KNOW-HOW

Building Information Modelling (BIM)

The future of construction is digital. Building Information Modelling (BIM) allows greater planning security, process optimization, efficiency and sustainability. Armacell is a BIM pioneer and offers a plug-in allowing technical insulation materials for building service equipment to be planned digitally. **Faster, more efficient and always up-to-date.**

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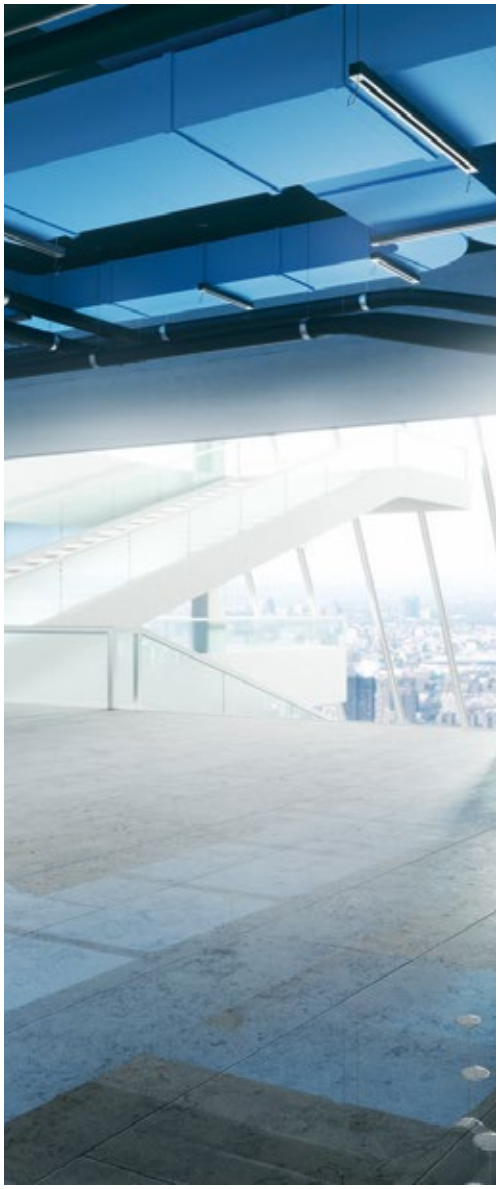
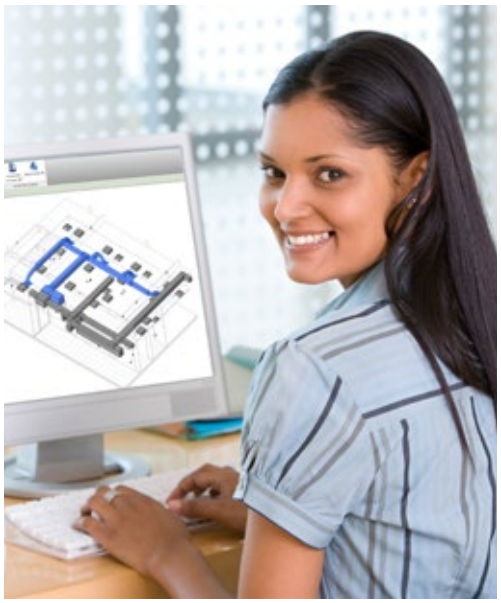




armacell®
DRIVING ENERGY EFFICIENCY

In terms of planning efficiency with BIM, one of the internationally best-known beacon projects: the 632-metre-high Shanghai Tower. Some 4000 m³ of ArmaFlex were installed on the building service equipment.

THE FUTURE BELONGS TO BIM

INTEGRATED PLANNING ACROSS THE BUILDING TRADES

The revolutionary effect of digitization on the economy and society will be comparable to that of the introduction of the steam engine in the 18th century or the principle of the division of labour made possible by mass production. 'Industry 4.0' stands for networks, intelligent systems, data availability and the interaction between human and machine. All the steps in the value chain will be based on networked systems.

At the moment, the construction industry is still bringing up the rear when it comes to digitization. Yet other sectors show that complex processes can be planned more efficiently and projects realized more cost-effectively. In the construction industry, major projects generally take 20 % longer than planned and go up to 80 % over budget. In some markets, construction productivity has even fallen since the 1990s.[1] According to estimates by the UK's National Audit Office, 30 % of construction costs are wasted due to unproductive activities.[2] Loss rates are likely to be similar or even higher in other countries. This lack of efficiency is particularly critical in view of its environmental impact. The building sector is the largest single source of global raw material use and the largest producer of waste. Furthermore, buildings have the greatest environmental impact during their operation: some 40 % of greenhouse gas emissions worldwide are caused by buildings. The need for higher energy efficiency, the shortage of resources, growth in population and increased urbanization all present the construction industry with huge challenges.

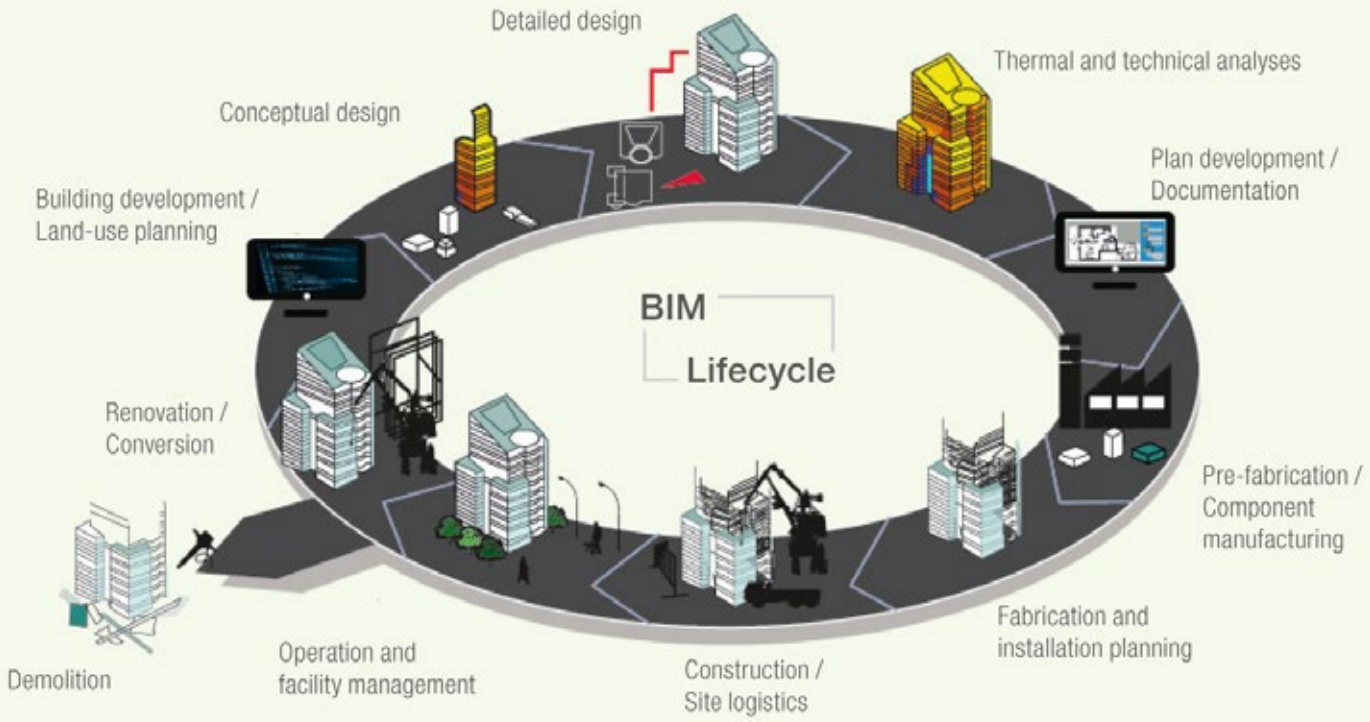
One reason for the lack of productivity in the construction sector is likely to be poor coordination between the many fragmented players in the industry. Inadequate information management has also been identified as a reason for the industry's ineffective performance.[3]

True to the motto 'First build virtually, then on the job site', BIM allows significant improvements and can also serve as a powerful tool for meeting sustainability requirements and optimizing energy and resource efficiency.[4]

Higher value creation with BIM

BIM relies on the integrated and seamless use of digital building models. These models form an information environment around the building and provide a reliable source for decision-making throughout the lifecycle – from the initial design to demolition. The planning method is based on a clearly defined division of tasks and communication interfaces between those involved. With the aid of BIM it is possible to avoid problems due to the use of different media formats, time-consuming multiple entries and redundant, and therefore error-prone, data management. Building data can be processed cooperatively by team members no matter where they are working. Economic and ecological aspects of the construction project can be accurately

BIM in the value chain



Source: GSP Network GmbH

forecast, evaluated and optimized. The value chain stretches from the conceptual and detailed design stage via the analysis and documentation, fabrication process and site logistics to facility management. The data can also be used for the demolition or renovation of the property.

BIM-based planning and construction processes improve planning quality. Not only do they enable the design to be optimized at an early stage and conflicts in the planning to be recognized (clash detection), they also allow an automatic comparison with building regulations and synchronized planning.

As early as 2007, the Center for Integrated Facilities Engineering (CIFE) at Stanford University showed that BIM offers considerable benefits on the basis of case studies (32 projects):

- Savings due to fewer unplanned changes (up to 40 %)
- More accurate cost estimates (accurate to within 3 %)
- Faster cost estimates (time savings of up to 80 %)
- Cost savings (up to 10 % of the contract value)
- Time savings (up to 7 %)[5]

Detection of clashes alone allowed construction costs to be reduced by 5.8 %.

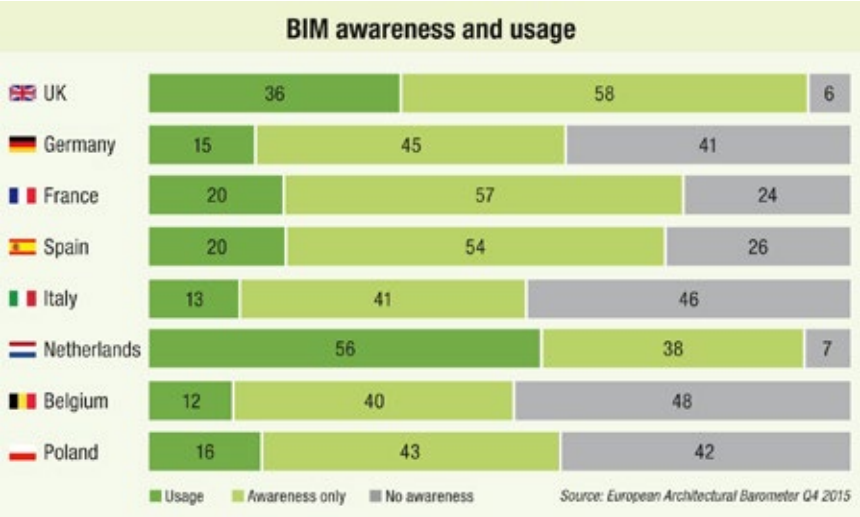
BIM is on the rise all over the world

One of the internationally best-known beacon projects in terms of planning efficiency with BIM is the 632-metre-high Shanghai Tower, the world's third tallest building and also one of the most sustainable skyscrapers. Construction of the building, which is made of steel, reinforced concrete, glass and aluminium, took only seven years. The project demonstrates just how powerful BIM is: the skyscraper's 20,000 m² twisting glass facade consists of thousands of different glass panels. Not a single complaint was received that a glass panel had the wrong dimensions or was allocated to the wrong construction stage.[6] Some 4000 m³ of ArmaFlex were installed on the building service equipment.
The USA is a pioneer in the use of BIM: as early as 2012, 71 % of architects, engineers,

building contractors and building owners used BIM. BIM has long been de facto standard in the USA and alongside the national guidelines there are now also local BIM guidelines in many major cities.

In Europe, Great Britain and the Netherlands are at the forefront. According to Arch-Vision, 36 % of British and 56 % of Dutch architects already use BIM.[7] The European Architectural Barometer is an international survey of architects in Germany, France, Italy, Spain, the UK, the Netherlands, Belgium and Poland which Arch-Vision carries out four times a year.

In the UK, the use of BIM has been a mandatory requirement when awarding contracts for major public construction projects since 2012. The British government estimates that this has led to savings of 1.7bn pounds. 66 % of the Major Projects Authority portfolio is delivered on time and budget, compared with 33 % in 2010.[8]



Not only in the UK, in Finland (2007), Norway and Denmark (2008) and the Netherlands (2011) too, the use of BIM is stipulated for publicly financed construction projects.

Towards European standards

The success of BIM depends on the creation of standardized processes and rules for compiling, sharing, using and managing data. Only then can uneconomical activities such as the repeated compilation and re-entry of data or the search for information be reduced. To this end, standardized processes and manufacturer- and software-independent data standards are required which can be used as exchange formats.

Finland and Norway were the first countries to set standards and develop innovative planning tools. IFC, a data exchange standard now accepted throughout the world, was developed by buildingSMART International and was supported and promoted by the Norwegian government from a very early stage. Norway also played a significant role in the development of the IDM Standard (Information Delivery Manual, ISO 29481–1:2010). The Netherlands established the first standards on the specification of product data. The UK has devel-

The Hilton Amsterdam Airport Schiphol Hotel in real-life (Foto: (c) 2016 Hilton Hotels & Resorts)

oped BIM processes and standards for implementation which could become international ISO standards. The US 'Level of Development' definition and the British phase model (PAS 1192 -> ISO 19650) have already become established as quasi-standards worldwide. So the first standards already exist at national and international level, but the development is by no means completed.

Internationally the process is coordinated by the International Organization for Standardization (ISO), at European level by the European Committee for Standardization (CEN). CEN/TC 442, was set up in 2015 and publishes harmonized European standards for BIM. As soon as a new ISO standard is registered with CEN, the national mirror committees first check whether there are conflicts with national standards and if necessary raise objections. There is a clear hierarchy of ISO, then CEN, then the national standard. The EU member states are not obliged to adopt ISO standards, but CEN standards must be adopted in national standards and the relevant national standards must be withdrawn if they are not in harmony with the EN standard. Therefore, if CEN adopts an ISO standard – as it is likely to do in the case of ISO 19650 – it must also be adopted in the EU member states.

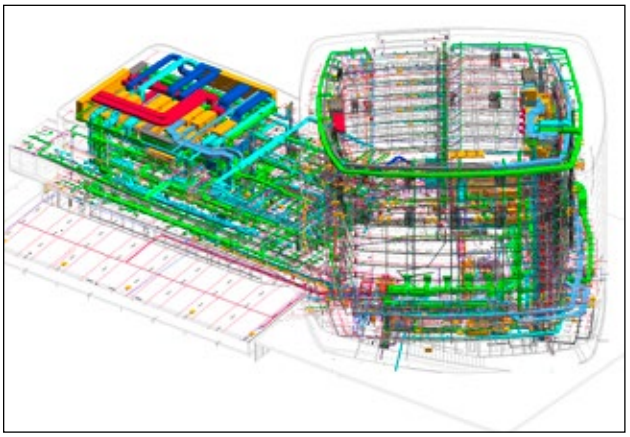
Nowadays, Europe has the greatest regional concentration of state-led BIM programmes worldwide.

The EU BIM Task Group was set up with the aim of uniting national efforts in a common and aligned European approach in order to develop a world-class digital construction sector. The task group represents public clients from 21 EU member states and brings together knowledge from industry, governments, the public sector, institutes and universities.
The European Commission awarded the EU BIM Task Group funding for two years (2016 – 2017) to deliver a common European network aimed at aligning the use of Building Information Modelling in public works.[10]
The UK's Department for Business, Innova-

tion and Skills (BIS) is the lead coordinator for the project. A European BIM guideline could then make the many national manuals superfluous and greatly simplify collaboration between players in the construction sector at European level.

BIM pioneers in the Netherlands

One of the first major projects in the Netherlands to be designed as a virtual model in a BIM environment was the Hilton Amsterdam Airport Schiphol Hotel. As such it is a true pioneering achievement by the Delft architecture company Mecanoo and engineering firms Deerns (Rijswijk) and ABT (Velp) together with the Schiphol Hotel Property Company (a subsidiary of Schiphol Real Estate). Because the hotel was designed using BIM, the model can now also be used to manage and maintain the building efficiently. Great importance was attached to the sustainability of the building. Energy consumption is 10 % lower than the Energy Performance Coefficient (EPC) legally required in the Netherlands. Consultant engineers Deerns achieved this feat by combining a wide range of energy-saving measures: hot and cold storage in water-bearing layers at a depth of 130 metres, low-temperature heating, heat recovery from conditioned air, high yield MEP systems for heat and cold generation due to the use of heat pumps, as well as energy-efficient lighting and optimized ventilation. The heating and cooling demands are met by heat pumps; heat wheels, twin-coil or cross-flow exchangers were installed for air-handling with heat recovery. All in all, Unica Installatietechniek installed 31 km of pipework in the building complex, around half of which is dedicated to climate control in the building. These pipes have feed temperatures of 10 °C and return temperatures of 18 °C. To protect the chilled-water pipes against condensation and energy losses, consultant engineers Deerns specified AF/ArmaFlex insulation material. AF/ArmaFlex was also installed on the air ducts. In 2012, when Unica developed the technical design in Autodesk Revit MEP, BIM was still in its infancy. Today, one in three new public buildings in the Netherlands is planned in BIM.



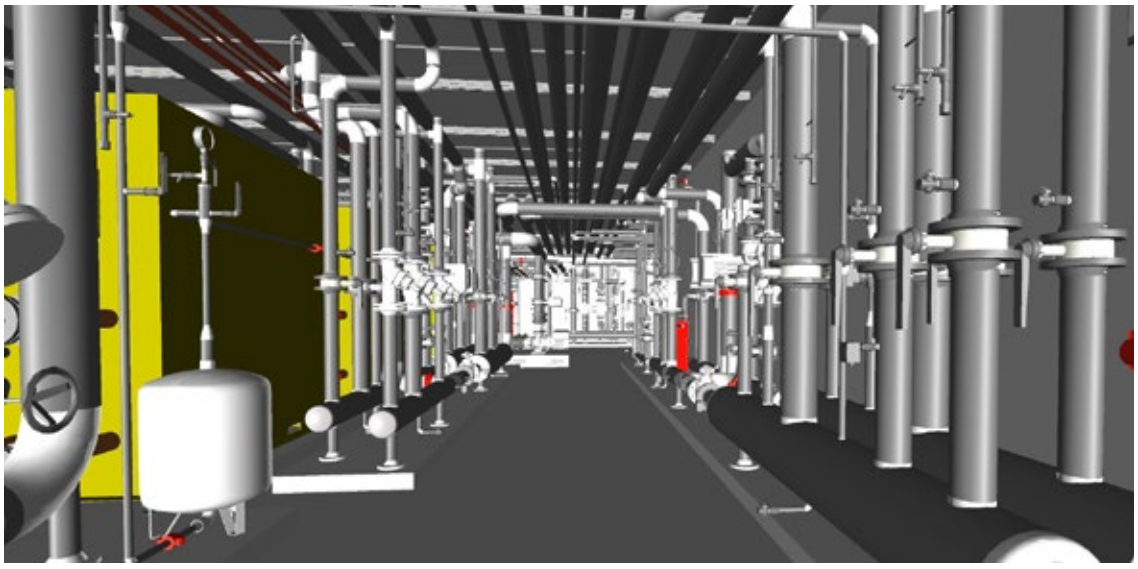
BIM model of the building (Illustration: Deerns)

Planning technical building service equipment with BIM

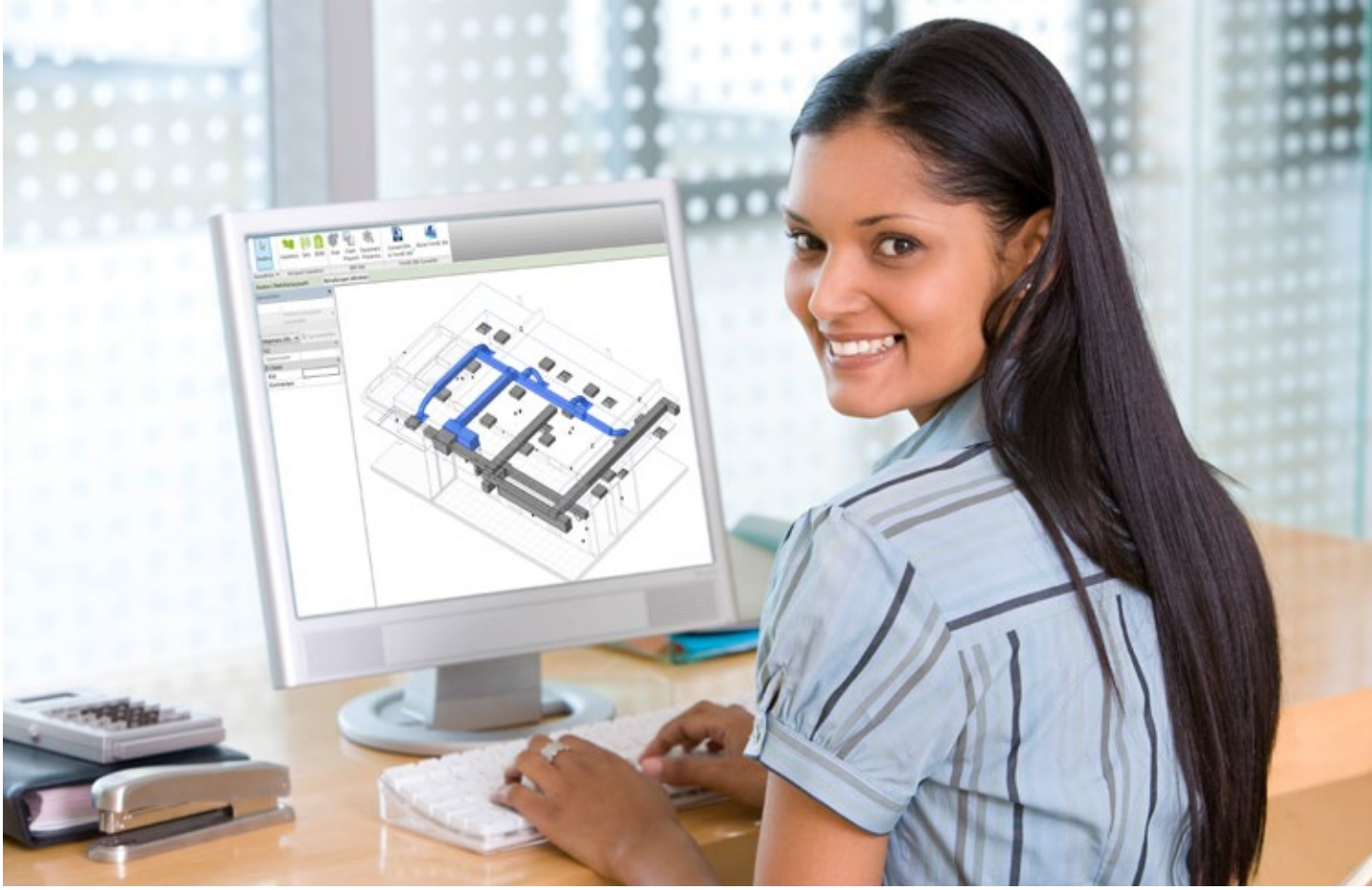
While BIM is rapidly becoming the standard in architects' offices, the building services sector is still lagging behind.[11]

So far only a few, mainly larger, consultant engineering offices work with 3D models. Yet BIM would be of particular benefit for planning building services where a high calculation effort is involved and the individual trades are interdependent. For building operators the advantages extend far beyond the design and construction phase, because all the information on the building can also be provided for its operation. This allows considerable cost savings in terms of both maintenance and energy consumption. But it is only possible to make full use of the potential if all steps in the value chain – i.e. also the planning and installation of the building services – are included. With BIM the building services can be integrated in the planning at an earlier stage than usual and all the relevant trades can be coordinated with each other. BIM also enables improved clash detection in the design phase and contributes to achieving greater efficiency in the construction phase, reducing construction costs and shortening the construction time.[12]

Naturally, specifiers will need support from construction product manufacturers. Their role is to develop software solutions which allow the specifiers to use their products in the BIM model. Some manufacturers already offer BIM objects for their products.



Modern building service equipment in one of the plant rooms of the Hilton Schiphol Hotel in the BIM model and in real-life (Photo and Illustration: Unica)



The Armacell BIM Plug-in can be downloaded free of charge from www.armacell.eu. An introduction to the tool is given in a video tutorial which can also be found here.

BIM and technical insulation

The insulation manufacturer Armacell introduced a BIM module for the Autodesk Revit® program in the USA as early as 2011. Since 2015 the company has been the first manufacturer of flexible insulation materials in the UK to provide BIM objects, which can be downloaded from the NBS National BIM Library free of charge. Now the company has gone a step further and introduced an Autodesk Revit® plug-in for planning technical insulation materials for building service equipment digitally.

The plug-in greatly simplifies the planning of technical insulation with BIM: unlike sanitary objects, for example, insulation has to be designed for equipment (e.g. pipes or ventilation ducts) which has already been planned. As the selection of the specific insulation material depends on various parameters (e.g. the diameter), it has to be entered actively by the user. Here errors often occur, because the data has to be looked up in the catalogue and then entered manually. In contrast, the new Armacell BIM plug-in accesses the data required directly in the model and supports the user in selecting and configuring products. Export from the Armacell product database allows the design process to be automated and the user does not need to make any manual entries. This makes the planning and design process simpler and faster and also reduces errors.

The Armacell BIM plug-in is available in all European languages and national users are automatically provided with the product data relevant to them.

Lean data set for complex models

When developing tools for BIM, Armacell's motto is 'less is more': the file size should be kept as small as possible, to avoid further 'inflating' models which are already very large. In addition, many attributes are not relevant for planning and the more the process can be automated, the more practical the instruments are for the specifier. Developing and enhancing the plug-in requires considerable effort on Armacell's

part as it has to be updated regularly for all the markets. But this tool not only makes it significantly easier for specifiers to embed technical insulation in the BIM model, it also provides greater planning reliability. The next step will be to collect experiences and feedback from users in order to further develop the plug-in. Not only is the building data model a living tool, the development of the individual instruments is also a dynamic process, which all those involved in construction must shape and drive to achieve more and more efficient work processes. Here the provision of technical solutions by the manufacturer is just one building block towards greater digitization in the construction sector.

Conclusion

The construction industry is not finding digitization easy. While a trend towards increased use of BIM can be observed among architects, the building service sector is still lagging behind. Yet BIM would be of particular benefit in the planning of building services where a high calculation effort is involved and the individual trades are interdependent. Of course, 'Building 4.0' does not depend solely on the manufacturer providing technical solutions. Politicians must create frameworks and incentives to promote BIM. Specifiers must familiarize themselves with BIM and construction contractors must discover its benefits. As is the case with all new technologies, there are BIM enthusiasts on the one hand and sceptics on the other. It is necessary to overcome reticence and develop pragmatic solutions. This in turn can only succeed if all those involved in construction play an active role in the process.

References

1. http://www.mckinsey.com/industries/capital-projects-and-infrastructure/our-insights/imagining-constructions-digital-future
2. https://www.nao.org.uk/wp-content/uploads/2001/01/000187.pdf
3. https://www.eiuperspectives.economist.com/strategy-leadership/rethinking-productivity-across-construction-industry/white-paper/rethinking-productivity-across-construction-industry
4. https://www.thenbs.com/knowledge/working-towards-a-unified-approach-to-bim-in-europe
5. Quoted from: CRC Construction Innovation. (2007). Adopting BIM for facilities management: Solutions for managing the Sydney Opera House, Cooperative Research Center for Construction Innovation, Brisbane, Australia.
6. Dipl. Ing. Uwe Wassermann: BIM – Die Digitalisierung der Großbauprojekte setzt sich durch (Digitization of major building projects is becoming widely accepted). In: Ernst & Sohn Special 2014 · BIM – Building Information Modeling; pages 48 – 51.
7. Arch-Vision: The United Kingdom and the Netherlands are clearly at the forefront when it comes to Building Information Modeling in Europe (Press Release from 31-05-2016) http://www.arch-vision.eu/persberichten/Press_release_1_European_Architectural_Barometer_Q4_2015.pdf
8. Quoted from: https://www.constructionnews.co.uk/government-lauds-bim-effect-in-17bn-of-major-projects-savings/8648849.article
9. Source: AEC3 Deutschland GmbH. Quoted from: BIM-Leitfaden für Deutschland - Information und Ratgeber. Endbericht. https://www.bmvi.de/SharedDocs/DE/Anlage/Digitales/bim-leitfaden-deu.pdf?__blob=publicationFile
10. eubim.eu
11. Steve Hunt: Why is the building-services sector lagging behind in BIM? In: MBS (Modern Building Services) August, 2015 http://www.modbs.co.uk/news/archive-story.php/aid/14890/Why_is_the_building-services_sector_lagging_behind_in_BIM_.html
12. Günther Mertz, General Manager of the BTGA (German federal industrial association technical building systems): „BIM wird die TGA grundlegend ändern" ("BIM will fundamentally change business services"). In: TGA Fachplaner 12-2014. https://www.tga-fachplaner.de/TGA-2014-12/BIM-wird-die-TGA-grundlegend-aendernldquo,-QUlEPTYyMjExNSZNSUQ9MTAwMjQ4.html

AUTHOR

Dipl. Ing. Michaela Störkmann
Armacell Technical Manager EMEA

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ABOUT ARMACELL

As the inventor of flexible foam for equipment insulation and a leading provider of engineered foams, Armacell develops innovative and safe thermal and mechanical insulation solutions that create sustainable value for its customers. Armacell's products significantly contribute to driving energy efficiency worldwide. With more than 3,300 employees and 25 production plants in 20 countries, Armacell operates two main businesses, Advanced Insulation and Engineered Foams. Armacell focuses on insulation materials for technical equipment, high-performance foams for acoustic and lightweight applications, recycled PET products, next-generation aerogel technology and passive fire protection systems.

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