

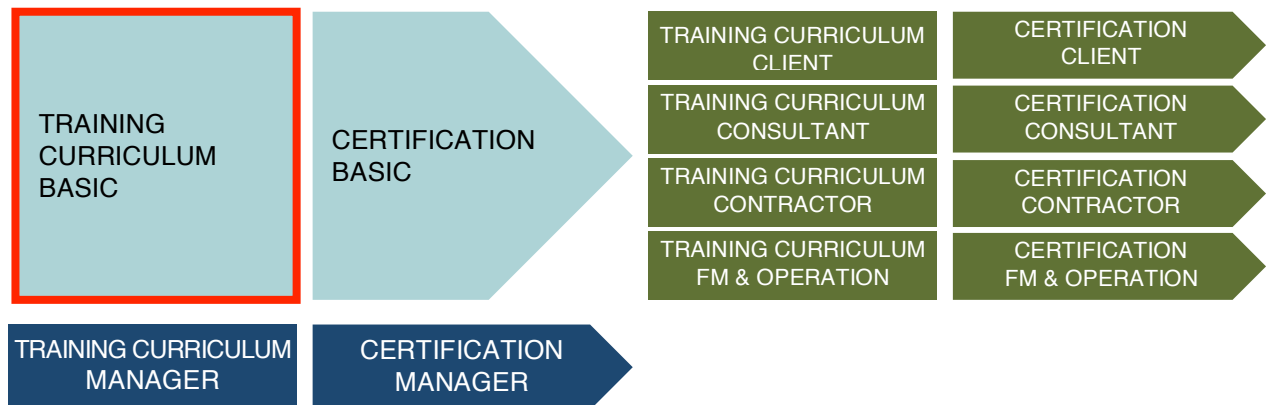
# buildingSMART Norway

## Training curriculum 01 – Basic

In addition to technological development, increased expertise is one of the best ways to change the future of the building industry. This training curriculum is part of buildingSMART Norway’s training programme aimed at developing relevant openBIM expertise. buildingSMART Norway’s training programme includes a training coordinator, a training portal on the association’s website (<http://www.buildingsmart.no/utdanning>), training curricula and user certification.

The training curricula describe the minimum learning outcomes for the respective modules. User certification is based on the same learning targets included in the training curricula.

### Training curricula and certification



Included in buildingSMART Norway’s training programme

Not included in buildingSMART Norway’s training programme



## Training curriculum – Basic

buildingSMART Norway’s Basic training curriculum is general and not linked to specific roles. The Basic module will form a baseline frame of reference for subsequent training. Emphasis is placed on providing broad expertise in a variety of different topics.

Learning objectives related to specific roles are described in the User training curriculum. The training curricula do not address the use of specific software tools or include training in construction competence.

### Multidisciplinary collaboration

buildingSMART Norway aims to contribute to a resource-efficient construction environment. The interaction both between technology and processes and between disciplines and stages is essential for the effective use of BIM/openBIM.

The Basic training curriculum focuses on understanding how your role interacts with others – and how this affects the use of openBIM.

## Learning objectives

### Learning module contents

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## Definitions

This training curriculum uses the following abbreviations and terms.

Abbreviation	Description
BIM	Building Information Modelling. Digital object-based modelling of a structure. In this context, a structure should be understood as everything built and constructed onshore. In the context of buildingSMART, we always mean openBIM, even when only BIM appears.
openBIM	BIM exchanged using open formats. Unless otherwise stated, this means the IFC format. Other openBIM formats include ifxXML, Simple ifcXML, BIM Collaboration Format (BDF) and associated schemas such as LandXML and CityGML.
IFC	Industry Foundation Classes. The term IFC is used for IFC files that are used to exchange information according to the buildingSMART Data Model.
bSDM	buildingSMART Data Model, previously also called the IFC model
bSDD	buildingSMART Data Dictionary, standardised data terminology
bSP	buildingSMART Process, previously called IDM. Based on ISO 29481-1
bSNP	buildingSMART Norway Process, bSP developed by buildingSMART Norway, previously called IDM. Based on ISO 29481-1

## Structure of the training curriculum

### Learning sources

In addition to this training curriculum, you should familiarise yourself with the following relevant documents:

- buildingSMART Norway Processes (bSNP) <http://www.buildingsmart.no/bs-prosess>
- buildingSMART Norway Guide <http://www.buildingsmart.no/bs-guiden>
- Educational info

### Primary learning objectives/learning modules

The training curriculum is divided into a number of learning modules, each with a primary learning objective.

### Learning target

Specific targets for learning outcomes. The sum of the learning targets within a module is intended to complement the primary learning objective of the module.

### Designations for learning objectives/learning targets

Based on Bloom's taxonomy for learning objectives, discussed in the document "Educational info", we use the following designations for learning objectives/learning targets:

"**Know...**" (Bloom level 1)

"**Understand...**" (Bloom level 2)

"**Apply...**" (Bloom level 3)

These verbs are used to describe learning objectives.

### Training curriculum numbering system

The learning targets in the training curricula are numbered using a three-part system:

- The first part specifies the training curriculum that the learning target is taken from.
- The second part specifies the module that the learning target is taken from.
- The third part is the serial number for the learning target.

### Syntax

- Each part is double-digit and allows for up to 99 options.
- Each part starts with 01.
- Each part is separated from the next by a hyphen.

### *First part, training curriculum*

The buildingSMART Norway training curricula consist of:

Basic	= 01
Manager	= 02
Client	= 03
Consultant	= 04
Contractor	= 05
Administrator	= 06

### *Second part, learning module*

The two digits comprising the second part of the number are the serial number for each primary learning objective/learning module.

### *Third part, learning target*

The two digits comprising the third part of the number are the serial number for each

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learning target.

### **Example**

The numbering system unambiguously refers to the individual learning targets in the training curriculum. For example, the number *01-02-03* specifies the Basic training curriculum, second primary learning objective/learning module and third learning target.

## **Using the training curriculum**

### **Target group**

All purchasers and users of openBIM and managers in organisations that order, use or develop solutions for openBIM.

### **Prerequisites**

The training curriculum requires no particular prior knowledge of openBIM collaboration. Specialist technical knowledge and an understanding of your role in projects and in the industry are required. Knowledge of BIM software relevant to your role is an advantage.

### **Using a computer during training**

The training curriculum does not require the use of a computer.

### **Duration**

This training curriculum allows for the use of various learning methods and forms. There is therefore no requirement for the minimum number of hours of training, but the number should be sufficient to complete the learning modules. Based on a “traditional” lecture-based course, we estimate that the duration should be 1 day (approximately 6–7 hours incl. breaks). This can be carried out flexibly, for example as two half-day modules, or as a lecture in combination with other learning forms. It is our opinion that learning modules can be extended to a 2-day course by e.g. including more examples of projects and/or tasks. The duration will also depend on the prior knowledge of the participants. If participants already have adequate experience using openBIM, instructors may consider adjusting the time spent on individual learning modules.

### **Learning portal**

buildingSMART Norway has created a “training portal” at <http://www.buildingsmart.no/utdanning> where we have collected relevant learning resources. Instructors and other members of buildingSMART Norway are encouraged to contribute personal examples and information.

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## 01. Learning Module openBIM projects – and effects of using openBIM

**Primary learning objective: Know the results and benefits from specific projects and understand the potential effect and changed distribution of effort.**

For some, this learning module will be a first encounter with BIM. Professionals who have not tried BIM may be understandably sceptical, wondering if BIM is this decade’s “hype” and if it really has any value. This primary learning objective mainly aims to generate motivation. The primary learning objective should convey that BIM has created economic benefits, increased quality and improved collaboration/working climate. The training curriculum is based on the “power of example”. We demonstrate potential benefits by referring to the successful implementation of BIM in specific projects. Course participants should understand that they too can realise such benefits if they follow the recommendations in the training curriculum. In order to make the examples easier to understand, we recommend that the selected projects have moderate ambitions and funds for the use of BIM.

No.	Learning target
<b>Project Examples</b>	
01-01-01	Know the effect of up to three projects that use openBIM and which demonstrate <ul style="list-style-type: none"> <li>- increased multidisciplinary collaboration</li> <li>- economic benefits</li> <li>- improved quality</li> </ul>
01-01-02	Know the benefits of openBIM for clients: <ul style="list-style-type: none"> <li>- More streamlined process</li> <li>- Increased consistency between order and result (quality)</li> <li>- Improved time and financial management</li> <li>- Improved profitability</li> </ul>
01-01-03	Know the benefits of openBIM for consultants: <ul style="list-style-type: none"> <li>- Improved quality of collaboration</li> <li>- Increased consistency in multidisciplinary coordinated production documentation</li> <li>- Competitive advantage because openBIM experience is requested for more and more projects</li> </ul>
01-01-04	Know the benefits of openBIM for contractors: <ul style="list-style-type: none"> <li>- Competitive advantage by being able to submit quotes and tenders with less uncertainty with regard to cost and time</li> <li>- Better management of time and finances</li> <li>- Improved profitability</li> </ul>
01-01-05	Know the benefits of openBIM for management and operations: <ul style="list-style-type: none"> <li>- Improved functionality in the building</li> <li>- Lower operating expenses</li> </ul> <p><i>The following point assumes FM &amp; Operation documentation is available from openBIM:</i></p> <ul style="list-style-type: none"> <li>- Improved access to and maintenance of FM &amp; Operation documentation</li> </ul> <p><i>The following points assume the use of an openBIM life-cycle cost analysis in the early stages of the project:</i></p> <ul style="list-style-type: none"> <li>- Lower operating expenses</li> <li>- Lower maintenance frequency</li> <li>- Greater flexibility in reconstruction/functional changes</li> </ul>
01-01-06	Understand that the work effort put into various stages is often different in openBIM design processes compared to conventional design processes: <ul style="list-style-type: none"> <li>- More work is put into planning.</li> </ul>

	<ul style="list-style-type: none"> <li>- Consultants often use the same or more time on BIM projects.</li> <li>- Contractors spend more time planning construction and coordinating with subcontractors.</li> </ul>
01-01-07	<p>Understand the effect (cost and benefit) of openBIM at the project level:</p> <ul style="list-style-type: none"> <li>- Benefits from better planning are reaped later in the project. The cost of better planning early in the project represents a relatively minor part of the staffing/turnover than in later stages.</li> <li>- Value creation for the entire project is greater and results are realised during the construction stage (in the form of fewer errors and better logistics) and during operation (in terms of improved functionality and lower costs).</li> </ul>

## 02. Learning Module openBIM and buildingSMART

**Primary learning objective: Understanding of openBIM and knowledge of buildingSMART.**

This learning module aims to explain the buildingSMART organisation at a general level and the three basic standards: buildingSMART Data Model/IFC, buildingSMART Data Dictionary and buildingSMART Process. These topics are often regarded as technical, boring and irrelevant for the practical application of BIM, but our experience is that without a general understanding of openBIM, the buildingSMART organisation and our standards, this area will always be a source of confusion. A general understanding of the buildingSMART Data Model and IFC format can enable individual participants to clarify needs and help to clearly explain project deliverables. This learning module aims to demystify new terms and concepts. The learning module begins by explaining basic terms and concepts that are important for understanding the overarching primary learning objectives.

No.	Learning target
<b>BIM and openBIM</b>	
01-02-01	Understand that BIM can include <ul style="list-style-type: none"> <li>- general model information</li> <li>- object geometry</li> <li>- object information</li> </ul>
01-02-02	Understand that openBIM is BIM exchanged using an open format (preferably IFC).
<b>Principles of digital object-based collaboration</b>	
01-02-03	Understand that an openBIM for a project consists of a series of discipline models (disciplineBIM) exchanged using the IFC format.
01-02-04	Understand that discipline models can be collected in an openBIM project using software (modelling software/model checkers/model viewers) and in a model server.
01-02-05	Understand the difference between work formats in disciplineBIM (e.g. Revit = .rvt) and interchange format (openBIM = .ifc). <ul style="list-style-type: none"> <li>- All modelling software uses proprietary data models and formats.</li> <li>- When you want to exchange this information with other software, disciplines and stages, you export it to IFC format.</li> </ul>
01-02-06	Understand that openBIM makes information available to all disciplines and project stages, while non-open BIM (i.e. BIM in proprietary formats) limits access to information.
<b>buildingSMART</b>	
01-02-07	buildingSMART is: <ul style="list-style-type: none"> <li>- a concept for smarter information sharing in the construction and property industry</li> <li>- a strategy for having open formats contribute to user-driven development of technology for the construction industry</li> <li>- a set of ISO standards for collaboration in the construction and property industry</li> <li>- a membership-based, discipline-neutral, non-profit organisation</li> <li>- projects using openBIM</li> </ul>
<b>buildingSMART Data Model (bSDM/IFC)</b>	
01-02-08	Understand that IFC is the open format used to exchange openBIM.
01-02-09	Understand what IFC-compatible software and buildingSMART-certified software means: <ul style="list-style-type: none"> <li>- IFC-compatible software can import and/or export IFC files.</li> <li>- When software is buildingSMART-certified, it means that buildingSMART International has certified the quality of the import and/or export of IFC files.</li> </ul>
01-02-10	Know where to find an overview of: <ul style="list-style-type: none"> <li>buildingSMART-certified software <a href="http://www.buildingsmart-tech.org/certification/ifc-certification-2.0/ifc2x3-cv-v2.0-certification/participants">http://www.buildingsmart-tech.org/certification/ifc-certification-2.0/ifc2x3-cv-v2.0-certification/participants</a></li> <li>IFC-compatible software <a href="http://www.buildingsmart-tech.org/implementation/implementations">http://www.buildingsmart-tech.org/implementation/implementations</a></li> </ul>
<b>buildingSMART Data Dictionary (bSDD)</b>	

01-02-11	<p>Know about the buildingSMART Data Dictionary (bSDD):</p> <ul style="list-style-type: none"> <li>- bSDD is standardised terminology linked to unique data codes to ensure the unambiguous understanding of object types, properties and classification regardless of software.</li> </ul>
01-02-12	<p>Know how the buildingSMART Data Dictionary (bSDD) is used.</p> <p>bSDD ensures a seamless transfer of all information between software programs. It will improve data quality and streamline information-intensive processes within e.g.:</p> <ul style="list-style-type: none"> <li>- cost estimation/descriptions</li> <li>- product information</li> <li>- purchasing</li> </ul>
<b>buildingSMART Process (bSP)</b>	
01-02-13	<p>Understand that good multidisciplinary collaboration requires consistency with regard to how modelling is performed by the relevant disciplines in each stage:</p> <ul style="list-style-type: none"> <li>- Coordination of discipline models requires that all models are at the same level in terms of geometry and properties.</li> </ul>
01-02-14	<p>Know that the Process Map is an overview of the roles, sequence and specific BIM deliverables of a given BIM-supported process.</p> <p>The Process Map is used to get an overview of those involved and sub-processes.</p> <ul style="list-style-type: none"> <li>- Ref. existing bS Process <a href="http://www.buildingsmart.no/bs-process">http://www.buildingsmart.no/bs-process</a></li> </ul>
01-02-15	<p>Know that an Exchange Requirement is a standardised specification of BIM deliverables in a given BIM-supported process.</p> <p>The Exchange Requirement is used to agree on BIM deliverables in projects and/or between software vendors.</p> <ul style="list-style-type: none"> <li>- Ref. existing bS Process <a href="http://www.buildingsmart.no/bs-process">http://www.buildingsmart.no/bs-process</a></li> </ul>
01-02-16	<p>Understand the context and difference between buildingSMART Processes (bSP) and BIM manuals:</p> <ul style="list-style-type: none"> <li>- A bSP describes requirements for a BIM deliverable for a single stage or a single process.</li> <li>- A BIM manual describes the sum of requirements for deliverables, modelling, naming, stage breakdown and role specification for an organisation or a specific project.</li> <li>- A BIM manual may include requirements from several bSP as well as organisation/project-specific requirements.</li> </ul>
01-02-17	<p>Know that a bS Process standardises BIM deliverables and software requirements.</p> <p>A bS Process can be established at the international or national level, and at the industry, group, project or organisation level.</p>



### 03. Learning Module Model Quality – openBIM software

**Primary learning objective: Understand how to open an IFC model and view information content with an IFC viewer. Understand what a DMS/Web Hotel and a BIM Server are.**

This learning module will provide participants with the knowledge that those with an IFC viewer can navigate around in IFC models and examine the properties of objects. An IFC viewer is a simple tool that provides a visual understanding of IFC models and where one can view object information. There are a number of free or inexpensive IFC viewers that can be used to get an overview of a project's models.

No.	Learning target
<b>Access information in IFC files</b>	
01-03-01	Understand that an IFC viewer is an independent software program that can display the geometry and properties of IFC files.
01-03-02	Understand at a general level how IFC viewers can be used: <ul style="list-style-type: none"> <li>- download a viewer</li> <li>- import IFC files (discipline models)</li> <li>- understand the information structure in IFC files (Project, Site, Building, Storey)</li> <li>- navigate around a model</li> <li>- access properties of objects</li> </ul>
01-03-03	Understand how to get information about IFC viewers. <a href="http://www.buildingsmart-tech.org/implementation/implementations">http://www.buildingsmart-tech.org/implementation/implementations</a> , see under model viewer. Three commonly used viewers are: <ul style="list-style-type: none"> <li>- Solibri Model Viewer <a href="http://www.solibri.com/products/solibri-model-viewer/">http://www.solibri.com/products/solibri-model-viewer/</a> (PC and Mac)</li> <li>- DDS-CAD Open BIM Viewer <a href="http://www.dds-cad.net/downloads/dds-cad-open-bim-viewer/">http://www.dds-cad.net/downloads/dds-cad-open-bim-viewer/</a> (PC)</li> <li>- FZKViewer (PC) <a href="http://www.iai.fzk.de/www-extern/index.php?id=2315&amp;L=1">http://www.iai.fzk.de/www-extern/index.php?id=2315&amp;L=1</a></li> </ul>
<b>Difference between a DMS/Web Hotel and a BIM Server</b>	
01-03-04	Understand what a DMS (Document Management System)/Web Hotel is: <ul style="list-style-type: none"> <li>- A DMS/Web Hotel is a system for storing, managing and exchanging file-based information in a project.</li> <li>- A DMS/Web Hotel can manage, store and exchange all kinds of file-based information, including IFC files.</li> <li>- A DMS/Web Hotel can manage revision history and access to information.</li> <li>- Examples of a DMS/Web Hotel include INTERAXO, ITBASE Project Web, Alfresco and many more.</li> </ul>
01-03-05	Understand what a model server is: <ul style="list-style-type: none"> <li>- A model server is a shared server that can manage, store and exchange model information.</li> <li>- A model server can provide access to BIM metadata, geometry and properties.</li> <li>- A model server can manage revision history and access to information.</li> <li>- A model server can conduct analyses of BIMs.</li> </ul>

## 04. Learning Module Getting started with openBIM

### Primary learning objective: Understand how to get started with openBIM.

This learning module will take participants from understanding what openBIM is on a conceptual level to understanding how they can get started with BIM in their own organisation.

The learning module will provide general recommendations on what must be clarified before you get started.

Organisations that use BIM for the first time often start with a simple project. It could be a client who wants to gain experience with BIM, or a consultant/contractor who will be providing services in a BIM project for the first time.

- Organise the project
- Define objectives (and ambitions)
- Define/specify specific information deliverables

No.	Learning target
<b>Clarify the organisation's maturity</b>	
01-04-01	Understand that you need to identify the technological level within the organisation and the project. BIM projects require a certain level of technological quality. <ul style="list-style-type: none"> <li>- Internet</li> <li>- Computer performance</li> <li>- LAN</li> </ul>
01-04-02	Understand that you need to identify staff competence in using software. Does anyone in the organisation/project have relevant experience with: <ul style="list-style-type: none"> <li>- defining requirements in a database</li> <li>- modelling discipline models</li> <li>- examining BIM using viewer software</li> <li>- performing analyses (clash detection, cost estimation, energy calculation, etc.)</li> <li>- using BIM to communicate with stakeholders (visualisation)</li> <li>- coordinating construction logistics</li> </ul>
01-04-03	Understand that you need to identify the maturity of the organisation or the project with regard to exchanging files/models. Does anyone in the organisation/project have relevant experience with: <ul style="list-style-type: none"> <li>- exchanging files in a Document Management System (Web Hotel, project hotel, etc.)</li> <li>- exchanging and collecting files on a model server (EDM, bimserver.org, etc.)</li> </ul>
01-04-04	Understand that you need to identify the maturity of the organisation and the project by setting and/or following up requirements for BIM deliverables. Does anyone in the organisation or project have relevant experience with: <ul style="list-style-type: none"> <li>- setting requirements for and following up BIM deliverables: format, rights and responsibilities (contract appendix)</li> <li>- performing BIM analyses (visualisation, clash detection, cost estimation, energy calculation, etc.) as part of the decision-making process</li> <li>- managing the project group's deliverables to ensure compliance with requirements and between disciplines</li> </ul>
<b>Defining objectives for using BIM</b>	
01-04-05	Understand that you need to clearly define your objectives for using BIM and then specify BIM deliverables to support these objectives. <ul style="list-style-type: none"> <li>- Information entered into the BIM should be targeted for specific objectives to achieve a positive cost-benefit effect</li> </ul>
01-04-06	Understand that it is a good idea to start with simple tasks in the first project, and then build on this as the organisation matures. <ul style="list-style-type: none"> <li>- An example of simple tasks is to start by using the model for multidisciplinary</li> </ul>

	coordination, clash detection and cost estimation.
01-04-07	Understand that the client must ensure that the project organisation agrees on the framework for BIM deliverables in advance. <ul style="list-style-type: none"> <li>- Requirements for the content of BIM deliverables (contract appendix)</li> <li>- Requirements for the format of BIM deliverables, as well as rights and responsibilities (contract)</li> </ul>
<b>Organising the project</b>	
01-04-08	Understand that the client must allocate a competent BIM Coordinator to the project.
01-04-09	Understand the division of responsibilities between different BIM roles in projects. <ul style="list-style-type: none"> <li>- BIM Strategist/Motivator: <ul style="list-style-type: none"> <li>- Develops strategy and goals for BIM in the organisation. Strategic and technological level.</li> <li>- Must stay updated and pass on knowledge about technology.</li> <li>- Develops the general BIM manual.</li> <li>- The role will eventually become an integral part of the project management team.</li> </ul> </li> <li>- BIM Coordinator: <ul style="list-style-type: none"> <li>- BIM superuser, transforms goals into specific requirements for BIM deliverables. Plans, facilitates and coordinates BIM in all stages of the project, including ensuring that necessary procedures are established, implemented and updated.</li> <li>- Develops the BIM manual further for the project level.</li> <li>- This role should be held by a key member of the design team, who follows the entire design process in close dialogue with the Design Manager.</li> </ul> </li> <li>- BIM Technician: <ul style="list-style-type: none"> <li>- BIM superuser, provides user support for BIM processes (software, information flow, version control, information exchange).</li> <li>- Supports the BIM Coordinator with regard to execution and organisation.</li> <li>- Uses the project's BIM manual.</li> </ul> </li> <li>- BIM Discipline Manager: <ul style="list-style-type: none"> <li>- BIM superuser, responsible for discipline models.</li> <li>- Establishes object libraries and sets up IFC export in line with project requirements.</li> <li>- Prepares the BIM manual for the specific discipline.</li> </ul> </li> </ul>
01-04-10	The project's BIM Coordinator must ensure the timely analysis of BIM as part of the decision-making process for the project.
<b>Define detailed requirements for deliverables</b>	
01-04-11	Understand that the BIM Coordinator must specify the deliverables for each discipline in detail from project start-up, based on the client's overall objectives: <ul style="list-style-type: none"> <li>- Detailed BIM deliverables should be ordered from project suppliers.</li> <li>- Requirements should be defined for milestones, sub-milestones and export for individual analyses.</li> <li>- The requirements for individual disciplines must conform with each other in order to support multidisciplinary collaboration.</li> </ul>
01-04-12	Understand that the consultants must deliver discipline models in IFC in accordance with the requirements set by the project's BIM managers. <ul style="list-style-type: none"> <li>- The consultant must establish models and IFC exports with an information level in line with project requirements.</li> </ul>
01-04-13	Understand that contractors should set standardised requirements for BIMs that they receive from consultants according to openBIM requirements in the Norwegian Contractors Association's (EBA) "Setting requirements for BIM projects".
01-04-14	Understand how to use sources to define your own requirements. <ul style="list-style-type: none"> <li>- buildingSMART Norway processes</li> <li>- Norwegian Directorate of Public Construction and Property BIM Manual</li> <li>- Norwegian Home Builders' Association BIM Manual</li> <li>- South/East Norway Regional Health Authority BIM Handbook</li> </ul>

<b>BIM meetings</b>	
01-04-15	Understand that you should hold a BIM kick-off meeting to agree on deliverables and sub-milestones for all project participants.
01-04-16	Understand that you should hold a technical BIM kick-off meeting, where BIM Discipline Managers test export/import and interdisciplinary exchange. <ul style="list-style-type: none"> <li>- Arrange an early test of simplified models with few objects, but where the object geometry and properties correspond to project requirements.</li> </ul>
01-04-17	Understand that it can be a good idea to set up a series of meetings for a BIM group, consisting of the project's BIM Coordinator and BIM Discipline Managers, to address challenges and find new solutions to optimise the use of BIM.

## 05. Learning Module Trends – use of openBIM in the future

**Primary learning objective: Know how openBIM/buildingSMART will change the industry.**

The use of BIM is still in its infancy. We are starting to see trends that indicate how this new technology will change the industry. And there are good examples that show that big changes are on the horizon.

This learning module aims to help us see the big picture and demonstrate that BIM is only the first step towards a more efficient building, construction and property industry.

The content of this learning module is not a prerequisite for being able to use openBIM in projects, but it is important to know that the industry is changing and that you should be part of these developments. This learning module is not included in user certification.

No.	Learning target
<b>Life-cycle cost</b>	
01-05-01	Know how openBIM can be used for life-cycle cost estimation. <ul style="list-style-type: none"> <li>- Using BIM to extract reliable key geometric data for life-cycle cost estimation saves a lot of time.</li> <li>- You only need a simple BIM to produce good key geometric data.</li> <li>- Even at an early stage, it pays to create simple concept models and test different solutions.</li> </ul>
<b>Lean Construction (LC) / Virtual Design and Construction (VDC)</b>	
01-05-02	Know the benefits of using LC/VDC in a project. <ul style="list-style-type: none"> <li>- Experiences with LC/VDC suggest that there are significant savings if one avoids downtime and errors.</li> </ul>
01-05-03	Know how openBIM is used in conjunction with LC/VDC. <ul style="list-style-type: none"> <li>- LC/VDC is a concept for the efficient management of design and construction. LC/VDC is entirely dependent on openBIM in order to manage information and communicate among project suppliers.</li> <li>- Integrated Concurrent Engineering (ICE) is a concept for efficient multidisciplinary design and engineering.</li> </ul>
<b>Industrialisation</b>	
01-05-04	Know what effects the construction industry achieves by using openBIM in the development of industrialisation. <ul style="list-style-type: none"> <li>- Prefabrication of composite structural elements is changing the construction site into an assembly site. Buildings can potentially be assembled much faster and with significantly fewer people involved than in conventional construction.</li> <li>- Industrialised production is generally characterised by a higher quality of the prefabricated structural elements.</li> </ul>
01-05-05	Know how openBIM can contribute to industrialised production: <ul style="list-style-type: none"> <li>- openBIM is a prerequisite for getting a clear overview of all the components of a building and how they fit together.</li> </ul>
<b>Processing applications for building permits</b>	
01-05-06	Know how openBIM can contribute to applications processing based on digital models. <ul style="list-style-type: none"> <li>- The Norwegian Directorate for Building Quality (DiBK) is working to establish digital applications processing.</li> <li>- The concept is that the local authority has a server that performs most of the applications processing, so that processes that previously took weeks and months can be completed in hours and days.</li> <li>- openBIM is sent to the authorities for an automatic check of the model. If the project application is within regulated frameworks, building permits can theoretically be</li> </ul>

	issued automatically.
<b>openBIM FM &amp; Operation</b>	
01-05-07	<p>Know examples using BIM as (part of) the FM &amp; Operation documentation.</p> <ul style="list-style-type: none"> <li>- Gathering all the information in BIM from the outset (design, construction and product data) will make it easy to access all the information in an operational situation.</li> </ul>
<b>Integrating sectors</b>	
01-05-08	<p>Know examples of how BIMs of buildings, installations and infrastructure can be assembled to coordinate projects involving multiple sectors.</p> <ul style="list-style-type: none"> <li>- An increasing number of urban construction and infrastructure projects require coordination between transport and communications, wires, installations and buildings. Coordination with BIM provides the same advantages between sectors as between disciplines in buildings.</li> </ul>