BIM in infrastructure – case study: Swedish road projects vägplan

Mateusz Nettmann

Moving Poland’s construction industry into the future with BIM

(BIM Event – BPCC)
AGENDA

- **Introduction:**
  - AECOM
  - Road design projects in Sweden
  - E4 Ljungby – Toftanäs
  - E10 Avvakko – Lappeasuando

- **BIM Advancements:**
  - Common Data Environment of ProjectWise
  - BIM... make it simple
  - Inviting the Client
  - Drawings meta-data
  - Point Clouds in Civil Engineering
  - Design Standards
  - Parametric Design
  - OpenRoads Civil Geometry and Civil Cells
  - „Intelligent“ slopes and ditches template
  - Isopach and contour analyses

- **BIM Benefits**

- **Q&A** *(during panel discussion)*
Introduction:

- AECOM
- Road design projects in Sweden
- E4 Ljungby – Toftanäs
- E10 Avvakko – Lappeasuando
Global partner

+150 countries where AECOM transforms communities

US$ 17.4 bn revenue during fiscal year 2016

+90k employees to serve clients around the world

#1 Airports
#1 Transportation
#1 International design
#1 Water
#1 General building
#1 Global design firm
Working without borders

We blend international expertise with local knowledge by sharing work across 28 countries among nearly 3,000 dedicated employees.

Recognized by Fortune magazine as a World’s Most Admired Company.
Road design projects in Sweden:

- until 2011 MX design only

- 2013 FSK06 Stockholm Bypass for Trafikverket
  (MX to InRoads)

- 2015 E4 Ljungby-Toftanäs for Trafikverket
  (InRoads to OpenRoads)

- 2017 E10 Avvakko-Lappeasuando for Trafikverket
  (more OpenRoads + CONNECT products)

- 2018? AB505 Hölövägen for Trafikverket
Scope of the Project
- Preliminary Design (2+1 to 2+2)
- Environmental Impact Assessment
- 31.5 km highway widening scheme
- 4 interchanges
- 1 service area
- 28 bridges

Client Insight
Trafikverket
- 98 400 km of state roads
- 41 000 km of municipal roads
- 76 100 km of private roads (state grant)
- 11 900 km of railway line
- Preliminary Design (1+1 to 2+1)
- Environmental Impact Assessment
- 18 km highway widening scheme
- 12 junctions
- 10 km local roads
- 2 big wild animal passages
- 1 bridge widening
- 1 new pedestrian bridge
- Poznań to Kiruna – 1 730 km
- Kiruna to Singapore – 9 605 km
- Poznań to Singapore – 9 686 km
BIM Advancements

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- BIM... make it simple
- Inviting the Client
- Drawings meta-data
- Point Clouds in Civil Engineering
- Design Standards
- Parametric Design
- OpenRoads Civil Geometry and Civil Cells
- “Intelligent” template for slopes and ditches
- Isopach and contour analyses
Common Data Environment of ProjectWise:

- only one *environment* for all data

- 3 *workflows*:
  - documents
  - Models
  - PDF renditions

- Not only design data in PW:
  - project management
  - project administration
  - e-mails
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- Not only design data in PW:
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BIM... make it simple:

- single file coordination model
- reference models description via:
  - (1) file name (Client file naming convention)
  - (2) description (type of information)
  - (3) logical (discipline and content)
- use of saved view
- all in one:
  - design assumption
  - 2D plan view
  - 3D plan view
  - profiles
  - cross-sections
- 2D and 3D data merge and vice versa
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Inviting the Client:

- the i-model container
- monthly snap shots
- providing education and support
- review via models instead of drawings
- Client included in the PW workflows
Drawings meta-data:

- ProjectWise integrated title block
- Drawing file name and its version (1)
- List of drawing references and its versions (2)
- List of native files and its versions (3)
Point Clouds in Civil Engineering

ProjectWise PointCloud Streaming over 100 GB of point clouds streamed

Pointools for review and edits
quick points reclassification

Descartes for data extraction
edges of pavement, lanes, power lines

Complex Terrain Model
LiDAR
Land Surveying
ProjectWise PointCloud Streaming over 100 GB of point clouds streamed

Pointools for review and edits quick points reclassification

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Complex Terrain Model LiDAR Land Surveying

**Scalable Terrain Model**

large terrain review in seconds detailed view on close-ups draped imaginary data interpretation one-site visits limited
Point Clouds in Civil Engineering

ALS data supplemented
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9 over-bridges scanned with high accuracy
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As-built models
Descartes used to create 3D solids
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**As-built models**
Descartes used to create 3D solids

**Headroom check**
Bridges’ models checked against 3D headroom components
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**As-built models**
Descartes used to create 3D solids

**Headroom check**
Bridges’ models checked against 3D headroom components

**Vertical geometry optimization**
New profile lowering minimalized
No bridges to be demolished
Maximum use of the ex. pavement
Design with confidence
OpenRoads Civil Cells:

- Library of Civil Cells:
  - Loop type junctions
  - Road access points
  - Lay-bys
"Intelligent" template for slopes and ditches:

- High embankment getting terrain water
- High embankment not getting terrain water
- Low embankment
- Cut
Isopach and contour analyses:

- for the design purpose
- for the review purpose
- for presenting results
BIM Benefits
BIM Benefits

- Better quality of data management
- Better quality of the design process and coordination
- Design time save
- Traveling time and cost save
- More information
- Review process via models not drawings
- Design models used directly for visualization
- Less/no errors
- Making Client happy
- Better sleep
- World Wide recognition via Bentley BeInspired Awards

- Each one above means MONEY, both for the Client and Consultant
- Q&A during panel discussion, 11:15 – 12:15