Whitepaper:

Addressing classification in the Danish AEC industry

Vers. 1 - June 2015

MT Højgaard A/S
Knud Højgaards Vej 9
2860 Søborg

+45 7012 2400
mth.dk

CVR 12562233

Addressing classification in the Danish AEC industry

June 2015
MT Højgaard A/S

Abstract
MT Højgaard has analysed 3.168.926 objects from 196 discipline specific BIM models and researched the use of classification in the Danish AEC industry. The research yields results concerning the use of specific Danish classification systems but also reveals how the Danish ICT regulations[1] have a considerable impact on the use of classification.

The aim of this paper is to present the status quo of the current practice for using classification by analysing BIM models in a wide number of projects tendered in the Danish AEC industry. The paper reveals the most common used classification systems while providing data driven facts on how the Danish ICT regulations impact the use of classification.

MT Højgaard found that SfB is the most common used classification system, represented by 48% of the design discipline contributions, but 37% don't use classification to any extent. Furthermore the use of classification systems is inconsistent resulting in a variety of different classification systems being implemented. This acts as a barrier to productivity as information can't be reused across projects. This proves the need for standardisation as it is found that the industry shows a level of maturity with 31% of design disciplines choosing to use classification even if no requirements exist on the project.

The paper shows a clear correlation between consistent use of classification and the requirements of the Danish ICT regulations. The governing framework of the ICT regulations prove to have a significant influence on the usage of classification for all disciplines thus ensuring a more effective flow of data and information exchange. It is MT Højgaards perception that the right requirements as implied by the ICT regulations and a standardised approach to classification will derive better collaboration across disciplines and projects hence enable the joint effort of driving productivity in the AEC industry.

The context of classification

Classification in the AEC (Architecture, Engineering and Construction) industry is generally characterised by little international standardisation. Differences in cultures and legislations have created a variety of differing methods and practices which have effected how information in the AEC industry is arranged for individual countries. Classification is intended to facilitate

[1] The ICT regulations are a set of requirements describing the use of Intelligent Communication Technology, ICT, on public funded projects in Denmark

the process of effectively sorting the vast amount of information associated with a construction project.

The need to handle data of many different types originating from different actors is a reality in any modern construction project. The amount of information in the AEC industry is rapidly increasing as an effect of working and collaborating through BIM and VDC[2], and so is the importance of the information. Information management has become a discipline by itself, and is widely practiced with e.g. Model Progression Specifications (MPS) and Level of Development (LOD). Tools like these are often deployed to ensure that the right information is created and exchanged at the right time in order to facilitate downstream activities such as quantity take-offs (QTO) and ICT coordination.

In general any BIM object can become a container for information intended for different purposes and created by different stakeholders. Taking the fragmented supply chain of a construction project into consideration it is known that the actors, contributing with information about specific objects in the BIM, deliver continuously during the project. These elements imply a certain level of complexity in the discipline of information management and increase the need for classification as standard practice in the industry.

Classification systems

SfB was developed in the 1950's in order to contribute to a clearer and more effective communication be-tween parties on the project and to support the exchange of project data.

DBK (Dansk Bygge Klassifikation) came along in 2006 to replace SfB and was the first example of a co-herent classification system in Denmark based upon international standards.

CCS (Cuneco Classifica-tion System) is devel-oped during 2012-2014 as a replacement for DBK. CCS is a national system that can be used for classification and identification of building compo-nent and locations and describe the relations between them.

BIM 7aa is a modernization of SfB. The method structure and coherence between building objects, offer lists, descriptions and amount of extraction as well as defining interfaces between advisor subjects. inter alia, classifications, properties and other relevant parameters.

OmniClass Construction Classification System is used for many applications, from organizing library materials, product literature, and project information, to providing a classification structure for electronic databases.

NS 8360 is developed in Norway to standardise type coding and classification of objects, connecting properties and values to the IFC model and supports an interaction between the parties on the project and between the phases in the projects lifecycle.

The method for analysis

MT Højgaard has thoroughly scrutinized the project material of more than 200 projects in order to clarify to which extent classification systems are used in the Danish construction industry. Thus the project material reflects a project in its early stage of the life cycle, but nevertheless forms the basis for a contractors work, and reflects how the framework for the contractors work is established on the project.

Each project consists of a number of design discipline contributions, i.e. discipline specific BIM models. The disciplines considered are architects, construction engineers and MEP which covers electrical, HVAC, sprinklers etc. Projects with project material in 2D are not investigated and neither are civil projects. The quality of the design material was decisive when assessing if a project could be included in this analysis, which is described in our white-paper from August 2014. Some projects with a very poor design quality have been discarded from this specific investigation to avoid outliers in the dataset for this white paper. The remaining projects were subjected to the data extraction process. The dataset for the analysis amounts to 80 projects comprising 196 discipline models and 3.168.926 BIM objects (exclusive spaces and interior).

[2] Building Information Modeling (BIM) and Virtual Design and Construction (VDC).

For each project the project material was investigated to identify if there exists any requirements towards the use of a classification system. In case the project stated requirements towards the use of classification, it was investigated how many objects were classified according to the classification syntax of the classification system, i.e. the prescribed composition of the classification code. The focus was not to identify if the correct classification code was used for a particular object, but if the correct syntax was used consequently, thus it is not considered if e.g. doors are assigned with the correct classification code for doors, but if the correct syntax specified by the given classification system, is used in general. Furthermore, if the project material didn't state any requirements, it was still investigated how many objects were classified.

Which classification system is the most common?

Before investigation which specific classification system is the most common, the first intriguing questions to answer are, "*is classification required in the project?*" and "*is classification used*?"

It can be concluded that classification systems are required in 36% of all projects, thus 64% of projects don't apply requirements towards classification systems. Even though 64% of the projects don't explicitly require classification systems it is found that 63% of the discipline models contain classified objects to some extent and 37% haven't used any classification this despite the fact that 3,1 percent had a requirement to use a classification system. The distribution of discipline models in regards to these two questions is represented in Figure 1.

	Not used	Used	Total
Not required	33,7%	30,6%	64%
Required	3,1%	32,7%	36%
Total	37%	63%	100%

Figure 1: The table shows the distribution of discipline models in regards to the requirements to and use of classification.

To grasp the full extent of Figure 1 it is important to recognize the gap between the project requirements and what is executed in practice. Sometimes no requirements for the use of classification exist but even so the design disciplines deliver BIM models with classified objects, and vice versa the project requires classification but the BIM models aren't classified.

By filtering the data and focusing on the projects where classification systems are used, regardless of the requirements in the project, it is identified that 48% of the projects use SfB for classification. The second most used classification system is DBK representing 8% of the projects. As mentioned before these numbers should be considered in regards to 37% of discipline models that don't apply any classification in their design. The results are represented in Figure 2.

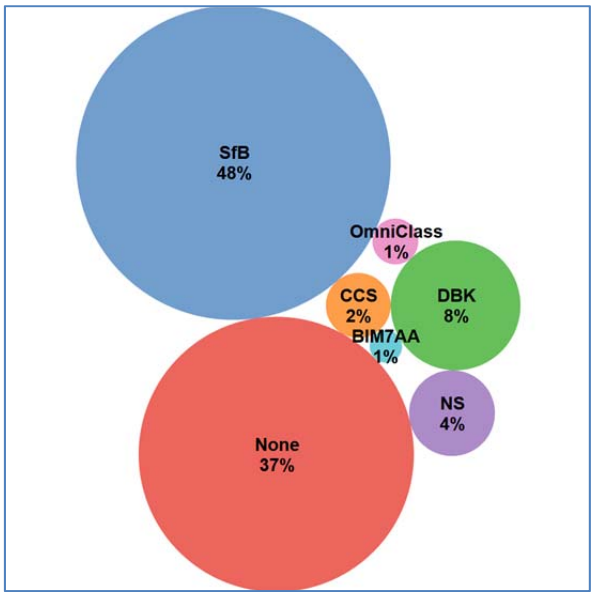

Figure 2: The bubble chart shows the frequency of use, by size, for each classification system.

After establishing the order of the most common classification systems, it becomes interesting to explore how many BIM objects are classified properly according to the syntax of each system. Extensive information take-offs were conducted from the 63% of discipline models using classification in order to analyse the properties of every BIM object.

It can be concluded that BIM7AA has the highest percentage of objects classified based on a single relatively small project comprised of 3035 objects compared with an overall average of 39.612 objects per project. The classification system SfB has 84% of objects classified based on 1.298.668 BIM objects. The results are displayed in the Figure 3.

Classification system used	% of objects classified	Number of projects	Avg. number of objects per project	Number of objects classified	Total number of objects (excl. spaces & interior)
BIM7AA	89%	1	3.035	2.708	3.035
SfB	84%	48	27.056	1.091.212	1.298.668
CCS	79%	4	111.247	352.881	444.986
DBK	69%	6	117.584	488.499	705.503
NS	49%	2	66.372	65.264	132.743
OmniClass	35%	1	4.966	1.739	4.966
None	0%	33	17.546	0	579.025
Total	63%	80	39.612	2.002.303	3.168.926

Figure 3: The table provides a complete overview of how many objects that are classified and how many projects each classification system have been applied on.

From figure 3 it can be concluded that SfB and DBK comprise 54 out of 59 projects where classification is applied, which is equivalent to 91% of all projects. Having established an overview of the usage of several Danish classification systems, based on these projects, it is interesting to search for potential drivers for classification.

The ICT regulations drive the use of classification

MT Højgaard has previously published white-papers on the effect of the national Danish ICT regulation on project performance (December 2014) and design quality (August 2014)

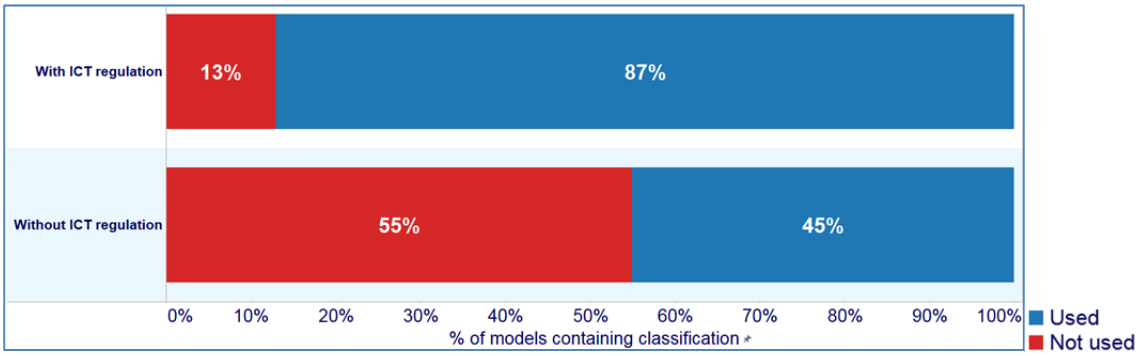

Figure 4: The figure shows how many discipline models that use classification as a comparison between projects covered by and not covered by the Danish ICT regulations.

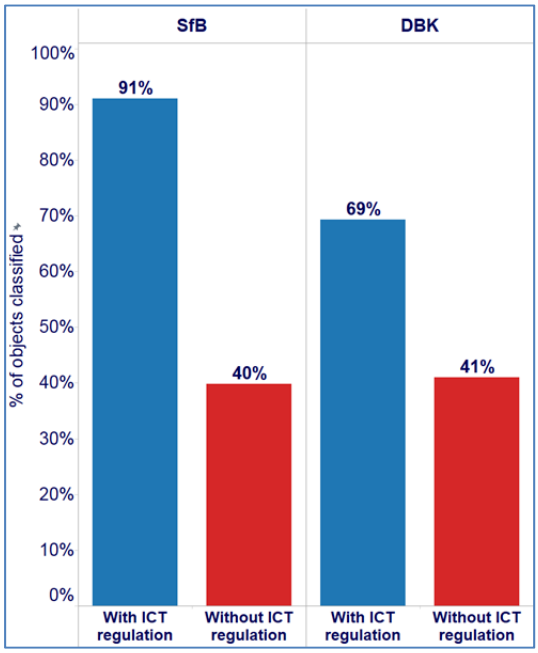

Figure 5: The figure illustrates the considerable increase of objects classified for the classification systems SfB and DBK when they are applied on projects governed by the Danish ICT regulations.

SfB and DBK comprise 91% of all projects where classification is applied and are the only classification systems used on projects both governed and not governed by the ICT regulations. For SfB the percentage of classified objects increase with 128% (from 40% to 91%) for projects governed by the ICT regulations and for DBK the increase is 68% (from 41% to 69%) according to Figure 5.

The individual disciplines ability to use classification is also influenced by the framework of the ICT regulations. For the MEP disciplines the percentage of classified objects increase by 376% (from 17% to 81%). For the architects an increase of 270% (from 20% to 74%) is experienced and the construction engineers the percentage of classified objects increase with 575% when the ICT regulations are applied. The results are depicted in Figure 6.

(mth.dk). The current Danish ICT regulations explicitly prescribe the use of classification, but leave the choice of classification systems open. Investigating if the ICT regulations are a driver for the use of classification, MT Højgaard has compared the use of classification on projects governed and not governed by the ICT regulations. The results are shown in Figure 4.

Comparing the distributions it becomes evident that the requirement inherent in the ICT regulations drives the use of classification even though 13% of the discipline models still don't use classification. It can also be concluded that projects without a mandate to use classification experience 55% of discipline models without classification. Thus discipline models without classification are reduced from 55% to 13% equivalent to a 76% reduction when the ICT regulations are applied which corresponds to an increase from 45% to 87% equivalent to 52% increase for discipline models using classification.

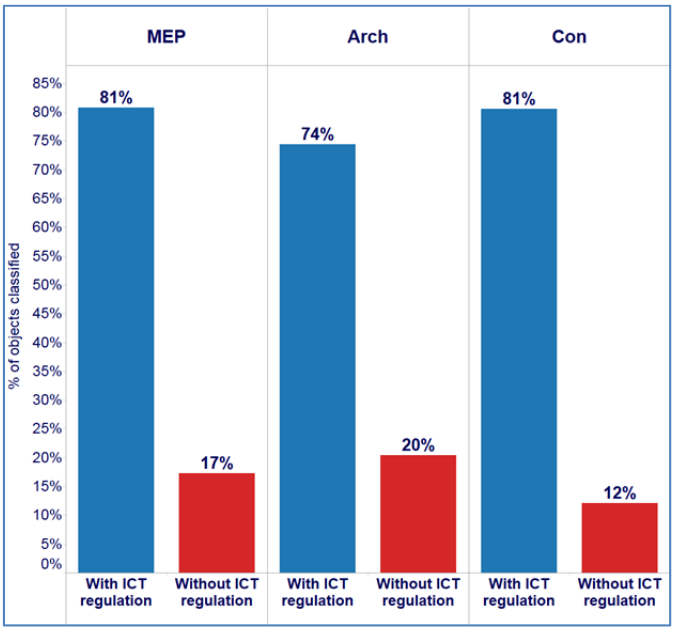

Figure 6: The figure displays the percentage of classified objects for each discipline when contributing to a project either governed - or not governed by the ICT regulations.

The results indicate that the framework provided by the regulations creates a substantially better basis for applying classification as a part of standard practice in the design of discipline models.

Relating the results of this analysis with MT Højgaards BIM value score from the December 2014 white paper, an interesting correlation is identified. The projects with no requirements of classification score 2.6 (out of 5) and projects with requirements to use classification score 3.7 (out of 5), which corresponds to a 44% increase in the BIM value score. It is important to state that many factors are critical for projects to get value out of BIM besides classification, but nevertheless it is an interesting correlation to investigate further in the future.

Potential in increased requirements and wider use

MT Højgaard has investigated the use of classification in the Danish AEC industry and we can conclude that a variety of different classification systems are used. It has also shown that some disciplines have established a standard practice for classifying BIM objects when designing the BIM models, but almost half of these do so without the governing effect of contractual requirements, which makes the classification useless to others. It has been established that there exist a potential for increasing the use of classification as 34% don't require or use classification. These observations are potential barriers to productivity in our industry.

	Not used	**Used**
Not required	• Change of practice • Provide insight • Promote productivity	• Standard practice • Limited action to get value • Utilize the large potential
Required	• Provide insight • Perform control	• Focus on getting value • Share best practice • Quantify value

Figure 7: The table contains action oriented bullets related to how the potential inherent in classification can be realized.

It is identified that SfB is the most common classification system but also that a variety of other classification systems are used reducing the chance of reusing information across projects. These findings reflect a need for a better framework, e.g. as implied by the ICT regulation. The effect, of the national Danish ICT regulations on the use of classification, has proven to be significant. The requirements and framework in the ICT regulations increase the use of classification in the Danish AEC industry. From a contractor's perspective it is crucial to apply the requirements of the ICT regulations or equivalent to enable the inherent benefits of classification across the industry and drive productivity as a joint effort.

To classify or not to classify - in an industry perspective

The results of this analysis clear the ground for addressing how the potential of classification can be realised by amplifying the requirements to- and use of classification in an industry heading towards an increased need for structured information and effective data flows. To facilitate the discussion the matrix presented earlier in the paper is used, but the numbers are translated to action oriented bullets.

The projects in the category *Not required* and *Not used* represent 34% and are a category where focus should be directed to change the current practice of working with BIM. It is MT Højgaards perception that one contributor to this change must be to provide information about the value of using classification both on a discipline level and project level but equally on an in-

dustry level. Extracting the value of using classification is a joint effort that can be achieved, only if all actors in the project cooperate. It is noticeable to consider that in the cases with no requirements, 92% of design disciplines don't use classification but when a requirement exists 91% adopt classification. Thus it is MT Højgaards perception that the right requirements i.e. as implied by the ICT regulations, will lead to significant increases in the use of classification.

Projects where requirements exist but classification wasn't used by the design disciplines represent 3%, which witnesses that the industry responds positively to requirements. One measure to eliminate this category is to perform control and clearly communicate the benefits of using classification.

The category where no requirements exist but the design disciplines use classification regardless is an indicator of an evolving standard practice within the industry. To have 31% applying classification even without requirements reflects a maturity-level in the industry, but without the governing effect of contractual requirements it is not feasible to base any activities on the classification in these cases. Without a guarantee that the classification will be maintained throughout the project it is too risky, and a lot of potential for the project is lost.

Projects with design disciplines subjected to requirements and using classification represent 33% and they must focus on realizing the potential value of using classification. Moreover the industry would benefit from quantifiable benchmarks proving how classification facilitates critical project activities such as faster iteration in the tender phase, model-based procurement or BIM FM. These benchmarks would be a facilitator for many reluctant actors to adopt the new work methods inherent in BIM and VDC and thereby to increase the productivity throughout the project life cycle together.

Information management is becoming a corner stone in the AEC industry and classification plays a crucial role in effective use of information. Achieving productivity gains in the AEC industry without BIM and VDC as one of the primary enablers is rarely advocated by professionals any more. Technology has become an integrated part of most projects and the industry. Embracing BIM and VDC inevitably requires accepting that some old tools in the toolbox must be replaced with new ones. And while replacing the tools it is critical to recognize that some new tools implied by BIM and VDC, don't yield results in the same way as a hammer and a nail. Some new tools don't return immediate results, but are necessary components in order to build the underlying architecture for harvesting the real value on a project and industry level.