomass, wind energy, ‘green’ electricity, ... The BBRI is responsible for their integration in buildings.
Technical Committees

The activities of the BBRI are oriented directly by thirteen Technical Committees. While eleven of them are the direct representation of a branch of the construction industry and are composed primarily of contractors, the other Committees focus on subjects of interest to several branches (hygrothermy, acoustics). In order to guarantee this ‘bottom-up’ approach, each Committee defines the actions that will be taken the following year, via working plans submitted for approval to the Standing Committee of the BBRI.

Rough Structure

Chairman  L. Eeckhout
Engineers-leaders  N. Huybrechts, B. Parmentier
Engineers TAC  C. Aerts, S. Vercauteren, J. Wijnants

Heating and Climate Control – HVAC

Chairman  R. Debruyne
Engineers-leaders  K. De Cuyper (until 8 May), C. Delmotte, J. Schietecat (until 8 May), P. Van den Bossche
Engineers TAC  I. De Pot, V. Jadinon

Paintworks, Flexible Wall and Floor Coverings

Chairman  J. Meuleman
Engineers-leaders  E. Cailleux, V. Pollet
Engineers TAC  G. De Raed, W. Van de Sande

Hard Wall and Floor Covering

Chairman  P. Goegebeur
Engineers-leaders  F. de Barquin (until the end of May), T. Vangheel
Engineers TAC  L. Firket, J. Van den Bossche
Technical Committees

Glazing

Chairman  A. Sanchez
Engineer-leader  V. Detremmerie
Engineers TAC  F. Caluwaerts, L. Lassoie

Sealing Works

Chairman  J. Coumans
Engineers-leaders  E. Mahieu, E. Noirfalisse
Engineers TAC  E. Mahieu, L. Lassoie

Roof Coverings

Chairman  G. Pierrard
Engineers-leaders  F. Dobbels, D. Langendries
Engineers TAC  E. Mahieu, O. Vandooren

Sanitary and Industrial Plumbing, Gas Installations

Chairmen  A. Dooms
Engineer-leader  K. De Cuypere
Engineers TAC  I. De Pot, V. Jadinon

Joinery

Chairman  L. Pype, W. Symoens
Engineers-leaders  S. Charron, V. Detremmerie, Y. Martin, E. Kinnaert
Engineers TAC  F. Caluwaerts, G. De Raed
Technical Committees

Stone and Marble

Chairman
H. Vanderlinden

Members

Engineers-leaders
V. Bams, F. de Barquin (until the end of May), D. Nicaise

Engineers TAC
L. Fisket, J. Van den Bossche

Plastering and Jointing

Chairmen
J. Van den Putte, J. Jacquemin

Members

Engineers-leaders
Y. Grégoire, A. Smits

Engineer TAC
S. Eeckhout

Hygrothermy

Chairman
E. De Kempeneer

Members

Engineers-leaders
X. Loncour, L. Vandaële

Engineers TAC
A. Acke, J.-M. Rostenne

Acoustics

Chairman
E. Kempeneers

Members

Engineers-leaders
L. De Geeter, B. Ingelberge (until the end of January 2012), M. Van Damme

Engineers TAC
M. Lignian, S. Vercauteren

Architects

Chairman
R. De Lathouwer

Vice-chairman
M. Procès

Members

Engineers-leaders
D. Langendries, P. Wouters
In order to successfully conduct its mission, the BBRI bases itself on the expertise of more than 230 staff members coming from a wide range of disciplines. This combination of professional skills, commitment and versatility helps to make the Institute the authorised body that it has become within its sector.

The BBRI strives to improve the quality in construction and strengthen the skills of the professionals of the sector. This task is far from being an easy one, considering the fragmentation of the building process and the diversity of the partners involved.

To accomplish its mission and anticipate technological developments, the BBRI can rely on a dynamic multidisciplinary team. Our staff thus ensures that the fruits of the scientific and technical research conducted by the Institute benefit building contractors, but also other professionals of the sector (architects, consultancy offices, surveyors, education, administrations, etc.).

The experience and pragmatism of some staff members combined with the innovative vision of others enable the Institute to publish practical works, provide custom-tailored technical advice as well as to organise courses and training sessions that meet the real needs of the sector.

Given the growing complexity of those needs and the increased interest in areas such as sustainable construction and renovation, finishing techniques, energy and indoor climate, IT applications in construction as well as the accessibility of buildings. The BBRI undertook numerous actions in these fields despite the stabilisation of the personnel at 236 employees in 2012.
The accounting department seeks to give an accurate overview of the Institute’s financial situation and to motivate the decisions taken with regard to management.

Affiliated members

On 31 December 2012, the BBRI had 82,350 members, including 53,650 one-man businesses. The graph below shows that this number increased by 21.58% over the course of the past ten years. If we take the index into account, the increase in fees collected for this period amounts to 15.84%.

Revenues and expenditures

The bar graphs at the top of the following page illustrate the evolution of the various revenues and expenditures relative to the total budget over the last three financial years. One thus finds that the fees of the members represent some 55% of the total revenues. Personnel costs – the most important item of all expenditures – has fluctuated between 66 and 67% over the past three years.
Destination of the expenditures

The diagram presented below shows the revenues and the expenditures which result from the activities of the BBRI, after distribution of the structural expenses. The latter represent not only the costs relating to the buildings and equipment, but also the administrative costs. This demonstrates that the totality of the available resources benefits, directly or indirectly, the construction companies. Indeed, if 90% of the total budget is directly invested for the benefit of the sector, 10% of that is valorised in research activities under contract which, in the long run, also benefit construction. Consequently, all of our resources are devoted to improving the quality and the competitiveness of the sector, which is ultimately the founding mission of the Institute.
During the meeting of the General Council of the BBRI on 24 April 2012, the composition of the General Council and the Standing Committee was approved as follows:

**General Council**

**Chairman**
J. Gheysens

**Vice-chairmen**
J. Coumans, J. Willemen, V. Favier

**Honorary chairmen**
E. Goes, R. Lenaers

**Members appointed by the Fédération Construction**

**Coopted members**
A. De Bie, V. Favier, B. Gilliot, C. Peeters, Y. Pianet, B. Zanardini

**Members appointed by the Bouwunie**

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

**Account Inspectors**
S. Drooghmans(t), L. Ninnin

**Statutory Auditor**
HLB Dodémont-Van Impe & C°

**Standing Committee**

**Chairman**
J. Gheysens

**Vice-chairmen**
J. Coumans, J. Willemen, V. Favier

**Members**

**Observer**
D. Otte, P. Villers
Jan Venstermans
Director General

Alain Billiet
Secretary General

Philippe Gosselin
Director Internal Education and Quality

Georges Klepfisch
Director External Relations for Standardisation and Certification

Olivier Vandooren
Director Information and Support to Companies

Johan Vyncke
Director Research and Innovation

Peter Wouters
Director Development and Valorisation

Bart Michiels
Head of Finance

Responsible publisher: Jan Venstermans
Research • Development • Information

Primarily financed by the membership fees of some 85,000 Belgian companies, representing virtually all of the construction trades, the BBRI has been considered for more than 50 years as one of the leading scientific and technical institutes, 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 in the Technical Committees, the Institute's research activities are closely aligned to the day-to-day needs of the sector.

With the aid of various official bodies, the BBRI encourages companies to continue innovating, offering advice that is tailored to the current social challenges and applicable to various domains.

Development, standardisation, certification and approval
At the request of public or private players, the BBRI also works on various development projects (contract research). 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, so that we can respond more quickly to the future needs of the various building 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. Our Internet site, adapted to the diverse needs of construction professionals, contains the publications of the Institute as well as more than 1,000 construction standards.

Nevertheless, personalised training and technical assistance remain essential for disseminating information and so, along with some 650 information sessions and thematic lectures offered by BBRI engineers, more than 26,000 pieces of advice are issued by the Technical Advice Division each year.