Managing and use of BIM at the New Østfold Hospital through design and construction

buildingSMART Forum 2015  BIM-Pilotprojekte erleben
Berlin 2015-12-01

Kjell Ivar Bakkmoen
Architect MNAL - Senior advisor BIM support
South-Eastern Norway Regional Health Authority / Sykehusbygg HF
Chair ISO TC 59/SC 13 Organization of information about construction works
Chair buildingSMART International User Group
Member buildingSMART Management Executive
Norwegian delegate to CEN/TC442 BIM
Our mission:

Provide high quality specialist healthcare services to all who need it, when they need it; irrespective of age, origin, ethnicity, gender or financial standing.

- **Norwegian specialist healthcare services**
  - State owned public funded health trusts established 2002, taking over from the counties
    - South-Eastern merged from South and East 2007
  - Four regional health authorities controls 26 hospital trusts

- **South-Eastern Norway Regional Health Authority (Helse Sør-Øst HSØ):**
  - Providing specialist health services for 2.8 Mill. inhabitants (56% of the Norwegian population)
  - Budget 2014: 72 bill. NOK ≈ 10 bill. USD, 8 bill. EUR
  - 9 Hospital trust, plus 5 private non commercial hospitals
  - 2,6 Mill. m² floor area (excl. private hospitals)
  - 75.000 employees
National Health Construction and building
Sykehusbygg HF

• Sykehusbygg HF - New national body for building hospitals:
  • Sharing experiences
  • Standard processes
  • Standard solutions (rooms, departments etc.)
  • Design management competence
  • Construction management competence
  • One client for all projects
HSØ BIM strategy

Innsatsområde Bygg og eiendom

Detprosjekt 10 – Prosjektledelse og prosjekttstyring - tilleggsmant BIM - Arbeidsgruppe

Rapport:
Implementering av BIM i Helse Sør-Øst

30.08.2011
Revksen 1.0
HSØ BIM strategy
HSØ BIM strategy

Nytt ostfoldsykehus

Sentralt styringsdokument for
Prosjekt nytt ostfoldsykehus

<table>
<thead>
<tr>
<th>Res.</th>
<th>Beskrivelse</th>
<th>Rev.</th>
<th>Dato</th>
<th>Ros</th>
<th>Status</th>
<th>Godkjent</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Parr prejudice</td>
<td>06.01.13</td>
<td>NH</td>
<td>PG</td>
<td>DB</td>
<td></td>
</tr>
<tr>
<td>02</td>
<td>For-kommersiell</td>
<td>16.12.10</td>
<td>NH</td>
<td>RS</td>
<td>DR</td>
<td></td>
</tr>
</tbody>
</table>

Side 1 av 30
HSØ BIM strategy

Nytt østfoldsykehus

BIM og åpenBIM strategi

Rapport:

Side 1 av 27

Side 1 av 30

© HSØ 2015 - kib
HSØ BIM strategy

Forsvarsbygg
The Norwegian Defence Estates Agency

Statsbygg
Public Construction and Property Management

Helse Sør-Øst
South-Eastern Norway Regional Health Authority

Helse Midt
Central Norway Regional Health Authority

JOINT STATEMENT – openBIM

Background

Our organizations have already implemented open international buildingSMART standards in our new building projects. We consider this to be the most future oriented solution for the building industry. Open standards, based on user-driven development of technology, gives the possibility to achieve seamless data exchange between all domains through the whole projectbuilding lifecycle. Based on this, our organizations have chosen buildingSMART’s openBIM standards as the foundation for exchange (export, import), storage and process of the Building Information Model. We consider the adaptation of open international standards as crucial in order to achieve the goals we have set for our organizations.

Intent

We consider predictability as a major value in our business development plan, and we want to give the building industry a clear understanding of our intentions.

While 1st of July 2016 we will demand that all software used in our projects in order to create, edit, store or process data from the Building Information Model, shall support interoperability, by communicating and sharing building information based on openBIM. This software shall be certified to export, link and import all information in the latest official version of open international format like IFC (ISO 16739) and Building SMART International official IDM's and Model View Definitions.

Open Signatory Process

Our intention is to add new signatories to this public statement. Signatories are intended to be other construction clients and building owners in Norway. New signatories must approve this public statement and must be accepted by all the existing signatories.

Annual Review

We expect the signatories to conduct an annual review of this Public Statement and revise it - based on consensus - according to new developments, as openBIM is rapidly evolving.

The following signatories agree with the intentions of this Public Statement.

Date: 28.02.2013

Peder Olsen
Chief Executive Officer (CEO)
South Eastern Norway Regional Health Authority
Within 1st of July 2016 we will demand that all software used in our projects in order to create, edit, store or process data from the Building Information Model, shall support complete interoperability, by communicating and sharing building information based on openBIM. This software shall be certified to export, link and import all information in the latest official version of open international format like IFC (ISO 16739) and BuildingSMART International official IDMs and Model View Definitions.
New Østfold Hospital
New Østfold Hospital – Project BIM strategy

Use of BIM shall contribute to achieve the project targets:
• Secure good information and basis for decisions
• Show positive and documented effects of the use of BIM and open BIM on costs, time, quality and Safety/health
• Facilitate for cost efficient facility management through the lifecycle of the building
• Carry though and document a showcase for other hospital projects
• Establish systematic procedures for the use of BIM and open BIM which will be of value / a learning case for other projects
• Better quality on the construction documentation
• Industrialization of the construction process
• Less errors on site
• Better user process
New Østfold Hospital – Facts

- Bed wards
- Psychiatry
- Treatment
- Services
- Helicopter
- Main entrance
- Bus terminal
New Østfold Hospital – Facts

• Kalnes
  – 89 500 m² gross area
  – 3 180 user rooms
  – 480 technical rooms
  – 620 corridors etc.
  – 21 lifts
  – 42 tube mail stations
  – 4282 doors – 2845 windows
  – 120 000 furniture and equipment articles
  – 1 000 types equipment 15 000 instances
  – 400 types furniture 15 000 instances
  – 2 000 types fixed furniture 20 000 instances
  – 1 500 types HVAC/data/lab etc. 15 000 instances

• Costs (P50-price level March 2014)
  – Total project cost 6 024 MNOK incl. Equipment and VAT
  – H-value 1,76
Construction 2013 og 2014

Installing medical technical equipment, site acceptance testing, starting up some departments January – October 2015

Opening new emergency ward and closing down old hospital November 2015
### New Østfold Hospital – Contract structure

#### 40 construction – 50 equipment contracts

<table>
<thead>
<tr>
<th>General requirements</th>
<th>Public roads</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Outdoor infrastructure - Roads, utilities, water, sewage</td>
</tr>
<tr>
<td></td>
<td>Site clearance, excavation, filling, earth moving</td>
</tr>
<tr>
<td></td>
<td>Foundations incl. installations</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>TREATMENT BUILDING 30.200 m²</th>
<th>BEDWARD BUILDING 38.400 m²</th>
<th>PSYCHIATRY 13.100 m²</th>
<th>SERVICES 3.600 m²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structure</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Building envelope</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Interior works incl fixed furniture</td>
<td>Interior works incl fixed furniture</td>
<td>Interior works incl fixed furniture</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Design build contracts for mechanical, electrical, ICT and specialised systems (many contracts)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Piping</td>
<td>Piping</td>
<td>Piping</td>
<td>Piping</td>
</tr>
<tr>
<td></td>
<td>Furniture, user equipment (many contracts)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Outdoor finishes (atrium gardens, green roofs)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Pre project

- 1997-12: Reviewing the Hospital structure of Østfold county
- 1999-05: The county decides to close all old hospitals and build one new
- 2001 Spring: Main function program adopted in Østfold county council
- 2001-July: Architectural competition started
- 2001 Fall: Decision concerning site
- 2002-01-01: New organization - Helse Øst

Ifc 2.0 april1999
Pre project

- 2002 Spring: Architectural competition decided
  Winning team: Ellassen Lambertz-Nielsen, Arkitema, AARTF

- 2002 Summer: Coordinated with other Helse Øst projects and postponed

- 2005: Process started again by the hospital

Competition project
Pre project

- Quality assurance of concept report
- Room function program finished
- Procurement of engineering contract
- Complete design team established
- HSØ's client project organization (PNØ) established
- Client and design team located together
- Updated concept design
- Start developed design

- 2009 Spring
- 2009 Fall
- 2009 Fall
- 2010-01-01
- 2010 March
- 2010-02-15
Developed design – Building permit application 2010

- Updated concept design
- Start developed design
- First joint BIM model by design team

2010-02-15

2010 summer

Export of disciplin Ifc models every week and joint to one model in Solibri
Developed design – Building permit application 2010

Syncronizing Revit – dRofus

Starting clash detections and model checks. Basic model checks in Solibri every month with report included in monthly report to client.

Radiator – furniture
Developed design – Building permit application 2010

Energy use

BIM strategy for the project

Cost estimate / budget

2010

Energy and interior climate simulation with IDA – ICE

Export to IFC imported into Calcus estimate software
Detail design 2011 ->

- Using Solibri model in meetings in user process
- Using Solibri report functionality as minutes / protocol from meetings
- Testing game technology
  - Not good enough
- Finished user process

- 2011 spring
- 2011 spring
- 2010 March
- 2011 June
Detail design – Construction 2011 - 2014

IFC model to software for cost estimate and writing specifications
Process diagrams / descriptions procedures
Tender documents
The IFC model is distributed with tender documents
Contracts

From individual and fragmented, to shared and standardized data

Expectations to the contractors model use:
- Study difficult solutions
- Vizualisation in meetings
- Quality assurance of quantities
### Expectations to the contractors model use:

- Study difficult solutions
- Vizualisation in meetings
- Quality assurance of quantities
Detail design – Construction 2011 - 2014

- IFC model to software for cost estimate and writing specifications
- Process diagrams / descriptions procedures
- Tender documents
- The IFC model is distributed with tender documents
- Contracts

2011 - 2013

Expectations to the contractors model use:
- Study difficult solutions
- Vizualisation in meetings
- Quality assurance of quantities
Piles are positioned based on coordinate-lists from the model.

Pile positioning from model.
Detail design – Construction 2011 - 2014

- 2012 Jan.: From Autocad w/Magcad to REVIT
- 2012: MEP (HVAC & Electrical)
- 2012: Calculation of voltage drop with model based tools (Fibdoc)
- 2012: Synchronization of equipment in model and equipment program/lists
- 2012 Spring: Calculation of HVAC noise and pressure drop in model
- 2012 May: Model available for everybody in the organization - Expectation crisis
- 2012 May – Solibri 7

Checking equipment

Plan for model ripeness
Detail design – Construction 2011 - 2014

- 2012: Client uses the model for progress simulation
- 2012 June: The project organizations moves to the site
- 2012 Fall: 2012 September Revit 2013
- 2012 Fall: 2012 September – Client take over the coordination of design
- 2012 Fall: 2012 September system for model control established
- 2012 Fall: 2012 October Autodesk Health check

Simulation of progress / scheduling for the structure with Navisworks Timeliner

BIM room with 2 projectors and screens on site. Adoption through challenging and facilitating
Learn that different Ifc exports from the same model give different results.

Start of large construction contracts.

Prefabrication of structure.

Drilling holes in concrete based on coordinate lists from MEP.

Soliibri 8.

Landscape: Autocad 2013.

Details of prefabrication models.
27. August 2013 50%

2013 August: Testing streaming of the model from central dataserver for a small group in the project team with Rendra. Still in progress and under development.

Possible to report issues based on model with Rendra.

All drawings (6040) available through streaming.

2013 August

2013 August

2013 October

2013 Nov.
Detail design – Construction 2011 - 2014

- Topping out ceremony – roof and envelope finished
- Visit of new minister of health

2014-01-08

2014-02-03
Streaming model for all in the project organization and some contractors
Export of properties in a similar way from all disciplines is important
March 2014 - Solibri 9
Large model:... 1 million objects 30 million properties
Revit 2014 Hotfix for MEP in order to improve performance (tuning of functions)
2014 October buildingSMART Award


No wifi on site, use 3G / 4G / LTE
Telecom providers installed four 4G senders
Contractors fill in FM documentation database (dRofus – TIDA)

Testing, testing, testing... that all systems work

Start using game technology to learn users / employees to know their new working environments (Attensi)
Commissioning / Handover - 2015

- Testing, testing, testing……
- Certification……
- Handover 1
- Psychiatry moves in, some ambulatoires
- Some diagnostic imaging and day surgery starts up
- Handover 2
- Emergency and in laid patients move in. Old hospital closed down

Official opening

Timeline:
- 2015
- 2015-04-07
- 2015-05-04
- 2015-09-22
- 2015-10-02
- 2015-11-02
- 2015-11-30

Events:
- 16.03.2015 - 29.03.2015: Uke 11 og 12 Virksomhetsrelaterede tjenestetester (VIT-3)
- 04.05.2015 - 06.05.2015: Næring og dyse pol Farmasistisk pol
- 05.05.2015 - 06.05.2015: Næring og dyse pol Farmasistisk pol
- 10.08.2015 - 21.08.2015: Uke 33 og 34 Virksomhetsrelaterede tjenestetester (VIT-1,5)
- 22.09.2015 - 23.10.2015: Operasjoner 1,5 Sterilcentral 1,5 Internet servicesenter 1,5 Tidlig drift
- 81.08.2015 - 11.09.2015: Uke 35 og 37 Virksomhetsrelaterede tjenestetester (VIT-2)

Additional Information:
- Official opening
- Commissioning
- Handover

[Image of people in a meeting room]
New Østfold Hospital
Design team authoring tools

- **ARK** - REVIT Architecture
- **RIB** - REVIT Structure
- **RIE** - Revit MEP with CQ tools/Naviate (from ACAD+MagiCAD)
- **RIV** - Revit MEP with MagiCAD (from ACAD+Magicad)
- **AKU** - Revit + Cowi adoption (from ACAD+COWI menu)
- **RIBr** - Revit + Cowi adoption (from ACAD+COWI menu)
- **Landscape** - Autodesk Civil
- **QA** - Solibri
- **Scheduling** - Safran -> MS Project + Naviswork
New Østfold Hospital
Sharing model data

• The model is available in standard IFC format.
• Open BIM

• All the disciplines export their models to Ifc every Thursday

• The client (PNØ) assembles the models to one model saved in Solibri format on Friday

• The assembled model is made available in a project hotel for the design team, the clients team and the contractors Monday morning

• The model is also uploaded to a central server for streaming to mobile devices
New Østfold Hospital
Export to Ifc

Different export tools gives different quality Ifc models

- REVIT Architecture  
  Revit, Naviate
- REVIT Structure  
  Revit
- Revit MEP / Naviate (EI)  
  Revit MEP, Naviate
- Revit MEP / MagiCAD (HVAC)  
  Revit MEP, Magicad, Naviate

- Very time consuming (up to 10 hours for a file)
- Ifc 2x3 – Important to get Ifc4 as fast as possible
<table>
<thead>
<tr>
<th></th>
<th>Services</th>
<th>Bed wards</th>
<th>Treatment</th>
<th>Psychiatry</th>
<th>Access</th>
</tr>
</thead>
<tbody>
<tr>
<td>A230 Building envelope</td>
<td>![image]</td>
<td>![image]</td>
<td>![image]</td>
<td>![image]</td>
<td>![image]</td>
</tr>
<tr>
<td>A240 Indoor</td>
<td>![image]</td>
<td>![image]</td>
<td>![image]</td>
<td>![image]</td>
<td>![image]</td>
</tr>
<tr>
<td>A270 Interiors</td>
<td>![image]</td>
<td>![image]</td>
<td>![image]</td>
<td>![image]</td>
<td>![image]</td>
</tr>
<tr>
<td>B200 Structure</td>
<td>![image]</td>
<td>![image]</td>
<td>![image]</td>
<td>![image]</td>
<td>![image]</td>
</tr>
<tr>
<td>X200 Structure Prefab (Tekla)</td>
<td>![image]</td>
<td>![image]</td>
<td>![image]</td>
<td>![image]</td>
<td>![image]</td>
</tr>
<tr>
<td>X230 Envelope Prefab</td>
<td>![image]</td>
<td>Husvik</td>
<td>Husvik</td>
<td>![image]</td>
<td>![image]</td>
</tr>
<tr>
<td>Services</td>
<td>Bed wards</td>
<td>Treatment</td>
<td>Psychiatry</td>
<td>Access</td>
<td></td>
</tr>
<tr>
<td>-------------------</td>
<td>-----------</td>
<td>-----------</td>
<td>------------</td>
<td>--------</td>
<td></td>
</tr>
<tr>
<td>A230 Building envelope</td>
<td>![Image]</td>
<td>![Image]</td>
<td>![Image]</td>
<td>![Image]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5 mb</td>
<td>73 mb</td>
<td>31 mb</td>
<td>32 mb</td>
<td></td>
</tr>
<tr>
<td>A240 Indoor</td>
<td>![Image]</td>
<td>![Image]</td>
<td>![Image]</td>
<td>![Image]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>9 mb</td>
<td>94 mb</td>
<td>53 mb</td>
<td>27 mb</td>
<td></td>
</tr>
<tr>
<td>A270 Interiors</td>
<td>![Image]</td>
<td>![Image]</td>
<td>![Image]</td>
<td>![Image]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>7 mb</td>
<td>134 mb</td>
<td>93 mb</td>
<td>30 mb</td>
<td></td>
</tr>
<tr>
<td>B200 Structure</td>
<td>![Image]</td>
<td>![Image]</td>
<td>![Image]</td>
<td>![Image]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5 mb</td>
<td>150 mb</td>
<td>36 mb</td>
<td>71 mb</td>
<td></td>
</tr>
<tr>
<td>X200 Structure Prefab (Tekla)</td>
<td>![Image]</td>
<td>![Image]</td>
<td>![Image]</td>
<td>![Image]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>7 filer, 68 mb</td>
<td>14 mb</td>
<td>15 mb</td>
<td></td>
<td></td>
</tr>
<tr>
<td>X230 Envelope Prefab</td>
<td>![Image]</td>
<td>![Image]</td>
<td>![Image]</td>
<td>![Image]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Husvik</td>
<td>Husvik</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## New Østfold Hospital
### Model files Electro

<table>
<thead>
<tr>
<th>Services</th>
<th>Bed wards</th>
<th>Treatment</th>
<th>Psychiatry</th>
<th>Access</th>
</tr>
</thead>
<tbody>
<tr>
<td>E300 Electrical</td>
<td><img src="image1" alt="Diagram" /></td>
<td><img src="image2" alt="Diagram" /></td>
<td><img src="image3" alt="Diagram" /></td>
<td><img src="image4" alt="Diagram" /></td>
</tr>
<tr>
<td>E300 Electrical U2, U1, 01</td>
<td><img src="image5" alt="Diagram" /></td>
<td><img src="image6" alt="Diagram" /></td>
<td><img src="image7" alt="Diagram" /></td>
<td><img src="image8" alt="Diagram" /></td>
</tr>
<tr>
<td>E300 Electrical 02, 03</td>
<td><img src="image9" alt="Diagram" /></td>
<td><img src="image10" alt="Diagram" /></td>
<td><img src="image11" alt="Diagram" /></td>
<td><img src="image12" alt="Diagram" /></td>
</tr>
<tr>
<td>E300 Electrical 04, 05, Roof</td>
<td><img src="image13" alt="Diagram" /></td>
<td><img src="image14" alt="Diagram" /></td>
<td><img src="image15" alt="Diagram" /></td>
<td><img src="image16" alt="Diagram" /></td>
</tr>
</tbody>
</table>
# New Østfold Hospital Model files Electro

<table>
<thead>
<tr>
<th>Services</th>
<th>Bed wards</th>
<th>Treatment</th>
<th>Psychiatry</th>
<th>Access</th>
</tr>
</thead>
<tbody>
<tr>
<td>E300 Electrical</td>
<td>19 mb</td>
<td></td>
<td></td>
<td>64 mb</td>
</tr>
<tr>
<td>E300 Electrical</td>
<td>58 mb</td>
<td>62 mb</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U2, U1, 01</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E300 Electrical</td>
<td>55 mb</td>
<td>53 mb</td>
<td></td>
<td></td>
</tr>
<tr>
<td>02, 03</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E300 Electrical</td>
<td>46 mb</td>
<td>38 mb</td>
<td></td>
<td></td>
</tr>
<tr>
<td>04, 05, Roof</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## New Østfold Hospital
Model files HVAC

<table>
<thead>
<tr>
<th>Services</th>
<th>Bed wards</th>
<th>Treatment</th>
<th>Psychiatry</th>
<th>Access</th>
</tr>
</thead>
<tbody>
<tr>
<td>V200 Carriers</td>
<td><img src="image1.png" alt="Image" /></td>
<td><img src="image2.png" alt="Image" /></td>
<td><img src="image3.png" alt="Image" /></td>
<td></td>
</tr>
<tr>
<td>V360 Air handling, tube mail etc</td>
<td><img src="image4.png" alt="Image" /></td>
<td><img src="image5.png" alt="Image" /></td>
<td><img src="image6.png" alt="Image" /></td>
<td></td>
</tr>
<tr>
<td>V360 Air handling U2 - 04 floors</td>
<td><img src="image7.png" alt="Image" /></td>
<td><img src="image8.png" alt="Image" /></td>
<td><img src="image9.png" alt="Image" /></td>
<td></td>
</tr>
<tr>
<td>V360 Air handling 05 – roof</td>
<td><img src="image10.png" alt="Image" /></td>
<td><img src="image11.png" alt="Image" /></td>
<td><img src="image12.png" alt="Image" /></td>
<td></td>
</tr>
<tr>
<td>V320 Floor heating</td>
<td><img src="image13.png" alt="Image" /></td>
<td><img src="image14.png" alt="Image" /></td>
<td><img src="image15.png" alt="Image" /></td>
<td></td>
</tr>
<tr>
<td>V365 Air handling units</td>
<td><img src="image16.png" alt="Image" /></td>
<td><img src="image17.png" alt="Image" /></td>
<td><img src="image18.png" alt="Image" /></td>
<td></td>
</tr>
</tbody>
</table>
## New Østfold Hospital
### Model files HVAC

<table>
<thead>
<tr>
<th>Services</th>
<th>Bed wards</th>
<th>Treatment</th>
<th>Psychiatry</th>
<th>Access</th>
</tr>
</thead>
<tbody>
<tr>
<td>V200 Carriers</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V360 Air handling, tube mail etc</td>
<td></td>
<td>138 mb</td>
<td></td>
<td>1 mb</td>
</tr>
<tr>
<td>V360 Air handling U2 - 04 floors</td>
<td>325 mb</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V360 Air handling 05 – roof</td>
<td>216 mb</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V320 Floor heating</td>
<td></td>
<td>8 mb</td>
<td></td>
<td></td>
</tr>
<tr>
<td>V365 Air handling units</td>
<td>5 mb</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Revit file 120 mb
- Export 2 hours
New Østfold Hospital Model files piping

<table>
<thead>
<tr>
<th>Services</th>
<th>Bed wards</th>
<th>Treatment</th>
<th>Psychiatry</th>
<th>Access</th>
</tr>
</thead>
<tbody>
<tr>
<td>V300 Plumbing</td>
<td><img src="image1" alt="Image" /></td>
<td><img src="image2" alt="Image" /></td>
<td><img src="image3" alt="Image" /></td>
<td><img src="image4" alt="Image" /></td>
</tr>
<tr>
<td>V300 Technical culvert U2</td>
<td><img src="image5" alt="Image" /></td>
<td><img src="image6" alt="Image" /></td>
<td><img src="image7" alt="Image" /></td>
<td><img src="image8" alt="Image" /></td>
</tr>
<tr>
<td>V311 Piping beneath building</td>
<td><img src="image9" alt="Image" /></td>
<td><img src="image10" alt="Image" /></td>
<td><img src="image11" alt="Image" /></td>
<td><img src="image12" alt="Image" /></td>
</tr>
<tr>
<td>V330 Sprinkler</td>
<td><img src="image13" alt="Image" /></td>
<td><img src="image14" alt="Image" /></td>
<td><img src="image15" alt="Image" /></td>
<td><img src="image16" alt="Image" /></td>
</tr>
<tr>
<td>V340 Gass &amp; pressurized air</td>
<td><img src="image17" alt="Image" /></td>
<td><img src="image18" alt="Image" /></td>
<td><img src="image19" alt="Image" /></td>
<td><img src="image20" alt="Image" /></td>
</tr>
<tr>
<td>Pneumatic waste system Eleiko</td>
<td><img src="image21" alt="Image" /></td>
<td><img src="image22" alt="Image" /></td>
<td><img src="image23" alt="Image" /></td>
<td><img src="image24" alt="Image" /></td>
</tr>
</tbody>
</table>
# New Østfold Hospital

## Model files piping

<table>
<thead>
<tr>
<th>Services</th>
<th>Bed wards</th>
<th>Treatment</th>
<th>Psychiatry</th>
<th>Access</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>V300 Plumbing</strong></td>
<td>124 mb</td>
<td>428 mb</td>
<td>503 mb</td>
<td>247 mb</td>
</tr>
<tr>
<td><strong>V300 Technical culvert U2</strong></td>
<td>12 mb</td>
<td>11 mb</td>
<td>12 mb</td>
<td>12 mb</td>
</tr>
<tr>
<td><strong>V311 Piping beneath building</strong></td>
<td>4 mb</td>
<td>8 mb</td>
<td>13 mb</td>
<td>14 mb</td>
</tr>
<tr>
<td><strong>V330 Sprinkler</strong></td>
<td>79 mb</td>
<td>179 mb</td>
<td>30 mb</td>
<td></td>
</tr>
<tr>
<td><strong>V340 Gass &amp; pressurized air</strong></td>
<td>4 mb</td>
<td>26 mb</td>
<td>49 mb</td>
<td>2 mb</td>
</tr>
<tr>
<td><strong>Pneumatic waste system Eleiko</strong></td>
<td>11 mb</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# New Østfold Hospital

## Model files

<table>
<thead>
<tr>
<th>Services</th>
<th>Bed wards</th>
<th>Treatment</th>
<th>Psychiatry</th>
<th>Access</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>85.300 m²</td>
<td>Services 3.600 m²</td>
<td>Bed wards 38.400 m²</td>
<td>Treatment 30.200 m²</td>
<td>Psychiatry 13.100 m²</td>
</tr>
</tbody>
</table>

- **Technical culvert U2**: 12 mb
- **V311 Piping beneath building**: 11 mb
- **V330 Sprinkler**: 12 mb
- **V340 Gass & pressurized air**: 14 mb
- **Pneumatic waste system Eleiko**: 4 mb

---

63 model files ≈ 4-5 GB Ifc

Assembled Solibri file 1,2 GB

Uses 20 GB memory to generate geometry

| 230 MB | 1 500 MB | 1 300 MB | 950 MB | 5 MB |
New Østfold Hospital
Model files
New Østfold Hospital
Experiences

• Large model is a challenge for all actors
  – Realistic model sizes. With all disciplines, 10.000 m2 is probably a realistic limit, and for some of the disciplines that is probably the limit for what they can handle.
  – Ad hoc splitting of the model is unfortunate
• Clear requirements to the model, objects and their properties.
  – Not BIM-manual, but BIM-Requirements
  – Manufacturers objects in the model
• Continuous control down to properties, it is impossible to clean up the model later
  – The authoring tools doesn’t follow the Ifc standard in everything
  – The client should involve in model checks
• The model should be developed in parallel for all the disciplines
New Østfold Hospital Experiences

• Clear responsibility for the model
  – Not BIM-coordinator, but BIM-responsible in the organization line

• Documentation of the model when you deliver it to the operator.
  – Which properties are really quality assured – Property angst
    • FireRate, MB_FireRate, CQ_FireRate, MC_FireRate

• Not only about the model, but digitization in a broader sense.

• Process and procedures, we have to change the way we work

• The tools must be ready when you start the processes, it is difficult / impossible to change procedures and ways of doing things when the procedures has been established.
New Østfold Hospital Experiences

• We don’t know what the model will be used for in the lifespan of a building.

• Important to have identification on all objects that might be used to link to other databases for any kind of use.
New Østfold Hospital Experiences

Bim Wedge simplified
New Østfold Hospital Tools

• Room, equipment and documentation database: dRofus
  – www.drofus.no

• Game technology: Attensi
  – www.attensi.no

• Model on mobile devices: Rendra O
  – www.rendra.no