



AUTODESK UNIVERSITY 2015

CS10324

BIM Support for the Construction Project from a Suppliers POV

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Learning Objectives

- The possibilities of project detailing in an early stage
- The use of automation tools for detailing
- The workflow to automatically integrate product solutions into the design
- The best practice to link the design with the construction site

Description

Building Information Modeling (BIM) not only has an impact on designers, but it also impacts suppliers of construction products. Today even suppliers are required to provide digital content for a BIM model. Hilti Corporation has developed a seamless integration of their products into AutoCAD software, Revit software, and Inventor software. The second evolution is then the provision of tools for automatic placement. Based on a linked setup and own developed plug-ins for Navisworks software, Revit software, and AutoCAD software, Hilti has created an expert tool for the market. But it's not only during the design process that the supplier can support digitally. With the integration of construction information already during the design process and export tools for AutoCAD software and Revit software, the simple exchange to jobsite tools can be achieved. The class will show how a customer can use detailed content from Hilti. Furthermore, we will give an inside look into the automated solutions found by using the Hilti Button. We will conclude with the best support for the execution by bringing information of a BIM model to the jobsite.

Your AU Experts

Nils Krönert started his carrier as a site manager within the German construction industry. After his Ph.D. about Construction Management with the focus on Requirements Engineering, he worked as a BIM Manager in the Middle East for almost 5 years. He was responsible for the successful BIM implementation on different large scale projects. In 2015, Nils joined the Hilti Group to expedite the BIM support from suppliers to design and construction professional.

Connor Christian's goal in BIM/VDC is to bring new technology into daily practice by creating procedures and tools that can be used by everyone. Connor has combined its practical knowledge with the ability to interface with computers down to the programming level to find a successful role in BIM/VDC at Kiewit. Outside of Kiewit Connor has worked to make BIM/VDC successful for the industry as a whole. Connor's drive to standardize BIM/VDC in the industry has led him to get involved in the NBIMS. As a member of the USACE BIM committee Connor works to create contract language that will not only assist the USACE but also other facility owners that are starting to require BIM/VDC on their projects.

Introduction

With the BIM developments in the last years, a lot of work processes has either changed or adapted to the new way of collaboration. One major aspect of the virtual design is the shift of effort from the construction phase to the design phase. This shift of effort is especially affecting manufactures. Before the BIM revolution, manufacturers were mainly focused on the jobsite as the main arena to promote and sell their products and services. But nowadays, virtual design has enabled decision-making to be done already in the design phase. Therefore manufactures now have to rethink their approach and support already the design phase with their knowledge and products. This is the new arena where procurement decisions are made. Those who wait for the construction phase will run the risk of finding themselves locked out before they even approach the jobsite.

Hilti, as a global market leader in providing electronic tools as well as fastening and protection applications for construction professionals, has understood this need and worked on solutions to it. Now, Hilti products, systems, and services offer innovative solutions to simplify the work processes not only on the job site but also already in the design phase. One of the main aspects of Hilti's sales strategy is the direct customer contact which provides immediate feedback but also enables to detect new developments and trends in the market. Very often, Hilti teams up with important customers to start the development of customer specific tools and supports. To research and understand BIM and this new way of working together better, Hilti has teamed up with Kiewit, one of the largest construction, mining and engineering companies.

Kiewit is one of the largest construction companies in North America, with a growing worldwide presence like Australia. Throughout Kiewit's history, the strategic focus was on infrastructure as well as high-rise projects. In the last years, Kiewit included also BIM within their work procedure and utilizing it to visualize and coordinate project conditions during planning, design and construction. In general, Kiewit's approach to BIM is to use the technology as a tool to enhance already successful procedures. Kiewit's vision is to employ cutting-edge software technologies to improve how information is created and shared among stakeholders throughout the project life-cycle. Overall, BIM provides an effective way for Kiewit to gain insight into the projects from a constructability and scheduling standpoint.

Kiewit's vision towards BIM is very simple: Enhanced communication, increased efficiency, and best-in-class quality. In short, BIM helps Kiewit to build a better building.

Hilti also acknowledge Kiewit's vision. However, Hilti as a manufacturer and supplier has to have a different approach than a construction company. To understand the possibilities of a manufacturer within the BIM environment better, it is important to define the role of the manufacturer more clearly. Hilti sees their role as a support to the different BIM processes and use cases. As a manufacturer, Hilti cannot be the initiator of a specific BIM use case like Kiewit but Hilti will always support the BIM use cases if a customer wants to utilize it.

Based on these customer requirements, Hilti started to develop a holistic BIM approach which supports the customer throughout the whole project life cycle. In order to provide the best solution to the customer, Hilti needs to support the designer within their design software. Beside the software support, Hilti sees also a big benefit in providing services to support the BIM work process of its customers. But not only is the support of the design software important but also to keep the job site in mind and consider possible implications already in that phase.

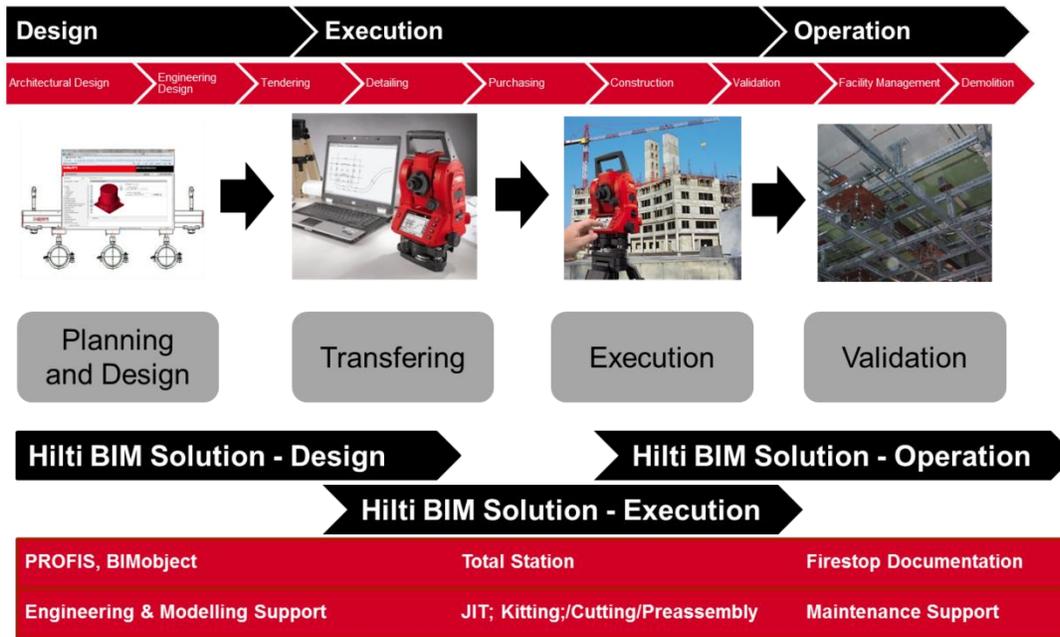


FIGURE 1: OVERVIEW HILTI BIM SOLUTIONS

With the shift of decisions to the design phase, the use of virtual models in order to avoid errors on the construction site requires the need for more detailed models and more information during design already. Therefore, very often, generic models are not sufficient anymore but real (virtual) products are needed to include into a BIM-model. Beside the geometric representation, it is also very important that detailed (numerical) information is included. The information is required for further analysis like sustainability or energetic analysis. Designers now need more detailed product information already in the virtual design.

Suppliers and manufactures know their products best and therefore can also provide the best information about it. With the developed BIM solutions, Hilti tries to bring the needed information to the customer. But not only are the virtual products important for the customer but also the engineering support. The support offered by Hilti helps the customer to select and design the best solution based on the project requirements.

Customer feedback shows that the majorities of designers work in certain environments like AutoCAD or Revit and want manufacturers to support them in these design software. For this reason, Hilti like other vendors, created a digital library to promote their content. With these libraries, designers can have direct access to the digital content of suppliers. The Hilti library is software independent, meaning that it supports multiple exchange formats. The technology is based on a script model and the object will be created online during the access. This gives the possibility to provide either 2D details or 3D components without additional effort.

However, this solution is not completely integrated into the work process of the designer. The designer still has to leave his design software and collect the information from the supplier. To avoid this obstacle, Hilti has developed plugins for AutoCAD and Revit which supports the direct integration. The customer now can directly access the libraries within his design software and search for the right product or information.

Although the library is widely used, the BIM technology offers an even better support for the customer. First of all, objects created for BIM can have a certain intelligence which can support the design process. But also this approach can be extended by automate the design process based on the information within a BIM model. And also with the use of Hilti objects in the design phase, information for the jobsite can already be prepared.

BIM support for Design

Within BIM the design phase gets a more important part, because the virtual design should be used for decision making. This increases the requirement for more detailed information also about fastening and protection objects, like anchors, installation parts and fire stop products. Therefore manufacturers are required to develop virtual products catalogues. However as different designers work in different software, manufacturers will gain the greatest benefit, if they provide and support a wide range of interface.

Hilti has developed a solution which supports a variety of interfaces. The library is based on a scripted database containing all the geometrical and numerical information of a product. After selecting a product the user can either select between more than 15 different export formats or a direct integration into a CAD system. This enables the customer to either create their own library or to utilize the online library directly in the design process.

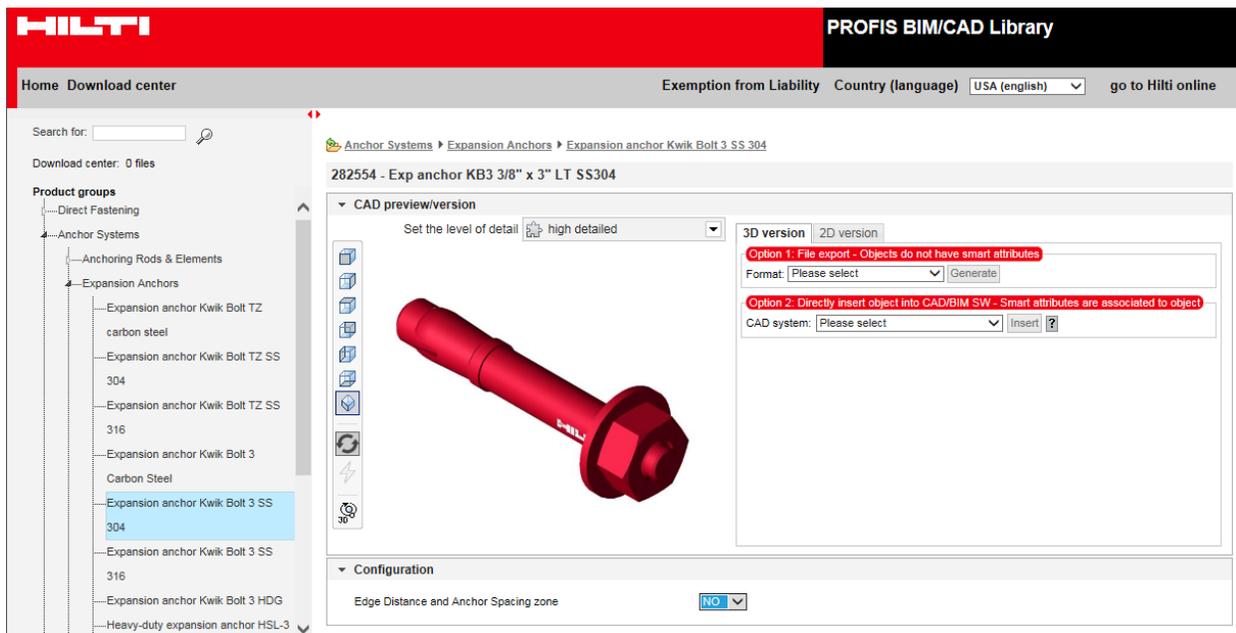


FIGURE 2: HILTI ONLINE PRODUCT LIBRARY

Not only have the objects of the library the right geometry for the design but also contains important information which can be utilized within different BIM use cases. The information even an AutoCAD-object contains are e.g. about the use (Certificates, environmental conditions) or purchase (item number, order quantity).



Attributes	
Part_no.	282554
Description	Exp anchor KB3 3/8" x 3" LT SS304
Manufacturer	Hilti
Homepage	http://www.hilti.com
Weight_in_gramm	46.460
Revit_vendor	Hilti
Base_unit_of_measure	PCE
Revit_Family_name	Exp anchor KB3 3/8" x 3" LT SS304
Minimum_order_quantity	50.000
Anchor_length_in_mm	3 in
Drill_bit_diameter_in_mm	3/8 in
Environmental_conditions	Outdoor
Base_materials	Concrete (light weight); Concrete (uncracked); Masonry (grout-filled...
Type_of_fixing	Pre-fastening; Through-fastening
Certificates	COLA (City of Los Angeles); ICC-ES report (concrete); Miami Dade Co...
EAN_Code	7613023249368

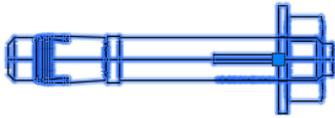


FIGURE 3: ATTRIBUTES OF A HILTI PRODUCT IN AUTOCAD

But to support the direct integration into the design software, Hilti has taken the next step and developed a plugin to be used within AutoCAD and Revit. Within AutoCAD the designer doesn't have to leave the program anymore and open a separate browser but can directly work within AutoCAD and integrate the models into the drawing.

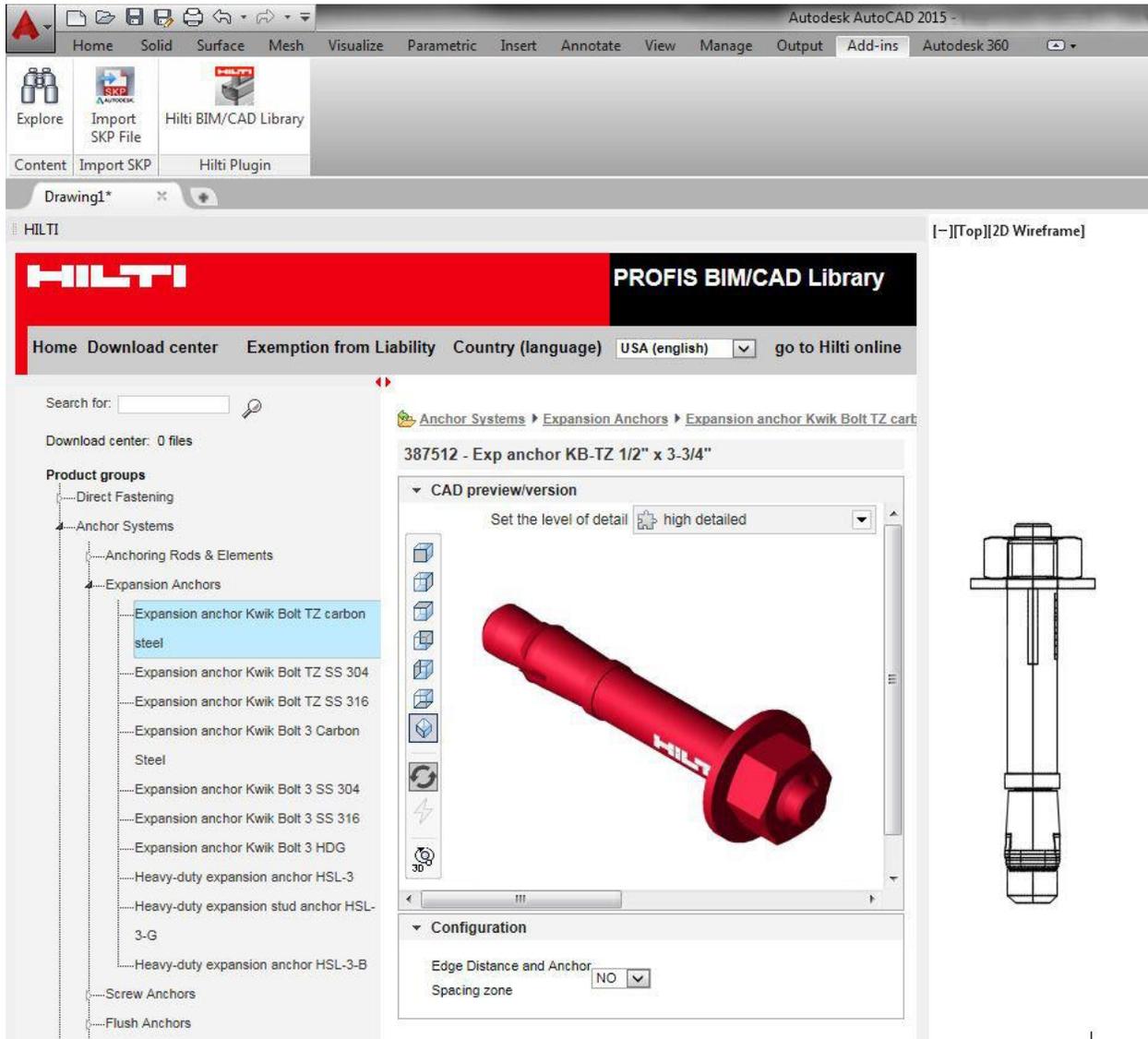


FIGURE 4: MANUFACTURES PLUGIN WITHIN AUTOCAD

In addition to the product library, Hilti developed software tools which help the calculation and design of details and also provide integration into the design software. With PROFIS Hilti offers application based software which can be utilized for different purposes (e.g. design of anchoring, design of pipe supports). A good example is PROFIS Installation for the calculation of pipe supports based on the load requirements from the pipes. With this software, the designer can simply create and calculate the right support. After he has confirmed the calculation, the calculated support can be exported into the design software like AutoCAD or even Revit. Within the design software the customer can easily place the calculated solution around the installation. This helps the designer to evaluate the needed space and to verify his design. The pipe support parts can then also be used for clash analysis or even a detailed quantity take-off in order to estimate the costs of the project.



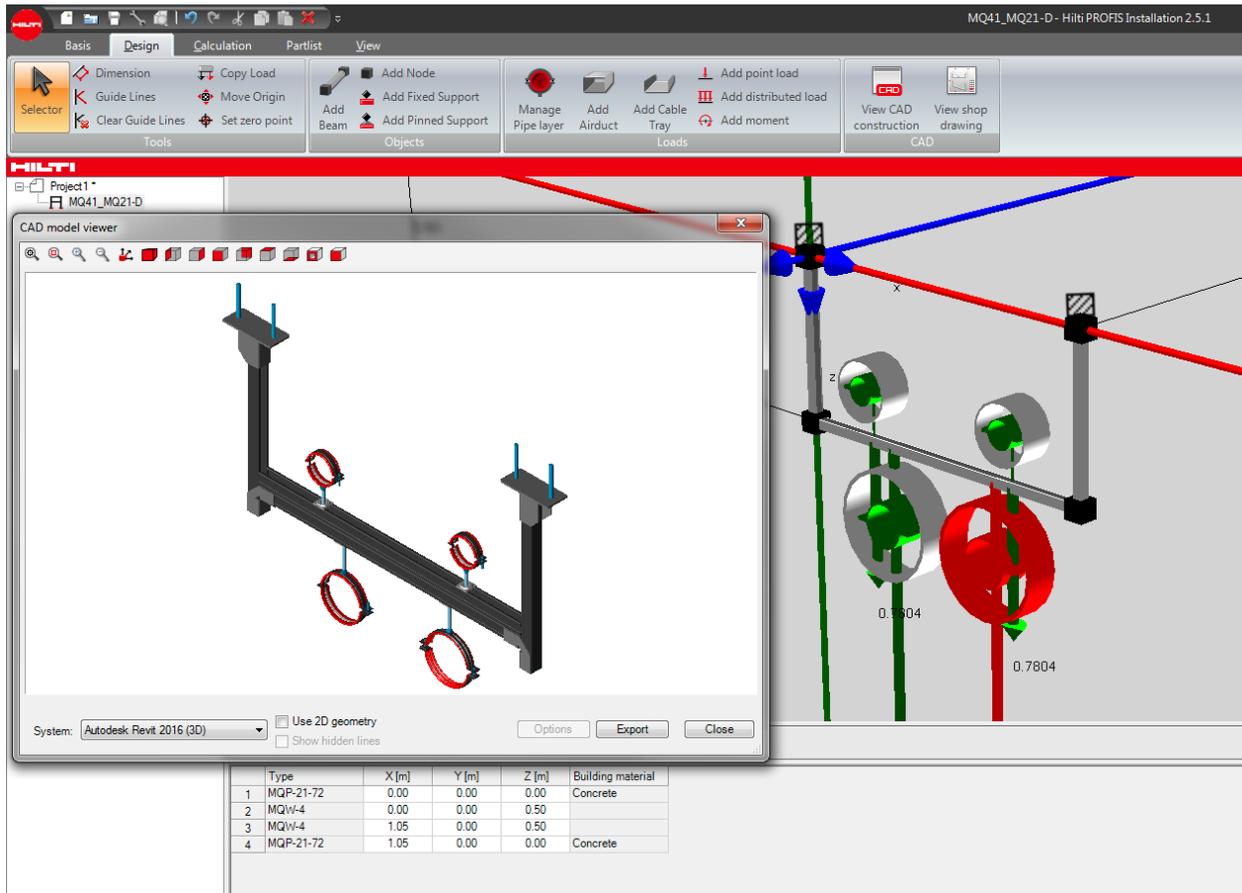


FIGURE 5: PIPE SUPPORT CALCULATION AND BIM EXPORT

All these possibilities are only the first step into customer support. Although the use of AutoCAD is still very high, it is not easy to provide the full potential of BIM within AutoCAD. In alignment with customers, Hilti therefore started to also support Revit content. Even though the product library offers an import to Revit, the objects from the library do not fully support the functionality of Revit. In order to provide this support, Hilti started to redevelop the objects and provide them on global content platforms like Autodesk Seek.

Beside the described tools which are an essential part to support the virtual design workflow, it is also important for a supplier to provide the right support service for customers. In general, the supplier is the expert for the products and the design segment of the products. With this expertise, Hilti can also provide engineering support but also can be part of a project team in order to optimize the digital model and provide a life-cycle orientated product.

With this kind of customer engagement, Hilti has the opportunity to enhance its tools more and more and also to set new milestones in technology. Based on the customer feedback, Hilti has now developed the automated design of its products within the BIM environment.

The latest development is the Hilti Firestop-Button. This Button is a new innovative piece of software, which fully integrates Firestop planning and execution into an existing BIM workflow. It helps the designer to automatically populate its BIM model with needed Firestop-products. The Firestop-Button



combines different software products and enhances them with the Hilti-own Firestop-logic. The software is integrated into Navisworks, Revit as well as AutoCAD MEP and Fabricator.

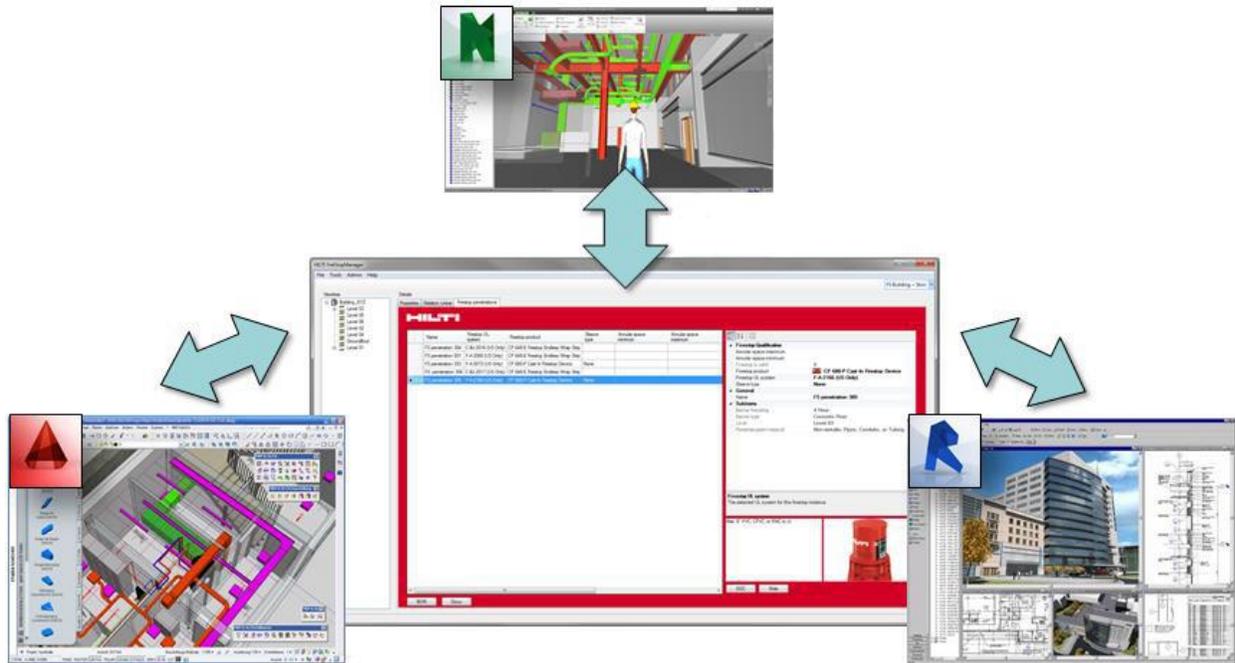


FIGURE 6: HILTI FIRESTOP-BUTTON FRAMEWORK (NAVISWORKS, REVIT, AUTOCAD MEP)

The Firestop Button requires only BIM models with basic Architecture and MEP-information. Within the Architecture, the fire rating of the walls and slabs has to be defined, whereas the MEP-model has to have information about the pipes, duct, ... (E.g. material).

The Firestop Button then takes this information and automatically evaluates which Firestop product is relevant and can be selected for each and every wall penetration of an MEP-element. The algorithm utilizes the functionality of Navisworks in order to identify the penetration with the federated models. In addition it indicates which penetration has been resolved and which are still open. All information from the analysis along with the object information will be stored in the Firestop database and can be passed on to the Firestop-Manager which is the actual evaluation tool.

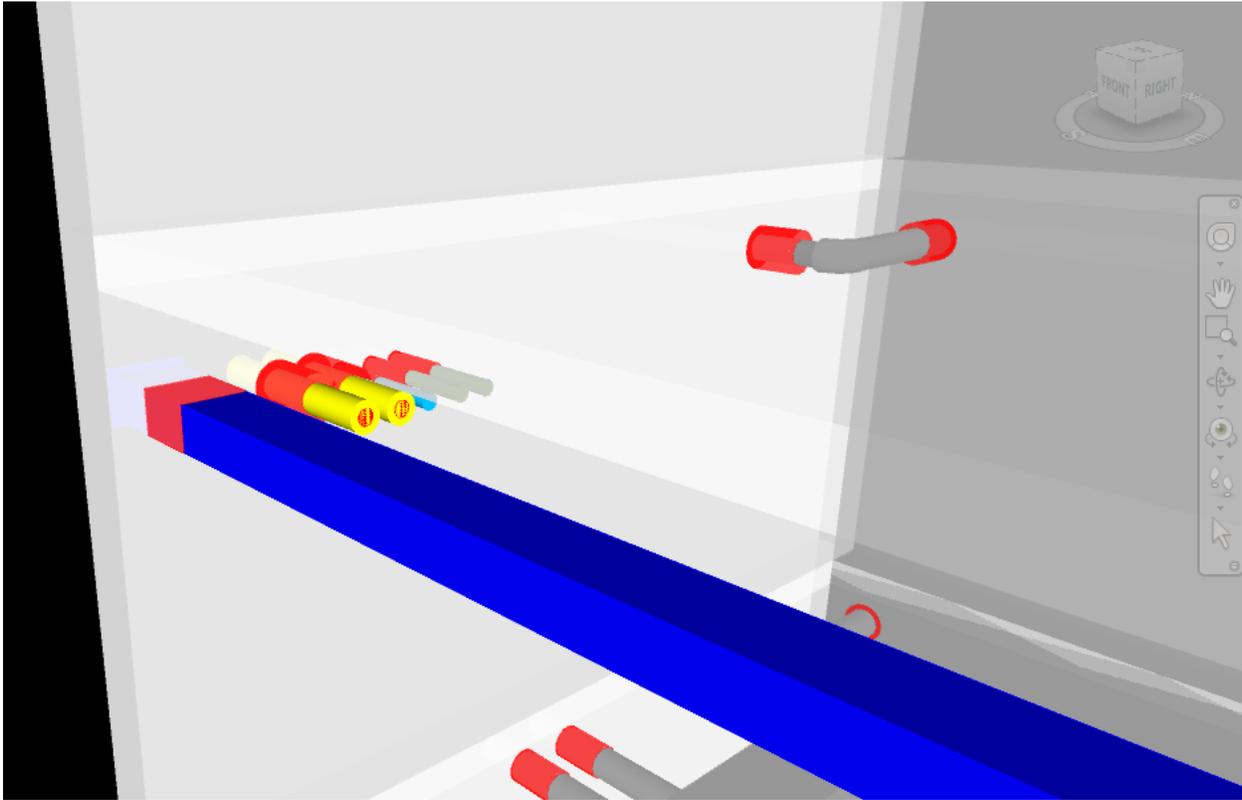


FIGURE 7: NAVISWORKS FIRESTOP ANALYSIS

The Navisworks analysis results will be evaluated by the Firestop-Manager. This independent tool contains the selection logic of the different Firestop-products. Based on the defined standards like the UL-System and the preferred selection of the user, the Manager will find the optimal solution for all the different MEP-Structure-penetrations and provide automatically generated recommendations. Each penetration will have a unique entry and can be easily reviewed by the user. Not only can the user agree on the calculated solution but he will also get more detailed information about the product with a direct link to existing approvals and instructions. In addition, the tool also summarizes all the different information in order to quantify the costs and prepare purchase orders with the prospective bill of materials. The tool will also indicate which penetration cannot be solved with the regular portfolio and needs further detailed attention (e.g. fire rating >4 hours). All these information will be stored in the Firestop database and can be reviewed graphically in Navisworks.

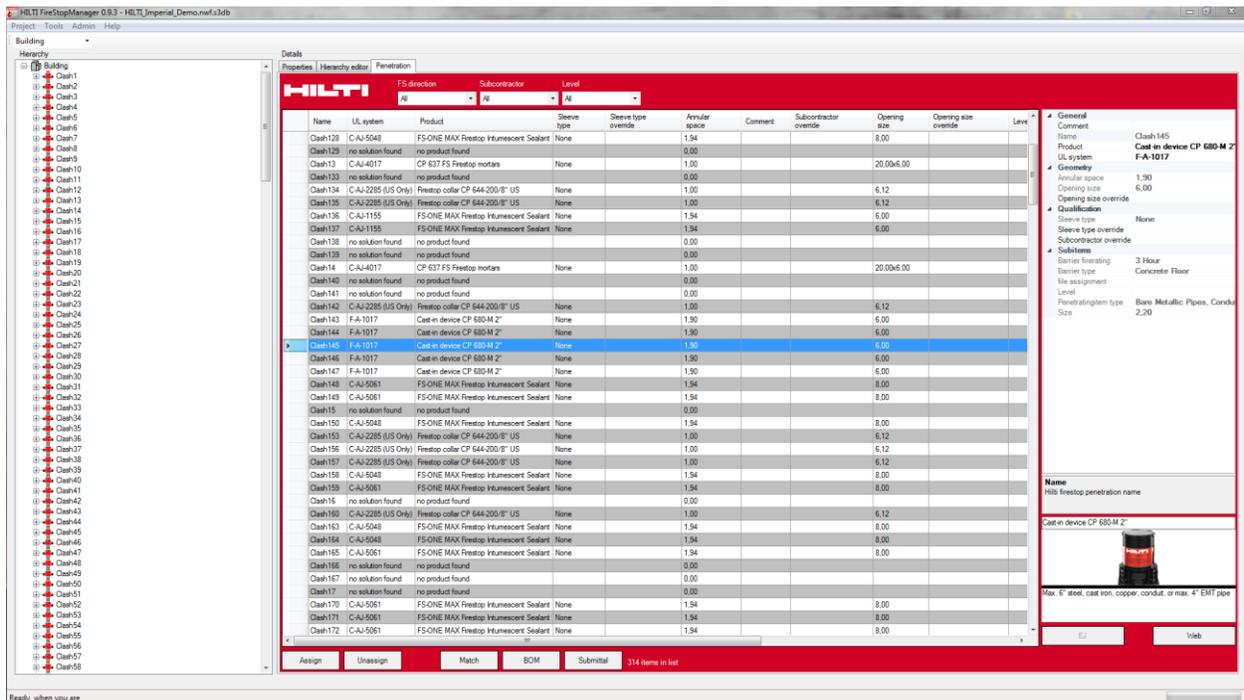


FIGURE 8: FIRESTOP MANAGER WITH DETAILED PENETRATION AND SOLUTION INFORMATION

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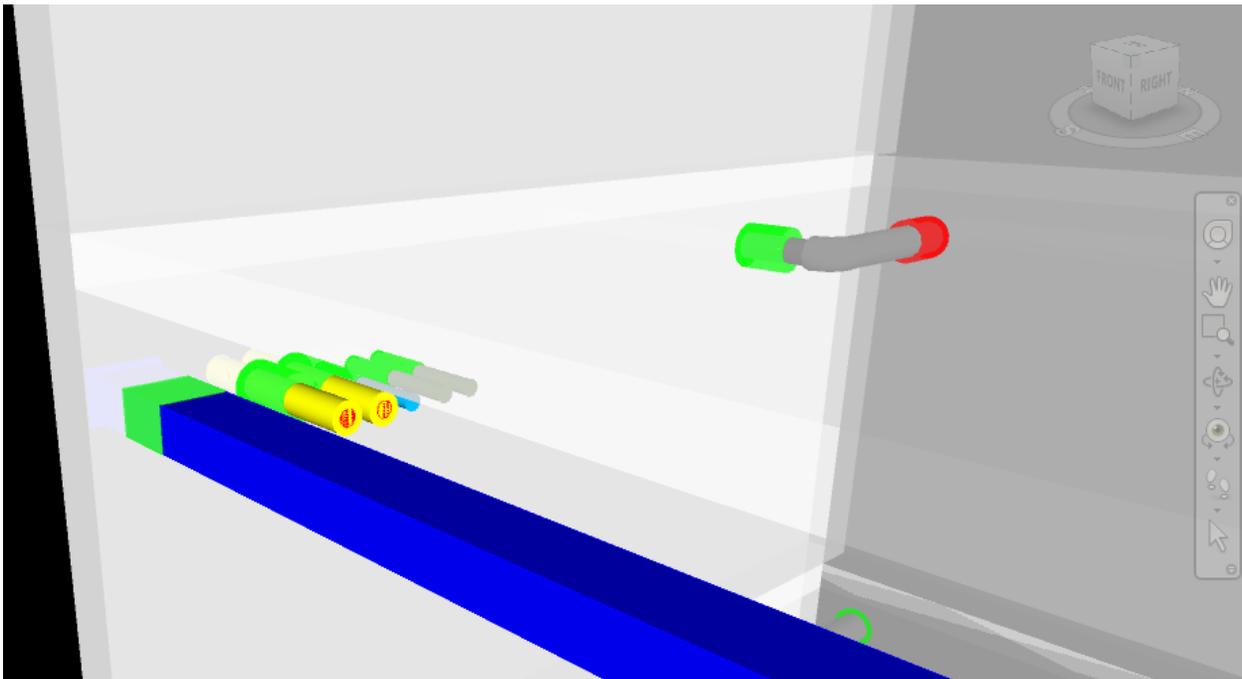


FIGURE 9: STATUS OF FIRESTOP-ANALYSIS INDICATING SOLVED AND STILL OPEN PENETRATIONS

After the user has agreed on the calculated result, the Manager can be used to automatically place the correct products within Revit or AutoCAD MEP into the BIM model. This step ensures that all the information will be part of the BIM process and can be shared with the different stakeholder. It also helps to verify the design and show the optimal Firestop solution.

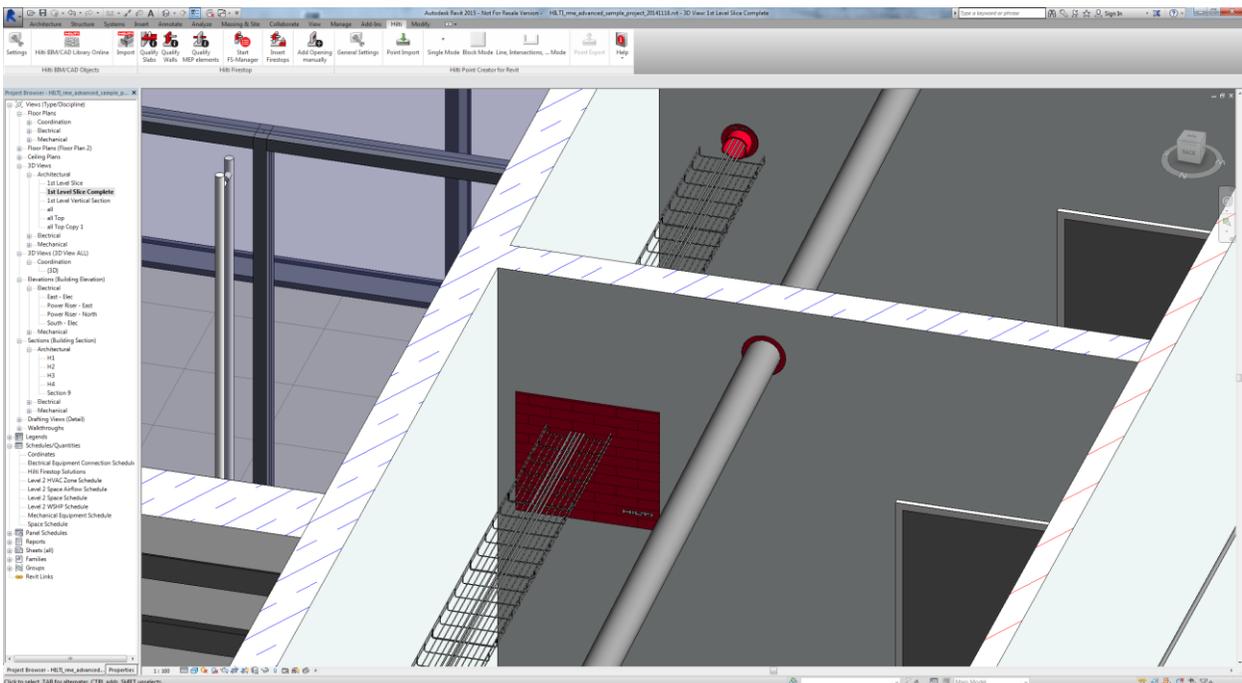


FIGURE 10: AUTOMATICALLY PLACED FIRESTOP-SOLUTIONS WITHIN THE BIM-MODEL

Overall the Firestop-Button helps minimize the effort for calculating and defining the right Firestop in a BIM model and therefore also in a building. Analysis shows that the working time can be reduced from days to minutes. In addition, this task can now be done easily in the design phase which helps enhance the model quality and secure the cost. .

BIM support for Execution

Beyond the design phase, suppliers have to also support the construction project and also during the execution phase. Especially during the execution phase, the use of BIM models can be beneficial for all stakeholders.

An important part for the supplier is the material logistic and all its involved tasks. One of the crucial elements is the Bill of Materials (BoM) which can be easily generated from a BIM model. Hilti has considered this task already in the design phase. By utilizing their different design support, the BIM models will be enriched with detail material information. Based on the BIM model, Hilti can easily identify which products are needed. And if the contractor has already linked the BIM model to a schedule, it is even possible to provide the correct amount of material to the jobsite at the correct time. Logistics could even be extended beyond single items so that there are complete preassemblies (like façade elements, installation parts) sent to the jobsite.



FIGURE 11: PREDEFINED MATERIAL SUPPORT BASED ON THE BIM MODEL

But not only is the material logistic important to the jobsite. For the contractor the question, how he can get the information of a BIM model is even more important. To answer this question, Hilti has developed tools and software to link the information from the BIM model to the real world. As part of its BIM-to-field approach, the Robotic Total Station (RTS) is a key element in the process chain. The RTS provides the possibility transfer measuring information to the jobsite. With its unique controller a drawing or model can be visualized and helps to site to identify important construction elements.



FIGURE 12: ONSITE USE OF A TOTAL STATION TO BRING A BIM-MODEL TO THE JOBSITE

For the correct preparation of the BIM model, Hilti has developed different plugins for AutoCAD and Revit. With the PointCreator, already the designer but also the contractor has the possible to define and create measuring points within a BIM model which should be transferred to the total station. The easy to use integration into the existing design software like Revit or AutoCAD ensures that already the designer can provide the information.

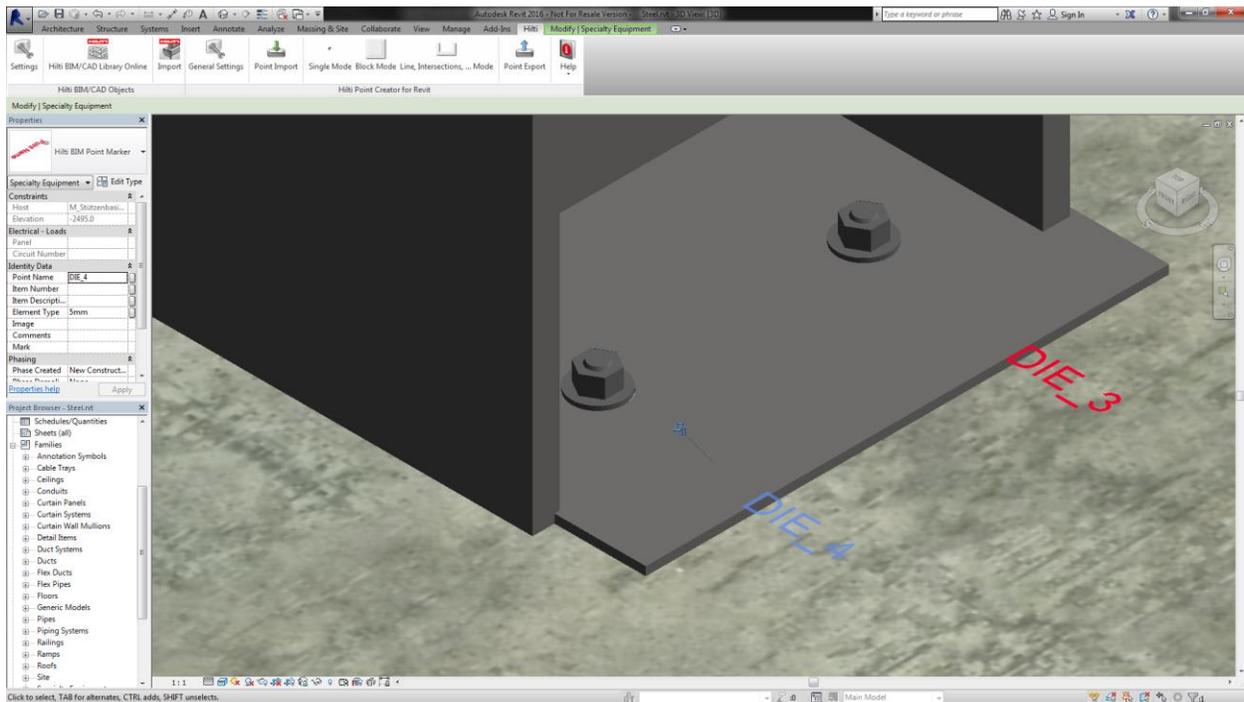


FIGURE 13: PLACING OF MEASURING POINTS WITHIN A BIM-MODEL

But also this step can be even simplified and taken care of automatically. With the implementation of measuring points already in the provided BIM objects, the designer doesn't have to think about the measuring anymore but will place the correct points already within the design phase by simply placing the wanted products in its design. In addition, by using objects from Hilti also additional information will be brought to the TotalStation. This helps the construction site to identify which products should be used for which drill hole.

	A	B	C	D	E	F	G	H	I
1	PtID	N(y) (Mete	E(x) (Mete	H(z) (Mete	Layer	Item No	Naming	Element	Color
2	DIE_1	5.467	3.612	-2.479		0 2018411	Anchor rod HIT-Z M12x105	INSERT	white
3	DIE_2	5.318	3.612	-2.48		0 2018411	Anchor rod HIT-Z M12x105	INSERT	white
4	DIE_3	3.013	3.61	-2.484		0 2018411	Anchor rod HIT-Z M12x105	INSERT	white
5	DIE_4	2.865	3.607	-2.48		0 2018411	Anchor rod HIT-Z M12x105	INSERT	white
6	DIE_5	4.469	4.14	-2.5	Foundation			INSERT	32
7	DIE_6	6.269	4.14	-2.5	Foundation			INSERT	32
8	DIE_7	6.269	2.94	-2.5	Foundation			INSERT	32
9	DIE_8	4.469	2.94	-2.5	Foundation			INSERT	32

FIGURE 14: EXPORTING MEASURING INFORMATION FROM A BIM-MODEL TO A TOTALSTATION

Conclusion

This lesson shows how suppliers can and should be part of the BIM process in all the different project phase of a construction. It shows the possibility but also the necessity for the use of product information already in the design phase and therefore the need of detailing at an earlier stage than before.

Based on this experience and the knowledge of a supplier, it is possible to even automate detailing procedures by utilizing the existing possibilities of the design software (Revit, AutoCAD, and Navisworks) and enhance them with the product specific information. This approach leads to big steps in the efficiency and can reduce the workload dramatically. It also helps to ensure the correct integration of the products and therefore eliminates the errors during design.

In addition, this lesson shows also how these information can be easily prepared and brought to the jobsite by using simple tools and plugins for Revit and AutoCAD.

