White paper

Efficient digital delivery of construction projects with COBie

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MT Højgaard has over the years developed a strong practice in the use of BIM. Today we practice both BIM and VDC to increase productivity through collaboration between the project parties with the common goal of delivering the best project to the client. The development of methods and opportunities in digital construction creates among other things a growing need for a better support for digital delivery of project information, so this information can be recycled throughout the building's lifecycle. It provides opportunity for an increase in productivity in the subsequent operation and maintenance, but it requires decisions from the client upon the operation and maintenance of the building, and this generates a need for clarification of which information should be handed over to the operation and maintenance (O&M). As a basis for this clarification MT Højgaard has developed a tool.

The digital handover has become more essential as a part of the clients O&M of the building. Some clients has for a while been placing requirements for the digital handover of the information of the building and how the information is structured and delivered. In a previous White paper, *The strength of the local BIM efforts in a larger perspective*, we describe how The Danish authority The Danish Building & Property Agency has set up a framework for digital collaboration using BIM in public construction projects in Denmark as of April 2013 in the form of ICT Regulation 118. The ICT Regulation provides a basis for the requirements on projects and reflects the importance of supporting the digital collaboration and exchange of information throughout the project. Subsequently The Danish Building & Property Agency has set up a method to assess the value of the requirements in the ICT Regulation. It appears from this assessment that the value of digital delivery is highly prioritized and therefore must be seen as of great importance for the client.

Basis for digital operation provides a better overview

The final handover of a building to the client includes delivery of documentation for as-built (construction geometry) and a collection of relevant information to be used in the following O&M.

An increasing number of clients require delivery of as-built and information, because it holds the potential to ensure efficient operation. Inspection, service and maintenance are often large budget items in the operating of a building, and if the necessary information about the project can be found and used digitally, it can provide a much better overview and opportunities to manage and optimize operations.

Delivery for the operation is often prepared close to the handover and is often a manual collection of information after the construction of the building. This delivery can be planned so that it is incorporated earlier in the construction process. Already in the design phase the client can decide what is to be delivered for the O&M, so that the needed information can be collected and

applied to the building component at the right time in the process. A planning of what information must be delivered at any time in the process will at the same time specify whether it is the architect, consultant or contractor who must deliver the information. This creates a clear and effective process for collecting the relevant information, while ensuring that the assignment is not pushed to the end, where each party must complete the work on each building.

To provide a framework for the clarification to take place, MT Højgaard has developed a tool that helps the project and the client to clarify the need for information for O&M and at the same time supports a structured and digital collection of the relevant information. The tool supports the use of Construction Operations Building Information Exchange (Cobie) and provides a structured approach to further work on information to O&M, and linkage between the project's as-built model and the corresponding information for O&M.

Digital delivery strengthened through standardization

Over the past years, MT Højgaard has found that the collection of O&M information is based on traditional methods of building component sheets. It costs the contractor time and the client money. An increasing focus on optimizing building operation can be supported by digitalizing the information to be used for the O&M. Therefore, it becomes necessary to exchange relevant information on the building and operation, and this requires common standards for the exchange of information to take place.

Therefore there is a need for a framework that can help to define and set standards for what requirements the developer must make tools, standards and content. Here, the Danish ICT regulations 118 and 119 can function as a part of the frame, for example, requirements for IFC, which holds the potential for a necessary exchange of information between the parties to the project from design to operation. The requirement to use IFC supports the digital handover of the as-built model, and when you link this with the delivery of information to O&M, it can be used in the following operation phase. The delivery of information is not subject to standards and therefore in 2016 still largely takes place in word and pdf.

MT Højgaard has learned that the tools for using the IFC as an exchange format gets better and better. MT Højgaard's study and white paper from August 2014 showed how the requirement for IFC helps increase design quality[1] and a subsequent study from 2015 showed that the number of projects with BIM and classification and IFC was booming[2] . Where IFC is used as an open standard in the construction process, US operating organizations developed the open standard COBie[3] that supports information exchange for the operation. IFC can be used to exchange information at different times in the construction process, so information that is required early in the project can be collected and exchanged through the project from design to operation.

Therefore, there is created a number of international initiatives, including COBie. COBie is a standard method to exchange data between BIM and the operation organization's O&M system and can be regarded as a container of information that can be used in different situations - assuming that someone previously has collected the information. It is therefore necessary to begin with deciding what information should be used in the O&M. This will provide the client with a complete set of information based on the requirements made in the project. COBie is based on Excel and may be considered as a structured collection of data and information for

[1] Read MT Højgaards White paper: *IFC - A driver for design quality in the AEC industry*, August 2014, mth.com.
[2] Read MT Højgaards White paper: *Addressing classification in the Danish AEC industry*, June 2015, mth.com.
[3] Read more on COBie på http://www.wbdg.org/resources/cobie.php or http://www.bimtaskgroup.org/cobie-uk-2012/

O&M, but also as a method to collect and exchange necessary data. The use of COBie offers great benefits for the O&M and enables among others an import of information about building components for O&M systems[4]. It requires a certain degree of standardization in addition to the requirements for use of IFC, made today in the Danish Executive Orders 118 and 119, for example, requirements for classification and cooperation on IFC[5].

The British government is working on a comprehensive standardization work to create a link between the construction industry, for example through the British standard: PAS1192-1: 2007, which is developed for the British government, whom as a great client in the construction and operation of building has a great interest in optimizing the operation of the building stock to reduce costs among other things. Today the British government therefore requires the use of BIM on public projects because it offers the possibility of developing and structuring relevant information about the building. For the British government, it's very much concerns Asset Information Management - that is, how to use information about the construction of the various British standards 1192-1, 1192-2, 1192-3, 1192-4 therefore describes how the information exchange can take place at each project.

Digital delivery on the basis of specific tools

Today MT Højgaard uses eg 3 tools to ensure exchange of information on each project: 1. Building Component Catalogue with Level Of Development (LOD), 2. *DK-COBie-2016 and 3. Model Progression Specification (MPS).*

MT Højgaard uses our *Building Component Catalogue with Level of Development (LOD)*[6] (LOD cataloque) to ensure a mutual understanding and agreement on the geometry and the information that must be for a BIM delivery at any given time. the LOD catalogue serves as an annex to the project's ICT agreement, and there is a clear connection to one of the other annexes: *DK-Cobie-2016* contains a list of selected building objects eg from LOD catalogue and used to identify, which building components as well as the specific information to be delivered to the client, see Appendix 1. It shall ensure that relevant information about the building of the individual building components can be found and used in the operation phase. Finally, the annex contains information about when information is to be applied to each object through the construction process indicated as datadrops, and allows you to specify which project partners to deliver the information. DK-Cobie-2016 uses the COBie standard and provides a reference for COBie extensions in Revit. In this way *DK-Cobie-2016* a platform for the third tool: *Model Progression Specification (MPS)*, which describes a plan for where in the construction process the different information should be delivered according to project milestones - *A Model Progression Specification - MPS*.

[4] Between the Poles: Facilities and operations management, http://geospatial.blogs.com/geospatial/facilities-and-operations-management/page/3/

[5] Read MT Højgaards White paper: *Value drivers in the Danish national ICT regulations*, December 2014, mth.com.

[6] MT Højgaards Building Component Catalogue with level of informations (LOD) is published in Danish, English, Norwegian and German on mth.com

The clear correlation between the three tools provide individually and overall a solid tool to support the digital building process and delivery and a framework for the client's requirements for delivery can be translated into a plan for information exchange throughout the project.

MT Højgaard's practice of digital handover in this way involves the use of COBie because it provides a structured set of information that can be transferred directly to the clients system for O&M[7].

The different parties in the construction process have various interests and requirements in relation to geometry and information. Where architect and consultant in the early stages are focused on geometry and the graphical expression in the project and not so much focus on information about the building, the contractor has an increasing need for information where finally the information plays a dominant role in the operating organization where it is used as knowledge about the building of the individual building[8], see Figure 1.

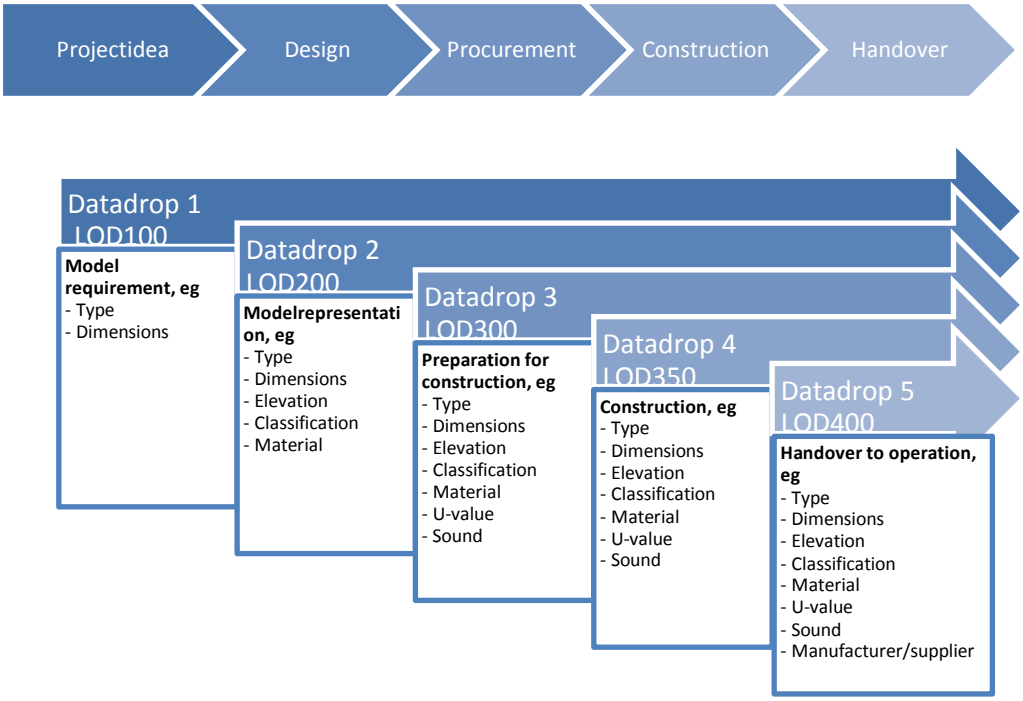

Figure 1 Process description for digital delivery of data drops

Today, we use the three tools to support the digital handover among eg for the construction of a new headquarter, and it is our assessment that the more people who share the same approach and use the same practice the easier it is to bring into use from project to project. Therefore we share knowledge and tools.

The need for a tool that can help to clarify and concretize the need for information for O&M is evident in the dialogue with different parties. For the client a comprehensive digital set of in-

[7] Read MT Højgaards book about BIM: *A practical guide to BIM in construction and infrastructure projects*, October 2015. The book can be downloadet on mth.com

[8] Optimization of Operations and Maintenance through Data Driven Decisions, Angela Lewis, 2014

formation provides value on a wide range of areas. Both in relation to space management and overview of the ongoing O&M tasks and the economy can now be shared in the operational organization instead of just being tacit and individual knowledge. Furthermore it will give access to a history based on each individual building component which gives a more qualified basis for total cost of ownership in the choice of spare parts.

Conclusion

MT Højgaard's focus on projects from society to operations involves among other things that information should be used throughout the project and in the following operation, so the client gets an optimized basis for the future O&M. It is part of the agenda to increase productivity not only in the construction process, but throughout the lifecycle of the project.

It provides far greater value and effective process if the contractor delivers relevant information instead of all available information on all parts of the building. At the same time it gives great value that the delivered information is digital and can be reused rather than delivered in binder with manuals for O&M in paper format. If the information should be usable in the operation, they must therefore be digital and incorporated from the start of the project.

More and more clients wishes to use O&M systems to gain an overview of the economy and the tasks associated with O&M of the construction. O&M system must be fed with information on the building components, which is provided at different stages in the construction process. It is therefore necessary that the client in the early phases defines requirements for what must be handed over to ensure the right framework for the information to be delivered and exchanged throughout the process.

In MT Højgaard the digital handover is supported, partly by using acknowledged standards and partly by the use of tools to help the project with the necessary clarification. The requirement to use standards such as IFC and COBie are expected to be able to help projects and industry in much larger extent in the future than today - considering the ongoing British standardization activities that may impact on the European level. Meanwhile MT Højgaard seizes the possibility of lifting the digital handover by further developing and using specific tools. In this way we increase the productivity of each project and helps raise the maturity level of the industry's digital journey.

References:

- *A practical guide to BIM in construction and infrastructure projects*, October 2015
- Building Component Catalogue with Level of Development Specification, MT Højgaard, December 2017
- Danish Building & Property Agency's website: http://www.bygst.dk/viden-om/digitalisering-af-byggeriet/ikt-bekendtgoerelsen/, May 2016
- Optimization of Operations and Maintenance through Data Driven Decisions, Angela Lewis, 2014
- White paper entitled *Addressing classification in the Danish AEC industry*, June 2015
- White paper entitled *IFC – A driver for design quality in the AEC industry*, August 2014
- White paper entitled *Value drivers in the Danish national ICT regulations*, December 2014.

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Appendix 1 - DK-COBie 2016

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Level of information for selected rooms and building components from MT Højgaards Building Component Catalogue with Level of Development Specification (LOD) used in the digital delivery to the client at handover in the end of a construction project. In the table below the datadrops for a piece of information of the individual room or building component is indicated as the different phases of the project:

DATADROP	DESCRIPTION	LOI-LEVEL
1	Model requirements: Information is applied in the preliminary project phase	100
2	Model representation: Information is applied in the design phase	200
3	Preparation for construction after tender phase: Information is applied in the planning phase	300
4	Construction: Information is applied during construction up until handover	350 and 400
5	Operation and maintenance (O&M): Information is updated during the O&M	400

The table below can be used as inspiration to the selection of rooms and building components and the related properties.

Room and building components	LOD-level	Properties	COBie property fields in Revit	Data drop	LOD-catalogue
Room	300	Quantity: volume (m3)	COBie.Type.NominalHeight COBie.Type.NominalLength COBie.Type.NominalWidth	1	100
		Classification	COBie.Type.AssetType	2	200
Foundation	300	Quantity: volume (m3)	COBie.Type.NominalHeight COBie.Type.NominalLength COBie.Type.NominalWidth	1	100
		Classification	COBie.Type.AssetType	2	200
		Material	COBie.Type.Material	2	200
		Data sheet	COBie.Type.WarrantyGuarantorParts	4	400
		Expected life (years)	COBie.Type.ExpectedLife	4	400
Concrete slab	300	Type	COBie.Type	1	100
		Quantity: area (m2)	COBie.Type.NominalLength COBie.Type.NominalWidth	1	100
		Classification	COBie.Type.AssetType	2	200
		Material	COBie.Type.Material	3	300
		Manufacturer/supplier	COBie.Type.Manufacturer	4	400
		Data sheet	COBie.Type.WarrantyGuarantorParts	4	400
		Colorcode for painted areas	COBie.Type.Color	4	400
		Warranty period (years) for the building where there is a written product warranty	COBie.Type.WarrantyDurationParts	4	400
		Intervals for planned maintenance (years)	COBie.Type.DurationUnit	4	400
		Expected life (years)	COBie.Type.ExpectedLife	4	400
Floor	300	Type	COBie.Type	1	100
		Quantity: area (m2)	COBie.Type.NominalLength COBie.Type.NominalWidth	1	100
		Location	COBie.Type.Area	2	200

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Room and building components	LOD-level	Properties	COBie property fields in Revit	Data drop	LOD-catalogue
		Classification	COBie.Type.AssetType	2	200
		Material	COBie.Type.Material	3	300
		Manufacturer/supplier	COBie.Type.Manufacturer	4	400
		Data sheet	COBie.Type.WarrantyGuarantorParts	4	400
		Colorcode for painted areas	COBie.Type.Color	4	400
		Warranty period (years) for the building where there is a written product warranty	COBie.Type.WarrantyDurationParts	4	400
		Intervals for planned maintenance (years)	COBie.Type.DurationUnit	4	400
		Expected life (years)	COBie.Type.ExpectedLife	4	400
		Installationdate (year)	COBie.Component.InstallationDate	4	400
		Operating range	COBie.Type.WarrantyDurationUnit	4	400
Roof	300	Type	COBie.Type	1	100
		Quantity: area (m2)	COBie.Type.NominalLength COBie.Type.NominalWidth	1	100
		Location	COBie.Type.Area	2	200
		Classification	COBie.Type.AssetType	2	200
		Material	COBie.Type.Material	3	300
		Manufacturer/supplier	COBie.Type.Manufacturer	4	400
		Data sheet	COBie.Type.WarrantyGuarantorParts	4	400
		Colorcode for painted areas	COBie.Type.Color	4	400
		Warranty period (years) for the building where there is a written product warranty	COBie.Type.WarrantyDurationParts	4	400
		Intervals for planned maintenance (years)	COBie.Type.DurationUnit	4	400
		Expected life (years)	COBie.Type.ExpectedLife	4	400
		Price, indicated by the construction costs incl. VAT per square meter	COBie.Type.ReplacementCost	4	400
		Installationdate (year)	COBie.Component.InstallationDate	4	400
		Operating range	COBie.Type.WarrantyDurationUnit	4	400
Ceiling	300	Type	COBie.Type	1	100
		Quantity: area (m2)	COBie.Type.NominalLength COBie.Type.NominalWidth	1	100
		Location	COBie.Type.Area	2	200
		Classification	COBie.Type.AssetType	2	200
		Material	COBie.Type.Material	3	300
		Manufacturer/supplier	COBie.Type.Manufacturer	4	400
		Data sheet	COBie.Type.WarrantyGuarantorParts	4	400
		Colorcode for painted areas	COBie.Type.Color	4	400
		Warranty period (years) for the building where there is a written product warranty	COBie.Type.WarrantyDurationParts	4	400
		Intervals for planned maintenance (years)	COBie.Type.DurationUnit	4	400
		Expected life (years)	COBie.Type.ExpectedLife	4	400
		Installationdate (year)	COBie.Component.InstallationDate	4	400
		Operating range	COBie.Type.WarrantyDurationUnit COBie.Type.Area	4	400
Steel beam	300	Type	COBie.Type	1	100
		Quantity: dimensions (WxHxL) (m)	COBie.Type.NominalLength COBie.Type.NominalWidth	1	100
		Location	COBie.Type.Area	2	200
		Classification	COBie.Type.AssetType	2	200
		Material	COBie.Type.Material	3	300
		Manufacturer/supplier	COBie.Type.Manufacturer	4	350
		Data sheet	COBie.Type.WarrantyGuarantorParts	4	350
		Colorcode for painted areas	COBie.Type.Color	4	350
		Warranty period (years) for the building where there is a written product warranty	COBie.Type.WarrantyDurationParts	4	350
		Intervals for planned maintenance (years)	COBie.Type.DurationUnit	4	350
		Expected life (years)	COBie.Type.ExpectedLife	4	350
		Installationdate (year)	COBie.Component.InstallationDate	4	350

Room and building components	LOD-level	Properties	COBie property fields in Revit	Data drop	LOD-catalogue
Concrete beam	300	Type	COBie.Type	1	100
		Quantity: dimensions (WxHxL) (m)	COBie.Type.NominalLength COBie.Type.NominalWidth	1	100
		Location	COBie.Type.Area	2	200
		Classification	COBie.Type.AssetType	2	200
		Material	COBie.Type.Material	3	300
		Manufacturer/supplier	COBie.Type.Manufacturer	4	400
		Data sheet	COBie.Type.WarrantyGuarantorParts	4	400
		Colorcode for painted areas	COBie.Type.Color	4	400
		Warranty period (years) for the building where there is a written product warranty	COBie.Type.WarrantyDurationParts	4	400
		Intervals for planned maintenance (years)	COBie.Type.DurationUnit	4	400
		Expected life (years)	COBie.Type.ExpectedLife	4	400
		Installationdate (year)	COBie.Component.InstallationDate	4	400
Concrete column	300	Type	COBie.Type	1	100
		Quantity: dimensions (WxHxL) (m)	COBie.Type.NominalLength COBie.Type.NominalWidth	1	100
		Location	COBie.Type.Area	2	200
		Classification	COBie.Type.AssetType	2	200
		Material	COBie.Type.Material	3	300
		Manufacturer/supplier	COBie.Type.Manufacturer	4	400
		Data sheet	COBie.Type.WarrantyGuarantorParts	4	400
		Colorcode for painted areas	COBie.Type.Color	4	400
		Warranty period (years) for the building where there is a written product warranty	COBie.Type.WarrantyDurationParts	4	400
		Intervals for planned maintenance (years)	COBie.Type.DurationUnit	4	400
		Expected life (years)	COBie.Type.ExpectedLife	4	400
		Installationdate (year)	COBie.Component.InstallationDate	4	400
Frame	300	Type	COBie.Type	1	100
		Quantity: dimensions (WxHxL) (m)	COBie.Type.NominalLength COBie.Type.NominalWidth	1	100
		Location	COBie.Type.Area	2	200
		Classification	COBie.Type.AssetType	2	200
		Material	COBie.Type.Material	3	300
		Manufacturer/supplier	COBie.Type.Manufacturer	4	400
		Data sheet	COBie.Type.WarrantyGuarantorParts	4	400
		Colorcode for painted areas	COBie.Type.Color	4	400
		Warranty period (years) for the building where there is a written product warranty	COBie.Type.WarrantyDurationParts	4	400
		Intervals for planned maintenance (years)	COBie.Type.DurationUnit	4	400
		Expected life (years)	COBie.Type.ExpectedLife	4	400
		Installationdate (year)	COBie.Component.InstallationDate	4	400
Concrete wall	300	Type	COBie.Type	1	100
		Quantity: dimensions (WxHxL) (m)	COBie.Type.NominalLength COBie.Type.NominalWidth	1	100
		Location	COBie.Type.Area	2	200
		Classification	COBie.Type.AssetType	2	200
		Material	COBie.Type.Material	3	300
		Manufacturer/supplier	COBie.Type.Manufacturer	4	400
		Data sheet	COBie.Type.WarrantyGuarantorParts	4	400
		Colorcode for painted areas	COBie.Type.Color	4	400
		Warranty period (years) for the building where there is a written product warranty	COBie.Type.WarrantyDurationParts	4	400
		Intervals for planned maintenance (years)	COBie.Type.DurationUnit	4	400
		Expected life (years)	COBie.Type.ExpectedLife	4	400
		Installationdate (year)	COBie.Component.InstallationDate	4	400
Light facade	350	Type	COBie.Type	1	100
		Quantity: area (m2)	COBie.Type.NominalLength	1	100

Room and building components	LOD-level	Properties	COBie property fields in Revit	Data drop	LOD-catalogue
			COBie.Type.NominalWidth		
		Location	COBie.Type.Area	2	200
		Classification	COBie.Type.AssetType	2	200
		Material	COBie.Type.Material	3	300
		Manufacturer/supplier	COBie.Type.Manufacturer	4	400
		Data sheet	COBie.Type.WarrantyGuarantorParts	4	400
		Colorcode for painted areas	COBie.Type.Color	4	350
		Warranty period (years) for the building where there is a written product warranty	COBie.Type.WarrantyDurationParts	4	400
		Intervals for planned maintenance (years)	COBie.Type.DurationUnit	4	400
		Expected life (years)	COBie.Type.ExpectedLife	4	400
		Price, indicated by the construction costs incl. VAT per square meter	COBie.Type.ReplacementCost	4	400
		Installationdate (year)	COBie.Component.InstallationDate	4	400
Heavy facade	300	Type	COBie.Type	1	100
		Quantity: area (m2)	COBie.Type.NominalLength COBie.Type.NominalWidth	1	100
		Location	COBie.Type.Area	2	200
		Classification	COBie.Type.AssetType	2	200
		Material	COBie.Type.Material	3	300
		Manufacturer/supplier	COBie.Type.Manufacturer	4	400
		Data sheet	COBie.Type.WarrantyGuarantorParts	4	400
		Colorcode for painted areas	COBie.Type.Color	4	350
		Warranty period (years) for the building where there is a written product warranty	COBie.Type.WarrantyDurationParts	4	400
		Intervals for planned maintenance (years)	COBie.Type.DurationUnit	4	400
		Expected life (years)	COBie.Type.ExpectedLife	4	400
		Price, indicated by the construction costs incl. VAT per square meter	COBie.Type.ReplacementCost	4	400
		Installationdate (year)	COBie.Component.InstallationDate	4	400
Light interior wall	300	Type	COBie.Type	1	100
		Quantity: area (m2)	COBie.Type.NominalLength COBie.Type.NominalWidth	1	100
		Location	COBie.Type.Area	2	200
		Classification	COBie.Type.AssetType	2	200
		Material	COBie.Type.Material	3	300
		Manufacturer/supplier	COBie.Type.Manufacturer	4	400
		Data sheet	COBie.Type.WarrantyGuarantorParts	4	400
		Colorcode for painted areas	COBie.Type.Color	4	400
		Warranty period (years) for the building where there is a written product warranty	COBie.Type.WarrantyDurationParts	4	400
		Intervals for planned maintenance (years)	COBie.Type.DurationUnit	4	400
		Expected life (years)	COBie.Type.ExpectedLife	4	400
		Price, indicated by the construction costs incl. VAT per square meter	COBie.Type.ReplacementCost	4	400
		Installationdate (year)	COBie.Component.InstallationDate	4	400
Door	300	Type	COBie.Type	1	100
		Quantity: number and area (m2)	COBie.Type.NominalLength COBie.Type.NominalWidth	1	100
		Location	COBie.Type.Area	2	200
		Classification	COBie.Type.AssetType	2	200
		Material	COBie.Type.Material	3	300
		Manufacturer/supplier	COBie.Type.Manufacturer	4	400
		Data sheet	COBie.Type.WarrantyGuarantorParts	4	400
		Colorcode for painted areas	COBie.Type.Color	4	400
		Warranty period (years) for the building where there is a written product warranty	COBie.Type.WarrantyDurationParts	4	400

Room and building components	LOD-level	Properties	COBie property fields in Revit	Data drop	LOD-catalogue
		Intervals for planned maintenance (years)	COBie.Type.DurationUnit	4	400
		Expected life (years)	COBie.Type.ExpectedLife	4	400
		Price, indicated by the construction costs incl. VAT per square meter	COBie.Type.ReplacementCost	4	400
		Installationdate (year)	COBie.Component.InstallationDate	4	400
		Operating range	COBie.Type.WarrantyDurationUnit	4	400
Window	300	Type	COBie.Type	1	100
		Quantity: number and area (m2)	COBie.Type.NominalLength COBie.Type.NominalWidth	1	100
		Location	COBie.Type.Area	2	200
		Classification	COBie.Type.AssetType	2	200
		Material	COBie.Type.Material	3	300
		Manufacturer/supplier	COBie.Type.Manufacturer	4	400
		Data sheet	COBie.Type.WarrantyGuarantorParts	4	400
		Colorcode for painted areas	COBie.Type.Color	4	400
		Warranty period (years) for the building where there is a written product warranty	COBie.Type.WarrantyDurationParts	4	400
		Intervals for planned maintenance (years)	COBie.Type.DurationUnit	4	400
		Expected life (years)	COBie.Type.ExpectedLife	4	400
		Price, indicated by the construction costs incl. VAT per square meter	COBie.Type.ReplacementCost	4	400
		Installationdate (year)	COBie.Component.InstallationDate	4	400
		Operating range	COBie.Type.WarrantyDurationUnit	4	400
Elevator	300	Type	COBie.Type	1	100
		Quantity: number		1	100
		Classification	COBie.Type.AssetType	2	200
		Material	COBie.Type.Material	3	300
		Manufacturer/supplier	COBie.Type.Manufacturer	4	350
		Data sheet	COBie.Type.WarrantyGuarantorParts	4	350
		Colorcode for painted areas	COBie.Type.Color	4	350
		Warranty period (years) for the building where there is a written product warranty	COBie.Type.WarrantyDurationParts	4	350
		Intervals for planned maintenance (years)	COBie.Type.DurationUnit	4	350
		Expected life (years)	COBie.Type.ExpectedLife	4	350
		Serienummer	COBie.Component.SerialNumber	4	350
Installations	300	Type	COBie.Type	1	100
		Quantity: number and length(m)	COBie.Type.NominalLength	1	100
		Location	COBie.Type.Area	2	200
		Classification	COBie.Type.AssetType	2	200
		Material	COBie.Type.Material	3	300
		Manufacturer/supplier	COBie.Type.Manufacturer	4	350
		Data sheet	COBie.Type.WarrantyGuarantorParts	4	350
		Colorcode for painted areas	COBie.Type.Color	4	350
		Warranty period (years) for the building where there is a written product warranty	COBie.Type.WarrantyDurationParts	4	350
		Intervals for planned maintenance (years)	COBie.Type.DurationUnit	4	350
		Expected life (years)	COBie.Type.ExpectedLife	4	350
		Installationdate (year)	COBie.Component.InstallationDate	4	350
		Operating range	COBie.Type.WarrantyDurationUnit	4	350
Pipes in terrain	300	Type	COBie.Type	1	100
		Quantity: number and length(m)	COBie.Type.NominalLength	1	100
		Location	COBie.Type.Area	2	200
		Classification	COBie.Type.AssetType	2	200
		Material	COBie.Type.Material	3	300

Room and building components	LOD-level	Properties	COBie property fields in Revit	Data drop	LOD-catalogue
		Manufacturer/supplier	COBie.Type.Manufacturer	4	400
		Data sheet	COBie.Type.WarrantyGuarantorParts	4	400
		Colorcode for painted areas	COBie.Type.Color	4	400
		Warranty period (years) for the building where there is a written product warranty	COBie.Type.WarrantyDurationParts	4	400
		Intervals for planned maintenance (years)	COBie.Type.DurationUnit	4	400
		Expected life (years)	COBie.Type.ExpectedLife	4	400
		Installationdate (year)	COBie.Component.InstallationDate	4	400
		Operating range	COBie.Type.WarrantyDurationUnit	4	400
Water carrying installations	300	Type	COBie.Type	1	100
		Quantity: number and length(m)	COBie.Type.NominalLength	1	100
		Location	COBie.Type.Area	2	200
		Classification	COBie.Type.AssetType	2	200
		Material	COBie.Type.Material	3	300
		Manufacturer/supplier	COBie.Type.Manufacturer	4	350
		Data sheet	COBie.Type.WarrantyGuarantorParts	4	350
		Warranty period (years) for the building where there is a written product warranty	COBie.Type.WarrantyDurationParts	4	350
		Intervals for planned maintenance (years)	COBie.Type.DurationUnit	4	350
		Expected life (years)	COBie.Type.ExpectedLife	4	350
		Installationdate (year)	COBie.Component.InstallationDate	4	350
		Operating range	COBie.Type.WarrantyDurationUnit	4	350
Ventilation	300	Type	COBie.Type	1	100
		Quantity: number, length(m) and volume(m3)	COBie.Type.NominalHeight COBie.Type.NominalLength COBie.Type.NominalWidth	1	100
		Location	COBie.Type.Area	2	200
		Classification	COBie.Type.AssetType	2	200
		Material	COBie.Type.Material	3	300
		Manufacturer/supplier	COBie.Type.Manufacturer	4	350
		Data sheet	COBie.Type.WarrantyGuarantorParts	4	350
		Colorcode for painted areas	COBie.Type.Color	4	350
		Warranty period (years) for the building where there is a written product warranty	COBie.Type.WarrantyDurationParts	4	350
		Intervals for planned maintenance (years)	COBie.Type.DurationUnit	4	350
		Expected life (years)	COBie.Type.ExpectedLife	4	350
		Installationdate (year)	COBie.Component.InstallationDate	4	350
		Operating range	COBie.Type.WarrantyDurationUnit	4	350
Electricity	300	Type	COBie.Type	1	100
		Quantity: number and length(m)	COBie.Type.NominalLength	1	100
		Location	COBie.Type.Area	2	200
		Classification	COBie.Type.AssetType	2	200
		Material	COBie.Type.Material	3	300
		Manufacturer/supplier	COBie.Type.Manufacturer	4	350
		Data sheet	COBie.Type.WarrantyGuarantorParts	4	350
		Colorcode for painted areas	COBie.Type.Color	4	350
		Warranty period (years) for the building where there is a written product warranty	COBie.Type.WarrantyDurationParts	4	350
		Intervals for planned maintenance (years)	COBie.Type.DurationUnit	4	350
		Expected life (years)	COBie.Type.ExpectedLife	4	350
		Installationdate (year)	COBie.Component.InstallationDate	4	350
		Operating range	COBie.Type.WarrantyDurationUnit	4	350