



How to Use Concrete Wall Design in RISA

Presenter: Deborah Brisbin, P.E.





RISAFloor 5.1



RISA-3D 9.1

Concrete Wall Design Programs

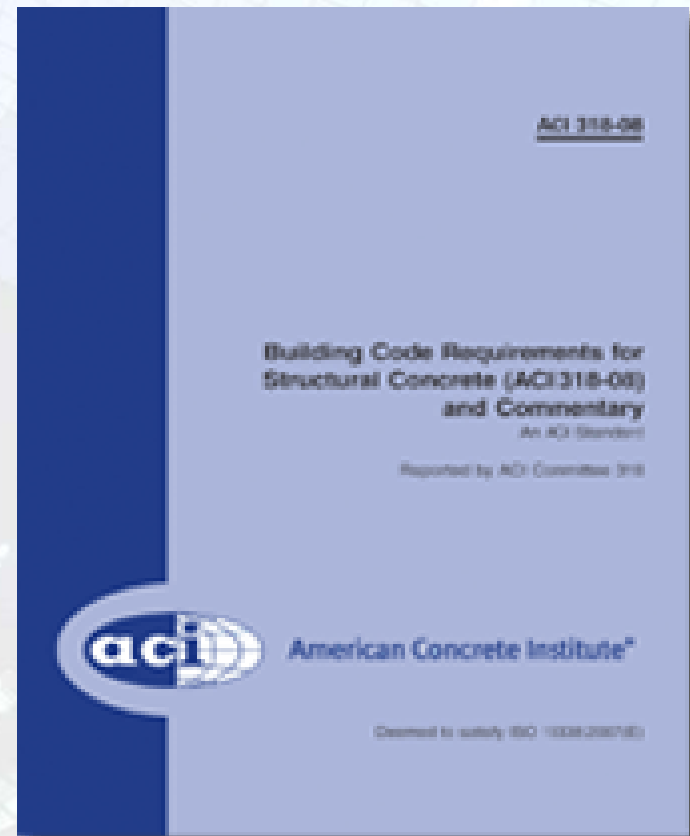
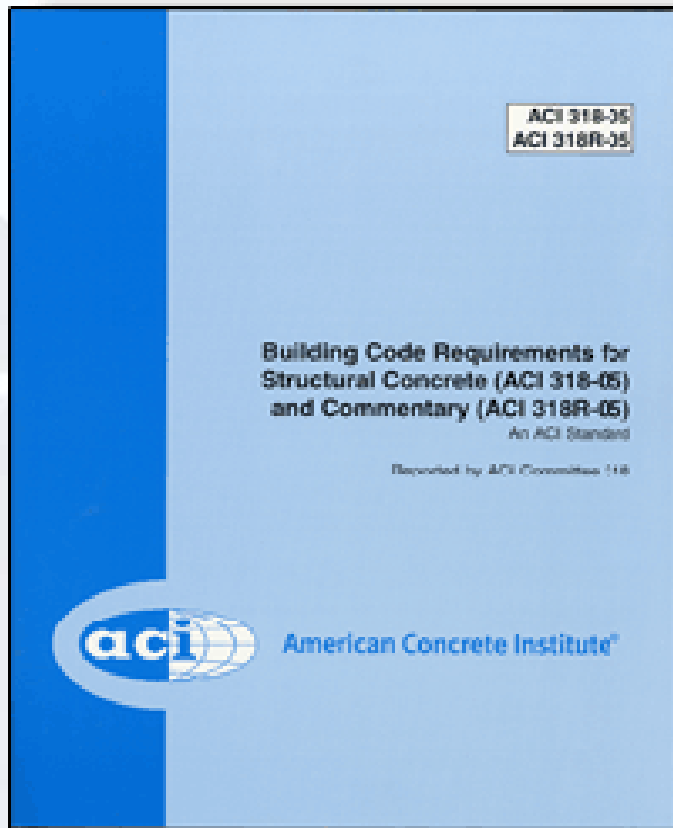


Image Courtesy of American Concrete Institute

REFERENCED CODES

What sections of the ACI apply to walls?

Section 7.6 General Reinforcement Spacing Requirements

- 7.6.1 minimum spacing requirements
- 7.6.5 maximum spacing requirements

Section 14.3 Wall Reinforcement Requirements

- 14.3.2 & .3 minimum reinforcement ratios requirements
- 14.3.4 thickness requirements
proportioning and cover checks
- 14.3.5 maximum spacing requirements

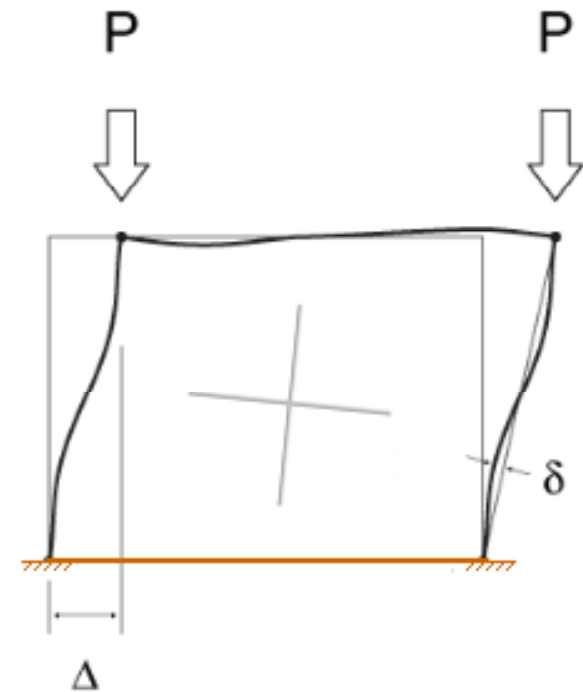
Section 11.9.8 and 11.9.9 Shear Reinforcement Requirements for Walls

- 11.9.8 if the V_u exceeds $0.5 \cdot \phi \cdot V_c$
- 11.9.9

ACI Concrete Design Requires P-Delta

Per 10.10.2 “the design ... shall be based on factored forces and moments from second-order analysis satisfying 10.10.3, 10.10.4 OR 10.10.5”

- Nonlinear Second Order Analysis (10.10.3)
- Elastic Second Order Analysis (10.10.4) ←
- Moment Magnification (10.10.5 & 10.10.6) ←

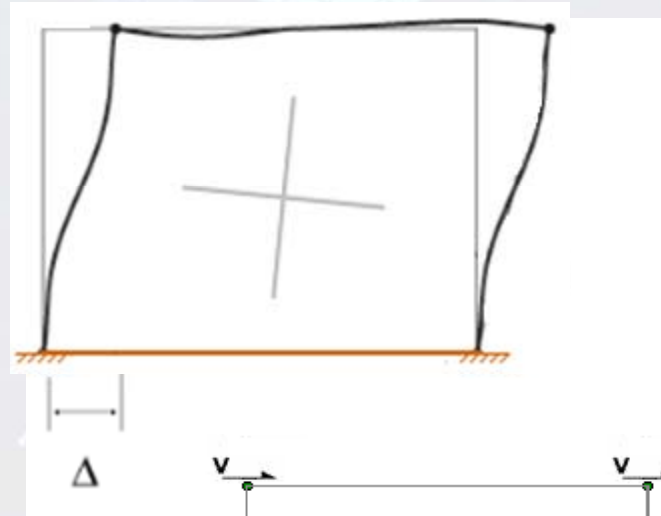
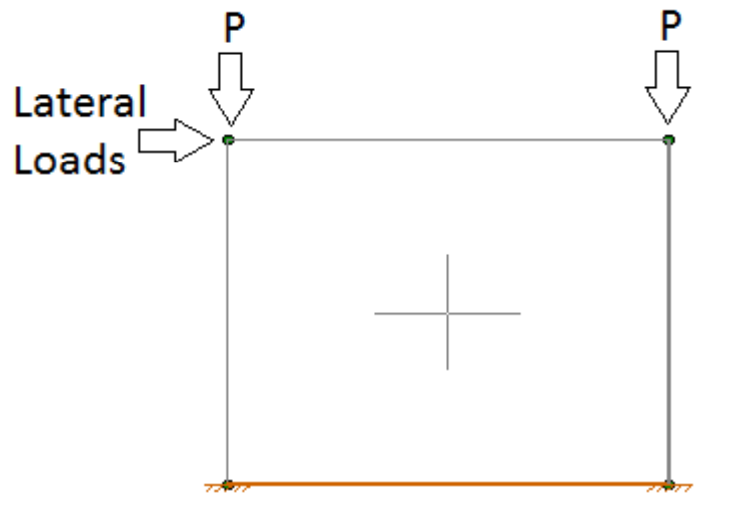


P-Delta

What is P-Delta in RISA?

The deflections induce secondary moments due to the fact that the wall is no longer co-linear.

As the wall is loaded, it deflects.



Secondary Shears:

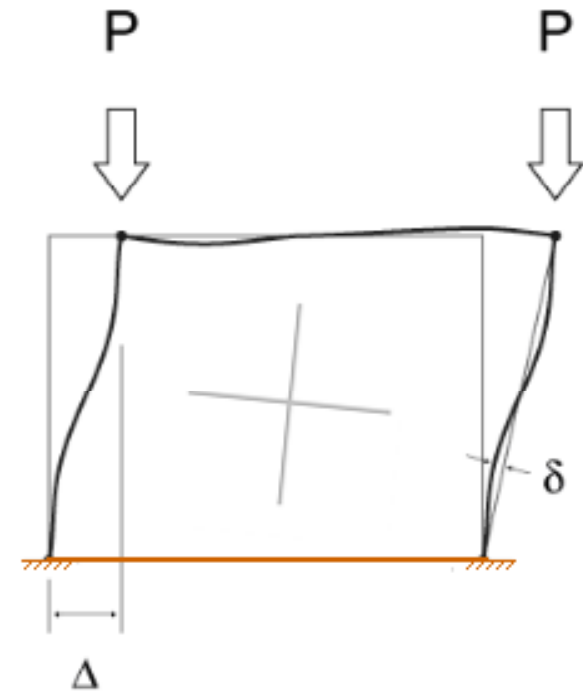
$$V = \frac{P \text{ (Axial Force)} \times \Delta}{\text{Ht of Wall}}$$

P-Delta

Elastic Second Order Analysis (10.10.4)

Big P-Delta Δ -delta

➤ Turn on the PDelta Check for all Load Combination



Load Combinations

Combinations Design

	Description	Sol...	PDelta	SR...	BLC	Factor	BLC	Factor	BLC
4	ACI 9-1 (a)	<input checked="" type="checkbox"/>	Y		DL	1.4			
5	ACI 9-2 (a) (a)	<input checked="" type="checkbox"/>	Y		DL	1.2	LL	1.6	
6	ACI 9-5	<input checked="" type="checkbox"/>	Y		DL	1.2	EL	1	LL
7	ACI 9-7	<input checked="" type="checkbox"/>	Y		DL	.9	EL	1	

P-Delta Options

- No (blank) - Don't perform P-Delta calculations for this combination
- Yes (Y) - Calculate P-Delta effects for ALL members/walls
- Compression (C) - Calculate P-Delta effects only for members/walls in compression

Ok Cancel Help

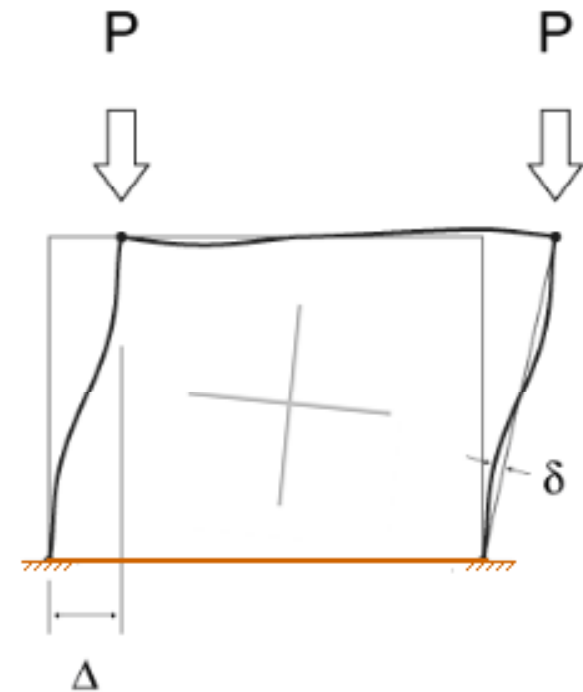
Big P-Delta

Little P-Delta

Element Curvature Effects
 δ - delta

Only Required for Slender walls to account for:

- Influence of Axial Loads
- Presence of Cracked regions
- Effects of load duration



Little P-Delta

First Check Wall Slenderness

Slender $\frac{kl_u}{r} \leq 22$ (Eq. 10-6)

l_u = full ht of wall or segments between diaphragms

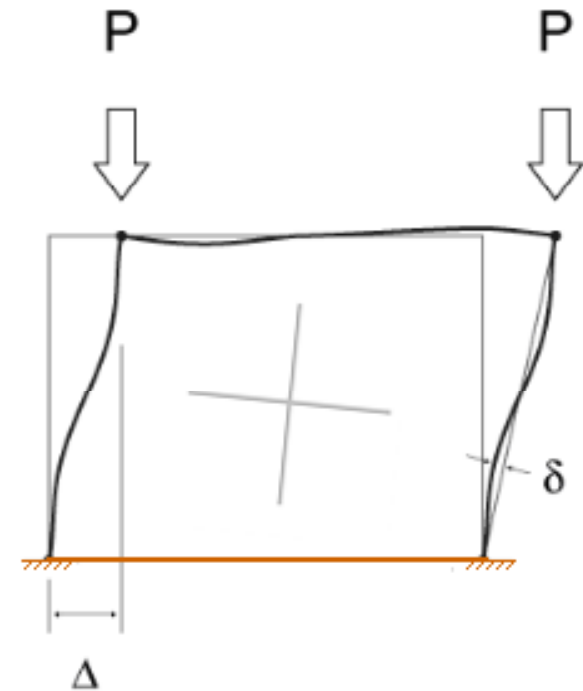
Yes or No



Little P-Delta not required

Moment Magnification (10.10.6)

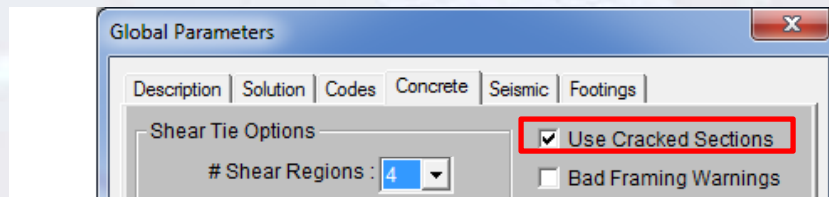
$EI = 0.25E_c I_g$ From Commentary
Minimum Moment per 10.10.6.5 (M2,min)



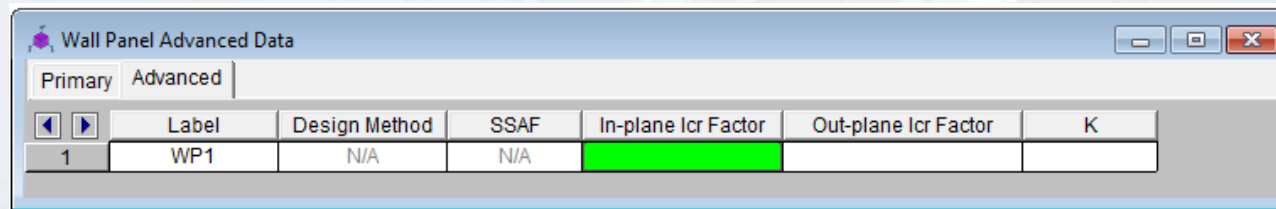
Little P-Delta

Cracked Sections

- Deflection is based on the I_g OR I_{cr}
- Global Parameters – Concrete Tab
Check “Use Cracked Sections”

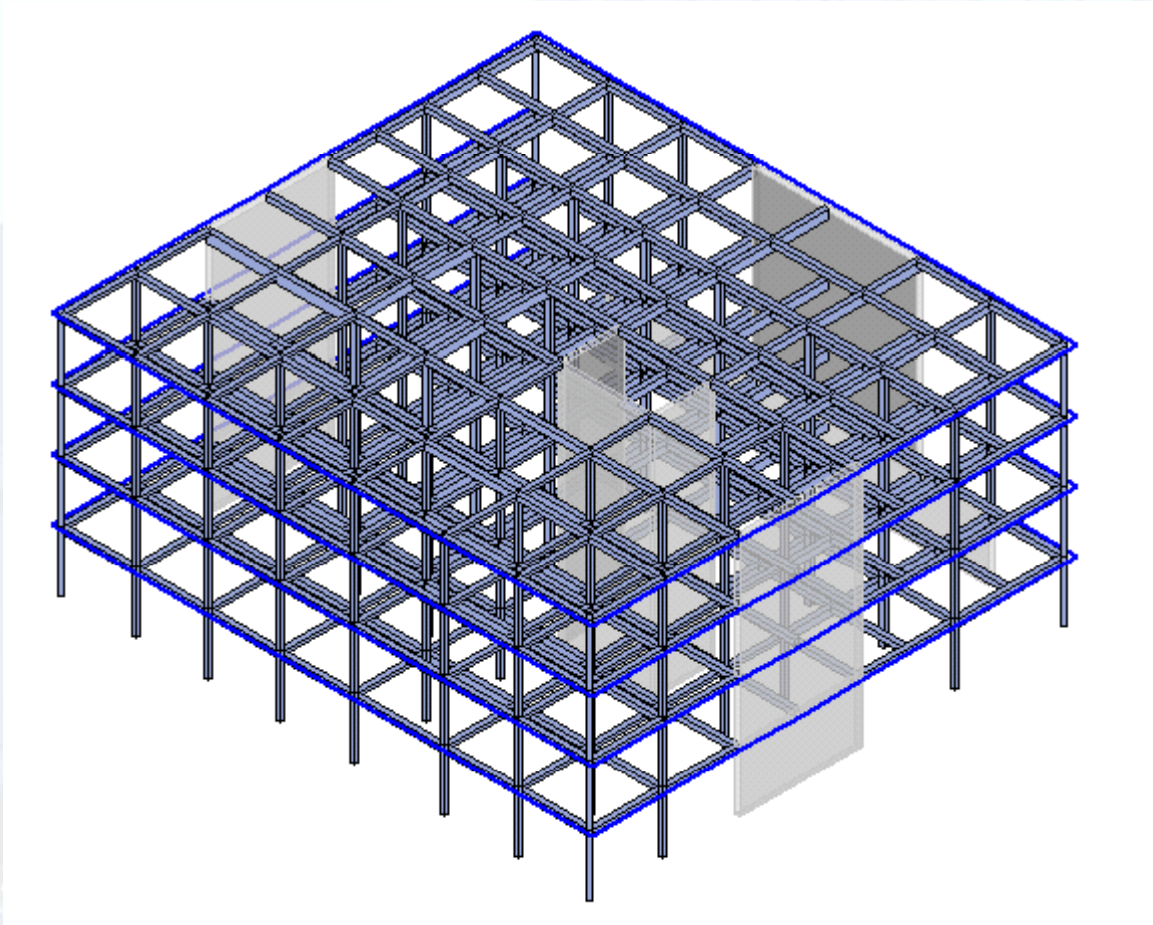


- Walls (10.10.4.1)
 - In-Plane $I_{cr} = 0.7I_g$ (Un-cracked)
 - Out-of-Plane $I_{cr} = 0.35I_g$ (Cracked)






Label	Design Method	SSAF	In-plane I_{cr} Factor	Out-plane I_{cr} Factor	K
1 WP1	N/A	N/A			

Cracked Moment of Inertia

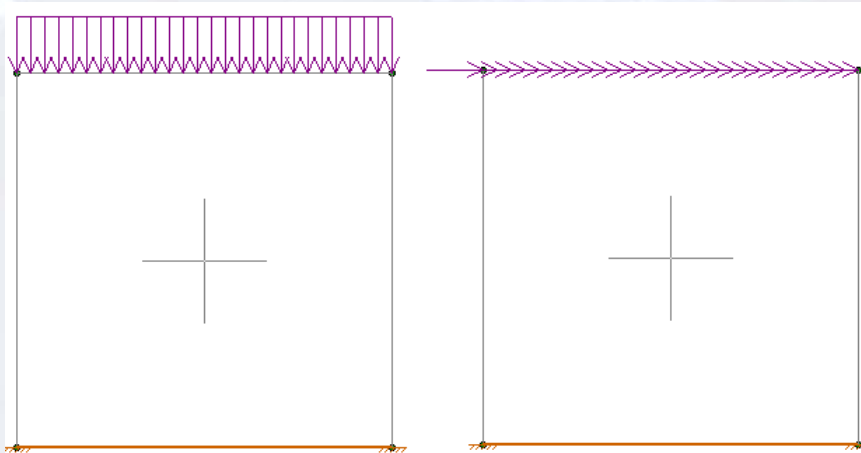


Modeling Walls in RISA

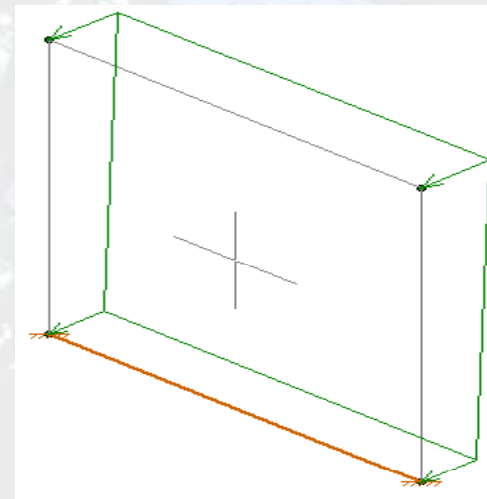
Types of Loading on Walls

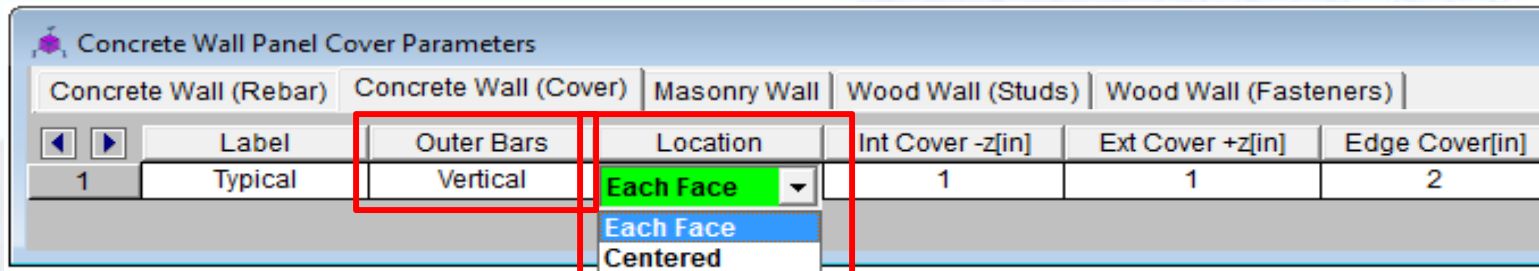
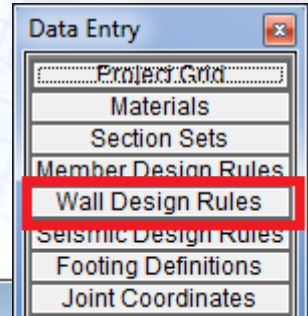
- Point Loads 
- Distributed Loads 
- Surface Loads 

In-Plane Loads



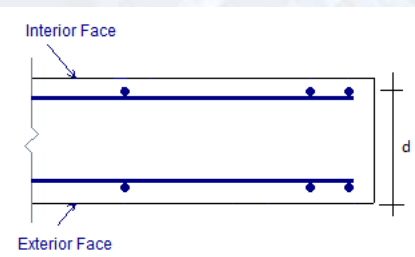
Out of Plane Loads



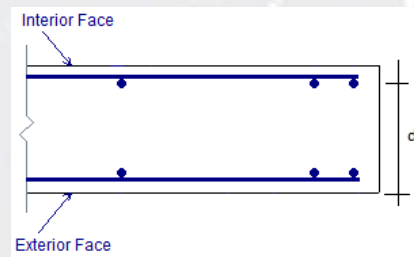


Outer bars orientation: (d measured from the vertical bars)

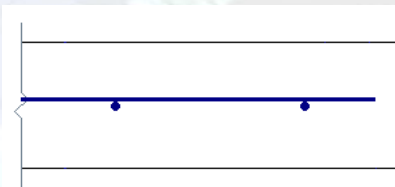
Vertical



Horizontal



Bars Centered

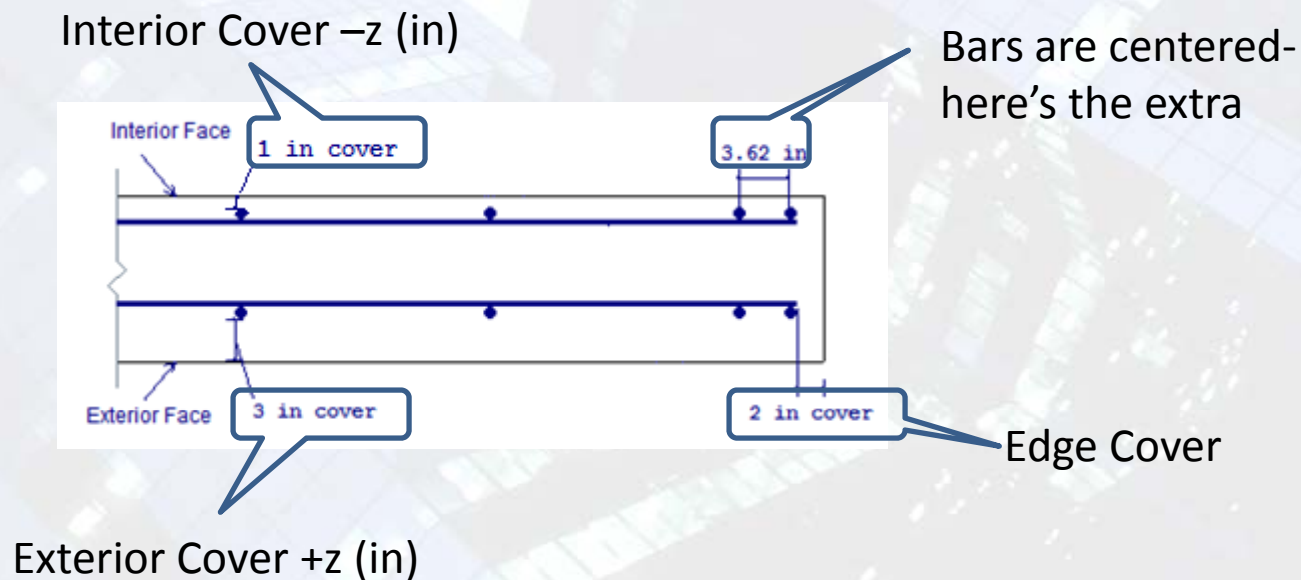


Concrete Wall Design Rules

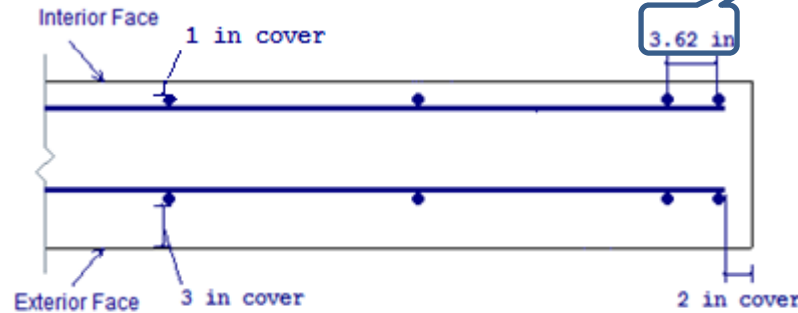
Concrete Wall Panel Cover Parameters

Concrete Wall (Rebar) | Concrete Wall (Cover) | Masonry Wall | Wood Wall (Studs) | Wood Wall (Fasteners)

	Label	Outer Bars	Location	Int Cover -z[in]	Ext Cover +z[in]	Edge Cover[in]
1	Typical	Vertical	Each Face	1	3	2



Concrete Wall Design Rules



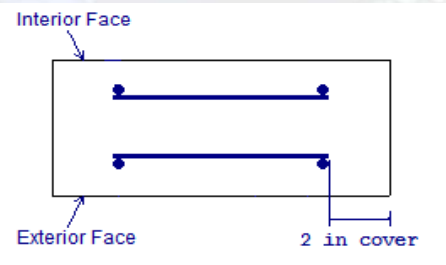
Bars are centered-
here's the extra

How does RISA calculate the "Extra"?

$$\text{Wall length} / \text{Required spacing} = \text{Spacing} + \text{Remainder}/2$$

Except very small walls:

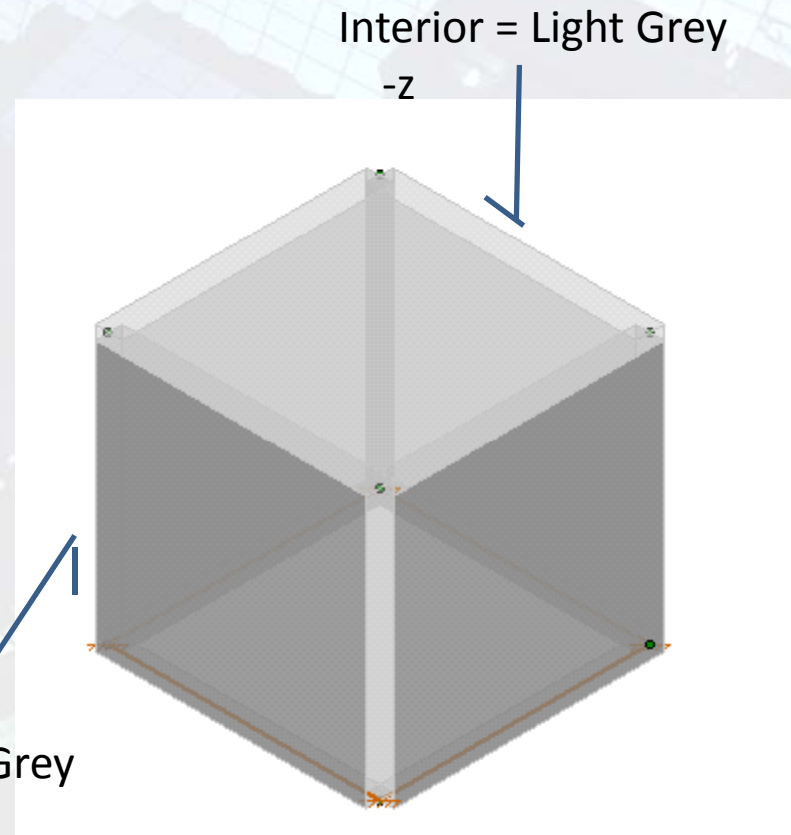
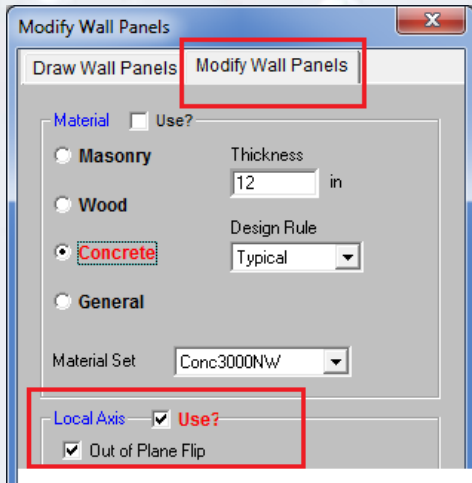
If ONLY two bars are required and cannot fit at this spacing, one bar will be placed at each end of the wall.



Concrete Wall Design Rules

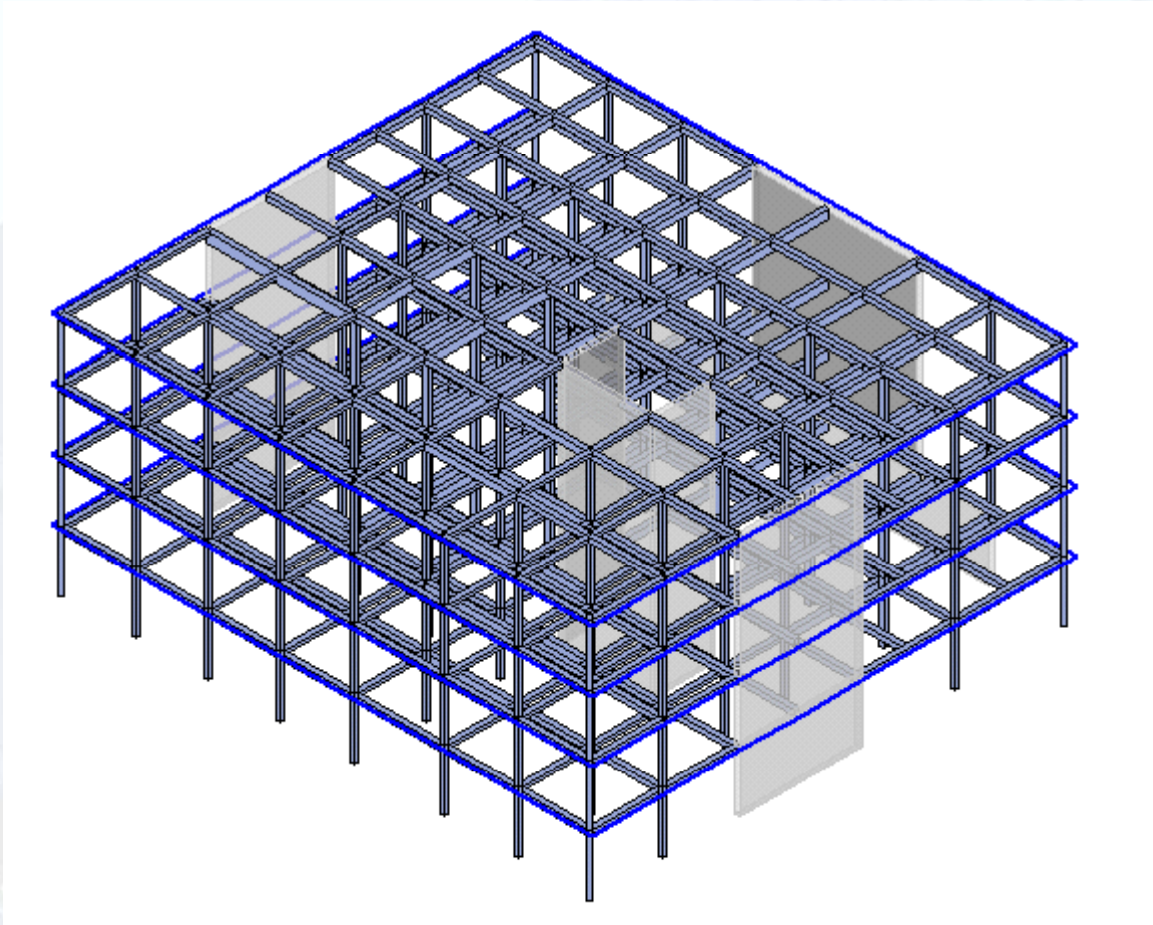
Concrete Walls are color coded in Rendered view so that you can determine your local axis and reinforcement.

Use ***New Modify Wall Panels- Flip Axis



Concrete Wall Design Rules

Let's see RISA in action!



Concrete Walls in RISA

What's Coming Soon?

- Openings in Concrete Walls
(RISA-3D 10.0 & RISAFloor 6.0)
- Retaining Walls in RISAFoundation
(RISAFoundation 4.0)





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.risa.com

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

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