Introducing RISAFloor ES

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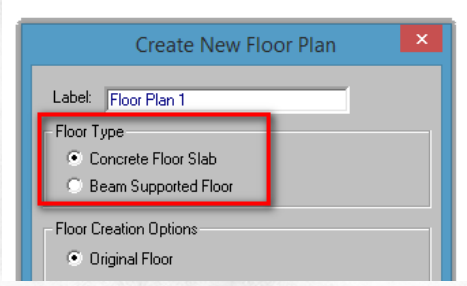
September 25, 2014

INTRODUCING RISAFLOOR ES

ES = Elevated Slab Design

What's the Difference in Floor Types?



INTRODUCING RISAFLOOR ES

ES = Elevated Slab Design

- Two-Way Slab Design based ACI 318-11, ACI 318-08
  ACI Defines Two-Way Slab: "slab system reinforced for flexure in more than one direction, with or without beams between supports."
- Design using Equivalent Frame Method
- Automated or manual design strips based on support lines
- Punching Shear Checks

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RISAFLOOR ES BUILDING MODELS

- Multi-story Concrete Buildings
- Podium Style Building
- Concrete & Steel
- Concrete & Masonry
- Concrete & Wood or CFS
- Single Story Concrete Slab
- One-Way Slab with T or L Beams

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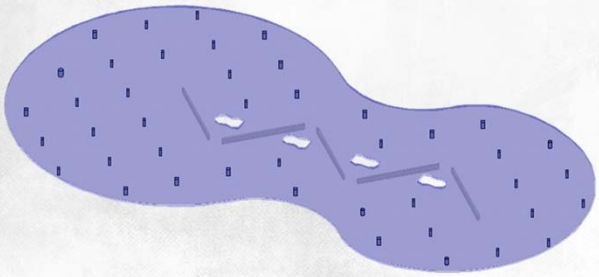
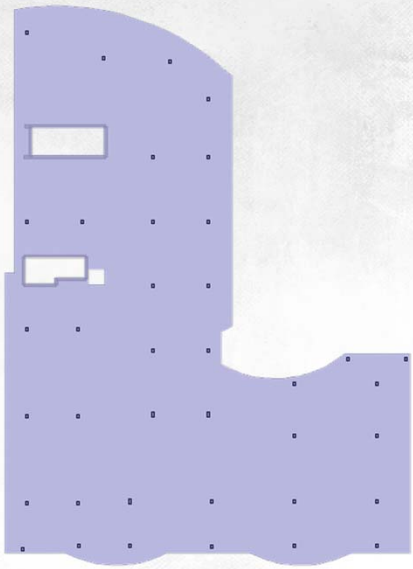
SLABS

- Any shape or size or thickness
- Customize the material properties
- Openings anywhere within the slab
- Beams not required!





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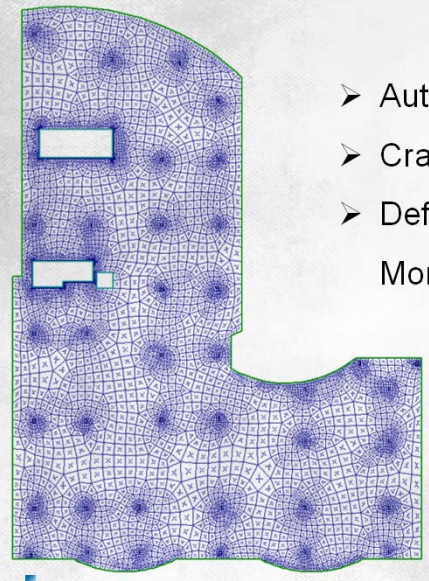
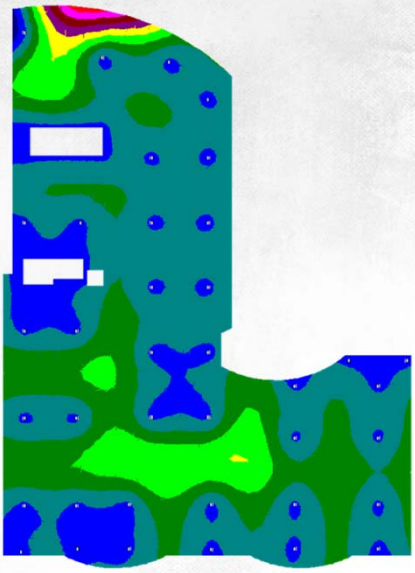
SLABS



- Automatic FEM model
- Cracked Section Analysis
- Deflection, Shear and Moment Contours



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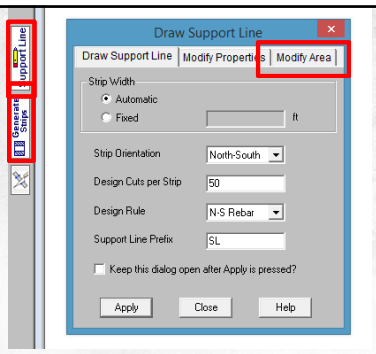
DESIGN STRIPS

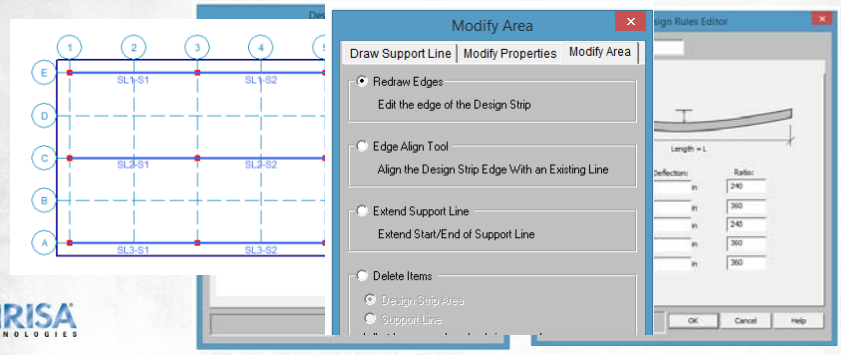
Design Strip = Region of Reinforcement Design

Step 1: Layout the Support Lines

Step 2: Generate Design Strips

Step 3: Review and Modify Design Strip Area's





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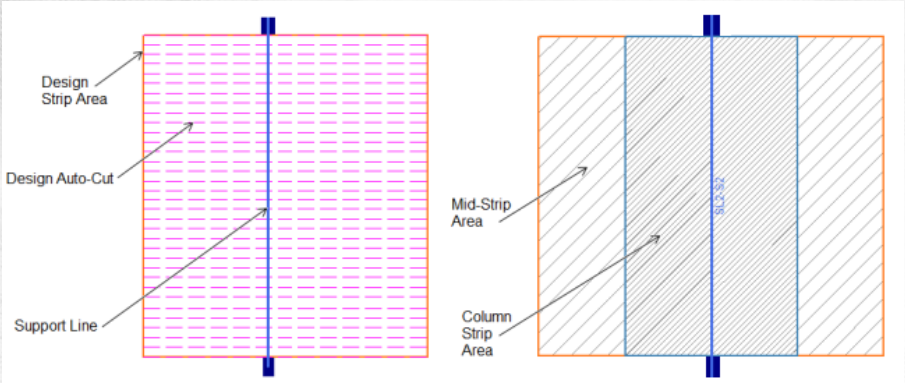
EQUIVALENT FRAME METHOD

ACI 13.5.1 Design Procedures

ACI 13.7.2- Equivalent Frame



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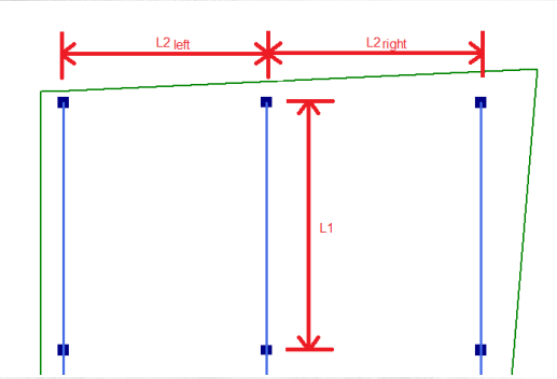
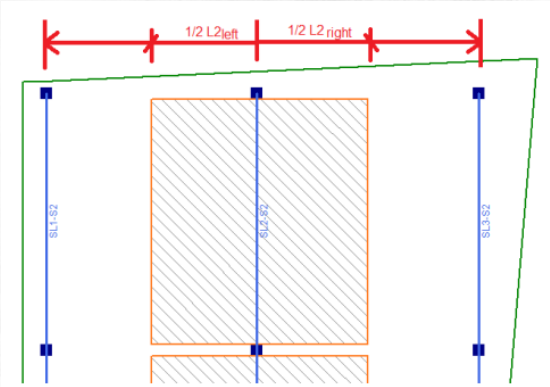
DESIGN

Auto Design Strips Generation





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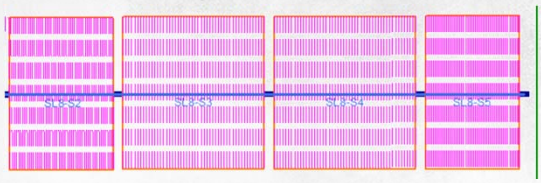
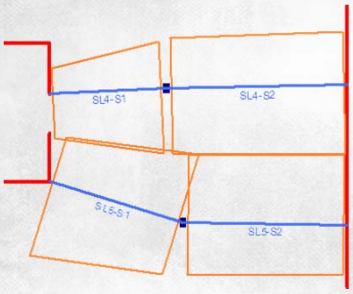
DESIGN

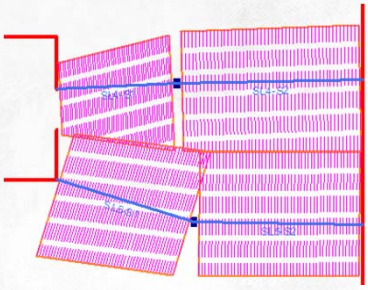
Design Strips

Design Cut





Internally Broken into Design Cuts



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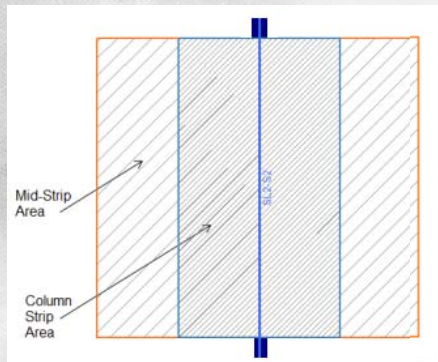
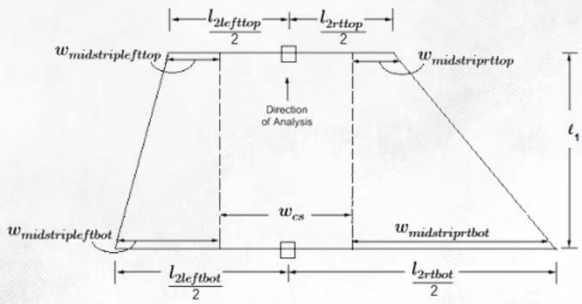
EQUIVALENT FRAME METHOD



How are the Strip Widths calculated?

Left Side | Right Side

$$w_{cs} := min\left(\frac{l_{2lefttop}}{2} \times \frac{1}{2}, \frac{l_{2leftbot}}{2} \times \frac{1}{2}, \frac{l_1}{4}\right) + min\left(\frac{l_{2rttop}}{2} \times \frac{1}{2}, \frac{l_{2rtbot}}{2} \times \frac{1}{2}, \frac{l_1}{4}\right)$$



(Noted in the Help file)

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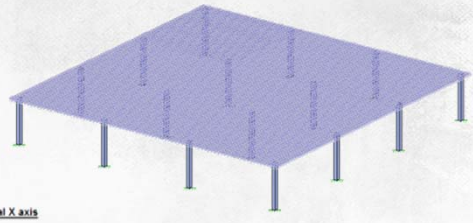
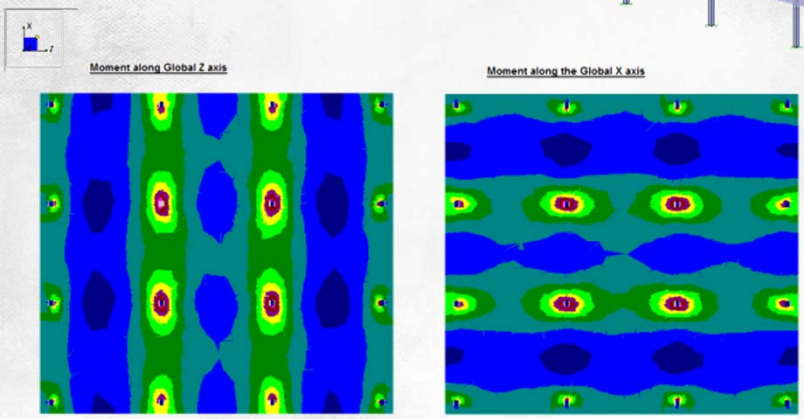
DESIGN

- To optimize reinforcement → Design Strips bound by the lines of zero shear.





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DESIGN RESULTS- CUTS

Area of Steel Required

Step 1 (**Analysis**): Calculate the area steel required by analysis.

Step 2 (**Min Flex**): Check ACI 10.5.1 Min reinforcement for flexure.

Step 3 **(4/3)**: Check ACI 10.5.3 4/3*As required by analysis.

ACI 318-11 Code Check

Top Bending Check	0.956	Bot Bending Check	0.000		
Gov Mu Top	64.434 k-ft	Gov Mu Bot	0 k-ft		
phi*Mn Top	67.369 k-ft	phi*Mn Bot	116.706 k-ft		
Tension Bar Fy	60 ksi	Concrete Weight	.145 k/ft^3	Top Cover	1.5 in
F'c	4 ksi	λ	1	Bottom Cover	1.5 in
Flex. Rebar Set	ASTM A615	E_Concrete	3644 ksi		
Top As Reqd:		Bot As Reqd:			
Analysis	2.051 in^2	Analysis	NA		
4/3	2.735 in^2	4/3	NA	As Reqd(T/S)	1.41831
Min Flex	2.316 in^2	Min Flex	NA	Rho Reqd(T/S)	0.00180
Top As Prvd	2.148 in^2	Bot As Prvd	3.927 in^2	Rho Prvd(Gross)	0.00771

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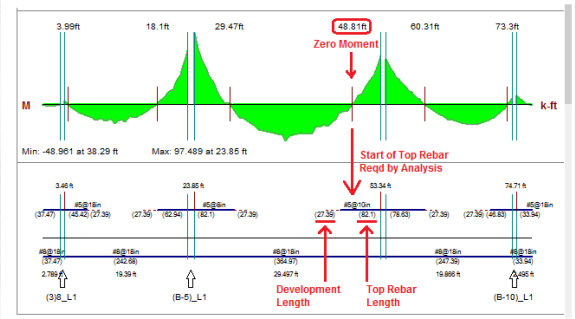
DESIGN RESULTS- DETAIL REPORT

<u>Top Reinforcement</u>

Step 1: Find the required length by analysis- Zero Moment location

Step 2: Calculate the development length ACI 12.2.2 & 12.10.3.

Step 3: Add Step 1 + Step 2 and check the minimum extensions ACI Fig 13.3.8.



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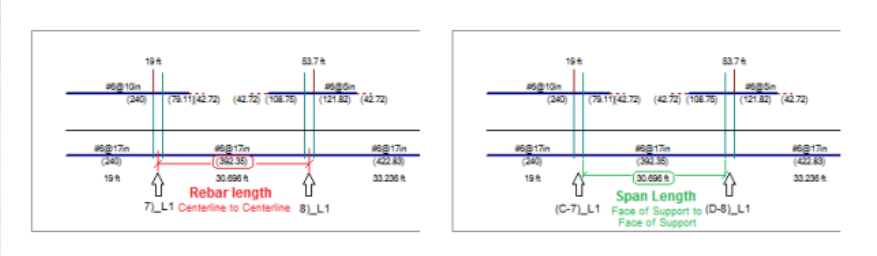
DESIGN RESULTS- DETAIL REPORT

Bottom Reinforcement

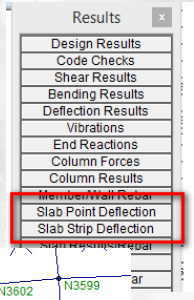
Considered Continuous across the span

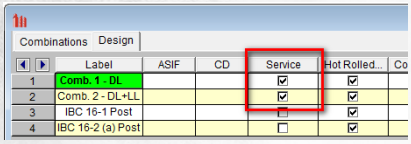


DEFLECTION

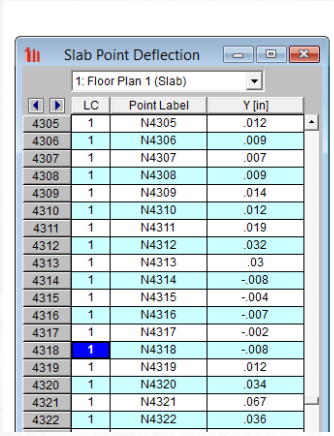
Slab Point Deflection

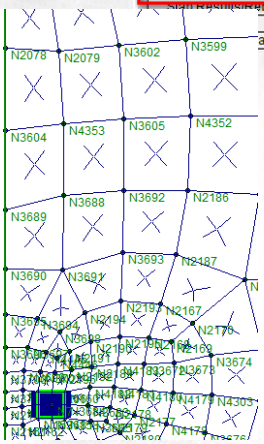
- Based on FEM results
- Requires Service Checkbox turned on in LC





- Deflection Results based on Plate Corner Points

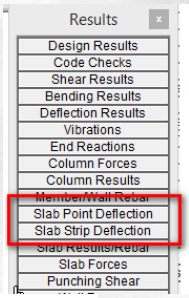




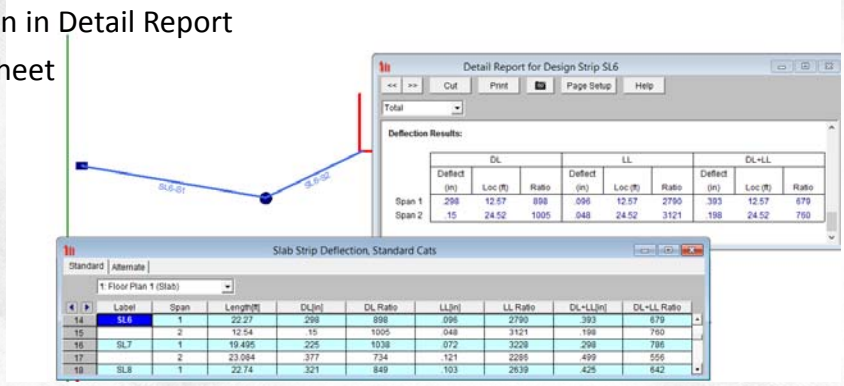
DEFLECTION

Slab Strip Deflection

- Based on Support Lines
- Calculated for each Load Category defined in Slab Design Rules



- Results shown in Detail Report and Spreadsheet



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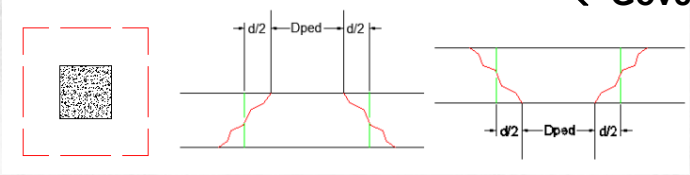
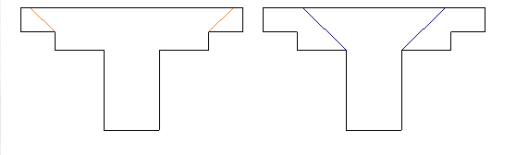
PUNCHING SHEAR

ACI 11.11 requires:

- One-way Shear
- Two-way action Shear aka Punching Shear ← **Governs**



Shear Caps- ACI 13.2.6



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