Precast Building Design
Revit, Robot Structural and Dynamo

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Class summary

In this class, we will talk about the importance of BIM to the precast engineering industry. The role of Revit, Robot Structural and other Autodesk tools in helping precast engineers and draftsmen. We will also go over a short introduction to Dynamo in Revit and learn about sending data from Revit to Robot.
Key learning objectives

At the end of this class, you will be able to:

- Learn how to extract an analytical model from a precast Revit model.
- Use Robot to perform structural analysis and understand its capabilities and limitations.
- Perform structural design in Robot.
- Write a basic Dynamo program that can help with precast structures.
Revit and Precast Modeling
Revit, a Total BIM Solution for Precast?

- **Advantages**
  - Better, more accurate estimates for bidding projects
  - Reduced errors and clash detection
  - Coordinate between trades
  - Possibly, eliminating the need for piece tickets (CAD/CAM)

- **Challenges**
  - Initial cost of adoption (software & training)
  - Client specific standards
  - Creation of piece tickets
  - Requires commitment and a plan
  - Integration with structural analysis software

- **Future**
  - Moving beyond 3D modeling (Project management, cost, operation)
Revit, a Total BIM Solution for Precast?
Robot Structural and Precast Design
To Robot or To React?

- React Technical Preview 4 released in June 2016
- Compatible with Dynamo 1.0
- Robot Structural development seemingly on hold
Robot Structural as a Precast Design Tool
Robot Structural as a Precast Design Tool

- Possible to use one-way hollow-core sections
- Beam sections with side-slabs (IT)
- No pre-defined double-tees or bulb-tees.
- Can generate forces from prestressing strands for bar elements only
Robot Structural as a Precast Design Tool

- Loads can be traced from an overlay
- Possible to model wood structure and calculate loads automatically
- Wind load generation
Robot Structural as a Precast Design Tool
Robot Structural as a Precast Design Tool
Robot Structural as a Precast Design Tool

FirstFloor
SampleBuilding

Beam46
Section 40x28

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Robot Structural as a Precast Design Tool
Examining the Robot-Revit Link
API’s and Dynamo
What is an API and how can I use it?

- API: Application Programming Interface
- Usually encapsulated in a Dynamic Link Library (DLL) file

To use the APIs of a program:
1. Developer must grant you access
2. You need the DLL file
3. Reference the DLL in your project (.NET, VBA or Dynamo)

```csharp
public void Draw2DLine(int x1, int y1, int x2, int y2)
{
    // Draw a 2D Line code...
}

Draw2DLine(0, 0, 10, 20);
```
Accessing APIs from coding environments

In Dynamo, if you can't find the nodes you need, you may need to add a special package (APIs for that program).

In other programs, look to add a reference to the library you intend to use.
Dynamo – Visual Programming

Visual programming is programming using graphical elements called “Nodes” and “Wires”

These nodes expose code available from APIs or allow you to write your own code.
Dynamo – Nodes, Wires & Ports

- Dynamo built-in nodes
- Revit nodes
- Robot Structural nodes
- React
- …
Dynamo – Revit Nodes

Example: Creating a row of columns

Run Dynamo
Revit nodes available under the Revit library
Example 1: Creating a row of columns
Example 2: Sending Analytical Elements to Robot Structural
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