

Cost Savings by Using Advanced VDC Tools and Processes, Case Studies from Europe



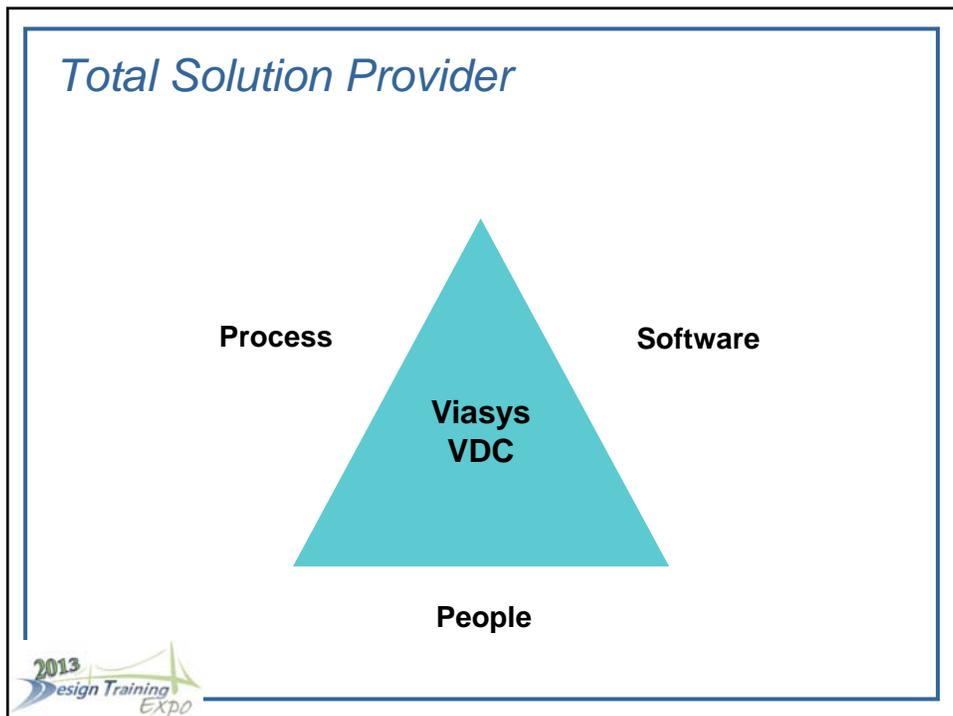
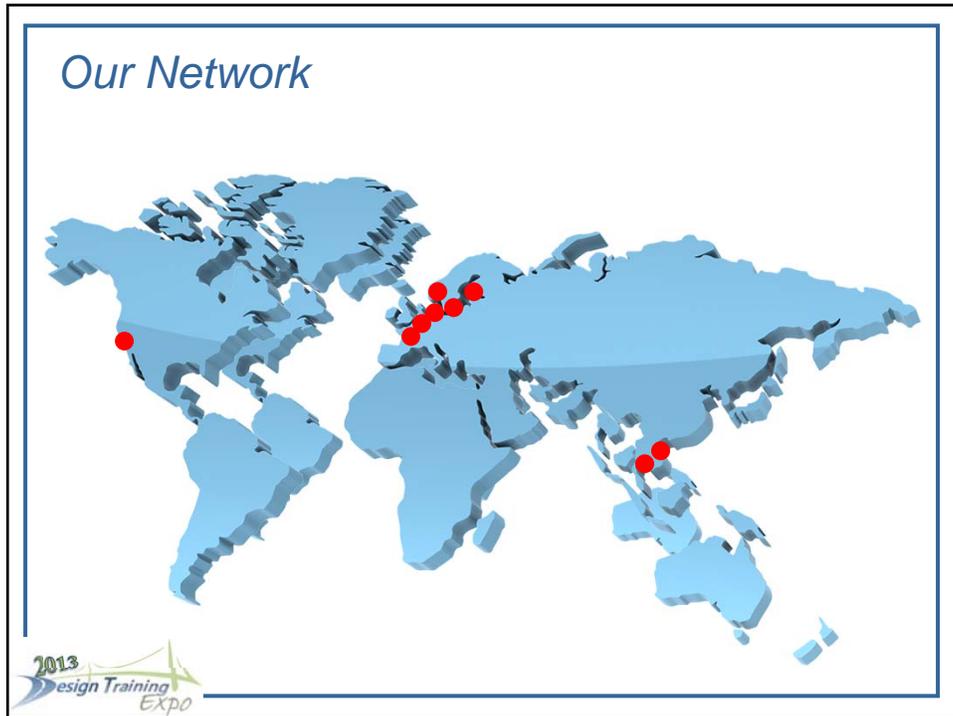
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Our Company

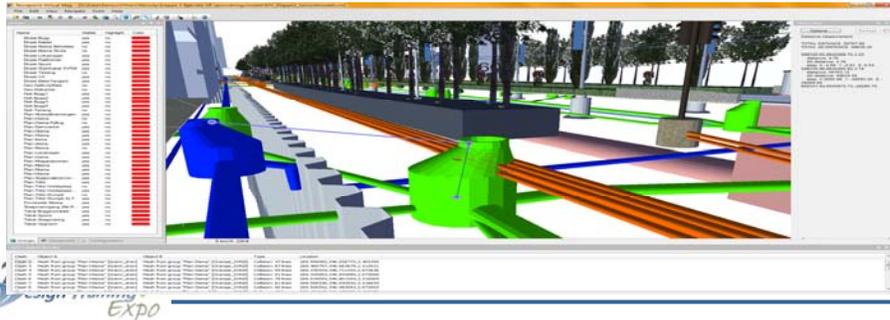
- ◆ Market leader in civil engineering IT systems in North Europe
- ◆ Long term strategy to grow
- ◆ Expanding to US market





Viasys VDC

- ◆ Dedicated to civil engineering
- ◆ Business critical total solution
- ◆ Customers as strategic partnerships
- ◆ Agile value creation for customer
- ◆ Strong commitment to long term development
- ◆ Promotes open standards



Your Partner in VDC Implementation

- ◆ VDC Consultation
 - ✓ Process assessment and implementation
- ◆ Software Implementation
 - ✓ Pilot projects
 - ✓ Implementation planning
 - ✓ User training
- ◆ User support
 - ✓ Local phone, email and web support



Value for Several Dimensions of VDC



- ◆ Enables over 4% savings in civil construction cost
- ◆ Better coordination and communication
- ◆ Effective presentations ja automated visualization
- ◆ Designed for mainstream VDC production
- ◆ Integrated into design tools and process
- ◆ Solution for each project phases and roles



VALUE FROM VDC



BIM-CIM-VDC Concepts, Definitions & Processes

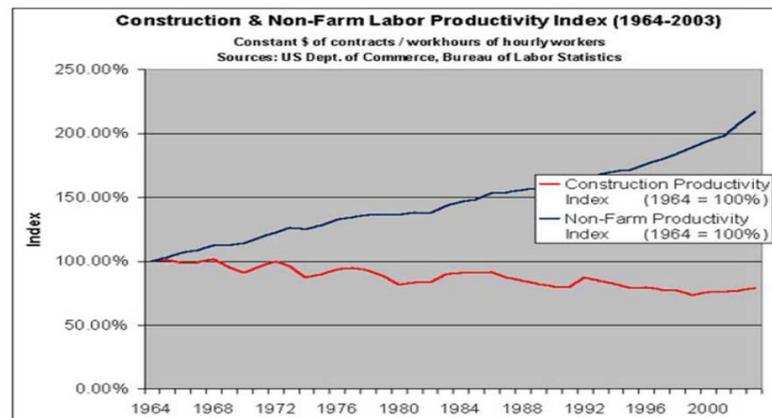
- **VDC or Virtual Design & Construction** is “the use of integrated multi-disciplinary performance models of design-construction projects to support explicit and public business objectives.”
- Stanford Center for Integrated Facility Engineering (CIFE)
- **CIM or Civil Integrated Management** is “the collection, organization and managed accessibility to accurate data and information related to a highway facility including planning, environmental, surveying, design, construction, maintenance, asset management and risk assessment.”
- FHWA, AASHTO, ARTBA & AGC
- **BiM - CiM or Building Information Model or Civil Information Model** is a digital database for an architectural or a civil facility from inception to life cycle, suite of software tools & associated set of processes to produce, communicate and analyze design and construction.

Further Reading: Virtual Design and Construction: Themes, Case Studies and Implementation Suggestions, By John Kunz & Martin Fischer, CIFE Working Paper #097 Version 14: January 2012 www.stanford.edu/group/CIFE/online.publications/WP097.pdf

Further Reading: BIM Handbook: A Guide to Building Information Modeling for Owners, Managers, Designers, by Chuck Eastman, et al (2008); buildingSMART Alliance, National BIM Standard-United States: <http://www.buildingsmartalliance.org/index.php/nbims>



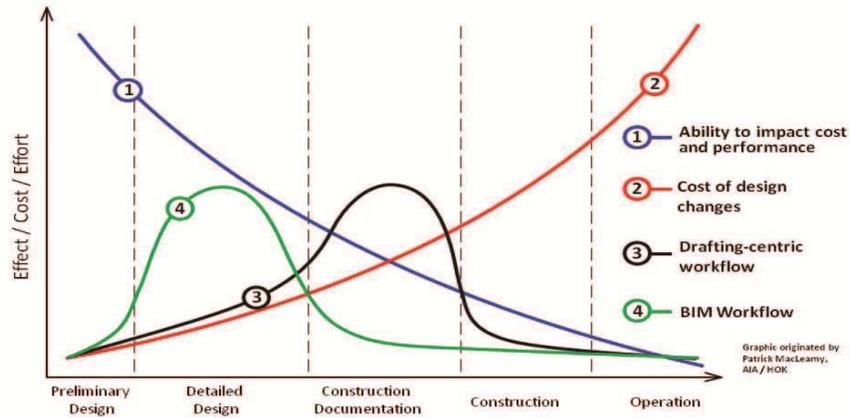
Industry Productivity Challenge



Courtesy of Stanford University



VDC Influence on Design Process



VDC makes it possible to influence total costs earlier when costs of changes are smaller.
 Source: CE News, Oct 2008, Image Patrick MacLeamy, HOK / AIA



Industry is changing from documents to models



2D Drawings



Single discipline
Manual & CAD
Discipline approach

3D Models



Single discipline
Limited intelligence
Discipline approach

3D Collaboration models



Multi discipline
VR-Visualization
Project approach

3D Integrated Intelligent models

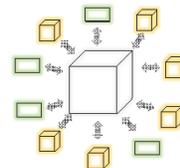
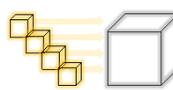


Multi discipline
Multi phase
Web-Server based
Life cycle approach

ISOLATED

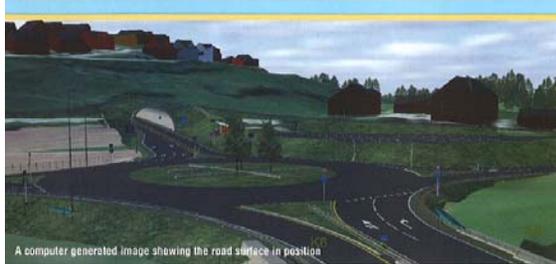
COLLABORATIVE

INTEGRATED



Closer to non-paper construction

A highly precise virtual reality model is being created in parallel with the design of a Norwegian road, to help avoid conflicts in both design and construction. (World Highways 7 January 2008)



A computer generated image showing the road surface in position

VISUALISATION

like this are promised by Novapoint, which is upgrading its basic architecture to allow one single data model to feed the various layers and design sectors in the future (see panel).

Olsson also wants to see the models becoming more acceptable to various government inspection agencies. For example he believes that the accuracy and realism of the model could allow the signage on the project to be approved directly for line of sight and legibility, because the signs are shown in exactly the position and to the design that they finally have. For this pilot at least however, the physical inspection is still being demanded for items like that.

Hagen would also like to see the model being advanced to allow the contractors to use it for planning their construction sequences and looking for potential difficulties.

"We are not there completely with this trial," says Hagen, but with this project we have taken a large step" ■

Novapoint
www.novapoint.com

drawing. And then that would have been too cluttered and you would ask them to separate it all again," he adds.

The model has helped particularly on this project which is being carried out very fast in just a year from start to finish, including the tunnel.

He would like to see more included in the visualisation to get a more direct link between the model and the work on site. At present the process of building the model is one way, information is passed into the model and it can be used for seeing all the problems - "and to keep the local community

"We think it is the first time a scheme has been done like this, certainly in Norway and probably in Europe"

Asbjørn Hagen

being used on site were from Denmark company Mikrofy.

"We are closer to completely non-paper construction," says Olsson, though not quite there yet. He says that increasingly the contractor will ask for much more detail about coordinates from the consultant rather than just being given perhaps two end points for a curve or a top position for a manhole, as was traditionally done. We had to calculate ourselves the intermediate points but now we ask for those too."

But though the 3D design model can generate such information, he

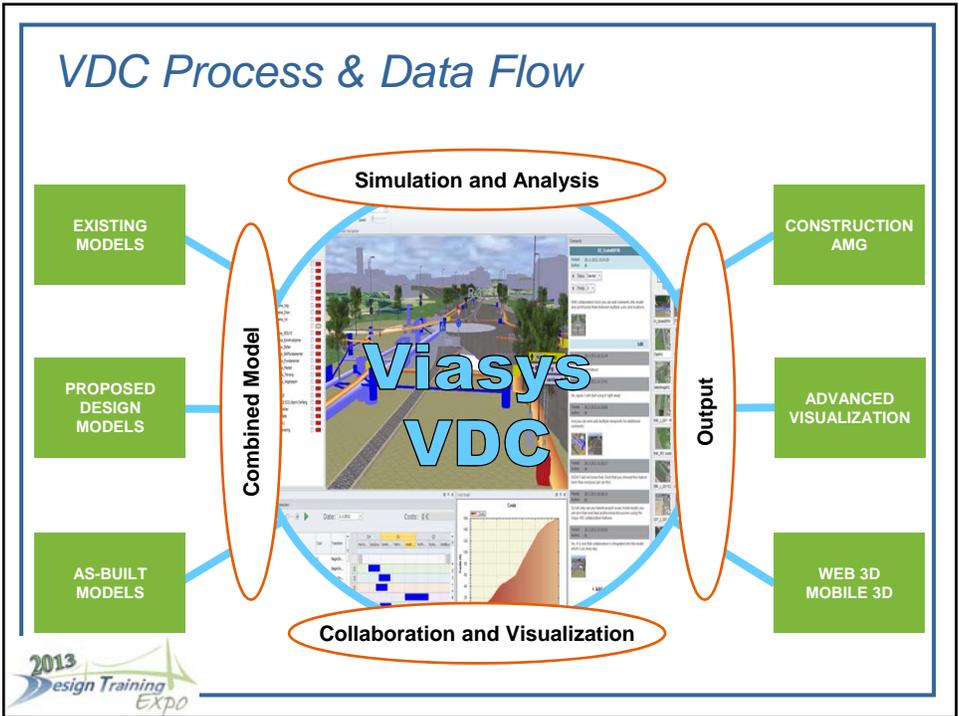
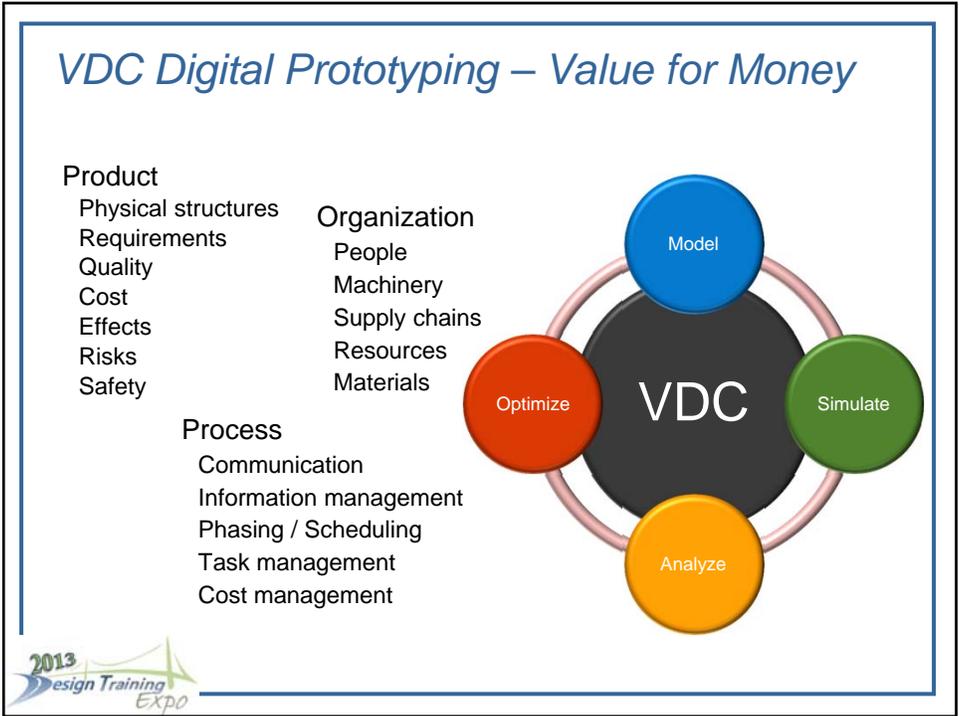


VDC in Project Lifecycle



Collaboration, information management and data flow throughout the whole project life cycle





Video – Sample VDC Model



PROJECT CASE STUDIES

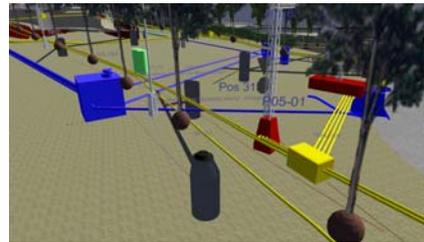
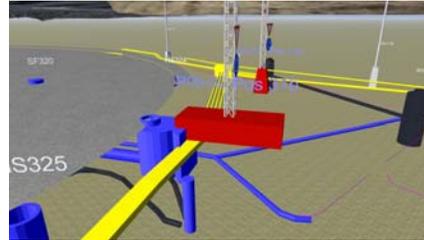


Value by Using VDC in Construction

Average cost per
change / conflict
has been calculated
to be about

~ \$ 9600

(Norwegian Road Authority)



VDC Benefits – ROI/CBA

(WisDOT / Lance Parve)

I-94 Mitchell IC Construction Project-\$294.4 m
Field Issues - \$22.2 m (669 DINs/CCOs)

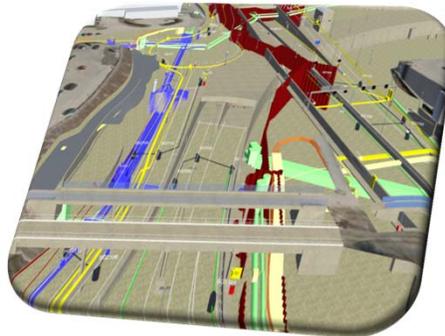
- ◆ GN-General: 30.5% (148-\$6.8 m) (\$45,674 per issue)
- ◆ RD-Roadway/Drainage: 25.5% (66-\$5.7 m) (\$85,631 per issue)
- ◆ WU-Wet Utilities/Drainage: 11.1% (90-\$2.4 m) (\$27,120 per issue)
- ◆ BR-Bridges: 8.0% (114-\$1.8 m) (\$15,557 per issue)
- ◆ NW-Noise Wall: 8.0% (14-\$1.8 m) (\$125,909 per issue)
- ◆ RW-Retaining Wall: 7.7% (78-\$1.7 m) (\$21,818 per issue)
- ◆ EW-Earthwork: 4.5% (17-\$1.0 m) (\$59,220 per issue)
- ◆ EL-Electrical/ITS/FTMS: 2.6% (93-\$0.6 m) (\$15,557 per issue)
- ◆ TR-Traffic: 2.1% (26-\$0.5 m) (\$18,174 per issue)
- ◆ SS-Sign Structures: 0.1% (23-\$0.02 m) (\$738 per issue)



Case Study: RV 150 Ring 3, Ulven – Sinsen, Norway
 Owner: Road Department, Contractor : Veidekke

- ◆ Part 1: VDC model was not used
 - ✓ About 250 out of 600 changes were caused by design conflict between domains
 - ✓ Additional cost of \$ 2.4 mill. (+4,6%)

- ◆ Part 2: VDC model was used
 - ✓ "There has been almost no design change/conflict on this parcel, E22", Petter Bakke, Veidekke
 - ✓ Potential cost savings \$ 2.4 mill.



Case Study: 31774 Gjøannes station, Norway
 Owner: KTP AS, Contractor: Veidekke

- ◆ Total 350 conflicts was found
- ◆ Half of them had not been detected without a VDC model
- ◆ Based on Norwegian Road Authority estimate potential cost savings have been \$ 1.7 mill



Contractor comments

«The 3D models we get for all domains, makes our working day easier and more efficient. **There has been almost no design change/conflict** on this parcel, E22»

Petter Bakke, Veidekke

"Continuity in production, for all our man and machine AND doing everything just once, is the two most important issues for a cost effective construction. The use of collaboration models on the Marienborg project, did that **we actually had almost zero stop at site**, caused by errors in design (like collision between domains). **We could produce continuously.**"

Bård-Olav Aune, SKANSKA

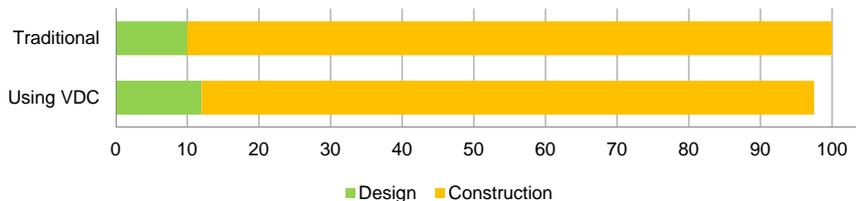
"In practise, **there are no longer any change/conflict in the design models** we get for each domain. We use the models for multiple purpose: Stake out, communication with construction workers to plan todays work etc. **We love working this way!**"

Erik Hval Olsen, Veidekke



VDC Potential in Construction

- ◆ Typical construction change orders are about 10% of construction costs
- ◆ By using VDC about half of change orders can be avoided
- ◆ 5% savings in construction costs
- ◆ VDC increases design costs but saves more in construction
 - ✓ More re-design in earlier phases due to digitally found clashes and design optimization between disciplines
 - ✓ Less waiting on site and less re-design during construction
 - ✓ Clearly positive ROI

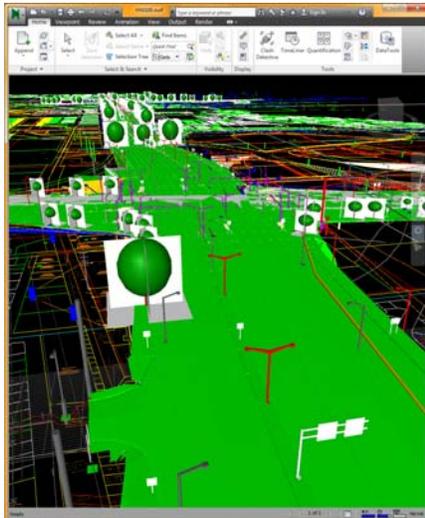


TOOLS AND METHODS

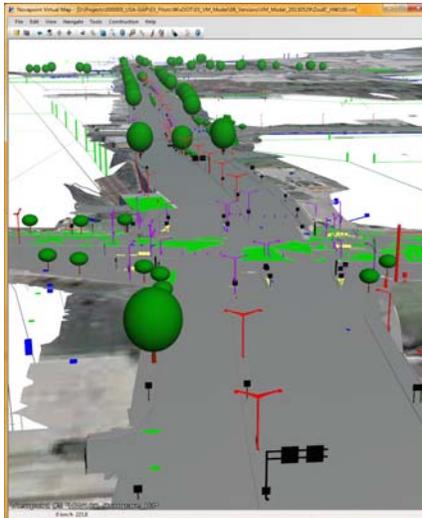


VDC Tools

Autodesk NavisWorks



Viasys VDC



Viasys VDC – Total Solution

Topics management
inside model
Cloud synchronization
Free desktop viewer
iOS Viewer

Real-time presentations
Basic visualization
Export images and animations
Export to advanced visualization tools

Clash detection
Measurement
Sections
Quantity and volume reports

Integrated into AutoCAD and Civil3D
Import Civil3D, DWG, LandXML, IFC, 3D

Automated parametric modeling:
simple to complex
2D to 3D
Symbols to 3d-objects
Materials and textures

5D Simulation
Driving Simulation
Import traffic simulation
Sun shadows and sky

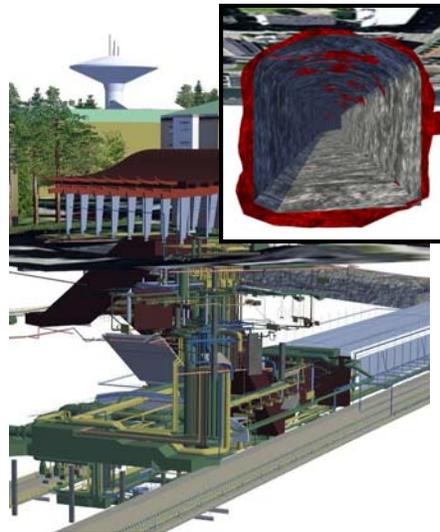
Parametric Modeling

- ◆ Integrated
 - ✓ AutoCAD
 - ✓ Civil3D
- ◆ Open standards
 - ✓ LandXML, IFC
- ◆ Parametric modeling rules
 - ✓ Lines to volume
 - ✓ Points to 3D elements
 - ✓ 2D to 3D
- ◆ Visualization
 - ✓ Materials, textures

Case Study: West Metro, Finland

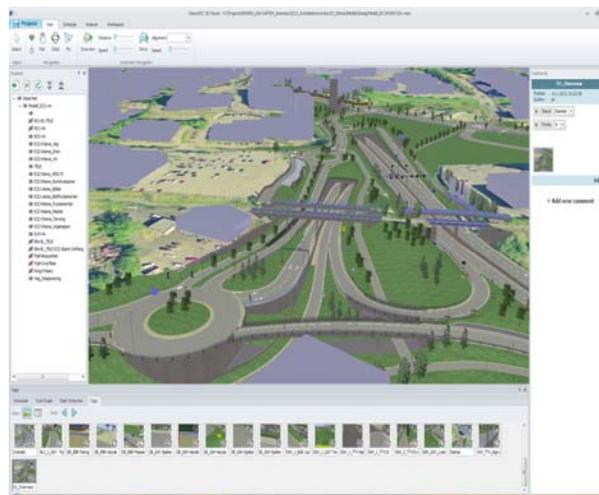
Owner: City of Espoo and Helsinki, Contractors: Multiple

- ◆ Combined data model
 - ✓ GIS (GML: surroundings)
 - ✓ CIM (LandXML: subway)
 - ✓ BIM (IFC: structures, MEP)
- ◆ Target in maintenance
 - ✓ AsBuilt model
 - ✓ Maintenance planning and operations in 5D
 - ✓ Digital service manual + 3d model + mobile
- ◆ Lifecycle Management
 - ✓ Design → Construct → Maintenance



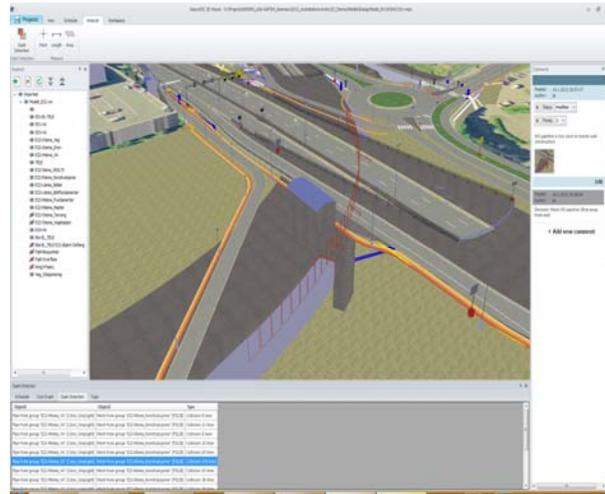
Multi Disciplinary Model Management

- ◆ Simplified model hierarchy (disciplines)
 - ✓ Visibility
 - ✓ Highlighting
- ◆ Easy BIM
 - ✓ Navigation
 - ✓ Collaboration
 - ✓ Information
- ◆ Show defects visually



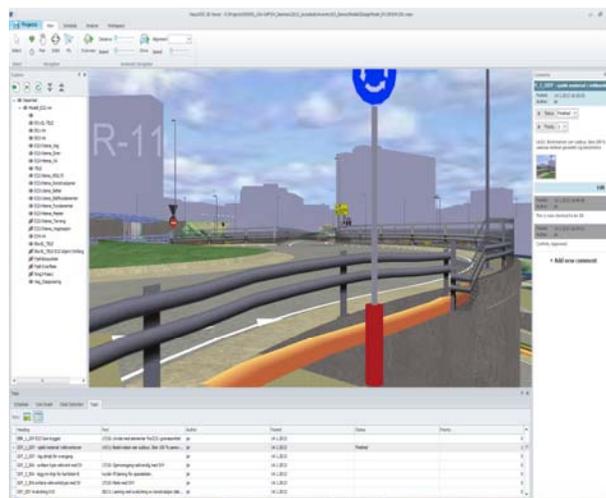
Clash Detection

- ◆ Simple clash detection
 - ✓ Quick check between disciplines
- ◆ Advanced clash detection
 - ✓ Complete model batch processing
 - ✓ Rules and value based resolution



Collaboration

- ◆ Issues with xyz
 - ✓ Description
 - ✓ Attributes
 - ✓ Comments
 - ✓ Screenshots
- ◆ Cloud sync
- ◆ Used for project management, cross disciplinary communication, generic feedback comments

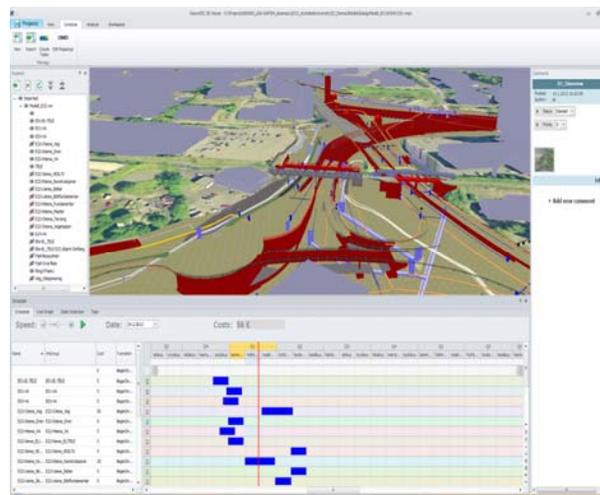


Video



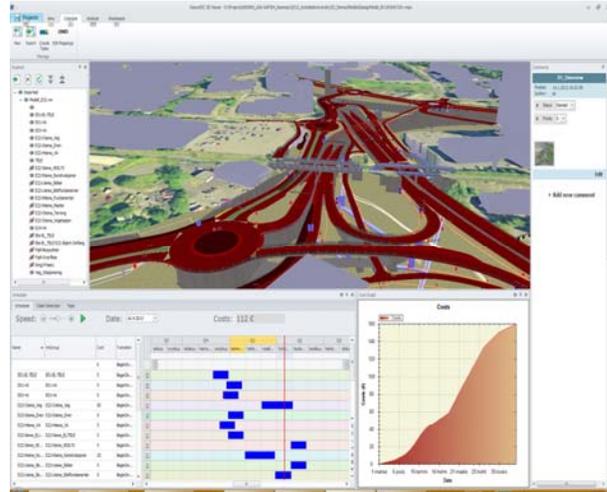
4D Simulation

- ◆ Easy scheduling from scratch
- ◆ MS Project support
- ◆ Visualization styles; remove, temporary, new
- ◆ 4D clash detection
- ◆ Multiple alternative schedules



5D Simulation

- ◆ Schedule properties
 - ✓ Cost
 - ✓ Materials
 - ✓ Machinery
 - ✓ Links
- ◆ Summary
- ◆ Graphs
- ◆ Customizable

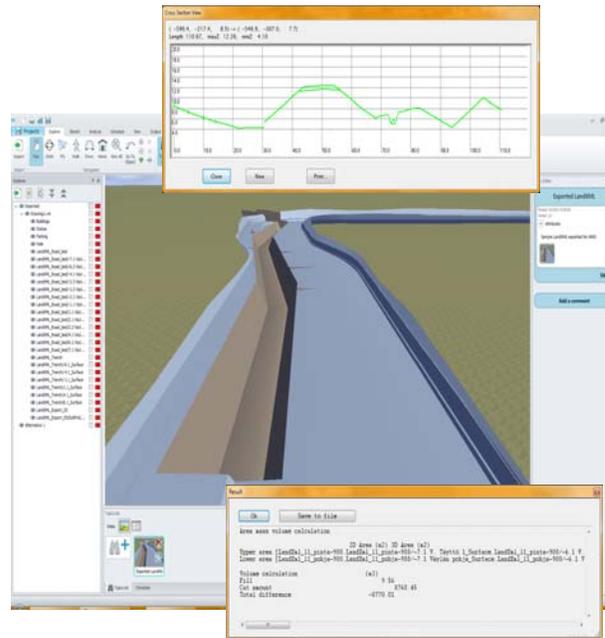


Video

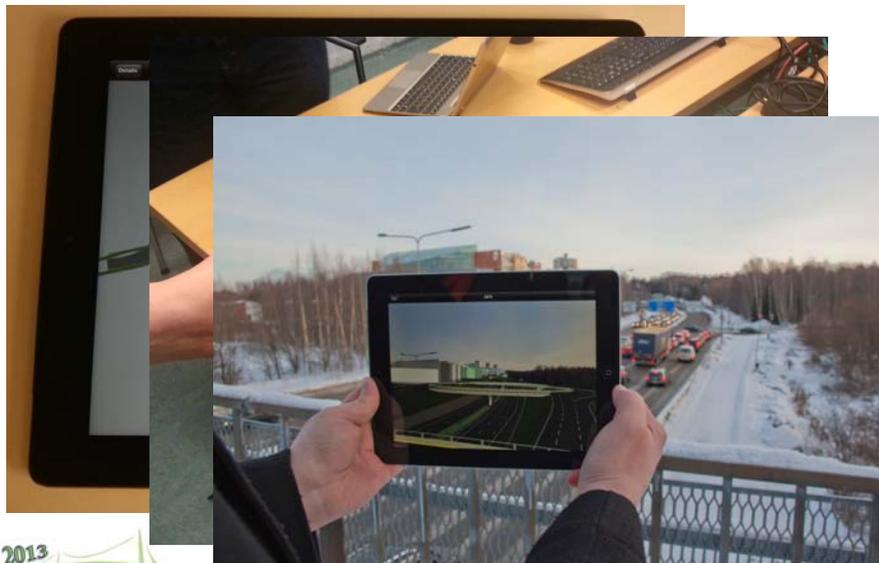


Output

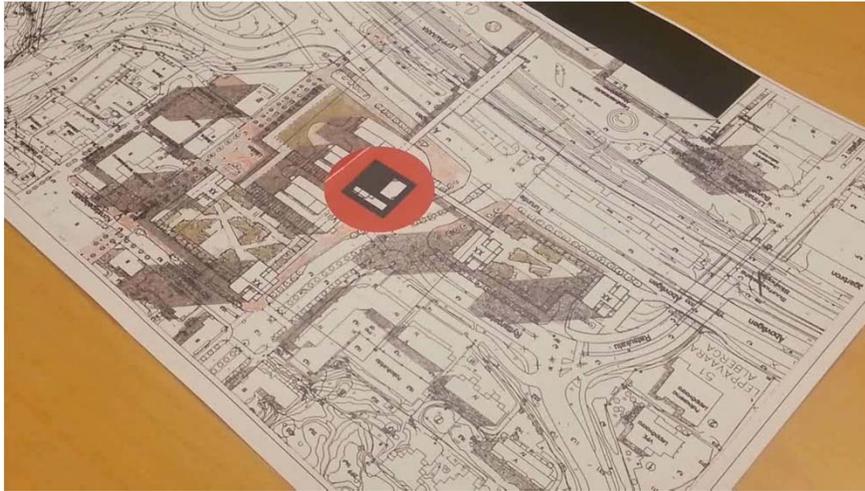
- ◆ Construction
 - ✓ Quantity and volume reports
 - ✓ Section views
 - ✓ LandXML for AMG
- ◆ Presentation
 - ✓ Viewer package
 - ✓ Images and animations
 - ✓ Export to 3D formats
- ◆ Viasys VDC Live
 - ✓ Publish for Web3D and Mobile3D



Viasys VDC Live Models



Video



2013
Design Training
Expo

Key Practical Methods for Successful VDC Implementation Practices in Projects in North Europe / Scandinavia

- ◆ Common rules and agreements
- ◆ Educate people for the process and tools
- ◆ Model is the main engineering tool
 - ✓ Collaboration using model
 - ✓ Design analysis, clash detection, simulation
 - ✓ Stakeout and AMG data from model
 - ✓ Continuous update of discipline models
 - ✓ Meetings are basically paperless
- ◆ Value based implementation
 - ✓ Focus on most critical disciplines first
- ◆ Implementation steps
 1. Model based design
 - Using products like Autodesk or Bentley
 2. Collaboration, simulation and analysis
 - Using products like Viasys VDC



2013
Design Training
Expo

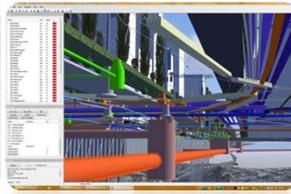
Viasys **VDC**

www.viasys.com

Model



Collaborate



Simulate

