What is BIM at the moment

- Data management
  - Open standards (IFC, Inframodel)
  - Data structured in same way (initial data models)
- Using new technologies
- New ways for project management
  - What information is needed, why, who and for what purpose
- AIM, asset information management
  - Open this from owner point of view. This is lacking in BuildingSMART at the moment, but it’s starting this autumn
- Information flow through product lifecycle so that information grows instead of lose
- It’s a tool making things better not a value itself
- It’s not only 3D modeling (geometry), in some cases it can be models than contain only geometrical information.
Current status in Finland
What we have already done

- Guidelines, common requirements for infrastructure BIM (YIV)
  - [www.infrabim.fi/en](http://www.infrabim.fi/en)
  - Official launch 5.5.2015, part 1-7

- Data exchange, Inframodel 3,

- Use of IFC for bridges, we are using elements that are already existing in IFC.

- Classification version 1.5
  - Extension is coming this autumn

- Terminology

- Lot of case studies in different project phases.
YIV (Common Infrastructure modeling requirements)

1. Managing model based projects
2. General model requirements
3. Requirements of initial information
4. Modeling in different design phases
5. Structural models (route models)
   5.1 Earth, foundation and rock constructions as well as pavement and surface structures
   5.2 Preparation instructions for as planned models of earth works (machine control model)
   5.3 As build model for earth works
6. Structural models (networks)
7. Structural models (bridges and other engineering structures)
8. Quality management of the infra model
9. Quantity takeoffs, cost calculation
10. Visualization
11. Utilization of the infra model during design, construction, use, and maintenance
YIV (Common Infrastructure modeling requirements)

1. Managing model based projects
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3. Requirements of initial information
4. Modeling in different design phases
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10. Visualization
11. Utilization of the infra model during design, construction, use, and maintenance

English version available in September
### Initial data "classification/library"

<table>
<thead>
<tr>
<th>Sub-folder</th>
<th>Content (depend on design phase)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A_terrain model</strong></td>
<td>• Ground surface model&lt;br&gt;• Ground water level data and/or model&lt;br&gt;• Complementary terrain data (trees and other vegetation)</td>
</tr>
<tr>
<td><strong>B_ground model</strong></td>
<td>• Existing soil investigations, points&lt;br&gt;• Bare rock&lt;br&gt;• Interpreted soil structures&lt;br&gt;• Ground water level data</td>
</tr>
<tr>
<td><strong>C_constructions</strong></td>
<td>• Data of existing constructions and systems etc:&lt;br&gt;  o Wire and device data&lt;br&gt;  o Wells&lt;br&gt;  o Bridges (visible structures)&lt;br&gt;  o Lightning&lt;br&gt;  o Road signs and information boards etc.</td>
</tr>
<tr>
<td><strong>D_map_and_GIS</strong></td>
<td>• Geographic Information Systems (environment, land use planning, soil map data, museum etc.)&lt;br&gt;• Existing traffic network&lt;br&gt;• Contaminated land&lt;br&gt;• Property boundaries and land owner data&lt;br&gt;• Right to use related to implementation (road, street and railway boundaries, landfill, temporary right to use, protected areas and zones)</td>
</tr>
<tr>
<td><strong>E_reference material</strong></td>
<td>• Other designs related to project</td>
</tr>
</tbody>
</table>
Creation process of initial data model

1. **Assignment**
   - Quality assurance of initial data
   - Documentation

2. **Order initial data**
   - Quality assurance
   - Documentation

3. **Modifying initial data**
   - Initial data model material
   - Documentation

4. **Initial data model handover**
   - Approval of model or its return to consultant to be complemented

5. **Orderer's checks**
## Meta data of initial data

<table>
<thead>
<tr>
<th>Data</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material</td>
<td>Material in question</td>
</tr>
<tr>
<td>Acquisition responsible</td>
<td>Who is responsible for ordering the material in question</td>
</tr>
<tr>
<td>Receiving date</td>
<td>Date, when material is received</td>
</tr>
<tr>
<td>Receiver</td>
<td>Who received the material (if different than material orderer)</td>
</tr>
<tr>
<td>Source</td>
<td>Where the material is obtained</td>
</tr>
<tr>
<td>Owner</td>
<td>Who owns the material (if different, than material source)</td>
</tr>
<tr>
<td>Owners contact details</td>
<td>Contact details of owner of material (for instance phone number and email)</td>
</tr>
<tr>
<td>Source system</td>
<td>Coordinate system and datum level, in which the material has initially been at the time of receiving</td>
</tr>
<tr>
<td>Source format</td>
<td>File format, in which material is received</td>
</tr>
<tr>
<td>Material date</td>
<td>Up-to-date material (time of surveying etc.). Uncertainties in italic.</td>
</tr>
<tr>
<td>Availability and restrictions of use</td>
<td>Limitations related to material: is material subject to charge, what copyright limitations are included in material etc.</td>
</tr>
<tr>
<td>Level of accuracy</td>
<td>If accuracy level can be given to material, it´s documented here. Also if the data is accurate or assumed.</td>
</tr>
<tr>
<td>Final product</td>
<td>File format, in which the material should be converted</td>
</tr>
<tr>
<td>Description</td>
<td>Field for possible complement descriptions and special observations</td>
</tr>
<tr>
<td>Lähtöaineisto</td>
<td>Tiedoston nimi</td>
</tr>
<tr>
<td>---------------</td>
<td>---------------</td>
</tr>
<tr>
<td>A  Maastomalli</td>
<td></td>
</tr>
<tr>
<td>A1 Kolmioverkko</td>
<td>Pisararata_KarkeMaanpinta_MKP_50_100_100_TIN.dwg</td>
</tr>
<tr>
<td>B  Maaperämalli</td>
<td></td>
</tr>
</tbody>
</table>

Pisara_kalliopintamalli.dwg
B2_Pisara_kalliopintamalli_KES.dwg

30.6.2015 • Tiina Perttula
Finnish Inframodel application document

LandXML v1.2

Under construction in parallel with first implementations of Inframodel 3

mandatory in LandXML v1.2

(exand Inframodel 3)

optional in Inframodel 3

(state)

table:

<table>
<thead>
<tr>
<th>mandatory unit type</th>
</tr>
</thead>
<tbody>
<tr>
<td>enumerated values</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>key</th>
<th>value</th>
<th>example values</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>unique name</td>
<td>e.g. [Pouta]</td>
</tr>
<tr>
<td>refID</td>
<td>end reference</td>
<td>e.g. [Kaal]</td>
</tr>
<tr>
<td>sID</td>
<td>start reference</td>
<td>e.g. [Wel]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>length</th>
<th>exact length of a pipe in field distance units</th>
</tr>
</thead>
<tbody>
<tr>
<td>objID</td>
<td>object ID number</td>
</tr>
<tr>
<td>scope</td>
<td>slope</td>
</tr>
<tr>
<td>state</td>
<td>state</td>
</tr>
</tbody>
</table>
INFRAMODEL 3.1
New extension

buildingSMART Finland 21.5.2015
Inframodl 3.1 – new parts and features

Extension contains
1. Coordinate systems
2. Meta Data
3. As build information
4. Geotechnical model / subsoil model
5. Geometry lines
6. Cross section parametres
7. Surface structure
8. Pavement structure
9. New network elements
10. Sign foundation, extend features
11. Ground Cables
12. Railing and fenses
13. Pile stabilization and mass stabilization
Inframodel 3.1 – new parts and features

http://www.inframodel.fi/im4

Inframodel testitympäristö

Versio 3.1

Sovellusskeema, versio 3.1
IM-skeema (sovelluskohtainen), versio 3.1
Arvojoukotskeema, versio 3.1 (fi/suomi)

Dokumentointi (html)
IM-skeema, dokumentointi, versio 3.1 (html)

Arvojoukot (Excel)

Nosto Consulting
It-Pie
Tekla
Vianova
Finnmap Infra
Sito
Inframodel 3.1 – new parts and features

definitions
• New elements (3,13)
• Elements that are in LandXML that are taken in use (3)
• Widening use of elements that are in IM3 (9)
• Widening attribute information and documentation (4, 7, 8, 9, 10, 11, 12)
• Sharpening documentation or classification (1, 4, 5)

• Next slides shows shortly some new features

Extension contains
1. Coordinate systems
2. Meta Data
3. As build information
4. Geotechnical model / subsoil model
5. Geometry lines
6. Cross section parameters
7. Surface structure
8. Pavement structure
9. New network elements
10. Sign foundation, extend features
11. Ground Cables
12. Railing and fences
13. Pile stabilization and mass stabilization
1. Coordinate systems - EPSG

Suomalaisten koordinaatistojen EPSG -koodit

<table>
<thead>
<tr>
<th>EPSG Code</th>
<th>Name</th>
<th>Alias</th>
<th>Selite</th>
</tr>
</thead>
<tbody>
<tr>
<td>4258</td>
<td>ETRS89</td>
<td>ETRS89-GRS80</td>
<td>geodetic 2D; φ, λ</td>
</tr>
<tr>
<td>4937</td>
<td>ETRS89</td>
<td>ETRS89-GRS80h</td>
<td>geodetic 3D; φ, λ, h</td>
</tr>
<tr>
<td>4936</td>
<td>ETRS89</td>
<td>ETRS89-XYZ</td>
<td>geocentric; X, Y, Z</td>
</tr>
</tbody>
</table>

**ETRS-TMzn-koordinaatistot**

<table>
<thead>
<tr>
<th>Koodi</th>
<th>Nimi</th>
<th>Alias</th>
<th>Selite</th>
</tr>
</thead>
<tbody>
<tr>
<td>5048</td>
<td>ETRS89-TM35FIN(N,E)</td>
<td></td>
<td>N,E country wide</td>
</tr>
<tr>
<td>3067</td>
<td>ETRS89-TM35FIN(E,N)</td>
<td></td>
<td>E,N country wide</td>
</tr>
<tr>
<td>3046</td>
<td>ETRS89-TM34</td>
<td></td>
<td>N,E 6 degrees</td>
</tr>
<tr>
<td>3047</td>
<td>ETRS89-TM35</td>
<td></td>
<td>N,E 6 degrees</td>
</tr>
<tr>
<td>3048</td>
<td>ETRS89-TM36</td>
<td></td>
<td>N,E 6 degrees</td>
</tr>
</tbody>
</table>

**ETRS-GKn - koordinaatistot** (JHS154:n mukaiset, itäkoordinaatin arvo keskimeridiaanilla n=500 000 m, n = keskimeridiaanin asteluku)

<table>
<thead>
<tr>
<th>Koodi</th>
<th>Nimi</th>
<th>Alias</th>
<th>Selite</th>
</tr>
</thead>
<tbody>
<tr>
<td>3873</td>
<td>ETRS89-GK19FIN</td>
<td></td>
<td>False Easting=19500000</td>
</tr>
<tr>
<td>3874</td>
<td>ETRS89-GK20FIN</td>
<td></td>
<td>False Easting=20500000</td>
</tr>
<tr>
<td>3875</td>
<td>ETRS89-GK21FIN</td>
<td></td>
<td>False Easting=21500000</td>
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<tr>
<td>3876</td>
<td>ETRS89-GK22FIN</td>
<td></td>
<td>False Easting=22500000</td>
</tr>
<tr>
<td>3877</td>
<td>ETRS89-GK23FIN</td>
<td></td>
<td>False Easting=23500000</td>
</tr>
<tr>
<td>3878</td>
<td>ETRS89-GK24FIN</td>
<td></td>
<td>False Easting=24500000</td>
</tr>
<tr>
<td>3879</td>
<td>ETRS89-GK25FIN</td>
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<td>False Easting=25500000</td>
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<tr>
<td>3880</td>
<td>ETRS89-GK26FIN</td>
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<td>False Easting=26500000</td>
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<tr>
<td>3881</td>
<td>ETRS89-GK27FIN</td>
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<td>False Easting=27500000</td>
</tr>
<tr>
<td>3882</td>
<td>ETRS89-GK28FIN</td>
<td></td>
<td>False Easting=28500000</td>
</tr>
<tr>
<td>3883</td>
<td>ETRS89-GK29FIN</td>
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<td>False Easting=29500000</td>
</tr>
<tr>
<td>3884</td>
<td>ETRS89-GK30FIN</td>
<td></td>
<td>False Easting=30500000</td>
</tr>
</tbody>
</table>
2. Meta data

Meta data for data and files
4. Soil models (1/3)

- Surface coding, code (surfaceCoding)
10. Sign foundations

New features

- Height of the foundation - describe using Units
- Material
- Foundation type

Volumetric space

```xml
<xs:enumeration value="Jalustan tilavaraus"/>
<xs:enumeration value="spaceAllocationLowerLeftCornerX"/>
<xs:enumeration value="spaceAllocationLowerLeftCornerY"/>
<xs:enumeration value="spaceAllocationUpperRightCornerX"/>
<xs:enumeration value="spaceAllocationUpperRightCornerY"/>
<xs:enumeration value="spaceAllocationRadius"/>
```
13. Pile and massastabilization (1/2)

Kuva 10. Esimerkki pilaristabiloinnin toteutusmallista.
13. Pile and massastabilization (2/2)

Amount of Binders (lime – cement) according to the soil parameters.
Classification

Codes and names of terrain break lines according to InfraBIM classification of top surface in combination model.
<table>
<thead>
<tr>
<th>Name of substructure</th>
<th>Abbreviation</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top combination surface</td>
<td>Yyp</td>
<td>201000 (240000)</td>
</tr>
<tr>
<td>Asphalt AB of wearing course, top surface</td>
<td>Kant1</td>
<td>214111</td>
</tr>
<tr>
<td>Unbound base course, top surface</td>
<td>Sitk</td>
<td>213100</td>
</tr>
<tr>
<td>Sub-base, top surface</td>
<td>Jak</td>
<td>212100</td>
</tr>
<tr>
<td>Filter course, top surface</td>
<td>Suod</td>
<td>211100</td>
</tr>
<tr>
<td>Lowest combination surface</td>
<td>Ayp</td>
<td>201200</td>
</tr>
<tr>
<td>Sub base, railway, lower surface</td>
<td>Tukao *</td>
<td>241020</td>
</tr>
<tr>
<td>Paver base, railway, top surface</td>
<td>Tuk *</td>
<td>241010</td>
</tr>
<tr>
<td>Interlayer, railway, top surface</td>
<td>Val *</td>
<td>212300</td>
</tr>
<tr>
<td>Frost blanket course, railway, top surface</td>
<td>Eris *</td>
<td>212200</td>
</tr>
<tr>
<td>Geotextile</td>
<td>Skang *</td>
<td>211200</td>
</tr>
<tr>
<td>Filter course, railway, top surface</td>
<td>Suod *</td>
<td>211100</td>
</tr>
<tr>
<td>Top surface combination surface of substructure</td>
<td>Ayyp *</td>
<td>210000</td>
</tr>
<tr>
<td>Fairway construction, lower surface</td>
<td>Vap</td>
<td>201100</td>
</tr>
<tr>
<td>Preloading bank</td>
<td>Epe *</td>
<td>181600</td>
</tr>
<tr>
<td>Loading berm</td>
<td>Vpe *</td>
<td>181500</td>
</tr>
<tr>
<td>Earth bank, top surface</td>
<td>Mpe</td>
<td>181100</td>
</tr>
<tr>
<td>Excavation for replacement of soil</td>
<td>Mv *</td>
<td>162500</td>
</tr>
<tr>
<td>Excavation for pipes and wires</td>
<td>Putk</td>
<td>162100</td>
</tr>
<tr>
<td>Frost insulation, lower surface</td>
<td>Routa *</td>
<td>142100</td>
</tr>
</tbody>
</table>
Infra-related standards – general information map

Source and reference data
- OGC, ISO19100 series standards
  - Basic methods and formats (services, GML)
  - Catalogue information
  - Metadata
- KuntaGML/KRYSP (Finnish adaptation of GML for cities and municipalities)
  - Land survey, maps
  - Town and city plans

INSPIRE
- National Finnish Infra-format
  - Soil investigation information

Design objects, structures
- LandXML
  - Civil engineering data
  - Infra structures
  - Networks

Inframodel (Finnish adaptation of LandXML)
- Header information, base information
- Transport networks
- Roads and streets
- Railways
- Waterways
- Areal structures
- Water supply and sewerage

IFC / Bridge extension
- Bridge structures
- Buildings
- Spaces
- Structures
- HVAC and mechanical design
- BOM
- Scheduling
- Cost

buildingSMART / IFC Connected structures
BIM task group UK

BIM MATURITY LEVELS – the official version

Above diagram produced by Mark Bew and Mervyn Richards
BIM maturity levels in Finland

- Maturity level 1 is about data management.
  - Document based structures.
  - 2D or 3D documents.
  - This can be made in every project.

- Maturity level 2 information is visualized in combined models. Projects that are using modeling are at this level.

- Maturity level 3 information is in objects
  - Information supports owners processes
  - Linked data about information that are needed in life cycle management

- Maturity level 4 information is linked in digital information about built environment. Interoperability and open interfaces
How do we collaborate with industry
buildingSMART Finland

- bS International
- bS Nordic
- Building SMART Finland
  - Infra Structure
  - City planning
  - Client (Building)
  - Designers (Building)
  - HPAC
  - Education
buildingSMART Finland Infra Structure

The building information foundation RTS

bsF

bsF Infra Steering group

Standardization  Guidelines  Communication  Education  Development

projects
The Purpose of the Group: We are the flywheel of the built infrastructure.

INFRA 2025 =
Physical Infrastructure + Information

Finland’s improved productivity and competitiveness

Strategy of the Infrastructure Industry Group

December 10, 2014
Purpose: We are the Flywheel of Built Infrastructure

The industry group is the flywheel of built infrastructure. We improve the competitiveness and productivity of Finland through cooperation in foresight, systematization, and transformation.
Purpose
"We are the flywheel of the built infrastructure"

Strategy Map

**Vision**

Infrastructure 2025 = Physical Infrastructure + Information

Foresight

Co-oper.

Systematization

Transformation

Arenas: what, for whom
- Driving the implementation and use of BIM; the management of the shared BIM information
- Clients and suppliers, educational establishments, standard-makers

Value and benefits
- Independent and open collaboration
- International networking and visibility
- Removal of productivity obstacles, advancement of new businesses

Vehicles: how
- Management process for BIM information
- Communication
- Collaborative teams
- Educational collaboration
- International collaboration
- Development projects

Resources
- Members’ knowledge, skills, and contribution
- Member fees (for continuous activities)
- Funding group’s investment (for continuous activities)
- Project funding (EU/TEKES, participants)

Productivity and competitiveness boost for Finland

This is what success looks like:
Infrastructure design and management processes are digitized

- Whole life-cycle coverage
- Comprehensive
- Collaborative and model-based
- Emergence of new services
- Enabler
## Roadmap

<table>
<thead>
<tr>
<th>Standards and guidelines</th>
<th>2015</th>
<th>2020</th>
<th>2025</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guidelines completed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inframodel 3.1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dictionary 1.6</td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Know-how</th>
<th>2015</th>
<th>2020</th>
<th>2025</th>
</tr>
</thead>
<tbody>
<tr>
<td>Training for specialization</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Processes</th>
<th>2015</th>
<th>2020</th>
<th>2025</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternative scenarios and roles</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reference process descriptions for operational processes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Information flows</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Open data</th>
<th>2015</th>
<th>2020</th>
<th>2025</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specialist team</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data store study</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Technologies</th>
<th>2015</th>
<th>2020</th>
<th>2025</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Interface needs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Automated information management</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Realization of real-time operations</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Continuous control, steering, and guidance
- Digitized infra processes
- Standard, guidelines and interfaces for the whole lifecycle
- Comprehensive information management know-how
- Collaborative model-based processes
- New services through open data
- Enabling technology
Good cooperation in Nordic level

Nordic chapter
- Sweden
- Finland
- Denmark
- Observators: Lithuania, Estonia
- Cooperation with Norway chapter

Norway has own chapter

Technical experts has had online meetings according to input to BuildingSMART infraroom ongoing projects
European level

- Good cooperation with other government agencies
- EU commission work shops for public client 2015-2016
- CEDR group for standardization of infra
  - Norway, Sweden, UK, Netherlands, Denmark, France, Finland
- NVF?
Chapters in NVF

- Beläggning
- Bruer
- Drift og vedlikehold
- Informasjonssystemer/ IKT
- ITS
- Kjøretøy og transporter
- Miljö
- Organisering och marknad
- Strategisk planering
- Transport i städer
- Trafiksäkerhet
- Tunnlar

- Utformning av vägar och gator
- Vägens konstruktion
Pilot projects
Selected projects

- VT 12
- City Rail loop
The City Rail Loop
Idea and goals of the City Rail Loop

- The majority of commuter trains to run in a tunnel under Helsinki city center.
- Gives more space to long distance trains.
- Stations: Töölö, Keskusta ja Hakaniemi
- Max speed 80 km/h
In 2035, 180,000 train passengers will travel via Pasila every day (more than a 50% increase).

Total length of railway line: 8 km
Length of tunnel section: 6 km

2 tunnels
2 tracks
Loop time from Pasila to Pasila: 12 min

Trains operate at 5 min intervals in both directions

Töölö 16,000 passengers/day

Hakaniemi 79,000 passengers/day
Journey time between the stations: 3 min

City Centre 43,000 passengers/day

Trains planned for the railway line: K, I, N, M and A.
Jobs and population in the Helsinki region
Source: Statistics Finland

- 2014: 700 thousand jobs
- 2035: 900 thousand jobs
- 2014: 1.4 million population
- 2035: 1.7 million population
BIM: Before starting the project
Before starting planning phase

• Decision to do planning phase and construction design phase using modeling was made in 2012

• Open workshops for consultants and contractors late 2012

• Modeling strategy early 2013
  • Goals and the use on model
  • Process
  • Actors and roles
  • Quality
  • Communication
  • Education
Before starting planning phase

- Collect data for initial data model, summer 2013

- Project portal for data, October 2013
  - possibilities to open models via data bank

- ICT and BIM guidelines for the project was finished early 2014
Goals and challenges of using BIM
Goals of using BIM

- **Combining Models**
  - Combining new Building- and Infrastructure models
  - Compiling new structures with existent structures

- **Quantities & Mass calculation**
  - Target: real time quantities

- **Continuous City model and collaboration with interest groups**
  - Authorities
  - Related projects
  - Underground City Plan

- **Generating information package that suits for maintenance systems**
Challenges of using BIM

Peculiar Project:
- Combining Infra- and Building structures
- Open LandXML/IM3 format
- Huge amount of initial data
- Dozens of interest groups
Initial data

- Initial data is basic information of the existing environment or other documents that are needed before starting the project design.
- Initial data can be for example in pfd, dgn, dwg, doc, tif, jpg – formats.
- Representing data in computer interpretable formats.
- All the computer applications used in the project should be able to utilize initial data.
- Everyone in the project should have access to initial database (project bank).
Initial data, approximate model of existing tunnels taken from the as build drawings

Scanned model of existing tunnels
Combination models
Combination models
Maintenance BIM
Maintenance bim

- Mobile Mapping
- GPR and pavement thickness measurements
- Model based reconstruction design
- Optimization and detailing of mass calculation
Road rehab process model

1. GPR & Core samples
2. Mobile Mapping Trimble MX8
3. Point cloud processing, Terrasolid
4. Terrain model (TIN) creation, Tekla Civil

- Alignment design and optimization, Tekla Civil
- Alignment export in VGP and line format
- BC-HCE, Export in binary to GCS900
- GPR & Core samples
- Mobile Mapping Trimble MX8
- Point cloud processing, Terrasolid
- Terrain model (TIN) creation, Tekla Civil
Conclusions

- Old road surface model produced quickly, model accuracy even better than 15 mm
- Design of pavement repair based on accurate surface model – well planned job, half done
- Road repair actions and quantities can be planned and optimized in advance –> shorter lead time
- Road geometry can be repaired based on model – optimization saves materials (milling/hauling)
- 3D Machine control systems in milling machine and paver improve accuracy and efficiency - work quality improved
Thank you!

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