Structural Design and Fabrication Workflow for 3D Reinforcement

Michael Conte - LPM Structural Analysis Solutions, Eng.
Joseph Pais - Product Director, Eng.
For Your Comfort and Safety

- Emergency Exits
- Mobile / Cell Phones => Silent!
- 1 Hour session
- Enjoy!!! 😊
Presentation Outline

- Learning Objectives
- Who We Are
- The “i” in BIM
- Traditional Workflow Challenges
- GRAITEC Reinforced Concrete BIM Designers
- Four Levels:
  - Incorporating the data-rich (intelligence) structural engineering model
  - Benefitting from the structural engineering model data
  - Utilizing the “i” in BIM to create drawings and schedules
  - Centralize project design information and provide easy access to extended team members
- Summary
- Questions
Learning Objectives

- Understand the value of connecting your engineering analysis model into your Revit workflow
- Understand the benefits of transferring your intelligent constructability data from Analysis & Design software to Revit® and vice versa
- Create a connected and advanced BIM workflow to utilize advantages that only intelligent BIM data offers
- Explore a working Design-to-Fabrication workflow powered by Autodesk® BIM 360®
Who We Are – Your Speakers

Michael Conte - Local Product Manager at Graitec Inc, an innovative software developer and solution provider in addition to being an Autodesk Platinum Partner operating across Europe & the United States. As a Structural Engineer from Montreal, Canada he has been providing structural analysis and design solutions to engineers throughout North America for over 5 years. From small engineering firms to large governmental entities, Michael has provided his expertise toward structural analysis software as well as a streamlining their BIM workflows.

Joseph Pais - Product Director at GRAITEC INNOVATION in charge of all internal products and also provides dynamic analysis and reinforced concrete consultancy to highly skilled GRAITEC customers. A structural engineer with 20 years’ experience in the AEC industry. Joseph started his career working for the French SNCF Company on the “Concorde Lafayette” train substation. Then, in 1997, he moved to GRAITEC France as a structural engineer doing demos-training-projects on the internal calculation software’s. Joseph has also taught dynamic analysis and reinforced concrete design for more than 10 years at the French university, Conservatoire National des Arts et Métiers (CNAM).
Who We Are – Graitec

- Innovative CAD and BIM software author, delivering cutting edge technology, and BIM implementation and support services to the AEC industry
- One of the largest Autodesk® Partners in the world
- 29 offices worldwide with over 400 staff ready to help you succeed
- Started in 1986 – 30+ years expertise developing CAD, BIM and Design solutions
- Over 50 000 customers worldwide
- Extensive BIM Technology portfolio & tailored customer-success service
The “i” in BIM

What is BIM?
- Building Information Modeling
- Intelligent model-based process that gives architecture, engineering, and construction (AEC) professionals the insight and tools to more efficiently plan, design, construct, and manage buildings and infrastructure.
- BIM is not just another term for a 3D model
  – It represents a work process

Intelligent Model Based Process
- Geometry
- Intelligence
- Information

The real power of BIM lies in the “Information”
Traditional Workflow: Engineer to Designer

Engineers
- FEA Software 3
- Revit
- AutoCAD
- Excel / Hand Calc's

Drawings
- Geometry:
  - .rvt
  - 3D DWG
  - Solids
  - IFC
  - ...

Reports

Designers/Drafter
- Revit
- AutoCAD
... unless you have a very sophisticated modeling transfer application available between programs, you’re stuck with maintaining two building information models – one for cross-disciplinary coordination and one for structural detailing, you’re in a world of pain.

Multiply that with the open BIM exchange format IFC, and your original world of pain now seems like The Bahamas.
Traditional Workflow Challenges - Engineer

- Use several different software
  - Stick model based, not true alignment - inconsistent BIM output

- Design results and documentation are not BIM
  - Reports, resistance diagrams and associated documentation

- Disconnected workflow
  - Replicating structural model is a repetitive process
  - Wastes time and can create potential errors

- Not utilizing BIM data can be either a conscious decision or not
  - Lack of trust based on poor collaboration experience
  - Do not know how to import/export a model (format, methodology, etc.)
Traditional Workflow Challenges – Designer/Drafter

- Most BIM workflow transfer only basic information
  - Simple geometry, cross-sections and material properties – not rebar

- 2D Engineering results and documentation
  - Lengthens the detailing process with a lot of reworking

- RC-detailing software is often 2D
  -Disconnected from the BIM process resulting in instantly outdated drawings
  - Modifying rebar results in time consuming changes to drawing

- Produce 2D views from a 3D model
  - Detailing in a dedicated RC-detailing system
Creating 3D Rebar & Drawings in Revit

1. Revit Model
2. Define Sections
3. Define Elevations
4. Add rebar, labels and dimensions
5. 3D Cage derived from 2D views
6. Add views to drawing sheets
Incorporating the data-rich (intelligence) structural engineering model
FEA Results in Revit

1. Revit BIM Model
2. BIM FEA Software capable of sharing constructability information
3. Revit Analytical Model
4. Revit Analytical Model + FEA Results
Benefitting from the structural engineering model data
Automated Structural Reinforcement Processes

3D Cage calculated from FEM Results

Automatic views and drawing sheets

Material and Bar Schedules

Engineers Design Report

ADVANCE BIM DESIGNERS
Entering manually the loads
FEA Results packages in Revit

- Benefitting from the engineering data, stored in the Revit results packages to streamline your connected BIM workflow for rebar projects
Utilizing the “i” in BIM to create drawings and schedules
Schedule and produce drawings

- BIM Designers can automate the drawings creation based on Revit templates
- Can create a Revit native rebar schedule
Schedule and produce drawings

- Assign bars to a sheet (can also filter on this parameter) and generate automatically the schedule bending schemas:

<table>
<thead>
<tr>
<th>Rebar Number</th>
<th>Quantity</th>
<th>Bar Diameter</th>
<th>Bar Length</th>
<th>Image</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>88</td>
<td>0.38&quot;</td>
<td>4' - 2&quot;</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>29</td>
<td>0.62&quot;</td>
<td>4' - 8&quot;</td>
<td></td>
</tr>
</tbody>
</table>
DEMO
Monitor your rebar project
Centralize project design information and provide easy access to extended team members
Autodesk proposes a large portfolio of Cloud solutions

- Gives project teams the tools to:
  - coordinate better
  - communicate more effectively
  - resolve issues quickly

- Resulting in faster and more efficient project delivery
A360 Drive and Viewer

- Connect to [https://viewer.autodesk.com/](https://viewer.autodesk.com/)
- You can upload models, browse,
- annotate, get info, etc.
- You can share a link to a model for “free”: [http://autode.sk/2mjTzMH](http://autode.sk/2mjTzMH)
GRAITEC BIM Designers – Next Generation Structural BIM Technology

- Supports connected BIM workflows
  - Trusted with zero loss of data

- Transfers intelligent BIM information
  - Geometry with constructability data: FEA results...

- Utilizes intelligent BIM information to automate processes:
  - Calculate and Design required reinforcement
  - Generate 3D structural rebar cages based on the design results
  - Create a design report to code requirements (USA, CAN, & Euro)
  - Produce necessary views and drawing (ensure they are complete)
  - Utilize the BIM information (schedules, BOM, cost, etc.)
Summary

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Questions