RISA Technologies

Using RISA to Design a Building from Foundation to Roof

Deborah Brisbin, P.E.
Total Building Design

Today’s Agenda

• Laying out your building in RISAFloor
  • Modeling in RISAFloor
  • Importing from DXF
  • Importing from Revit Structure
• Design Criteria
• Loads
  • Uniform Area Loads
  • Snow loading-Tapered Area Loads
  • Point Loads & Distributed Line Loads
• Columns & Walls
  • Defining Splices in Columns
  • Wall Openings
• Parent & Child Relationships
• Rigid versus Flexible Diaphragms

RISA 3D Lateral Loads
Total Building Design

Today’s Agenda

• Laying out the building geometry

• Columns

• Area Loads

• Design Criteria

• Parent & Child Relationships

• Rigid versus Flexible Diaphragms

• RISA-3D Lateral Loads

• RISAFoundation
Laying out the Building Geometry

- Drawing the model in RISAFloor
  First → "Supports": Columns & Walls
  Then Beam systems

- Import your model from a Drawing
  DXF format
  Plan Level - Floor by Floor

- Import your model from Revit Structure
  ENTIRE model is Imported
Columns

Column are modeled as **Column Stacks**
which occupy a particular “plan” location within the building model.

**Single Story Stack**

**Multiple Story Stack**
Columns

View the **Column Stacks** graphically by double clicking on the column to open the **Column Stack Manager**.

**Splices** are Column Segments can be viewed in the **Columns Spreadsheet** OR Added Graphically.
Design Criteria - Design Rules

Control your member design based on:
- Depth
- Width
- Maximum Code Check

Control the Deflection using DL, LL, or DL+LL Ratios or Maximums
Area Loads

• Area Loads are Automatically Applied based on the Floors Spreadsheet

<table>
<thead>
<tr>
<th>Floors</th>
<th>Label</th>
<th>Elevation</th>
<th>Area Load Default</th>
<th>Deck Default</th>
<th>Deck Angl...</th>
<th>Parent</th>
<th>Inacti...</th>
<th>Splic...</th>
<th>Splic...</th>
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<tbody>
<tr>
<td>1</td>
<td>Floor Plan 1</td>
<td>10</td>
<td>Public</td>
<td>Flat Slab</td>
<td>0</td>
<td>None</td>
<td>10</td>
<td>Moment</td>
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<tr>
<td>2</td>
<td>Floor Plan 2</td>
<td>20</td>
<td>Office</td>
<td>Metal Deck</td>
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<td>None</td>
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<tr>
<td>3</td>
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<td>Roof</td>
<td>Metal Deck</td>
<td>0</td>
<td>None</td>
<td>7.5</td>
<td>Moment</td>
<td></td>
</tr>
</tbody>
</table>

• Default Area Loads defined in the Area Loads Definitions Spreadsheet

Additive Check box – Otherwise loads replace each other
PreDL, Post DL - Pre and Post composite Dead Loads
LL Type-  LL - Live Load (Reducible on Non-Reducible),
RLL - Roof Live Load (Reducible on Non-Reducible)
SL - Snow Load
SLN - Non Shedding Snow Load
RL - Rain Load

Vibration Live Loads- used to check floor vibration per AISC Design Guide 11
Dyn Load- Dynamic Mass- the load used for Seismic weight above and beyond the self weight – PreDL and PostDL are NOT included.
Area Loads

- One Way or Two Way Load Attribution defined in the Deck Definitions Spreadsheet - Loads tab

<table>
<thead>
<tr>
<th>Label</th>
<th>Two Way</th>
<th>Self Wt [kcf]</th>
<th>Const DL [kcf]</th>
<th>Const LL [kcf]</th>
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<td>Flat Slab</td>
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<td>0.075</td>
<td>0</td>
<td>0.02</td>
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<tr>
<td>Composite Deck</td>
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<td>0</td>
<td>0.02</td>
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<tr>
<td>Metal Deck</td>
<td></td>
<td>0.003</td>
<td>0</td>
<td>0.02</td>
</tr>
<tr>
<td>Wood</td>
<td></td>
<td>0.003</td>
<td>0</td>
<td>0.02</td>
</tr>
</tbody>
</table>

One Way Load

Two Way Load
Walls

Material: Wood
Masonry
General (Concrete, CF Steel, etc.)

Type: Gravity
Lateral (also Gravity loads)

Openings: Doors
Windows

Regions needed for Design (Piers)
Parent & Child Relationships

Parent Floor is the Original Floor

Child Floor is a COPY of the Parent Floor

All Geometry & Loads on the Parent floor ➡️ Child Floor

All Geometry & Loads on the Child floor ➡️ Parent Floor

**Note:** You can Detach Parent from Child but there is no return.
Diaphragms

Diaphragms are defined in RISAFloor as you add the Slab or Deck edge.

**Rigid Diaphragms:**
RISAFloor uses Membrane Rigid Diaphragms:
The Lateral loads are distributed the In-Plane Lateral Loads, while allowing for the beams and frames to take out of plane vertical loads.

Diaphragm spreadsheet available in RISA-3D:

The **Eccentricity** is used to used to defined the amount of accidental eccentricity used for the calculation of your seismic loads.

Note: These eccentricities are ignored for flexible diaphragms.
Diaphragms

Flexible Diaphragms:
Distributes lateral loads directly to the Lateral members

- RISAFloor/RISA-3D will analyze all flexible diaphragms
- RISAFloor/RISA-3D will design Wood Flexible Diaphragms
  - You must define a Diaphragm Region in order to get design
  - Diaphragm regions are rectangular in shape, and must be oriented along the principal X and Z axes.
  - RISA-3D will provide nailing patterns and panel thickness required with Chord Forces.
RISA-3D Lateral Loads

RISA calculates the Wind Load Force for EACH diaphragm:

Wind Load Parameters

<table>
<thead>
<tr>
<th>Wind Code</th>
<th>Importance Cat</th>
<th>Topographic Fac. K1</th>
<th>Topographic Fac. K2</th>
<th>Topographic Fac. K3</th>
<th>Directional Fac. Kd</th>
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<tr>
<td>ASCE 7-05</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
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<tr>
<td>Wind Speed (mph)</td>
<td>90</td>
<td>Exposure Cat</td>
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<td>0</td>
<td>0</td>
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<tr>
<td>Exposure Cat</td>
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<td></td>
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<td>0</td>
<td>0</td>
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<tr>
<td>Base Elevation</td>
<td>10</td>
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<td></td>
<td></td>
<td></td>
</tr>
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</table>

Wind Generation Floor Force/Stress Results

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>2nd Floor</td>
<td>0.012</td>
<td>0.008</td>
<td>0.005</td>
<td>0.005</td>
<td>5.663</td>
<td>5.055</td>
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</table>

RISA calculates the Seismic Force for each diaphragm:

Seismic Load Parameters

<table>
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<th></th>
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<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>ASCE 7-2005</td>
<td>0.035</td>
<td></td>
<td>4.0</td>
<td>0.035</td>
<td></td>
<td>4.0</td>
<td>0.75</td>
<td>0.75</td>
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</tr>
<tr>
<td>Base Elevation</td>
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<td></td>
<td></td>
<td>0.27</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Occupancy Cat</td>
<td>1 or II</td>
<td></td>
<td></td>
<td>S_D1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Seismic Generation Force Results

<table>
<thead>
<tr>
<th>Floor Level</th>
<th>Height (ft)</th>
<th>Weight (k)</th>
<th>Force X (k)</th>
<th>Force Z (k)</th>
<th>CG X (ft)</th>
<th>CG Z (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2nd Floor</td>
<td>10</td>
<td>148.127</td>
<td>5.38</td>
<td>5.38</td>
<td>41.253</td>
<td>59.918</td>
</tr>
</tbody>
</table>
RISAFoundation

- Loads from RISAFloor (Gravity) and RISA-3D (Lateral)
- Loads based on Categories
  From RISA-3D – you must define Load Categories
- Slabs, Footings and Grade Beams
Final Things to Consider About RISA Building System

- One Model for both Gravity and Lateral Design
  - One file means less data to manage
  - All changes to geometry apply to the entire structure
- Export the model to finish your Construction drawings
  - DXF – floor by floor
  - Revit Structure

Learn more in depth features about RISAFoundation

** New Webinar** August 11, 2010

Comprehensive Design of Shallow Foundations with RISAFoundation
Questions?

Please let us know if you have questions.

We will answer as many questions as time permits during the webinar.

Once the webinar is closed, we will post all Q&A’s to our website: [www.risatech.com](http://www.risatech.com)

For further information, contact us at: info@risatech.com

THANK YOU!