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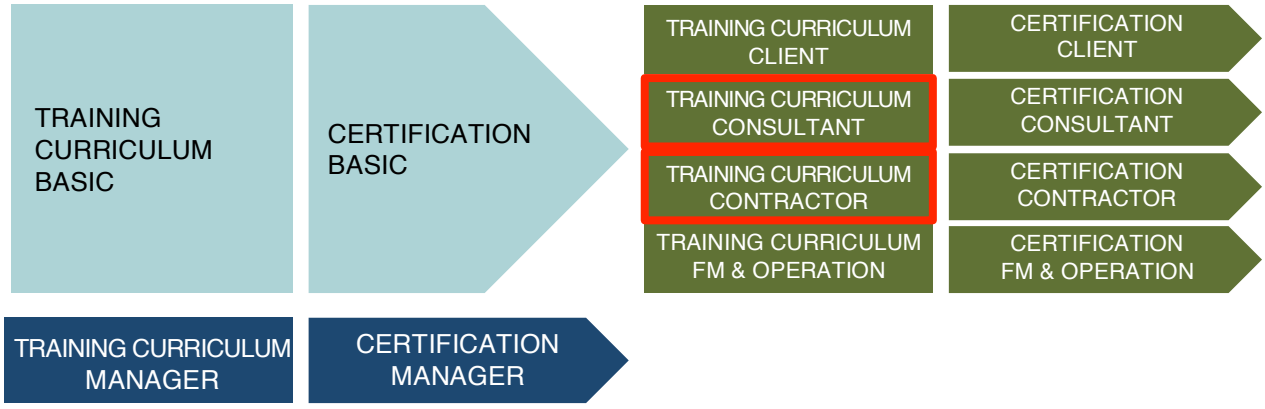
buildingSMART Norway
Training curriculum 04 – CONSULTANT
Training curriculum 05 – CONTRACTOR

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



Training curriculum – User (Consultant and Contractor)

buildingSMART Norway's User training curriculum builds on learning from the Basic training curriculum. Courses based on this training curriculum thus assume a basic understanding of openBIM, buildingSMART and topics related to initiating BIM projects.
Courses based on this training curriculum will provide an understanding of the key topics that guarantee effective collaboration between disciplines and stages.
This training curriculum is aimed at two general groups of disciplines: Consultant and Contractor. We believe that competence requirements are the same for both groups.
The term Consultant covers both architects and engineers. All disciplines under these are separate disciplines. However, when it comes to the principles for collaboration using openBIM, the competence requirements are very similar.
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 User training curriculum focuses on understanding how your role functions in the interaction between disciplines – and how this affects the use of openBIM. It is essential that you understand that the information entered into the BIM, whether geometry or properties, is used by others outside your discipline or the closest link in the value chain. It may be that BIM project requirements do not seem relevant, but they are still important for other disciplines or stages.
To succeed with effective collaboration with BIM, all those involved, particularly those doing the modelling and enhancing the models, correctly according to established project requirements.

Learning objectives

Learning module contents

Definitions

This training curriculum uses the following abbreviations and terms:

Abbreviation	Description
BIM	Building Information Model. Digital object-based model 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 module has 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 objective.

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

Where learning targets are identical to learning targets from another training curriculum, the first part of the number may not match the number of the present training curriculum. The Consultant and Contractor training curricula have been merged for the time being. Thus, the first part of the number uses 04 (Consultant).

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 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 architects, engineers and responsible contractors who directly or indirectly use 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 it should be sufficient to complete

the learning modules. Based on a “traditional” lecture-based course, we estimate that the duration should be 2 days (approximately 12–14 hours incl. breaks). This can be carried out flexibly, for example as four 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 3-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, the instructor 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.

Organisational

01. Learning module: Framework conditions

No two projects are alike. What works well in one project will not automatically work in another. BIM is an investment in a project and, like all other investments, should pay off. You should get back more than you put in. Therefore, you should consider what you will be using the BIM for based on the individual project and the project organisation. It is also important to make clear agreements early in the project with regard to formats, as well as rights and responsibilities for BIM deliverables. It is important to understand that setting the right framework conditions for BIM deliverables can have a direct impact on what you get back from using BIM. The quality of BIM deliverables, like all other types of services, depends on the agreements that govern them, the processes in which they are performed, and those who participate.

No.	***Learning target***
04-01-01	Understand how the use of BIM supports the decision-making process. BIM is a tool that can assure quality and provide a basis for decision-making processes. Targeted and disciplined use of BIM can have a major effect with relatively little effort.
04-01-02	Understand that, in most cases, implementing BIM in an organisation will involve an investment in software, hardware and training.
04-01-03	Understand how it can be advantageous to perform modelling with simple BIM objects and small amounts of information content in the early stages of a project. The complexity and level of information in the model will develop in step as the project matures.
04-01-04	Understand that project size and complexity can dictate what the BIM is used for. – If it is a large and complex project, it can e.g. pay to use the BIM to create complex analyses of egresses, acoustics and voltage drop calculations and to simulate construction logistics. – If it is a small and simple construction project, the multidisciplinary coordination (including clash detection) and cost estimation will be the objectives of the BIM that will create profit.
04-01-05	Understand that all information entered into the model has a cost associated with initiation and verification. – Information must be utilised at some point during the project life-cycle to defend the cost of establishing it. – For example, if you are going to use the model for multidisciplinary coordination, it is essential that all relevant disciplines provide models at the right level at the same time, and that dedicated resources are allocated to carry out clash detections and adequate

	technical assessments. – Procedures must be established for processing and following up deviations as an integral part of the design process.
04-01-06	Understand how to make contractual agreements on format and precedence of deliverables. - What formats should milestone deliverables include? IFC and proprietary formats. If proprietary formats will also be used, they must often be cleaned up to ensure compliance with IFC. - What formats should weekly deliverables include? Which type of deliverable takes precedence over another? In many projects, the description takes precedence over the drawing, which takes precedence over the BIM. In other words, if there is a discrepancy between two types of information, precedence is given to the information included in the description and then in the drawing.
04-01-07	Understand how to make contractual agreements on the usage rights for model files and object directories (only the current project or free use). - There is plenty of opportunity to reuse well-designed solutions, such as a hospital ward. Some believe that such efficiency-enhancing reuse is a key reason to use BIM. Others will say that reuse creates added value for building owners and should be remunerated accordingly. To avoid conflict over reuse rights, it is advisable to enter into an agreement on usage rights before starting work. - BIM objects may include significant amounts of information on requirements or properties, e.g. space objects can contain many requirements for spaces with specific intended uses. Object libraries are often developed by designers over the course of several projects. If the client is to have access and the right to use objects in other projects, it is recommended that this be agreed in advance.
04-01-08	Understand how to contractually define/limit liability for the use of model files for the purpose specified by the assignment. - Using BIM for different purposes may set different requirements for the model. A BIM intended to create clash detection does not necessarily have all the information needed to perform cost estimation based on the model. Or a BIM intended for cost estimation is often too detailed to create an energy calculation from the model. - If models intended for one purpose are used for purposes other than what was agreed in the contract, the model provider is not liable for the outcome of the non-agreed purpose. - It is therefore recommended to agree in advance what the BIM is to be used for and ensure that the information in the model covers all future use of the model.
04-01-09	Know what stages BIM projects are broken down into in accordance with ISO 29481-1: 2010 – Building information modelling – Information delivery manual – Part 1: Methodology and format. If you use BIM manuals developed by other organisations, it is advisable to ensure that the division of stages in the BIM manual corresponds or can be linked to the project's stages. A missing stage can create confusion in the project about which delivery requirements apply. - It is advisable to use ISO 29481-1:2010 for the division of stages; see Appendix 1.
04-01-10	Understand that BIM does not automatically result in savings and increased quality. The creation and use of BIM should be planned and monitored in relation to objectives. - The design disciplines will be working concurrently. If the technical design disciplines are contracted late in the project and only perform a single calculation, you lose a large part of the benefit of BIM as a coordinating tool.

	- BIM does not automatically reduce expenses in the programming, concept and design stage, but good preliminary work can produce an overall reduction of project costs. - Contractors in BIM projects often spend more time on planning construction activities and coordination with subcontractors. Good preliminary work will reduce the rate of errors and downtime during construction.

02. Learning module: Multidisciplinary coordination

A significant benefit from using BIM is that you can coordinate the interface between disciplines significantly more efficiently and better than with manual drawing-based quality assurance. However, the quality depends on all disciplines delivering at the same level and utilising the potential benefit to which everyone contributes.

No.	***Learning target***
04-02-01	Understand that it is the project manager's responsibility to set specific general requirements for how the BIM should be used. Examples of objectives include: - If the BIM is to be used to build a low-energy building, you should simulate energy and focus on structural engineering. - If the aim is to cut project costs, the focus should be on improving the efficiency of the construction process. - If the objective is to increase quality, you need to have good procedures for multidisciplinary coordination and clash detection and the ability to use BIM in communication with users and the contractor.
04-02-02	Understand that the design management team (primarily the BIM Coordinator) must set specific requirements for BIM deliverables, and that these requirements should anticipate needs for geometry and information in subsequent project stages.
04-02-03	Understand that it can be an advantage for the client to have the consultant use BIM to visualise the project for the client and for users.
04-02-04	The client is responsible for ensuring that there is a BIM Coordinator for the design stage, while the main contractor has the corresponding responsibility for providing a BIM Coordinator for the construction stage. Both BIM Coordinators shall conduct periodic multidisciplinary clash detection, with deviation follow-up procedures.
04-02-05	Understand that the main contractor should have the construction-stage BIM Coordinator plan construction using visualisations and a progress simulation from the BIM together with the subcontractors.

Model

03. Learning module: Model

No.	***Learning target***
General modelling rules for multidisciplinary BIM collaboration	
04-03-01	Understand that an architect must specify a common origin to be used by anyone who makes discipline models.
04-03-02	Understand that all disciplines should work with the same storey subdivision, as far as possible. If the software does not allow you to subdivide storeys or there are very good reasons for using a different division in a discipline, a unified procedure for handling this must be established.

04-03-03	Understand that you must use the correct object type when modelling.
04-03-04	Understand that the IFC export from the modelling software must be set to export objects and properties to the correct IFC entities (object types), IFC enumeration (subtype), IFC properties and IFC attributes.
04-03-05	Understand how to name object types correctly. - Short name – IFC: IfcXxx.Name Project-specific short name that can be used for e.g. drawings (e.g. OW-01 for an outer wall) - Logical name – IFC: IfcXXX.Description Description (e.g. 2x13 mm plasterboard + 48 mm insulated stud frame + vapour barrier + 198 mm insulated stud frame + 9 mm ext. plasterboard + 36 mm ventilation + horiz. timber cladding) - Type name – IFC: Object type IfcXxx.ObjectType Unified Norwegian standard for type names (according to Norwegian standard NS8360 BIM Objects)
04-03-06	Understand that you must specify the correct storey on objects and divide systems/structures by storey. - All objects should be assigned to the storey where they are located. - Some object types are often modelled over several floors (e.g. precast shafts or glass walls). These are assigned to the lowest storey where they are represented. - It is advisable to break down objects as much as possible so that contractors can make the most detailed simulation of the construction.
04-03-07	Understand that you need to agree on how to duplicate objects. Some objects are included in more than one discipline model. Often, architecture modelling also includes columns, floor slabs, sanitary installations and lighting, although other disciplines are responsible for modelling and describing them. - If the project allows multiple disciplines to model the same object, it is recommended that only the discipline that has contractual responsibility for describing objects enter the properties of BIM objects. - The project must agree on how to unambiguously inform the contractor and subcontractor that duplicate objects from the non-responsible discipline should not be taken into account when ordering or during construction. - The project must establish a procedure for the coordination of duplicate objects so that they are the same for all discipline models.
04-03-08	Understand how to correctly model walls/covering of floor slabs and column fronts - Covering for floor slabs and column fronts should be modelled as a separate small wall object. - Most modelling software allows you to run walls past the front edges of slabs and adjusts the wall profile. This method gives the wrong amounts for cost estimations using BIM.
04-03-09	Understand that objects must correctly specify whether they are interior or exterior.
04-03-10	Understand that stairs must be modelled using the right software. - If it is a complex stair construction, stairs must be modelled using stair software. - Each step must be modelled as a floor slab if it constitutes an independent piece, e.g. an exterior staircase on the ground. - Each stair must be exported to the correct IFC class depending on whether it is a stair element or a floor slab.
Documentation of the IFC4 model	
04-03-11	Know about the documentation for buildingSMART Data Model version IFC4 http://www.buildingsmart-tech.org/ifc/IFC2x4/rc4/html/index.htm Show how under Annex B you can search for:

	- object types (Entities) - object sub-types (Enumeration Types) - properties (Property Sets) - call-off quantities (Quantity Sets)
NS 8360 BIM Objects	
04-03-12	Know about the Norwegian standard for BIM NS 8360 BIM Objects – Naming and properties of BIM objects and object libraries for structures
04-03-13	Understand that the type name is a national standard. The type name is intended to ensure that objects can be automatically recognised by the software. It is therefore important that the type name is specified correctly. In accordance with NS 8360 BIM Objects, type names are specified for: - structural objects, based on a given syntax dictated by NS 8351, a standardised type code and potentially a dimension. - technical objects, based on a given syntax dictated by NS 8351 and, if applicable, NS 3420.
04-03-14	Understand that, in accordance with “NS 8360 BIM Objects”, you should always use IFC4 properties (if they exist) to exchange information about objects.
04-03-15	Understand that, in accordance with “NS 8360 BIM Objects”, you can create new properties if they are not in IFC4. New properties are given a prefix of up to four alphanumeric characters, which is linked to the property name with an underscore, e.g. TFM_.

BIM Objectives

04. Learning module: BIM deliverables

General understanding of objective-specific descriptions of delivery requirements. In order to ensure unambiguous delivery requirements that can be used in the interface between software, roles and stages, they must be described both generally, so as to understand the context and objective, and in detail, so that there is no doubt as to the scope of the delivery. Delivery requirements from buildingSMART Norway are baseline best practices that can be used “as is”, or adjusted in relation to the project’s needs. If you make an adjustment, it is important to communicate to all relevant affected parties that delivery requirements have changed.

No.	***Learning target***
bSN Process descriptions and bSN Guide’s Guidelines for setting objectives	
04-04-01	Know that buildingSMART Norway has contributed to / developed / adopted process descriptions for some of the most common objectives for using BIM. These include: - visualisation - clash detection - 4D construction simulation - building programming - cost estimation - purchasing (contractor’s cost estimation for construction and electrical disciplines) - BIM geo-referencing - The Norwegian Contractors Association’s (EBA) requirements for BIM from consultants Process descriptions are available from the buildingSMART Norway website.
04-04-02	Know that the buildingSMART Norway Guide covers a variety of guidelines for setting objectives that have the same function as process descriptions. The content of process descriptions will be included in the buildingSMART Norway Guide’s guidelines

	for setting objectives.
04-04-03	Understand that process descriptions and guidelines for setting objectives do not describe quality requirements for discipline outputs (i.e. good architecture, calculations, project management, etc.), but how to document and exchange decisions in BIM.
bSN Process descriptions / bSN Guide's process guidelines – general introduction	
04-04-04	Understand that the general introduction is essential reading for Project Managers, Design Managers, BIM Coordinators and BIM Discipline Managers so that they can contribute to ensuring that the project execution supports the process. If, for example, you want to use the model for multidisciplinary coordination, it is essential that the requirements for discipline models have the same level, that deliveries are made in accordance with requirements and that there are dedicated resources for collecting discipline models and follow-up, in addition to procedures for managing deviations.

buildingSMART Norway Processes – delivery requirements

The following learning modules use the same structure as for buildingSMART Norway Processes.

05. Learning module: P01 – Coordination model and construction planning

No.	***Learning target***
Visualisation	
04-05-01	Understand that the objective of using BIM for visualisations is to see the building as a whole or objects in order to gain a better understanding. - The advantage of using BIM for visualisations is that three-dimensional graphics are easier to understand than drawings for forming a spatial understanding. - Visualisations are not an exact tool that can answer whether a solution is right or wrong. Visualisations improve technical insight and communication.
04-05-02	Understand that visualisations do not require all building elements to be included in the model, but that an appropriate geometric abstraction level is defined for any given objective or stage. It is only appropriate to include in the model what will actually be visualised. Models with a lot of information slow down your computer.
04-05-03	Understand that visualisations can be used for many different purposes. Some of the most common are: - exterior – view buildings, landscape and infrastructure in their entirety - interiors – view the building's interior incl. furniture and fittings in their entirety - structural engineering/logistics – see the relationship between discipline models - system/technical – view selected disciplines, systems or object groups
Multidisciplinary coordination	
04-05-04	Understand that the objective of using BIM for clash detection is to find deviations in the design work between disciplines before construction begins, and to coordinate the multidisciplinary design process. The clash detection tool can collect several disciplineBIMs and find deviations in geometrical size and/or location of objects within or across disciplines.
04-05-05	Understand that the advantage of using BIM for clash detection is that the software tools themselves can find many types of deviations and report them in a way that supports follow-up activities at design meetings.
04-05-06	Understand that the advantage of using BIM for clash detection assumes that there is a Design Manager or that the BIM Coordinator has the authority to have designers

	correct deviations.
04-05-07	Understand that the BIM Coordinator should describe rules for what is an acceptable deviation. Understand that the BIM Coordinator or Design Manager should facilitate a methodical process for reporting deviations. Understand that the BIM Coordinator or Design Manager should regularly facilitate procedures for designers to correct deviations.
04-05-08	Understand that multidisciplinary coordination with BIM assumes corresponding levels in discipline models in relation to the project stage, and that all objects that require and/or occupy physical space should ideally be modelled in a complete model for clash detection.
Building planning	
04-05-09	Understand that the objective of using BIM for progress management is to optimise building logistics through visualisation and virtual simulation.
04-05-10	Understand that one of the benefits of using BIM for progress management is that you can link objects in the BIM to schedules from several project management tools. Visualisation of construction can reveal bottlenecks and other logistical challenges. BIM tools for visualising progress cannot report whether a solution and logistics are appropriate. The BIM supports technical understanding and can thus help to optimise logistics.
04-05-11	Understand that the geometric level of maturity and division of objects in the BIM should be representative of the timeline breakdown for the project.

06. Learning module: P02 – Building programming

The Client's requirements specification (building programme) can be entered into a database that can follow the project throughout its life-cycle. The advantage of using a database is that several people can work on the same system at the same time and receive updated information in real time.

No.	***Learning target***
04-06-01	Understand that a building programme database that can be connected to a BIM will also be able to conduct automatic checks as to whether all spaces are modelled and whether there are deviations with regard to area, property requirements, equipment, etc.
04-06-02	Understand that building programming in BIM and against a database assumes the systematic and disciplined use of space numbering.
04-06-03	Understand that although a physical space is in principle air delimited by walls, floor slabs and a ceiling, a space in a BIM context is a virtual object that can be linked to a long series of functional requirements. - A space in BIM is exported as IfcSpace.
04-06-04	Understand that you can set requirements for functions at several levels (project, building, storey, zone and space). - By far, most requirements are placed at the space level (IfcSpace). - The IFC model includes a wide range of requirement properties that can be linked to a space (IfcSpace). - Most of the requirements documented in a space are satisfied by objects that are adjacent to or located inside the space. For example, requirements for electrical outlets in a space are satisfied by the required number of outlets being modelled in the BIM.

07. Learning module: P03 – Cost estimation/Life-cycle cost estimation

No.	*Learning target*
04-07-01	Understand that the objective of using BIM for cost estimation is to utilise the BIM's quantity reporting and more or less automatic recognition of object types for pricing.
04-07-02	Understand that one of the benefits of using BIM for cost estimation is that it provides highly efficient and precise call-off quantities and a good overview of alternative solutions. Cost estimation supported by BIM is a powerful tool that can be used as support for daily decision-making.
04-07-03	Understand that detailed cost estimation assumes that relevant objects have correct values for: - object type - U-value (W/(m²K)) - fire resistance (REIM) - bearing/non-bearing - interior/exterior

08. Learning module: P04 – Object and product labelling (FM & Operation)

No.	*Learning target*
04-08-01	Understand that FM & Operation with regard to BIM means that the geometry corresponds "as built" and that the BIM's objects are clearly identifiable with regard to the actual delivered products. - Ideally, all designed requirements, relevant geometry and product information should be available in or via the BIM. - It is recommended that you code BIM objects with unambiguous, standardised product codes.
04-08-02	Understand that the objective of having the BIM represent the real building to the greatest possible extent throughout its life-cycle is that it streamlines access to information, enabling decisions to be made on the right basis. In many projects, huge sums are squandered due to not having efficient access to product information. The causes of such waste include: - Decisions on maintenance not being taken, or being taken too late. - Warranties on products not being used in the event of flaws. - Areas not being managed optimally. - Energy consumption not being controlled intelligently.
04-08-03	Understand that it is advisable to identify BIM objects with the corresponding manufacturer and serial number for the product. It is advisable to use the GS1 system, GTIN (Global Trade Item Number). The GTIN and serial number are entered into the IFC model using the following properties: - *GTIN number: Pset_ManufacturerTypeInformation. GlobalTradeItemNumber* - *Serial number: Pset_ManufacturerOccurrence. SerialNumber* - *SGTIN (GTIN + Serial Number): IfcClassification* No serial number is needed; only the GTIN number is used.
04-08-04	Understand that an increasing number of Norwegian projects require that objects be marked using a project-specific system developed by the Norwegian Directorate of

	Public Construction and Property called the Multidisciplinary Labelling System (TFM). The Norwegian BIM standard NS 8360 BIM Objects describes how all stages of the TFM system shall be documented in the BIM.

09. Learning module: P05 – Geo-referencing

No.	***Learning target***
04-09-01	Understand that geo-referencing is a standardised method for uniquely specifying the location of a BIM compared to actual coordinates. The purpose of geo-referencing a BIM on a map is to unambiguously determine the three-dimensional coordinates of where the building is to be built.
04-09-02	Understand that geo-referencing assumes an agreed project-specific zero point (X, Y and Z coordinates). - It is advisable to place the project-specific zero point such that the entire building is located in the upper-right quadrant and with a positive Z value for the bottom storey. - The project-specific zero point is then referenced in the X, Y and Z values and the angle to the map.
04-09-03	Know that geo-referencing does not set additional requirements for the model itself.
04-09-04	Understand which datum/coordinate system (EUREF NTM or UTM) is preferred by different users: - EUREF UTM is required by Norwegian municipalities – it is the system that the municipalities have based their system on. - EUREF NTM is required by contractors – UTM can lead to deviations that are too large in relation to permitted tolerances. There is software available that can transform coordinates between given UTM and NTM maps.

Appendices

Appendix 1 – ISO 29481-1:2010 for division of stages

Based on ISO 29481-1		
Stage/ Stage ID	**English stage name**	**Norwegian stage name**
S00	Portfolio requirements	Behov
S01	Conception of need	Konkretisere behov
S02	Outline feasibility	Mulighetsstudie
S03	Substantive feasibility	Konkretisere gjennomførbarhet
S04	Outline conceptual design	Skisseprosjekt
S05	Full conceptual design	Forprosjekt
S06.1	Coordinated design	Detaljprosjekt
S06.2	Procurement	Innkjøp
S07	Production Information	Arbeidstegning
S08.1	Construction	Bygging
S08.2	Off-site construction	Bygging prefab
S08.3	FM/Operation documentation	FDV-informasjon
S08.4	Commissioning	Ibruktaking
S09	Operation and maintenance	Drift og vedlikehold
S10	Disposal	Avhending

Appendix 2 – Purposes/Objectives

buildingSMART Norway's purpose/objective definitions			
Purpose ID	**Norwegian purpose name**	**English purpose name**	**Covered by this training curriculum**
P01	Koordineringsmodell og byggeplanlegging	Coordination model and construction planning	X
P02	Romprogrammering	Building Programming (PBie)	X
P03	Kostnadskalkyle/Livsløpskostnadskalkyle	Cost Estimation/Life-Cycle Cost Estimation	X
P04	Objekt- og produktmerking (FDV)	FM Documentation	X
P05	Georeferering	Geo-Referencing	X
P06	Energianalyse	Energy Analysis	
P07	Overdragelse til entreprenør	Handover to contractor	
P08	Byggeteknisk prosjektering	Structural Engineering	
P09	Brann prosjektering inkl. rømningsveianalyse	Fire Engineering + Egress Analysis	
P10	Akustisk prosjektering	Acoustical Engineering	
P11	Elektroteknisk prosjektering	Electrotechnical Engineering	
P12	Universell utforming	Accessibility Analysis	

Appendix 3 – Role definitions

buildingSMART Norway roles	
Role ID	
R0	***Management***
R0-01	Project management
R0-02	Design management
R0-03	Construction management
R0-04	BIM Strategist
R0-05	BIM Coordinator
R0-06	BIM Discipline Manager
R1	***Stakeholder***
R1-01	User
R1-02	Administrator
R1-03	Operator
R2	***Construction and architecture***
R2-01	Structural Engineer
R2-02	Architect
R2-03	Fire Safety Engineer
R2-04	Acoustical Engineer
R2-05	Structural Engineer, outdoors
R2-06	Landscape Architect
R3	***Mechanical Engineer***
R3-01	Mechanical Engineer – Pipework
R3-02	Mechanical Engineer – Ventilation
R3-03	Mechanical Engineer – Water/wastewater
R3-04	Mechanical Engineer – Ventilation, outdoors
R4	***Electrical Engineer***
R4-01	Electrical Engineer – Electric power
R4-02	Electrical Engineer – Telecommunications and automation
R4-03	Electrical Engineer – Passenger and cargo transport
R4-04	Electrical Engineer – Electrical systems, outdoors
R5	***Governmental authorities***
R5-01	Regulating authority
R5-02	Planning authority
R5-03	National authority
R6	***Responsible contractors***
R6-01	Contractor – Construction Manager
R6-02	Subcontractor

Appendix 4 – Naming of types and objects

In accordance with NS8360:2015 Table 1 – Naming of object types and occurrences

Property	Description
IfcRoot.Name	Used for a single function category/rough classification of objects. If the application supports IfcClassification, it should be used instead.
IfcRoot.Description	Can be the unique name or number of an object.

In accordance with NS8360:2015 Table 2 – Classification of object types and occurrences in accordance with this standard

Property	Description
IfcClassificationReference.Identification	The code, e.g. 2316_1001.198_2001.9_3001.13
IfcClassificationReference.Name	Optional. Text describing the code, preferably automatically generated from text in Tables A.1–A.17. In the above example, the code would mean: Insulated timber frames, 198 mm; Plasterboard exterior, 9 mm; Plasterboard interior, one layer, 13 mm.
IfcClassificationReference.ReferencedSource	The source, i.e. NS 8360
IfcClassificationReference.Description	Optional. Source title: BIM Objects – Naming, type coding and properties of BIM objects and object libraries for structures