

StructurePoint is a software company that provides concrete design solutions. Formerly the engineering software group of the Portland Cement Association (PCA), StructurePoint (SP) is located in Chicago and does business all around the world with clients in North America, the Middle and Far East. SP has representatives in India, Thailand, Saudi Arabia, Lebanon and the UAE. Formerly PCA products, the SP product line include design and analysis software for reinforced concrete beams, columns, mats, walls, slab systems, and frame analysis. These six programs make up the SP Suite. The software programs can be purchased as the Suite or individually to meet your specific needs over a large business computer network or as single standalone serving one laptop.

**Work quickly.
Work simply.
Work accurately.**

**StructurePoint's Productivity Suite of powerful software tools
for reinforced concrete analysis & design**

spwall
Finite element analysis & design of reinforced, precast ICF & tilt-up concrete walls

spcolumn
Design & investigation of rectangular, round & irregularly shaped concrete column sections

spbeam
Analysis, design & investigation of reinforced concrete beams & one-way slab systems

spslab
Analysis, design & investigation of reinforced concrete beams & slab systems

spmats
Finite element analysis & design of reinforced concrete foundations, combined footings or slabs on grade

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2

The SP Suite has the capability to design an entire concrete structure from foundation to roof. These programs are based on the methods, equations, and procedures found in ACI 318 and CSA 23.3 in English and Metric units. Due to the schedule of updating the concrete codes, the five code driven software are given a major upgrade every three years along with annual updates. The SP suite is designed to allow the user to work quickly, simply and accurately. In essence, you can get to a final design solution fast with confidence and little training and wasted time.

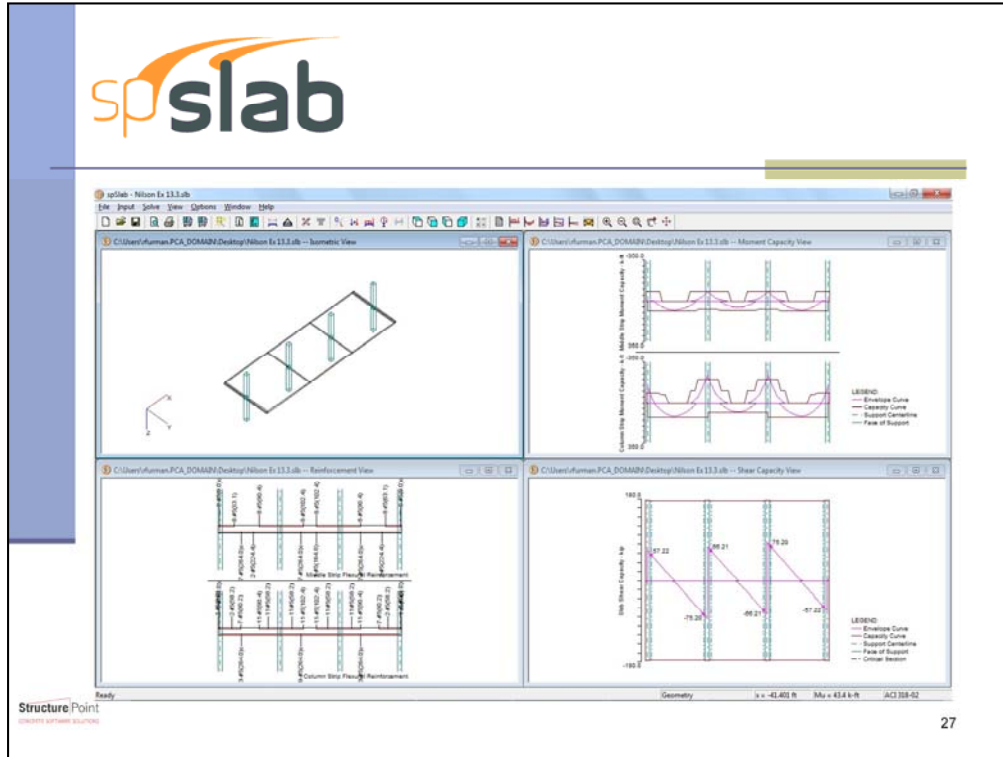
The Industry Standard



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3

Use of the StructurePoint software can be found in many publications regarding reinforced concrete design and analysis.



Formerly pcaSlab and ADOSS, spSlab was created for the analysis and design of reinforced concrete beams and slab floor systems. Two-way slab systems are analyzed using the Equivalent Frame Method. Beams and frames of up to 22 spans can be analyzed and designed. In addition to the design option, spSlab has the capability of investigating existing beams and slab systems. spSlab includes provisions for slab band systems as well as punching shear check and deflection calculations using either cracked or gross sections. For beams, moment redistribution as well as combined shear and torsion design are available. In addition to the required area of reinforcing steel at the critical sections, spSlab provides a complete bar schedule that includes the number of bars, bar sizes, and lengths.

Options



General Information | Span Control | Solve Options |

Labels
Project: [Demonstration Design]
Name:
Engineer:

Options
Design code: [ACI 318M-08] Run mode:
 Design
Reinforcement: [ASTM A615M] Investigation

Frame
No. of Supports: [2] Floor System:
 Two-Way
 Left cantilever Right cantilever One-Way/Beam

Other
 Distance location as ratio of span

OK Cancel Help

Two-way systems

General Information | Span Control | Solve Options |

Design Options
Live load pattern ratio: [100] %
 Compression Reinforcement User Slab Strip Widths
 Decremental Reinf. Design User Distribution Factors
 One-way Shear In Drop Panels Beam T-Section Design
 Distribute Shear to Slab Strips Long. Bm. Supt. Design
 Ignore side on a free edge if within 4 times the slab thickness from the face of the support. Trans. Bm. Supt. Design

Deflection calculation options
Sections to use in deflection calculations are:
 Gross (included) Effective (included)
In negative moment regions, to calculate Iy and Mor use:
 Rectangular Section T-Section

Calculate long-term deflections
Duration of load: [60] months Sustained part of live load: [0] %

OK Cancel Help

One-way systems

General Information | Span Control | Solve Options |

Design Options
Live load pattern ratio: [100] %
 Compression Reinforcement Effective flange width
 Decremental Reinf. Design Rigid beam-column joint
 Tension Analysis and Design Moment Redistribution

Tension Analysis and Design
Tension type: Equilibrium No
 Compatibility Yes
Strips in Ranges: No Yes

Deflection calculation options
Sections to use in deflection calculations are:
 Gross (included) Effective (included)
In negative moment regions, to calculate Iy and Mor use:
 Rectangular Section T-Section

Calculate long-term deflections
Duration of load: [60] months Sustained part of live load: [0] %

OK Cancel Help

Floor systems are intricate with many choices available to an engineer. These choices are reflected in spSlab's General Information tab. From here the user has the option to choose which code and what edition to follow, the units, if compression reinforcement is to be used, what percentage of live load is sustained for long term deflections, and if transverse or longitudinal beams are included in the support design to name a few.

Span Data



■ Defining Spans

■ Span Manipulation

Span Data dialog box showing input fields for span properties and a table of defined spans.

Slabs/Flanges | Longitudinal Beams | Ribs

Span: 2 Length: 18 ft Width Left: 7 ft
Location: Interior Thickness: 7 in Width Right: 7 ft

Span No.	Location	Length	Thickness	Width-L	Width-R
1	Interior	0.7	7	7	7
2	Interior	18	7	7	7
3	Interior	18	7	7	7
4	Interior	18	7	7	7
5	Interior	0.7	7	7	7

General Information dialog box showing support selection and span control list.

General Information | Span Control | Solve Options

Support Selection
 Left Support Right Support

State
Reset All
Restore
Delete

Span Control List

New#	Old#	Sup L/R	Copy
1-CL	1-CL	- / 1	
2	2	1 / 2	
3	3	2 / 3	
4	4	3 / 4	
5-CR	5-CR	4 / -	

Insert
Before < After >

Copy
Before < After >

Move
Before < After >

With the number of supports defined under General Information, spSlab automatically populates the Span Data dialog box with spans between supports and, if specified, cantilevered spans on the ends. The Span Data window allows each span to be given unique section properties. The Span Control window is a convenient way to edit entire spans. It allows for new spans to be inserted and existing spans to be duplicated, moved, or deleted.

Support Data



■ Defining Supports

■ Boundary Conditions

Sup.	Stiff%	HxA	c1A	c2A	HxB	c1B	c2B	Shear	Gamma
1	100	9	16	16	9	16	16	Yes	No
2	100	9	16	16	9	16	16	Yes	No
3	100	9	16	16	9	16	16	Yes	No
4	100	9	16	16	9	16	16	Yes	No

Sup. No	Kz	Ky	Far End - Above	Far End - Below
1	0	0	Fixed	Fixed
2	0	0	Fixed	Fixed
3	0	0	Fixed	Fixed
4	0	0	Fixed	Fixed

The supports dimensions entered into spSlab are used to determine the torsional stiffness of the system and to check the punching shear capacity of the slab system. The boundary conditions are used to simulate the conditions that the slab will experience at the supports. Adjusting these boundary conditions can be quite useful in creating a more realistic slab system than could otherwise be created. For example, since transverse beams can only be specified at the support locations this may cause a problem if there are transverse beams between columns that should be providing torsional stiffness to the system. The problem with this situation is that even if columns are given zero dimensions they still prevent vertical deflection. To bypass this problem, the supports can be given spring stiffnesses of negligible magnitudes. This will allow the system to act as if there is no column while including the torsional resistance of the transverse beams.

Reinforcement



■ Design

Reinforcement Criteria dialog box. The 'Beams' tab is active. It has sub-tabs for 'Top bars' and 'Bottom bars'. Fields include: Clear (1.5), Bar size (Min: #4, Max: #4), Spacing (Min: 1, Max: 10), and Reinf. ratio (Min: 0.18, Max: 2). A checkbox 'There is more than 12 in of concrete below top bars.' is present. Buttons: OK, Cancel, Help.

■ Investigation

Reinforcing Bars dialog box. The 'Column Strip Bars' tab is active. Fields include: Bar size (#5), No. of bars (11), Length (ft) (7.5311), Top left position, and Cover (in) (1.125). A 'Span = 22 ft' label is shown. Buttons: Add, Modify, Delete, OK, Cancel, Help.

Size	Type	Count	Cover	Length	Start
#5	TopL	11	1.125	7.53112	--
#5	TopL	11	1.125	4.8506	--
#5	TopR	7	1.125	7.51534	--
#5	TopR	2	1.125	4.8506	--
#5	BotC	13	1.125	--	--

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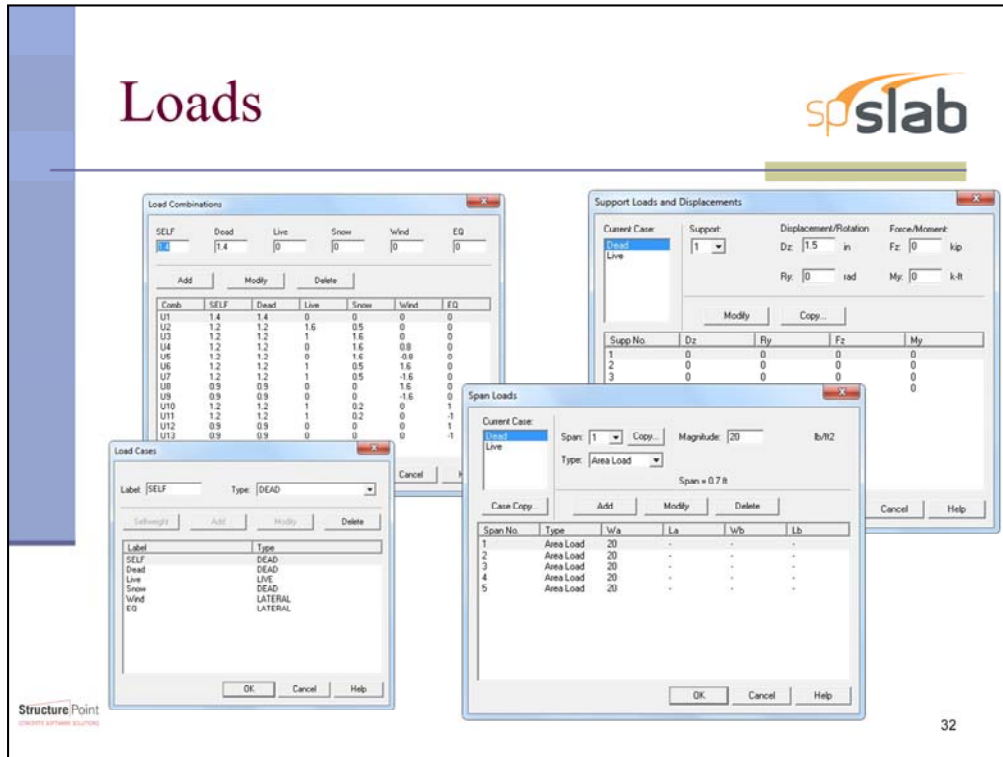
31

The choices for reinforcing change depending on the mode of spSlab being used. For the design mode the program takes user inputs for clear cover, the range of bar sizes, the minimum and maximum spacing between bars, as well as the minimum and maximum reinforcing ratio.

For the investigation mode, the bar size, number of bars, and their length are inputted as well as their location within the slab. For the horizontal position, the user can choose to either make the bars continuous across the bottom or top of the span, specific to just the left or right top of the span, or discontinuous through the bottom.

When performing the calculation of limits of reinforcing spacing spSlab accounts for the bend in the transverse reinforcing. Assuming that the bar makes contact at the middle of the bend gives a more accurate calculation of reinforcing spacing.

Loads



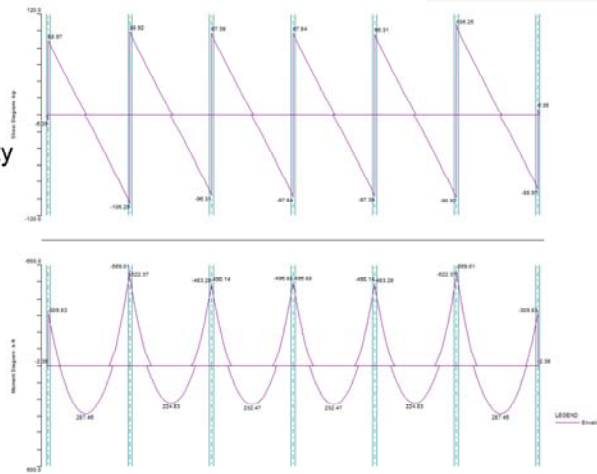
32

The user has load input choices of area loads, line loads, and point loads. These loads are designated a label to identify them and allow them to be factored. The system can be further modified to include concentrated forces on the supports along with prescribed support displacement and rotation. spSlab accounts for lateral loads as well by modeling them as moments acting on the ends of a span.

Graphical Output



- Loads
- Internal Forces
- Moment Capacity
- Shear Capacity
- Deflections
- Reinforcement



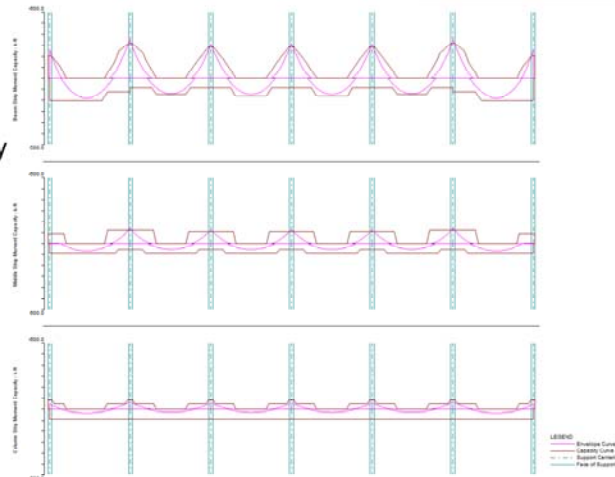
Internal Force Diagrams

With all of the inputs completed spSlab will provide the user with a graphical output of the loads acting on the system, the internal forces, the system's moment and shear capacity, the deflections, and the required reinforcing.

Graphical Output



- Loads
- Internal Forces
- Moment Capacity
- Shear Capacity
- Deflections
- Reinforcement



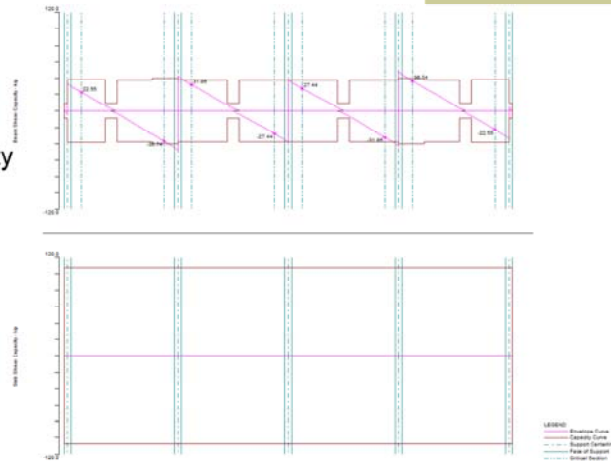
Moment Capacity Diagrams

The moment capacity diagrams include individual results for the beam strip, the column strip, and the middle strip.

Graphical Output



- Loads
- Internal Forces
- Moment Capacity
- Shear Capacity
- Deflections
- Reinforcement



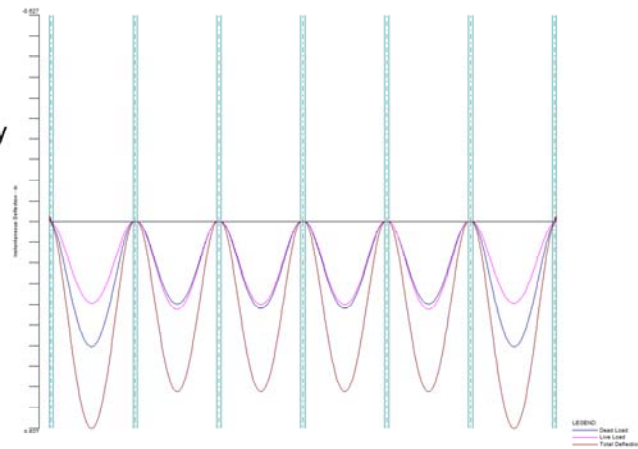
Shear Capacity Diagrams

The shear capacity diagrams include the results for both the beam and the slab.

Graphical Output



- Loads
- Internal Forces
- Moment Capacity
- Shear Capacity
- Deflections
- Reinforcement



Deflection Diagram

The deflection diagram displays the dead load, live load, a total deflections. Due to spSlab's capability to adjust the percent of live load sustained and time duration for long-term deflection calculation, the program allows for quick checks of ACI 9.5 – Control of deflections.

Text Ouput



- Input Echo
- Design Results
- Column Forces
- Internal Forces
- Deflections

The screenshot shows the 'Results Report' window with several sections of data:

Deflections

Span	Dir	Zone	Defl	Max	Min
1	Right	Right	0.00	-0.14	0.00
2	Left	Left	-0.41	-0.34	0.00
3	Left	Left	-0.35	-0.27	0.00
4	Left	Left	-0.35	-0.27	0.00
5	Left	Left	-0.35	-0.27	0.00

Column Forces

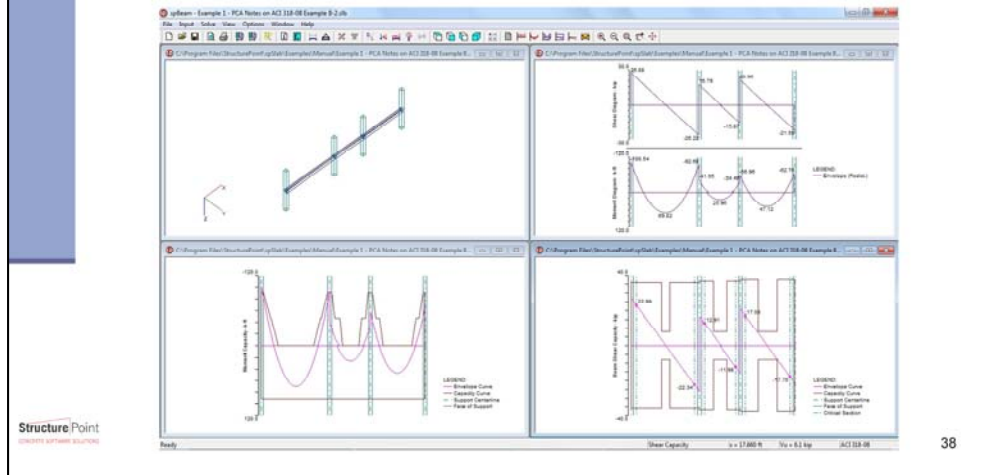
Span	Dir	Zone	Force	Max	Min
1	Right	Right	0.00	-0.00	0.00
2	Left	Left	-0.41	-0.34	0.00
3	Left	Left	-0.35	-0.27	0.00
4	Left	Left	-0.35	-0.27	0.00
5	Left	Left	-0.35	-0.27	0.00

Internal Forces

Span	Dir	Zone	Moment	Max	Min
1	Right	Right	0.00	-0.00	0.00
2	Left	Left	-0.41	-0.34	0.00
3	Left	Left	-0.35	-0.27	0.00
4	Left	Left	-0.35	-0.27	0.00
5	Left	Left	-0.35	-0.27	0.00

spSlab will also create a text based Results Report when the file has been solved. The report is split into an Input Echo, Design Results, Column Forces, Internal Forces, and Deflections. Each of these screens can be printed or saved individually or by using the Customize tab some or all of the sections can be combined into a single document.

- Analysis, design, and investigation of R/C beams and one-way slab systems



spBeam is a limited version of spSlab. It includes all the elements of spSlab that apply to beams and one-way slab systems. In this program, beams and slabs up to 22 spans can be analyzed and designed. Moment redistribution as well as torsion and shear design are available for beams. In addition to providing the area of reinforcing steel at the critical sections, spBeam provides a complete bar schedule that includes the number of bars, bar sizes, and lengths.

Options



The image displays two screenshots of the spBeam software's options dialog box. The left screenshot shows the 'General Information' tab, and the right screenshot shows the 'Solve Options' tab.

General Information (Left Screenshot):

- Labels: Project: spSlab/spBeam Manual, Example 1; Frame: PCA Notes on ACI 318-08, Example 8-2; Engineer: StructurePoint
- Options: Design code: ACI 318-08; Reinforcement: ASTM A615
- Run mode: Design; Investigation
- Frame: No. of Supports: 4
- Floor System: One-Way/Beam; Left cantilever; Right cantilever
- Other: Distance location as ratio of span

Solve Options (Right Screenshot):

- Design Options: Live load pattern ratio: 100 %
- Compression Reinforcement; Effective flange width
- Incremental Reinf. Design; Rigid beam-column joint
- Moment Redistribution
- Torsion Analysis and Design: Torsion type; Equilibrium; Compatibility; Stairs in flanges; No; Yes
- Deflection calculation options: Sections to use in deflection calculations are: Gross (uncracked); Effective (cracked)
- In negative moment regions, to calculate I_g and M_{cr} use: Rectangular Section; T-Section
- Calculate long-term deflections: Duration of load: 60 months; Sustained part of live load: 0 %

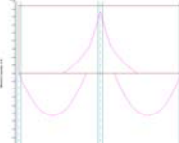
spBeam's options are similar to spSlab's, but notice that it forces the user to design the floor system as a one-way system. Beyond this, the options are identical to spSlab's one-way stem options.

Moment Redistribution



For ACI 318-08, 05, and 02

$$\delta = \begin{cases} 0, & \text{if } \epsilon_t < 0.0075 \\ 1000\epsilon_t, & \text{if } \epsilon_t \geq 0.0075 \end{cases} \text{ or}$$



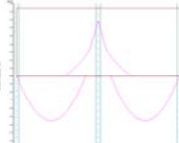
Top Reinforcement

Span Zone	Width	Width	Area (in ²)	Sp (in)	AsPrime	AsMin	AsMax	SpReq	AsReq	Bars
1 Left	2.08	0.00	0.467	0.000	0.000	1.084	9.792	0.000	3#8	*3
Middle	2.08	3.70	15.400	0.000	0.094	1.084	9.792	0.071	3#8	*3 *1
Right	2.08	33.18	23.333	0.000	0.136	1.084	9.792	0.704	3#8	*3
2 Left	2.08	33.18	0.467	0.000	0.136	1.084	9.792	0.704	3#8	*3
Middle	2.08	3.70	8.400	0.000	0.094	1.084	9.792	0.071	3#8	*3 *1
Right	2.08	0.00	23.333	0.000	0.000	1.084	9.792	0.000	3#8	*3

NOTES:
 *1 - Design governed by minimum reinforcement.
 *3 - Number of bars governed by maximum allowable spacing.

For ACI 318-99

$$\delta = \begin{cases} 0, & \text{if } (\rho - \rho') > 0.5\rho_b \\ 20\left(\frac{\rho - \rho'}{\rho_b}\right), & \text{if } (\rho - \rho') \leq 0.5\rho_b \end{cases} \text{ or}$$



Moment Redistribution Factors

Span	Side	Orig Mo	Calculated	Factored	Limit (%)	Applied
1	Right	0.00	0	0.00000	0.00	0.00
2	Left	33.18	8	0.20988	9.98	10.00
2	Right	33.18	8	0.20988	9.98	10.00
3	Left	0.00	0	0.00000	0.00	0.00

Top Reinforcement

Span Zone	Width	Width	Area (in ²)	Sp (in)	AsPrime	AsMin	AsMax	SpReq	AsReq	Bars
1 Left	2.08	0.00	0.467	0.000	0.000	1.084	9.792	0.000	3#8	*3
Middle	2.08	2.01	15.400	0.000	0.082	1.084	9.792	0.038	3#8	*3 *1
Right	2.08	23.44	23.333	0.000	0.136	1.084	9.792	0.418	3#8	*3
2 Left	2.08	23.44	0.467	0.000	0.136	1.084	9.792	0.418	3#8	*3
Middle	2.08	2.01	8.400	0.000	0.082	1.084	9.792	0.038	3#8	*3 *1
Right	2.08	0.00	23.333	0.000	0.000	1.084	9.792	0.000	3#8	*3

NOTES:
 *1 - Design governed by minimum reinforcement.
 *3 - Number of bars governed by maximum allowable spacing.

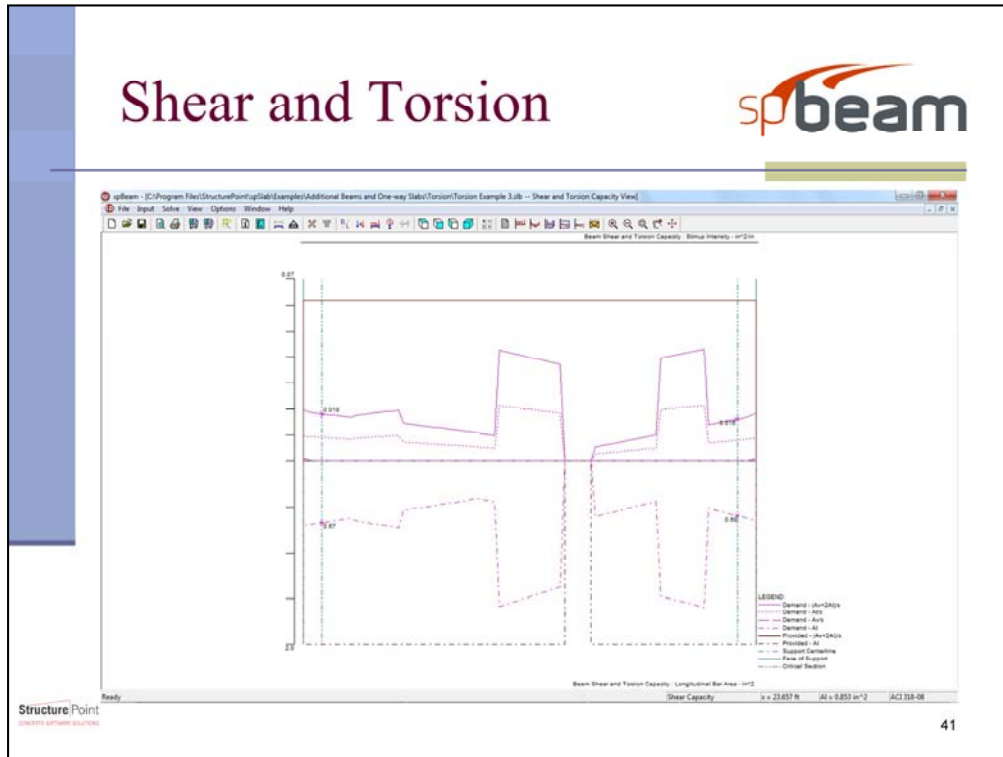
For CSA A23.3

$$\delta = 30 - 50\frac{c}{d}$$




The moment reduction option is available for all editions of both the CSA and ACI code. By using the equations shown, spBeam will allow for the reduction of negative moments. The results for a one-way system with the moment reduction option enabled displays the calculation procedure including the original moments and the percent factored.

Shear and Torsion



With the torsion option engaged, both shear and torsion contribute to the required transverse reinforcing. The torsional design is based on a thin-walled tube, space truss analogy. Either the equilibrium or compatibility torsion conditions can be applied. The capacity diagram as well as the text report split the required transverse reinforcing into that required for shear, torsion, and total capacity.

The moment redistribution and torsion design options are also available in spSlab.

The slide features the StructurePoint logo in the center, with 'Structure' in black and 'Point' in a larger black font, separated by a vertical line. A red line above 'Structure' forms a triangle pointing right. Below the logo, the text 'CONCRETE SOFTWARE SOLUTIONS' is written in red. A white rectangular box with a blue border contains the contact information: 'Call: +1-847-966-4357' and 'Email: info@StructurePoint.org' in red. The slide has a blue vertical bar on the left and a green horizontal bar at the top right.

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58

StructurePoint would be glad to hear from you and receive your feed back as well as answer any questions regarding the program features, capabilities, price, and licensing options