StatsBygg BIM-Manual 2.0 (SBM2)

- Why?
- What?
- How? (with demo)
- When?
- What’s next?

EU BIM Task Group - 2019-08-28
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Chief Engineer – Domain Coordinator at Statsbygg BIM Section
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One of the authors of Statsbygg BIM Manuals since 2008
Has been working with Statsbygg BIM Manual 2.0 solutions since 2015

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WHO – HARALD ONARHEIM

BIM-technician – FiO – Oslo Vocational University, 2009
CEO – Digital Problem Solver at DIGIBIM AS

Has worked with open BIM (IFC) solutions since 2008

Has been implementing SBM1.2.1 in projects since 2011

One of the authors of SBM2 since 2014, and practical/technical implementation since 2019.

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WHY A BIM MANUAL?
SOME CHALLENGES

• Different projects specify the BIM requirements differently (extent of properties used vary, and non-standard properties used)
• The current BIM Manual is PDF only (>100 pages) - difficult to follow and not according to 2019 digitalization ambitions
• The current BIM Manual is not very precise, and with imbalanced requirement levels
• The current BIM Manual can not easily be validated in software
• The current BIM Manual is old (Dec 2013) and partly out-of-date
• The current BIM Manual specifies IFC 2x3 requirements only (no IFC4)
FROM STATSBYGG DIGITALIZATION STRATEGY

«...a common digital model of all relevant buildings...»

«...efficient building operations ... through digitalization...»

«...interact digitally...»

«...digitalization to promote innovation in AEC...»
WHAT WE HOPE FOR IN A NEW BIM MANUAL

- Common, precise base requirements for all projects (but further adapted to individual needs in each project) to raise model quality
- Use of «maturity» properties to communicate intended BIM usage better
- Avoid (and possibly remove) unwanted/unnecessary «spam» properties
- Automated validation in software for requirement set – that can be carried out by both the design team and the client
- Freeing up time for handling tasks that can not be automated
- Using open standards for model (IFC), requirement set (mvdXML), and issue reporting back to CAD systems (BCF)
WHAT IS OUR NEW BIM MANUAL?
STATSBYGG BIM MANUALS – A BRIEF HISTORY

• The path to today’s BIM Manual:
  – 1.0 (2008): Made for «HITOS» full conceptional project (a lot of «BIM textbook»)
  – 1.1 (2009): Made for «HITOS» coordinated project (very specific on some parts)
  – 1.2 (2011): Transfer to today’s tabular form
  – 1.2.1 (2013): Minor changes, error corrections, clarifications – this manual is still usually the legally valid version in building projects
  – 1.2.1 (validation adapted interpretation – 2019)

• The new BIM Manual (abbreviated SBM2):
  – 2.0 ARCH/STRU (started in 2015): with BIM Consult / SWECO BIM Lab
  – 2.0 MECH/ELEC/(ARCH/STRUC revision) (2017-2018): with COWI
  – 2.0 All domains (from Q3/2018→max 4 Years): with Multiconsult / DigiBIM
SCOPE

• A manual with requirements for the information content and form in model deliverables («product»), from actors of different domains in different project milestones and phases (requirements that can be validated)

• A manual with a certain level of model structure guidance («product»)

OUT OF SCOPE

• NOT a manual for defining the modelling «processes» («how to make the product»)

• NOT a manual for CAD drawing requirements (CAD Manual)

• NOT a manual for setup and structuring of model deliveries in a web hotel
WHAT IS THE ESSENCE OF THE VALIDATION?

– For this **OBJECT TYPE** (e.g. *IfcDoor*) that **exists** in the IFC model:
  • Does it contain the **PROPERTIES** (e.g. *FireRating*) that the BIM manual requires from THIS actor (e.g. ARCH) by THIS milestone (e.g. 3.2.9)?
  • Are these properties specified at the «**RIGHT PLACE**» in the model (e.g. for a door (*IfcDoor*) does the property *FireRating* exist in a property set (Pset) named *Pset_DoorCommon*) applied to *IfcDoor*?
  • **IF** requirements are set for data «values»: Are they according to valid **VALUES**? For a *FireRating* e.g., *EI60* will be a valid value, whereas *DonaldTrump* is not.
...AND WHAT DOES IT NOT DO?

- SBM2 does **NOT** validate for:
  - the *professional* quality of the model
  - the correct professional *design solutions*
  - if correct *object type* is used for the right building part / component - e.g. if a stair is modelled as one `IfcStair` of a number of stacked `IfcSlab` objects
  - object types that do **NOT** exist in the current model - e.g. `IfcRamp`
  - Relations - e.g. that this wall has a relation to the door at denne veggen har relasjon til dør mounted in the wall [SW like Solibri can]
  - Clash detection [SW like Solibri can]

- Checked only IF defined:
  - list of valid values – e.g. EI30, EI60, EI90, EI120 for *simple* fire ratings
  - «REGEX» expressions (the syntax of a composite string) – if they are to be checked one has to agree om syntax, and this syntax must be supported by the software
HOW TO USE THE STATSBYGG BIM MANUAL? (WITH DEMO)
VALIDATION PRINCIPLE WITH SBM2
DEMO – WHO DELIVERS WHAT, HOW AND WHEN?
DEMO –

- Requirement templates for main domains/disciplines
  - Architectural (ARK) [ARCH]
  - Landscape (LARK) [LARCH]
  - Structural (RIB) [STRU]
  - Electrical (RIE) [ELEC]
  - Mechanical and plumbing (RIV) [MECH]
DEMÖ – WHAT

- Domain/discipline specific requirements are structured by Objects (type), e.g. IfcWall, and include
  - General information
    - Object properties such as; Name, Description, etc. (existence check)
  - Level of Geometry (LoG)
    - Object geometrical maturity (manual check)
  - Property-sets Common/others (IFC Standard)
    - Object Property set properties such as; Acoustic rating, Fire rating, Is External, etc. (existence check)
  - Userdefined Property sets and properties; **NOSSB_Nn**
    - Additional requirements not covered by the IFC Standard such as; Design status (MMI), «TFM» ID code, ReqTriggers (e.g. Electrical power), etc.
  - Quantities (QTO) [not decided yet]
Available Object-types and applicable property sets and properties

Descriptions for Object-type, Property sets, Properties and LoG (geometrical maturity)

LoG (geometrical maturity) definitions are mainly requirement guidelines for contractual documents
Object-type IfcWall

Property «Name»

Property IfcWall_IfcRoot.Name

Is set as requirement (x) (no «X» means no requirement)
Requirement reports and exports

.pdf format (report)

.mvdxml format (export)
<table>
<thead>
<tr>
<th><strong>B.x.x.1</strong> Early in phase: Is the project updated and on track?</th>
<th><strong>B.x.x.5</strong> After inter-domain coordination: Do the domains work well together?</th>
<th><strong>B.x.x.9</strong> Final delivery in phase: Does the project deliver according to requirements?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early in phase:</td>
<td>After inter-domain coordination:</td>
<td>Final delivery in phase:</td>
</tr>
<tr>
<td>Is the project updated and on track?</td>
<td>Do the domains work well together?</td>
<td>Does the project deliver according to requirements?</td>
</tr>
</tbody>
</table>
DEMO – HOW

• SBM 1.2.1 = IFC 2x3
  - Structured by IFC 2x3 object types, property sets and properties
  - Includes all requirement sets in Statsbyggs current BIM manual (Ref#)
  - Possible outputs/exports; .mvdXML and .pdf

• SBM 2.0 = IFC 4 + extensions (Statsbygg defined properties)
  - Structured by IFC 4 object types, property sets and properties
  - Includes all requirements recommended by project team
  - Includes requirement specifications of object geometrical detail level (LoG)
  - Includes Statsbygg defined property sets and properties (NOSSB_Nn)
DEMO – THE VALIDATION PROCESS?

Video demo: https://youtu.be/HfTdoPyTZBU?t=168
WHEN WILL THE BIM MANUAL BE USEFUL AND FINISHED?
## Working on SBM2 Modules – A Long Way to Go...

### End User Interface (GUI)
- **Generic requirements and guidance (NO validation)**
  - **Design Phases**
    - Domain (discipline) requirements
    - ARCH/STRUC/MECH/ELEC
  - **Construction**
    - Domain (discipline) requirements
    - ARCH/STRUC/MECH/ELEC
  - **FM and operations**
    - Domain (discipline) requirements
    - ARCH/STRUC/MECH/ELEC
  - **LAANDSC req.**
    - LANDSC req.
  - **FIRE ENG / ACOUSTIC ENG req.**
    - FIRE ENG / ACOUSTIC ENG req.
- **OPTIONS according to project BIM/GIS-strategy**
  - 4D (time planning)
  - 5D (cost planning)
  - 3D reinforcement
  - Digital building pit
  - Drill Robot
  - ...more...

### Validation
- **Validation of EXISTENCE**
- **Validation of VALUES**
- **Validation of valid syntax (REGEX)**

### The requirements
- **GREEN = SBM2 solution exists**
- **YELLOW = SBM2 solution started**
- **ORANGE = SBM2 solution approaching**
- **GREY = SMB2 solution NOT started yet**
## DEPENDING ON IFC4 CERTIFICATIONS TO ADVANCE...

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>In use in current building projects</td>
<td>Yes</td>
<td>Not yet</td>
</tr>
<tr>
<td>Human Readable (PDF)</td>
<td>Yes, only</td>
<td>Yes, also</td>
</tr>
<tr>
<td>Machine Readable (mvdXML)</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Generic / high level requirements exist (not validated)</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Requirement type SHALL</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Requirement type (SHALL), i.e. «only if activated in project)</td>
<td>Yes, if template adapted</td>
<td>Yes, template adapted</td>
</tr>
<tr>
<td>Requirement type SHOULD</td>
<td>Yes, if INTERPRETED</td>
<td>No</td>
</tr>
<tr>
<td>Requirement type «trigger»</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Can be validated vs. IFC2x3 models</td>
<td>Yes (SHALL req.)</td>
<td>Later on if we HAVE to</td>
</tr>
<tr>
<td>Can be validated vs. IFC4 models</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Validation of EXISTENCE of something</td>
<td>Yes (SHALL req.)</td>
<td>Yes</td>
</tr>
<tr>
<td>Validation of VALUES of av valid list</td>
<td>No</td>
<td>Yes, if template adapted</td>
</tr>
<tr>
<td>Validation of valid SYNTAX (REGEX)</td>
<td>No</td>
<td>Planned</td>
</tr>
</tbody>
</table>
### REQUIREMENTS («X») ADAPTED TO PROJECT GOALS

#### Purpose

<table>
<thead>
<tr>
<th>Nr.</th>
<th>BIM-formål</th>
<th>Relevant i Statsbygg fase</th>
<th>Relevant i Statsbygg-fase</th>
<th>Relevant i Statsbygg fase</th>
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<tbody>
<tr>
<td>7</td>
<td>Programminn og etablering av topprogram</td>
<td>x</td>
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<tr>
<td>8</td>
<td>Kostnadsanalyse (inntaksanalyse)</td>
<td>x</td>
<td>x</td>
<td>x</td>
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<tr>
<td>9</td>
<td>Analyse av innsatskostnader</td>
<td>x</td>
<td>x</td>
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<td>10</td>
<td>Analyse av miljø- og klimariskning (BREEM)</td>
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<td>x</td>
<td>x</td>
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<tr>
<td>11</td>
<td>Utvikling 2D-tegnings</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>12</td>
<td>Projekteringstilrette (modellsetting, modellrer)</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>13</td>
<td>Simulering av strøm- og røykaprøve</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>14</td>
<td>Simulering og optimalisering av akustikk</td>
<td>x</td>
<td>x</td>
<td>x</td>
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<tr>
<td>15</td>
<td>Optimisering og planløp av teorier for evaluering</td>
<td>x</td>
<td>x</td>
<td>x</td>
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<tr>
<td>16</td>
<td>Energi-analyse</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>17</td>
<td>Lydberegninger</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>18</td>
<td>Stat- og skygge-studier</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>19</td>
<td>Vindanalyse (løsne vindavvikling, bevegelseslignende og skygger av)</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>

#### Relevant phases

<table>
<thead>
<tr>
<th>BIM</th>
<th>Fra Statsbygg prosjektoversikt</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ankre BIM-prosjekt. Avvik fra jordstandard som skal begynnes og formulere prosjektoversikt. Referanse til proekskart avvik.</td>
</tr>
</tbody>
</table>
«IFC4 – STILL LACK OF CERTIFIED SOFTWARE

Press release - 28 November 2019

Is the construction industry ready to meet the requirements of tomorrow?

Four large Norwegian public building clients and owners - Norwegian Defence Estates Agency, Norwegian Health Authorities, South Eastern Norway Regional Health Authority, and Statsbygg - have established and signed a joint statement. This joint statement defines requirements for all parties involved in their projects to use software based on open standards for all parts of the project. This will put pressure on architects, consultants, software vendors and contractors to implement the new technology.

All four organisations have already implemented the requirement for open standards for 3D modelling and documentation (Building Information Modelling - BIM). We have now acquired experience in using the new tools and methods.

Experience from projects completed in accordance with the requirement for open BIM standards has shown that the construction industry has not yet fully taken advantage of the new technology and methods. It is therefore important for our organisations to send clear signals to the market and create predictability.

The joint statement sends clear signals to architects, consultants and contractors about which software they can use in their building projects.

What does the mean in practice for those who intend to participate in Norway’s largest future building projects?

- All software used in all projects, with effect from 2 July 2020, will be certified according to the latest open BIM standard (SN EN 1971:2016). This means that architects, contractors, etc. can now use the tools and methods involved (architectural and engineering) and international suppliers to ensure that they are compliant with the new requirements.
WHILE WAITING FOR IFC4 CERTIFIED SOFTWARE...

- «Double Up» BIM Manuals efforts
  - Validation of IFC2x3 models with Statsbygg BIM Manual 1.2.1 requirement set
  - Validation of IFC4 models with Statsbygg BIM Manual 2.0 requirement set

<table>
<thead>
<tr>
<th></th>
<th>IFC2x3</th>
<th>IFC4</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIM manual 1.2.1</td>
<td>Today’s Manual</td>
<td></td>
</tr>
<tr>
<td>BIM manual 1.2.1 - validate version</td>
<td>Pitstop – Validating it</td>
<td>Tomorrow’s Manual</td>
</tr>
<tr>
<td>BIM manual 2.0</td>
<td></td>
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</tbody>
</table>
WHAT’S NEXT IN THE PIPELINE?
WORKS NOW

• mvdXML requirements sets according to SBM1.2.1 for IFC 2x3 models for disciplines ARCH, STRUC, MACH, ELEC (published)

• mvdXML requirements sets according to SBM2 for IFC 4 models for disciplines ARCH, STRUC (not yet published by 2019-08-28)

• SBM2 site where the mvdXML files are published [Norwegian]: https://sites.google.com/view/statsbyggs-bim-manual-2-0-sbm2/hjem


• SBM2 teaser video [7 min]: https://youtu.be/HfTdoPyTZBU
COMING UP... [1]

• The work on a *Landscape Architecture* (LARCH) requirement set template has come quite far – hope for a launch Q4/2019

• Dialogue with the *Norwegian Contractors Association* (EBA) and the *Precast concrete association* about required properties for the construction and as built phases started

• Will be aligned with the results from *Standards Norway* and *buildingSMART* committee SN/K 374 for standardized *Product Data Templates* (PDT), based on CEN/TC 442 WG4
COMING UP... [2]

- Working with requirement sets for the «condition disciplines» like fire and acoustic engineering, that do NOT themselves have BUILT objects in the model, but set requirements for other discipline models, like ARCH models.
Most major CAD systems must have IFC4 RV export certification before we can introduce IFC4 as an operational requirement in actual building projects.
TESTING, TESTING, TESTING IN PROJECTS ..... 

- Gol trafikkstasjon
- UiO - Livsvitenskap
- BUFetat Bergen
- Nasjonalmuseet (PNN)
- Norges arktiske universitetsmuseum
- Nytt veksthus Tøyen
- Ullersmo / Eidsberg fengsler
- BUS2 (Barne- og ungdomssjukehuset)
- Kunsthøyskolen i Bergen (KHiB)
- Fosshaugane – Høgskulebygget (ARK «SlimBIM»)
- Inntrøndelag tingrett (ARK «SlimBIM»)
- Statsarkivet (ARK «SlimBIM»)
- Ørje Tollsted (ARK «SlimBIM»)
ALSO ON THE «TO DO» LIST...

• Running «pilot projects»
• In-house training and external «marketing»
• Improving the end user interface (GUI)
• Translations
  – BIMQ: English \(\rightarrow\) Norwegian
  – Generic requirement document: Norwegian \(\rightarrow\) English
THANK YOU FOR YOUR ATTENTION!

Frode Mohus – Harald Onarheim