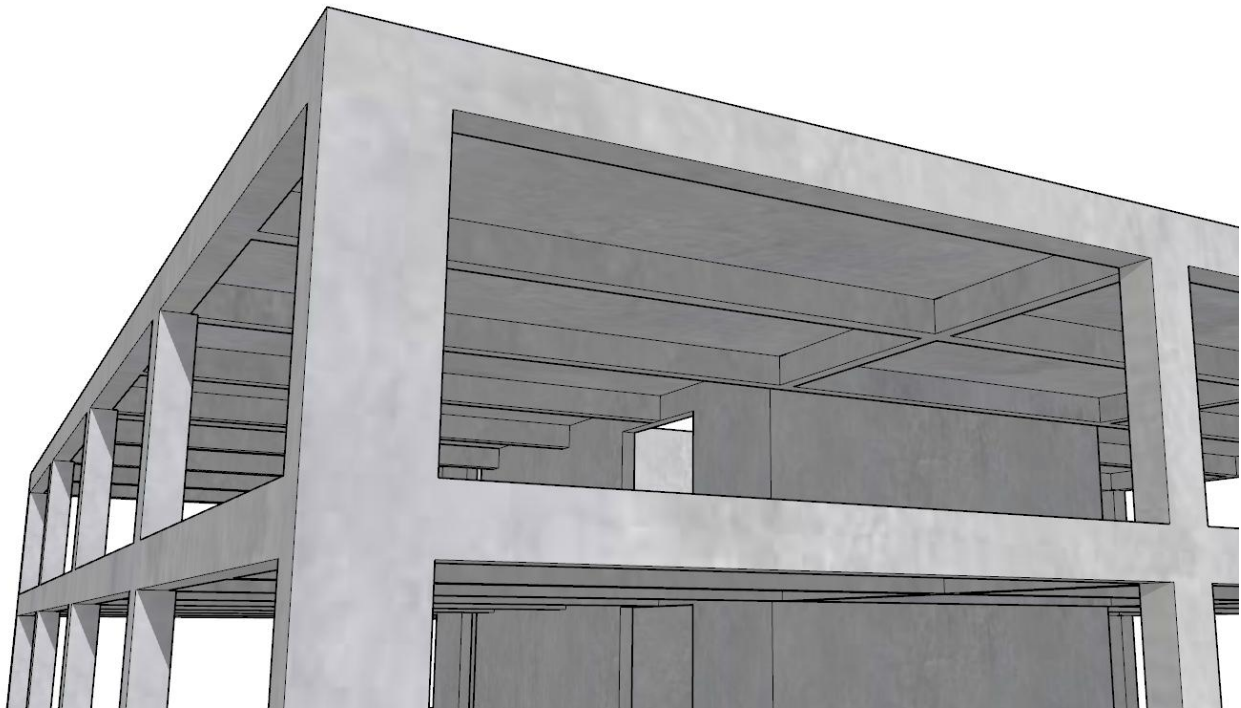
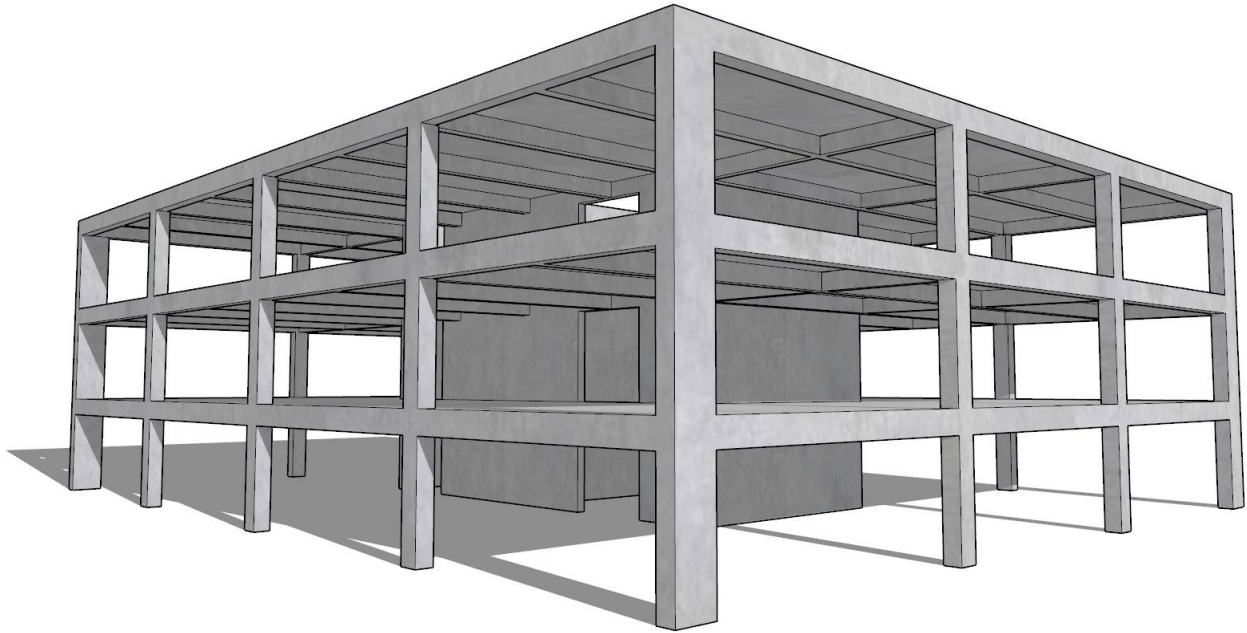


One-Way Slab Analysis and Design (ACI 318-14)



One-Way Slab Analysis and Design (ACI 318-14)

A one-way slab is a type of reinforced concrete floor system designed to carry loads predominantly in one direction. Typically, the ratio of the longer span length to the shorter span length in this system is greater than or equal to 2. In a one-way slab system, the reinforcement is primarily provided in the shorter span direction to resist the applied loads. However, minimum reinforcement is provided in the longer span direction to account for temperature and shrinkage effects.

This example will demonstrate the analysis and design of the one-way reinforced concrete slab shown below using ACI 318-14 provisions. Steps of the structural analysis, flexural design, shear design, and deflection checks will be presented. The results of hand calculations are then compared with the reference results and numerical analysis results obtained from the [spBeam](#) engineering software program by [StructurePoint](#).

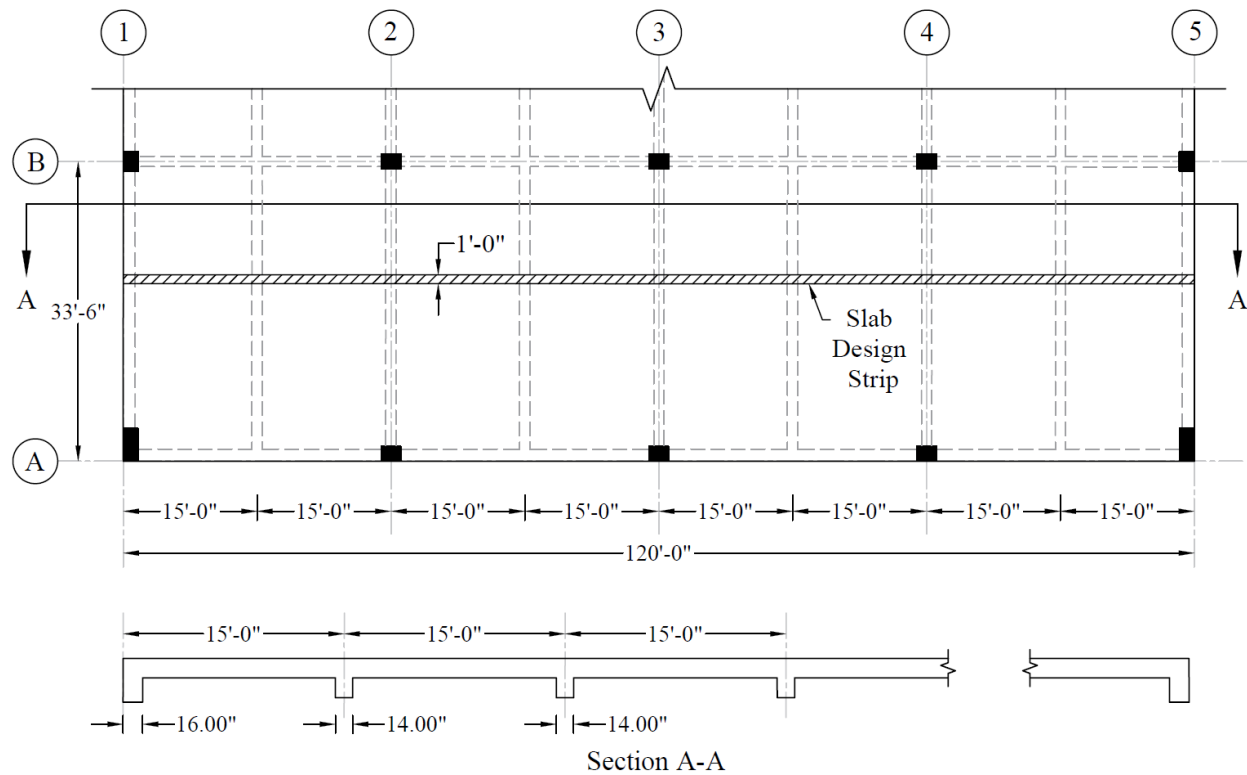


Figure 1 – Continuous One-Way Concrete Slab Floor System

Contents

1. Notations	2
2. Preliminary Member Sizing	4
3. Determination of Span Loads.....	4
4. Determination of Design Moment and Shear	5
5. Flexural Design	7
6. Shear Design	12
7. Design the Transverse Top Steel at Girders	12
8. Deflections	13
9. One-Way Slabs Analysis and Design – spBeam Software.....	13
10. Comparison of Design Results	39
11. Observations & Discussions.....	41
11.1. Modeling End Supports Conditions	41
11.2. Modeling Transverse Beams	41
11.3. One-Way (Beam Action) Shear Critical Section.....	42

Code

Building Code Requirements for Structural Concrete (ACI 318-14) and Commentary (ACI 318R-14)

References

- Reinforced Concrete Mechanics and Design, 7th Edition, 2016, James Wight, Pearson, Example 5-7
- [spBeam Engineering Software Program Manual v10.00](#), [STRUCTUREPOINT](#), 2024
- “[One-Way Wide Module \(Skip\) Joist Concrete Floor System Design \(ACI 318-14\)](#)” Design Example, [STRUCTUREPOINT](#), 2023
- “[Reinforced Concrete Continuous Beam Analysis and Design \(ACI 318-14\)](#)” Design Example, [STRUCTUREPOINT](#), 2018
- “[Deflection Observations in Girder-Supported Beams and One-way Slabs](#)” Technical Article, [STRUCTUREPOINT](#), 2017
- Contact Support@StructurePoint.org to obtain supplementary materials ([spBeam](#) model: DE-One-Way-Slab-ACI-318-14.slbx)

Design Data

$f'_c = 4,000$ psi normal weight concrete ($w_c = 150$ lb/ft³)

$f_y = 60,000$ psi

Superimposed dead load, $SDL = 20$ psf (floor covering, the ceiling, and mechanical equipment)

Live load, $L_o = 80$ psf (including partitions)

Use #4 bars for reinforcement ($A_s = 0.20$ in.², $d_b = 0.50$ in.)

Clear cover = 0.75 in.

ACI 318-14 (Table 20.6.1.3.1)

Solution

1. Notations

This section (based on ACI 318-14 provisions) defines notation and terminology used in this design example:

- a = depth of equivalent rectangular stress block, in.
- A_b = area of an individual bar or wire, in.²
- A_g = gross area of concrete section, in.² For a hollow section, A_g is the area of the concrete only and does not include the area of the void(s)
- A_s = area of nonprestressed longitudinal tension reinforcement, in.²
- $A_{s,min}$ = minimum area of flexural reinforcement, in.²
- b = width of compression face of member, in.
- b_w = web width or diameter of circular section, in.
- c = distance from extreme compression fiber to neutral axis, in.
- c_c = clear cover of reinforcement, in.
- d = distance from extreme compression fiber to centroid of longitudinal tension reinforcement, in.
- d_b = nominal diameter of bar, wire, or prestressing strand, in.
- f'_c = specified compressive strength of concrete, psi
- f_s = tensile stress in reinforcement at service loads, excluding prestressing reinforcement, psi
- f_y = specified yield strength for nonprestressed reinforcement, psi
- h = overall thickness, height, or depth of member, in.
- l = span length of beam or one-way slab; clear projection of cantilever, in.
- l_n = length of clear span measured face-to-face of supports, in.
- M_u = factored moment at section, in.-lb
- M_n = nominal flexural strength at section, in.-lb
- s = center-to-center spacing of items, such as longitudinal reinforcement, transverse reinforcement, tendons, or anchors, in.
- V_c = nominal shear strength provided by concrete, lb
- V_u = factored shear force at section, lb
- w_c = density, unit weight, of normalweight concrete or equilibrium density of lightweight concrete, lb/ft³

- w_u = factored load per unit length of beam or one-way slab, lb/in.
- β_1 = factor relating depth of equivalent rectangular compressive stress block to depth of neutral axis
- ε_t = net tensile strain in extreme layer of longitudinal tension reinforcement at nominal strength, excluding strains due to effective prestress, creep, shrinkage, and temperature
- λ = modification factor to reflect the reduced mechanical properties of lightweight concrete relative to normal weight concrete of the same compressive strength
- ρ = ratio of A_s to bd
- ϕ = strength reduction factor

2. Preliminary Member Sizing

In lieu of detailed calculation for deflections, ACI 318 Code gives minimum slab thickness for solid nonprestressed one-way slabs in **Table 7.3.1.1**.

For this one-way slab system, the minimum slab thicknesses per ACI 318-14 are:

$$\text{End bay: } h_s = \frac{l}{24} = \frac{15 \times 12 - \frac{16}{2}}{24} = \frac{172}{24} = 7.17 \text{ in.} \quad \text{\textit{ACI 318-14 (Table 7.3.1.1)}}$$

$$\text{Interior bays: } h_s = \frac{l}{28} = \frac{15 \times 12}{28} = \frac{180}{28} = 6.43 \text{ in.} \quad \text{\textit{ACI 318-14 (Table 7.3.1.1)}}$$

The reference selected a 7 in. slab thickness (slightly below 7.17 in.) which requires the assessment of the deflection in the exterior span.

3. Determination of Span Loads

$$\text{Slab Self-Weight} = t_{slab} \times w_c = \frac{7}{12} \times 150 = 87.50 \text{ lb/ft}^2$$

The following gravity load combinations are considered:

$$U = 1.40 \times D \quad \text{\textit{ACI 318-14 (Eq. 5.3.1a)}}$$

$$w_u = 1.40 \times (87.50 + 20) = 150.50 \text{ psf}$$

$$U = 1.20 \times D + 1.60 \times L \quad \text{\textit{ACI 318-14 (Eq. 5.3.1b)}}$$

$$w_u = 1.20 \times (87.50 + 20) + 1.60 \times 80 = 257.00 \text{ psf}$$

Span loads are governed by the second load combination.

4. Determination of Design Moment and Shear

The factored moment and shear can be determined using the ACI 318 simplified method if the following requirements are satisfied: **ACI 318-14 (6.5.1)**

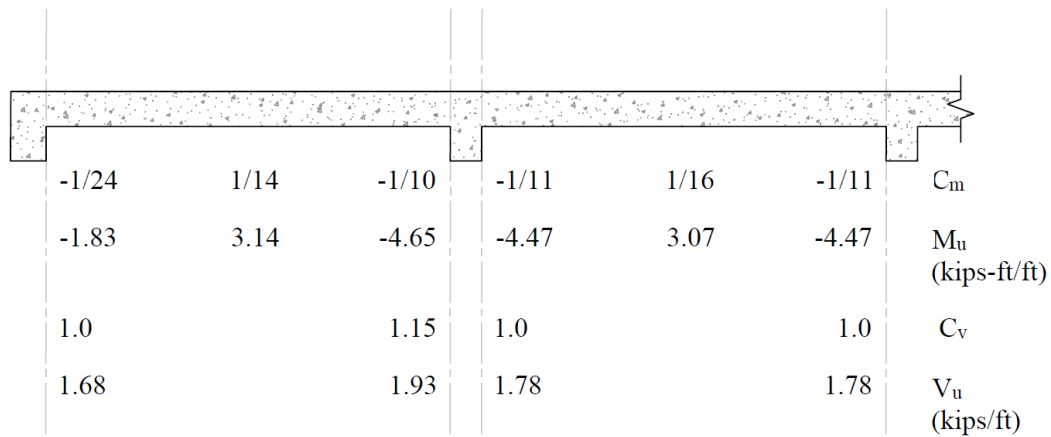
- ✓ Members are prismatic.
- ✓ Loads are uniformly distributed.
- ✓ $L \leq 3D$ ($80 \text{ psf} \leq 3 \times 107.50 = 322.50 \text{ psf}$)
- ✓ There are at least two spans.
- ✓ The longer of two adjacent spans does not exceed the shorter by more than 20 percent.

Thus, the approximate coefficients can be used. The factored moment and shear values are determined and summarized in the following tables. **ACI 318-14 (Table 6.5.2 and Table 6.5.3)**

Note that a unit strip of 1 ft is considered for the analysis and design of the one-way slab system covered in the Design Example.

Table 1 – One-Way Slab Design Moment Values		
Location		Design Moment Value
End Spans	Exterior Support Negative*	$\frac{w_u \times l_n^2}{24} = \frac{0.257 \times 13.08^2}{24} = 1.83 \frac{\text{kips-ft}}{\text{ft}}$
	Mid-span*	$\frac{w_u \times l_n^2}{14} = \frac{0.257 \times 13.08^2}{14} = 3.14 \frac{\text{kips-ft}}{\text{ft}}$
	Interior Support Negative†	$\frac{w_u \times l_n^2}{10} = \frac{0.257 \times 13.46^2}{10} = 4.65 \frac{\text{kips-ft}}{\text{ft}}$
Interior Spans	Mid-span Positive**	$\frac{w_u \times l_n^2}{16} = \frac{0.257 \times 13.83^2}{16} = 3.07 \frac{\text{kips-ft}}{\text{ft}}$
	Support Negative**	$\frac{w_u \times l_n^2}{11} = \frac{0.257 \times 13.83^2}{11} = 4.47 \frac{\text{kips-ft}}{\text{ft}}$
* $l_n = 15.00 - \frac{16}{12} - \frac{14}{2 \times 12} = 13.08 \text{ ft}$ ** $l_n = 15.00 - \frac{14}{2 \times 12} - \frac{14}{2 \times 12} = 13.83 \text{ ft}$ † $l_n = \frac{13.08 + 13.83}{2} = 13.46 \text{ ft}$ <u>ACI 318-14 (Table 6.5.2)</u>		

Table 2 – One-Way Slab Design Shear Values	
Location	Design Shear Value
End Span at Face of First Interior Support	$1.15 \times \frac{w_u \times l_n}{2} = 1.15 \times \frac{0.257 \times 13.08}{2} = 1.93 \frac{\text{kips}}{\text{ft}}$
At Face of all other Supports	$\frac{w_u \times l_n}{2} = \frac{0.257 \times 13.08}{2} = 1.68 \frac{\text{kips}}{\text{ft}}$ (For Exterior Spans)
	$\frac{w_u \times l_n}{2} = \frac{0.257 \times 13.83}{2} = 1.78 \frac{\text{kips}}{\text{ft}}$ (For Interior Spans)



The diagram shows a horizontal slab with four vertical supports. The slab is divided into three spans. Below the slab, a table lists design values for each span and at the supports. The values are: Span 1: -1/24, 1/14, -1/10; Support 1: -1.83, 3.14, -4.65; Span 2: -1/11, 1/16, -1/11; Support 2: -4.47, 3.07, -4.47; Span 3: 1.0, 1.15, 1.0; Support 3: 1.68, 1.93, 1.78. The values are in kips-ft/ft for moments and kips/ft for shear.

-1/24	1/14	-1/10	-1/11	1/16	-1/11	C_m
-1.83	3.14	-4.65	-4.47	3.07	-4.47	M_u (kips-ft/ft)
1.0		1.15	1.0		1.0	C_v
1.68		1.93	1.78		1.78	V_u (kips/ft)

Figure 2 – Moment and Shear Coefficients and Design Values

5. Flexural Design

Calculate the required reinforcement to resist the first interior support negative moment:

$$M_u = 4.65 \text{ kips-ft/ft}$$

Use #4 bars with 0.75 in. concrete clear cover per ACI 318-14 (Table 20.6.1.3.1). The distance from extreme compression fiber to the centroid of longitudinal tension reinforcement, d , is calculated below:

$$d = h - \text{clear cover} - \frac{d_{\text{Longitudinal bar}}}{2}$$

$$d = 7.00 - 0.75 - \frac{0.50}{2} = 6.00 \text{ in.}$$

To determine the area of steel, assumptions have to be made whether the section is tension or compression controlled, and regarding the distance between the resultant compression and tension forces along the slab section (jd). In this example, tension-controlled section will be assumed so the reduction factor ϕ is equal to 0.90, and jd will be taken equal to $0.978 \times d$. The assumptions will be verified once the area of steel is finalized.

$$\text{Assume } jd = 0.978 \times d = 0.978 \times 6.00 = 5.87 \text{ in.}$$

Unit strip width, $b = 12 \text{ in.}$

$$A_s = \frac{M_u}{\phi \times f_y \times jd} = \frac{4.65 \times 12,000}{0.90 \times 60,000 \times 5.87} = 0.176 \frac{\text{in.}^2}{\text{ft}}$$

Recalculate 'a' for the actual $A_s = 0.176 \text{ in.}^2$ per ft:

$$a = \frac{A_s \times f_y}{0.85 \times f'_c \times b} = \frac{0.176 \times 60,000}{0.85 \times 4,000 \times 12} = 0.259 \text{ in.}$$

$$c = \frac{a}{\beta_1} = \frac{0.259}{0.85} = 0.305 \text{ in.}$$

$$\varepsilon_t = \left(\frac{0.003}{c} \right) \times d_t - 0.003 = \left(\frac{0.003}{0.305} \right) \times 6.00 - 0.003 = 0.056 > 0.005$$

Therefore, the assumption that section is tension-controlled is valid.

$$A_s = \frac{M_u}{\phi \times f_y \times \left(d - \frac{a}{2} \right)} = \frac{4.65 \times 12,000}{0.90 \times 60,000 \times \left(6.00 - \frac{0.259}{2} \right)} = 0.176 \frac{\text{in.}^2}{\text{ft}}$$

The minimum reinforcement shall not be less than

$$A_{s,min} = \text{greater of } \begin{cases} \frac{0.0018 \times 60,000}{f_y} A_g \\ 0.0014 A_g \end{cases} = \begin{cases} \frac{0.0018 \times 60,000}{60,000} \times 12 \times 7 \\ 0.0014 \times 12 \times 7 \end{cases} = \begin{cases} 0.151 \\ 0.118 \end{cases} = 0.151 \frac{\text{in.}^2}{\text{ft}}$$

ACI 318-14 (Table 7.6.1.1)

$$A_{s,req} = \max \left\{ \begin{matrix} A_s \\ A_{s,min} \end{matrix} \right\} = \max \left\{ \begin{matrix} 0.176 \\ 0.151 \end{matrix} \right\} = 0.176 \frac{\text{in.}^2}{\text{ft}}$$

For this required steel area, the steel reinforcement ratio is

$$\rho = \frac{A_s / \text{ft}}{b \times d} = \frac{0.176}{12 \times 6} = 0.00245$$

This reinforcement ratio is notably low, typical for many slabs. Hence, it's evident that the selected slab thickness is adequate for the design bending moments.

$$\text{Provide No. 4 bars at 12 in. } A_{s,prov} = 0.20 \frac{\text{in.}^2}{\text{ft}} > A_{s,req} = 0.176 \frac{\text{in.}^2}{\text{ft}}$$

The maximum allowed spacing (s_{max}):

$$s_{max} = \text{lesser of } \begin{cases} 3h \\ 18 \text{ in.} \end{cases} = \begin{cases} 3 \times 7 \\ 18 \text{ in.} \end{cases} = \begin{cases} 21 \text{ in.} \\ 18 \text{ in.} \end{cases} = 18 \text{ in.}$$

ACI 318-14 (7.7.2.3)

Thus, $s = 12 \text{ in.} < s_{max} = 18 \text{ in.}$

Calculate the required reinforcement to resist the exterior span positive moment:

$$M_u = 3.14 \text{ kips-ft/ft}$$

The distance from extreme compression fiber to the centroid of longitudinal tension reinforcement:

$$d = 6.00 \text{ in.}$$

To determine the area of steel, assumptions have to be made whether the section is tension or compression controlled, and regarding the distance between the resultant compression and tension forces along the slab section (jd). In this example, tension-controlled section will be assumed so the reduction factor ϕ is equal to 0.9, and jd will be taken equal to $0.986 \times d$. The assumptions will be verified once the area of steel is finalized.

$$\text{Assume } jd = 0.986 \times d = 0.986 \times 6.00 = 5.91 \text{ in.}$$

Unit strip width, $b = 12 \text{ in.}$

$$A_s = \frac{M_u}{\phi \times f_y \times jd} = \frac{3.14 \times 12,000}{0.90 \times 60,000 \times 5.91} = 0.118 \frac{\text{in.}^2}{\text{ft}}$$

Recalculate 'a' for the actual $A_s = 0.118 \text{ in.}^2$ per ft:

$$a = \frac{A_s \times f_y}{0.85 \times f'_c \times b} = \frac{0.118 \times 60,000}{0.85 \times 4,000 \times 12} = 0.174 \text{ in.}$$

$$c = \frac{a}{\beta_1} = \frac{0.174}{0.85} = 0.204 \text{ in.}$$

$$\varepsilon_t = \left(\frac{0.003}{c} \right) \times d_t - 0.003 = \left(\frac{0.003}{0.204} \right) \times 6.00 - 0.003 = 0.085 > 0.005$$

Therefore, the assumption that section is tension-controlled is valid.

$$A_s = \frac{M_u}{\phi \times f_y \times \left(d - \frac{a}{2} \right)} = \frac{3.14 \times 12,000}{0.90 \times 60,000 \times \left(6.00 - \frac{0.174}{2} \right)} = 0.118 \frac{\text{in.}^2}{\text{ft}}$$

The minimum reinforcement shall not be less than

$$A_{s,min} = \text{greater of } \begin{cases} \frac{0.0018 \times 60,000}{f_y} A_g \\ 0.0014 A_g \end{cases} = \begin{cases} \frac{0.0018 \times 60,000}{60,000} \times 12 \times 7 \\ 0.0014 \times 12 \times 7 \end{cases} = \begin{cases} 0.151 \\ 0.118 \end{cases} = 0.151 \frac{\text{in.}^2}{\text{ft}}$$

ACI 318-14 (Table 7.6.1.1)

$$A_{s,req} = \max \left\{ \begin{matrix} A_s \\ A_{s,min} \end{matrix} \right\} = \max \left\{ \begin{matrix} 0.118 \\ 0.151 \end{matrix} \right\} = 0.151 \frac{\text{in.}^2}{\text{ft}}$$

Provide No. 4 bars at 12 in. $A_{s,prov} = 0.20 \frac{\text{in.}^2}{\text{ft}} > A_{s,req} = 0.151 \frac{\text{in.}^2}{\text{ft}}$

The maximum allowed spacing (s_{max}):

$$s_{max} = \text{lesser of } \begin{cases} 3h \\ 18 \text{ in.} \end{cases} = \begin{cases} 3 \times 7 \\ 18 \text{ in.} \end{cases} = \begin{cases} 21 \text{ in.} \\ 18 \text{ in.} \end{cases} = 18 \text{ in.} \quad \text{ACI 318-14 (7.7.2.3)}$$

Thus, $s = 12 \text{ in.} < s_{max} = 18 \text{ in.}$

Check the shrinkage and temperature reinforcement ($A_{s,S\&T}$) requirement:

$$A_{s,S\&T} = 0.0018 \times b \times h = 0.0018 \times 12 \times 7 = 0.151 \frac{\text{in.}^2}{\text{ft}} \geq 0.0014 \frac{\text{in.}^2}{\text{ft}} \quad \text{ACI 318-14 (Table 7.6.1.1)}$$

$$s_{max,S\&T} = \text{lesser of } \begin{cases} 5h \\ 18 \text{ in.} \end{cases} = \begin{cases} 5 \times 7 \\ 18 \text{ in.} \end{cases} = \begin{cases} 35 \text{ in.} \\ 18 \text{ in.} \end{cases} = 18 \text{ in.} \quad \text{ACI 318-14 (7.7.2.4)}$$

Thus, use $s = 15 \text{ in.} < s_{max,S\&T} = 18 \text{ in.}$

Therefore, provide No. 4 bars at 15 in. o.c., as shrinkage and temperature reinforcement.

$$A_s / \text{ft} = A_b \left(\frac{12 \text{ in.}}{\text{bar spacing in inches, } s} \right) = 0.20 \times \left(\frac{12 \text{ in.}}{15 \text{ in.}} \right) = 0.160 \frac{\text{in.}^2}{\text{ft}} > A_{s,S\&T} = 0.151 \frac{\text{in.}^2}{\text{ft}}$$

Using the equation above, this results in a steel area equal to 0.160 in.²/ft. These bars can be placed either in the top or bottom of the slab. If they are placed at the top, they should be placed below the top flexural reinforcement to permit the larger effective depth for that flexural reinforcement, and similarly, they should be placed on top of the bottom layer of flexural reinforcement, as shown in [Figure 3](#).

Check reinforcement spacing for crack control:

The maximum spacing of the flexural reinforcement closest to the tension face of the slab shall be:

$$s = 15 \times \left(\frac{40,000}{f_s} \right) - 2.5 \times c_c \leq 12 \times \left(\frac{40,000}{f_s} \right) \quad \text{ACI 318-14 (Table 24.3.2)}$$

$$f_s = \frac{2}{3} \times f_y = \frac{2}{3} \times 60,000 = 40,000 \text{ psi} \quad \text{ACI 318-14 (24.3.2.1)}$$

$$c_c = 0.75 \text{ in.}$$

Thus,

At supports and mid-span

$$s = 15 \times \left(\frac{40,000}{40,000} \right) - 2.50 \times 0.75 = 13.13 \text{ in.} \leq 12 \times \left(\frac{40,000}{40,000} \right) = 12 \text{ in.}$$

$$s = 12 \text{ in.} < s_{max} = 18 \text{ in.}$$

Thus, maximum bar spacing is 12 in.

Based on the procedure outlined above, values for all span locations are given in the following table.

Table 3 – One-Way Slab Flexural Design Summary					
	External Support	Exterior Midspan	First Interior Support	Interior Midspan	Second Interior Support
M_u (kips-ft/ft)	1.83	3.14	4.65	3.07	4.47
A_{s, req'd} (in.²)	0.068	0.118	0.176	0.115	0.169
A_{s, min} (in.²)	0.151	0.151	0.151	0.151	0.151
Select bars	No. 4 at 12 in.	No. 4 at 12 in.	No. 4 at 12 in.	No. 4 at 12 in.	No. 4 at 12 in.
A_{s, provided} (in.²)	0.200	0.200	0.200	0.200	0.200

The reference provides standard bar cutoff points for one-way slabs that satisfy the limitations on span lengths and loadings in ACI 318-14 (Table 6.5.2). These values are shown in the [following Figure](#).

Wight 7th (8-8 and Fig. A-5c)

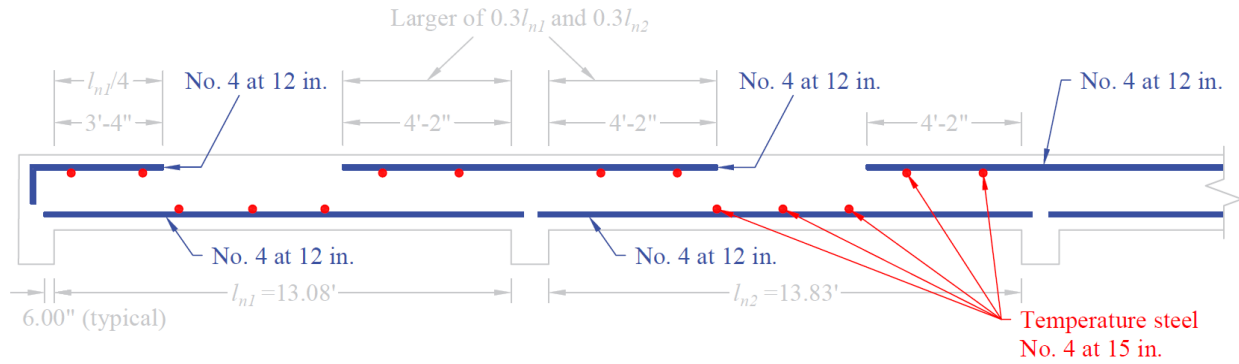


Figure 3 – Slab Reinforcement Detailing

6. Shear Design

From [Table 2](#) above, the shear value in end span at face of first interior support governs.

$$V_u = 1.15 \times \frac{w_u \times l_n}{2} = 1.15 \times \frac{0.257 \times 13.08}{2} = 1.93 \frac{\text{kips}}{\text{ft}}$$

Shear strength provided by concrete:

$$\phi V_c = \phi \times (2 \times \lambda \times \sqrt{f'_c} \times b_w \times d) \quad \text{ACI 318-14 (Eq. 22.5.5.1)}$$

$$\phi V_c = 0.75 \times (2.00 \times 1.00 \times \sqrt{4,000} \times 12 \times 6) = 6830.52 \frac{\text{lb}}{\text{ft}} = 6.83 \frac{\text{kips}}{\text{ft}}$$

Where:

$$\lambda = 1.00 \text{ (for Normal Weight)} \quad \text{ACI 318-14 (Table 19.2.4.2)}$$

$$\phi = 0.75 \text{ (for Shear)} \quad \text{ACI 318-14 (Table 21.2.1)}$$

$$V_u = 1.93 \frac{\text{kips}}{\text{ft}} < \phi V_c = 6.83 \frac{\text{kips}}{\text{ft}}$$

Therefore, the slab shear capacity is adequate.

7. Design the Transverse Top Steel at Girders

[ACI 318-19 \(7.5.2.3\)](#) requires that top transverse reinforcement be designed for the slab to carry the factored floor load acting on the effective width of the overhanging flange (slab), which is assumed to act as a cantilevered beam. The definitions for the width of the overhanging slab are given in [ACI 318-19 \(Table 6.3.2.1\)](#) for interior and exterior girders. For this floor system, the [Reference](#) provides additional discussion.

8. Deflections

Since the preliminary slab thickness met minimum thickness requirement, the deflection calculations are not required except for the exterior bay. Deflection values are calculated and provided for every model created by [spBeam](#) Program and can be used by the engineer to make additional optimization decisions for all the spans including the exterior bay. Refer to [spBeam Results Section 1.5.1](#) notes related to the minimum slab thickness, and [Section 3.2.1](#) for instantaneous deflection values to assess deflection against applicable limits.

9. One-Way Slabs Analysis and Design – spBeam Software

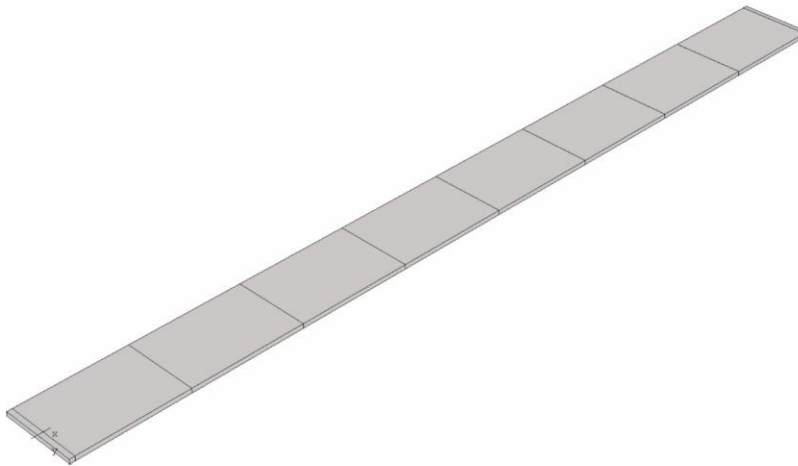
[spBeam](#) is widely used for analysis, design and investigation of beams, and one-way slab systems (including standard and wide module joist systems) per American (ACI 318-14) and Canadian (CSA A23.3-14) codes. [spBeam](#) can be used for new designs or investigation of existing structural members subjected to flexure, shear, and torsion loads. With capacity to integrate up to 20 spans and two cantilevers of wide variety of floor system types, [spBeam](#) is equipped to provide cost-effective, accurate, and fast solutions to engineering challenges.

[spBeam](#) provides top and bottom bar details including development lengths and material quantities, as well as live load patterning and immediate and long-term deflection results. Using the moment redistribution feature engineers can deliver safe designs with savings in materials and labor. Engaging this feature allows up to 20% reduction of negative moments over supports reducing reinforcement congestions in these areas.

For illustration and comparison purposes, the following figures provide a sample of the results obtained from an [spBeam](#) model created for the one way slab discussed in this example.



spBeam v10.00 (TM)
A Computer Program for Analysis, Design, and Investigation of
Reinforced Concrete Beams and One-way Slab Systems
Copyright © 1988-2024, STRUCTUREPOINT, LLC.
All rights reserved



StructurePoint

Licensee stated above acknowledges that STRUCTUREPOINT (SP) is not and cannot be responsible for either the accuracy or adequacy of the material supplied as input for processing by the spBeam computer program. Furthermore, STRUCTUREPOINT neither makes any warranty expressed nor implied with respect to the correctness of the output prepared by the spBeam program. Although STRUCTUREPOINT has endeavored to produce spBeam error free the program is not and cannot be certified infallible. The final and only responsibility for analysis, design and engineering documents is the licensee's. Accordingly, STRUCTUREPOINT disclaims all responsibility in contract, negligence or other tort for any analysis, design or engineering documents prepared in connection with the use of the spBeam program. Licensed to: StructurePoint, LLC. License ID: 00000-0000000-4-1C985-1C985

Contents

1. Input Echo.....	3
1.1. General Information.....	3
1.2. Solve Options.....	3
1.3. Material Properties.....	3
1.3.1. Concrete: Slabs / Beams.....	3
1.3.2. Concrete: Columns.....	3
1.3.3. Reinforcing Steel.....	3
1.4. Reinforcement Database.....	4
1.5. Span Data.....	4
1.5.1. Slabs.....	4
1.6. Support Data.....	4
1.6.1. Columns.....	4
1.6.2. Boundary Conditions.....	4
1.7. Load Data.....	5
1.7.1. Load Cases and Combinations.....	5
1.7.2. Area Loads.....	5
1.8. Reinforcement Criteria.....	6
1.8.1. Slabs and Ribs.....	6
1.8.2. Beams.....	6
2. Design Results.....	6
2.1. Top Reinforcement.....	6
2.2. Top Bar Details.....	7
2.3. Top Bar Development Lengths.....	8
2.4. Bottom Reinforcement.....	8
2.5. Bottom Bar Details.....	9
2.6. Bottom Bar Development Lengths.....	9
2.7. Flexural Capacity.....	10
2.8. Slab Shear Capacity.....	12
2.9. Material TakeOff.....	12
2.9.1. Reinforcement in the Direction of Analysis.....	12
3. Deflection Results: Summary.....	12
3.1. Section Properties.....	12
3.1.1. Frame Section Properties.....	12
3.1.2. Frame Effective Section Properties.....	13
3.2. Instantaneous Deflections.....	14
3.2.1. Extreme Instantaneous Frame Deflections and Corresponding Locations.....	14
3.3. Long-term Deflections.....	15
3.3.1. Long-term Deflection Factors.....	15
3.3.2. Extreme Long-term Frame Deflections and Corresponding Locations.....	15
4. Screenshots.....	17
4.1. Extrude 3D view.....	17
4.2. Loads - Case A - SELF.....	18
4.3. Loads - Case B - Dead.....	19
4.4. Loads - Case C - Live.....	20
4.5. Internal Forces.....	21
4.6. Moment Capacity.....	22
4.7. Shear Capacity.....	23
4.8. Deflection.....	24
4.9. Reinforcement.....	25

STRUCTUREPOINT - spBeam v10.00 (TM)
Licensed to: StructurePoint, LLC. License ID: 00000-0000000-4-1C985-1C985
C:\StructurePoint\spBeam\DE-One-Way-Slab-ACI-14.slbx

Page | 3
10/7/2025
12:03 PM

1. Input Echo

1.1. General Information

File Name	C:\StructurePoint\...DE-One-Way-Slab-ACI-14.slbx
Project	One-Way Slab
Frame	Interior Frame
Engineer	StructurePoint
Code	ACI 318-14
Units	English
Reinforcement Database	ASTM A615
Mode	Design
Number of supports =	9 + Left Cantilever + Right Cantilever
Floor System	One-Way/Beam

1.2. Solve Options

Live load pattern ratio = 100%
Deflections are based on cracked section properties.
In negative moment regions, Ig and Mcr DO NOT include flange/slab contribution (if available)
Long-term deflections are calculated for load duration of 60 months.
0% of live load is sustained.
Compression reinforcement calculations NOT selected.
Default incremental rebar design selected.
Moment redistribution NOT selected.
Effective flange width calculations NOT selected.
Rigid beam-column joint NOT selected.
Torsion analysis and design NOT selected.

1.3. Material Properties

1.3.1. Concrete: Slabs / Beams

w _c	150 pcf
f' _c	4 ksi
E _c	3834.25 ksi
f _r	0.474342 ksi

1.3.2. Concrete: Columns

w _c	150 pcf
f' _c	4 ksi
E _c	3834.25 ksi
f _r	0.474342 ksi

1.3.3. Reinforcing Steel

f _y	60 ksi
f _{yt}	60 ksi
E _s	29000 ksi
Epoxy coated bars	No

STRUCTUREPOINT - spBeam v10.00 (TM)
Licensed to: StructurePoint, LLC. License ID: 00000-000000-4-1C985-1C985
C:\StructurePoint\spBeam\DE-One-Way-Slab-ACI-14.slbx

Page | 4
10/7/2025
12:03 PM

1.4. Reinforcement Database

Size	Db	Ab	Wb	Size	Db	Ab	Wb
	in	in ²	lb/ft		in	in ²	lb/ft
#3	0.38	0.11	0.38	#4	0.50	0.20	0.67
#5	0.63	0.31	1.04	#6	0.75	0.44	1.50
#7	0.88	0.60	2.04	#8	1.00	0.79	2.67
#9	1.13	1.00	3.40	#10	1.27	1.27	4.30
#11	1.41	1.56	5.31	#14	1.69	2.25	7.65
#18	2.26	4.00	13.60				

1.5. Span Data

1.5.1. Slabs

Notes:

*a - Deflection check required for panels where slab thickness (t) is less than minimum (Hmin).

The program checks one-way slab or beam thickness based on minimum requirement for ACI 318-14 code as specified in Tables 7.3.1.1 and 9.3.1.1.

Span	Loc	L1	t	wL	wR	H _{min}
		ft	in	ft	ft	in
1	Int	0.667	7.00	5.000	5.000	0.80 LC
2	Int	14.333	7.00	5.000	5.000	7.17 *a
3	Int	15.000	7.00	5.000	5.000	6.43 ---
4	Int	15.000	7.00	5.000	5.000	6.43 ---
5	Int	15.000	7.00	5.000	5.000	6.43 ---
6	Int	15.000	7.00	5.000	5.000	6.43 ---
7	Int	15.000	7.00	5.000	5.000	6.43 ---
8	Int	15.000	7.00	5.000	5.000	6.43 ---
9	Int	14.333	7.00	5.000	5.000	7.17 *a
10	Int	0.667	7.00	5.000	5.000	0.80 RC

1.6. Support Data

1.6.1. Columns

Support	c1a	c2a	Ha	c1b	c2b	Hb	Red %
	in	in	ft	in	in	ft	
1	0.00	0.00	0.000	16.00	120.00	0.000	100
2	0.00	0.00	0.000	14.00	120.00	0.000	100
3	0.00	0.00	0.000	14.00	120.00	0.000	100
4	0.00	0.00	0.000	14.00	120.00	0.000	100
5	0.00	0.00	0.000	14.00	120.00	0.000	100
6	0.00	0.00	0.000	14.00	120.00	0.000	100
7	0.00	0.00	0.000	14.00	120.00	0.000	100
8	0.00	0.00	0.000	14.00	120.00	0.000	100
9	0.00	0.00	0.000	16.00	120.00	0.000	100

1.6.2. Boundary Conditions

Support	Spring		Far End	
	K _z	K _{ry}	Above	Below
	kips/in	kip-in/rad		
1	0.00	357200.00	Fixed	Fixed
2	0.00	0.00	Fixed	Fixed
3	0.00	0.00	Fixed	Fixed
4	0.00	0.00	Fixed	Fixed
5	0.00	0.00	Fixed	Fixed
6	0.00	0.00	Fixed	Fixed
7	0.00	0.00	Fixed	Fixed
8	0.00	0.00	Fixed	Fixed

Rotational stiffness can be used to simulate the end support condition (for this example, the end support is a spandrel beam integral to the external span end). The ACI code approximates the moment at spandrel beam end support to $(w_u \times l_n^2)/24$ (ACI 318-14 Table 6.5.2). This can be used as a basis to estimate the rotational stiffness of the spandrel beam with a few iterations.

STRUCTUREPOINT - spBeam v10.00 (TM)
Licensed to: StructurePoint, LLC. License ID: 00000-0000000-4-1C985-1C985
C:\StructurePoint\spBeam\DE-One-Way-Slab-ACI-14.slbx

Page | 5
10/7/2025
12:03 PM

Support	Spring		Far End	
	K _x kips/in	K _y kip-in/rad	Above	Below
9	0.00	357200.00	Fixed	Fixed

1.7. Load Data

1.7.1. Load Cases and Combinations

Case	SELF	Dead	Live
Type	DEAD	DEAD	LIVE
U1	1.200	1.200	1.600

1.7.2. Area Loads

Case/Patt	Span	Wa psf
SELF	1	87.50
	2	87.50
	3	87.50
	4	87.50
	5	87.50
	6	87.50
	7	87.50
	8	87.50
	9	87.50
	10	87.50
Dead	1	20.00
	2	20.00
	3	20.00
	4	20.00
	5	20.00
	6	20.00
	7	20.00
	8	20.00
	9	20.00
	10	20.00
Live	1	80.00
	2	80.00
	3	80.00
	4	80.00
	5	80.00
	6	80.00
	7	80.00
	8	80.00
	9	80.00
	10	80.00
Live/Odd	1	80.00
	3	80.00
	5	80.00
	7	80.00
Live/Even	9	80.00
	2	80.00
	4	80.00
	6	80.00
Live/S1	8	80.00
	10	80.00
	1	80.00

STRUCTUREPOINT - spBeam v10.00 (TM)
Licensed to: StructurePoint, LLC. License ID: 00000-0000000-4-1C985-1C985
C:\StructurePoint\spBeam\DE-One-Way-Slab-ACI-14.slbx

Page | 6
10/7/2025
12:03 PM

Case/Patt	Span	Wa psf
	2	80.00
Live/S2	2	80.00
	3	80.00
Live/S3	3	80.00
	4	80.00
Live/S4	4	80.00
	5	80.00
Live/S5	5	80.00
	6	80.00
Live/S6	6	80.00
	7	80.00
Live/S7	7	80.00
	8	80.00
Live/S8	8	80.00
	9	80.00
Live/S9	9	80.00
	10	80.00

1.8. Reinforcement Criteria

1.8.1. Slabs and Ribs

	Units	Top Bars		Bottom Bars	
		Min.	Max.	Min.	Max.
Bar Size		#4	#4	#4	#4
Bar spacing	in	1.00	18.00	1.00	18.00
Reinf ratio	%	0.14	5.00	0.14	5.00
Clear Cover	in	0.75		0.75	

There is NOT more than 12 in of concrete below top bars.

1.8.2. Beams

	Units	Top Bars		Bottom Bars		Stirrups	
		Min.	Max.	Min.	Max.	Min.	Max.
Bar Size		#5	#8	#5	#8	#3	#5
Bar spacing	in	1.00	18.00	1.00	18.00	6.00	18.00
Reinf ratio	%	0.14	5.00	0.14	5.00		
Clear Cover	in	1.50		1.50			
Layer dist.	in	1.00		1.00			
No. of legs						2	6
Side cover	in					1.50	
1st Stirrup	in					3.00	

There is NOT more than 12 in of concrete below top bars.

2. Design Results

2.1. Top Reinforcement

Notes:

*3 - Design governed by minimum reinforcement.

*5 - Number of bars governed by maximum allowable spacing.

Span Zone	Width ft	M _{max} kip-ft	X _{max} ft	A _{s,min} in ²	A _{s,max} in ²	A _{s,req} in ²	S _{p,prov} in	Bars
1 Left	10.00	0.00	0.000	1.512	13.005	0.000	12.000	10-#4 *3 *5
Midspan	10.00	0.00	0.000	1.512	13.005	0.000	12.000	10-#4 *3 *5
Right	10.00	0.00	0.000	1.512	13.005	0.000	12.000	10-#4 *3 *5
2 Left	10.00	18.41	0.667	1.512	13.005	0.687	12.000	10-#4 *3 *5

STRUCTUREPOINT - spBeam v10.00 (TM)
Licensed to: StructurePoint, LLC. License ID: 00000-0000000-4-1C985-1C985
C:\StructurePoint\spBeam\DE-One-Way-Slab-ACI-14.slbx

Page | 7
10/7/2025
12:03 PM

Span Zone	Width ft	M _{max} kip-ft	X _{max} ft	A _{s,min} in ²	A _{s,max} in ²	A _{s,req} in ²	Sp _{prov} in	Bars
Midspan	10.00	0.00	7.208	0.000	13.005	0.000	0.000	---
Right	10.00	42.81	13.750	1.512	13.005	1.617	12.000	10-#4 *5
3 Left	10.00	42.81	0.583	1.512	13.005	1.618	12.000	10-#4 *5
Midspan	10.00	2.29	9.575	1.512	13.005	0.085	12.000	10-#4 *3 *5
Right	10.00	42.67	14.417	1.512	13.005	1.612	12.000	10-#4 *5
4 Left	10.00	42.61	0.583	1.512	13.005	1.610	12.000	10-#4 *5
Midspan	10.00	2.36	9.575	1.512	13.005	0.088	12.000	10-#4 *3 *5
Right	10.00	43.15	14.417	1.512	13.005	1.631	12.000	10-#4 *5
5 Left	10.00	43.16	0.583	1.512	13.005	1.631	12.000	10-#4 *5
Midspan	10.00	2.60	9.575	1.512	13.005	0.096	12.000	10-#4 *3 *5
Right	10.00	43.01	14.417	1.512	13.005	1.625	12.000	10-#4 *5
6 Left	10.00	43.01	0.583	1.512	13.005	1.625	12.000	10-#4 *5
Midspan	10.00	2.60	5.425	1.512	13.005	0.096	12.000	10-#4 *3 *5
Right	10.00	43.16	14.417	1.512	13.005	1.631	12.000	10-#4 *5
7 Left	10.00	43.15	0.583	1.512	13.005	1.631	12.000	10-#4 *5
Midspan	10.00	2.36	5.425	1.512	13.005	0.088	12.000	10-#4 *3 *5
Right	10.00	42.61	14.417	1.512	13.005	1.610	12.000	10-#4 *5
8 Left	10.00	42.67	0.583	1.512	13.005	1.612	12.000	10-#4 *5
Midspan	10.00	2.29	5.425	1.512	13.005	0.085	12.000	10-#4 *3 *5
Right	10.00	42.82	14.417	1.512	13.005	1.618	12.000	10-#4 *5
9 Left	10.00	42.81	0.583	1.512	13.005	1.618	12.000	10-#4 *5
Midspan	10.00	0.00	7.125	0.000	13.005	0.000	0.000	---
Right	10.00	18.40	13.666	1.512	13.005	0.687	12.000	10-#4 *3 *5
10 Left	10.00	0.00	0.667	1.512	13.005	0.000	12.000	10-#4 *3 *5
Midspan	10.00	0.00	0.667	1.512	13.005	0.000	12.000	10-#4 *3 *5
Right	10.00	0.00	0.667	1.512	13.005	0.000	12.000	10-#4 *3 *5

2.2. Top Bar Details

Span	Bars	Left		Continuous		Right			
		Length ft	Bars	Length ft	Bars	Length ft	Bars	Length ft	Bars
1	---	---	---	---	10-#4	0.67	---	---	---
2	8-#4	4.98	2-#4	3.28	---	---	8-#4	6.09	2-#4
3	---	---	---	---	10-#4	15.00	---	---	---
4	---	---	---	---	10-#4	15.00	---	---	---
5	---	---	---	---	10-#4	15.00	---	---	---
6	---	---	---	---	10-#4	15.00	---	---	---
7	---	---	---	---	10-#4	15.00	---	---	---
8	---	---	---	---	10-#4	15.00	---	---	---

STRUCTUREPOINT - spBeam v10.00 (TM)
Licensed to: StructurePoint, LLC. License ID: 00000-0000000-4-1C985-1C985
C:\StructurePoint\spBeam\DE-One-Way-Slab-ACI-14.slbx

Page | 8
10/7/2025
12:03 PM

Span	Left				Continuous		Right			
	Bars	Length ft	Bars	Length ft	Bars	Length ft	Bars	Length ft	Bars	Length ft
9	8-#4	6.09	2-#4	3.20	---		8-#4	4.98	2-#4	3.28
10	---		---		10-#4	0.67	---		---	

2.3. Top Bar Development Lengths

Span	Left				Continuous		Right			
	Bars	DevLen in	Bars	DevLen in	Bars	DevLen in	Bars	DevLen in	Bars	DevLen in
1	---		---		10-#4	12.00	---		---	
2	8-#4	12.00	2-#4	12.00	---		8-#4	12.00	2-#4	12.00
3	---		---		10-#4	12.00	---		---	
4	---		---		10-#4	12.00	---		---	
5	---		---		10-#4	12.00	---		---	
6	---		---		10-#4	12.00	---		---	
7	---		---		10-#4	12.00	---		---	
8	---		---		10-#4	12.00	---		---	
9	8-#4	12.00	2-#4	12.00	---		8-#4	12.00	2-#4	12.00
10	---		---		10-#4	12.00	---		---	

2.4. Bottom Reinforcement

Notes:

*3 - Design governed by minimum reinforcement.

*5 - Number of bars governed by maximum allowable spacing.

Span	Width ft	M _{max} kip-ft	X _{max} ft	A _{s,min} in ²	A _{s,max} in ²	A _{s,req} in ²	Sp _{Prov} in	Bars
1	10.00	0.00	0.334	0.000	13.005	0.000	0.000	---
2	10.00	34.00	7.085	1.512	13.005	1.279	12.000	10-#4 *3 *5
3	10.00	33.83	7.747	1.512	13.005	1.273	12.000	10-#4 *3 *5
4	10.00	35.88	7.500	1.512	13.005	1.351	12.000	10-#4 *3 *5
5	10.00	35.91	7.500	1.512	13.005	1.353	12.000	10-#4 *3 *5
6	10.00	35.91	7.500	1.512	13.005	1.353	12.000	10-#4 *3 *5
7	10.00	35.88	7.500	1.512	13.005	1.351	12.000	10-#4 *3 *5
8	10.00	33.83	7.253	1.512	13.005	1.273	12.000	10-#4 *3 *5
9	10.00	34.00	7.248	1.512	13.005	1.279	12.000	10-#4 *3 *5

STRUCTUREPOINT - spBeam v10.00 (TM)
Licensed to: StructurePoint, LLC. License ID: 00000-0000000-4-1C985-1C985
C:\StructurePoint\spBeam\DE-One-Way-Slab-ACI-14.slbx

Page | 9
10/7/2025
12:03 PM

Span	Width ft	M _{max} kip-ft	X _{max} ft	A _{s,min} in ²	A _{s,max} in ²	A _{s,req} in ²	Sp _{prov} in	Bars
10	10.00	0.00	0.334	0.000	13.005	0.000	0.000	---

2.5. Bottom Bar Details

Span	Long Bars			Short Bars		
	Bars	Start ft	Length ft	Bars	Start ft	Length ft
1	---			---		
2	8-#4	0.00	14.33	2-#4	0.00	8.09
3	8-#4	0.00	15.00	2-#4	6.75	2.00
4	8-#4	0.00	15.00	2-#4	6.50	2.00
5	8-#4	0.00	15.00	2-#4	6.50	2.00
6	8-#4	0.00	15.00	2-#4	6.50	2.00
7	8-#4	0.00	15.00	2-#4	6.50	2.00
8	8-#4	0.00	15.00	2-#4	6.25	2.00
9	8-#4	0.00	14.33	2-#4	6.25	8.09
10	---			---		

2.6. Bottom Bar Development Lengths

Span	Long Bars		Short Bars	
	Bars	DevLen in	Bars	DevLen in
1	---		---	
2	8-#4	12.00	2-#4	12.00
3	8-#4	12.00	2-#4	12.00
4	8-#4	12.00	2-#4	12.00
5	8-#4	12.00	2-#4	12.00
6	8-#4	12.00	2-#4	12.00
7	8-#4	12.00	2-#4	12.00
8	8-#4	12.00	2-#4	12.00
9	8-#4	12.00	2-#4	12.00
10	---		---	

STRUCTUREPOINT - spBeam v10.00 (TM)
Licensed to: StructurePoint, LLC. License ID: 00000-0000000-4-1C985-1C985
C:\StructurePoint\spBeam\DE-One-Way-Slab-ACI-14.slbx

Page | 10
10/7/2025
12:03 PM

2.7. Flexural Capacity

Span	x ft	A _{s,top} in ²	Top			Status	Bottom				
			ΦM _n ⁺ kip-ft	M _u ⁺ kip-ft	Comb Pat		A _{s,bot} in ²	ΦM _n ⁺ kip-ft	M _u ⁺ kip-ft	Comb Pat	Status
1	0.000	2.00	-52.68	0.00	U1 All	OK	0.00	0.00	0.00	U1 All	OK
	0.334	2.00	-52.68	-0.16	U1 Odd	---	0.00	0.00	0.00	U1 All	OK
	0.667	2.00	-52.68	-0.57	U1 Odd	---	0.00	0.00	0.00	U1 All	OK
2	0.000	2.00	-52.68	-29.92	U1 Even	---	2.00	52.68	0.00	U1 All	OK
	0.667	2.00	-52.68	-18.41	U1 Even	OK	2.00	52.68	0.00	U1 All	OK
	2.283	2.00	-52.68	0.00	U1 All	OK	2.00	52.68	6.71	U1 S2	OK
	3.283	1.60	-42.35	0.00	U1 All	OK	2.00	52.68	15.84	U1 S2	OK
	3.984	1.60	-42.35	0.00	U1 All	OK	2.00	52.68	21.88	U1 Even	OK
	4.984	0.00	0.00	0.00	U1 All	OK	2.00	52.68	28.48	U1 Even	OK
	5.246	0.00	0.00	0.00	U1 All	OK	2.00	52.68	29.79	U1 Even	OK
	7.085	0.00	0.00	0.00	U1 All	OK	2.00	52.68	34.00	U1 Even	OK
	7.086	0.00	0.00	0.00	U1 All	OK	2.00	52.68	34.00	U1 Even	OK
	7.167	0.00	0.00	0.00	U1 All	OK	1.97	51.85	33.97	U1 Even	OK
	8.086	0.00	0.00	0.00	U1 All	OK	1.60	42.35	32.63	U1 Even	OK
	8.242	0.00	0.00	0.00	U1 All	OK	1.60	42.35	32.17	U1 Even	OK
	9.171	1.49	-39.39	0.00	U1 All	OK	1.60	42.35	28.22	U1 Even	OK
	9.242	1.60	-42.35	0.00	U1 All	OK	1.60	42.35	27.83	U1 Even	OK
	11.133	1.60	-42.35	-11.71	U1 Odd	OK	1.60	42.35	12.59	U1 Even	OK
3	12.133	2.00	-52.68	-19.92	U1 Odd	OK	1.60	42.35	0.82	U1 Even	OK
	13.750	2.00	-52.68	-42.81	U1 S2	OK	1.60	42.35	0.00	U1 All	OK
	14.333	2.00	-52.68	-54.36	U1 S2	---	1.60	42.35	0.00	U1 All	OK
	0.000	2.00	-52.68	-54.36	U1 S2	---	1.60	42.35	0.00	U1 All	OK
	0.583	2.00	-52.68	-42.81	U1 S2	OK	1.60	42.35	0.00	U1 All	OK
	5.425	2.00	-52.68	-1.56	U1 Even	OK	1.60	42.35	27.12	U1 Odd	OK
	6.746	2.00	-52.68	0.00	U1 All	OK	1.60	42.35	32.64	U1 Odd	OK
	7.500	2.00	-52.68	0.00	U1 All	OK	1.90	50.15	33.78	U1 Odd	OK
	7.746	2.00	-52.68	0.00	U1 All	OK	2.00	52.68	33.83	U1 Odd	OK
	7.747	2.00	-52.68	0.00	U1 All	OK	2.00	52.68	33.83	U1 Odd	OK
	7.748	2.00	-52.68	0.00	U1 All	OK	2.00	52.68	33.83	U1 Odd	OK
	8.748	2.00	-52.68	-0.36	U1 Even	OK	1.60	42.35	32.44	U1 Odd	OK
	9.575	2.00	-52.68	-2.29	U1 Even	OK	1.60	42.35	29.34	U1 Odd	OK
	14.417	2.00	-52.68	-42.67	U1 S3	OK	1.60	42.35	0.00	U1 All	OK
	15.000	2.00	-52.68	-54.14	U1 S3	---	1.60	42.35	0.00	U1 All	OK
4	0.000	2.00	-52.68	-54.14	U1 S3	---	1.60	42.35	0.00	U1 All	OK
	0.583	2.00	-52.68	-42.61	U1 S3	OK	1.60	42.35	0.00	U1 All	OK
	5.425	2.00	-52.68	-1.77	U1 Odd	OK	1.60	42.35	30.23	U1 Even	OK
	6.499	2.00	-52.68	0.00	U1 All	OK	1.60	42.35	34.54	U1 Even	OK
	7.499	2.00	-52.68	0.00	U1 All	OK	2.00	52.68	35.88	U1 Even	OK
	7.500	2.00	-52.68	0.00	U1 All	OK	2.00	52.68	35.88	U1 Even	OK
	7.501	2.00	-52.68	0.00	U1 All	OK	2.00	52.68	35.88	U1 Even	OK
	8.501	2.00	-52.68	-0.07	U1 Odd	OK	1.60	42.35	34.63	U1 Even	OK
	9.575	2.00	-52.68	-2.36	U1 Odd	OK	1.60	42.35	30.42	U1 Even	OK
5	14.417	2.00	-52.68	-43.15	U1 S4	OK	1.60	42.35	0.00	U1 All	OK
	15.000	2.00	-52.68	-54.72	U1 S4	---	1.60	42.35	0.00	U1 All	OK
	0.000	2.00	-52.68	-54.72	U1 S4	---	1.60	42.35	0.00	U1 All	OK
	0.583	2.00	-52.68	-43.16	U1 S4	OK	1.60	42.35	0.00	U1 All	OK
	5.425	2.00	-52.68	-2.59	U1 Even	OK	1.60	42.35	30.29	U1 Odd	OK
	6.499	2.00	-52.68	-0.45	U1 Even	OK	1.60	42.35	34.59	U1 Odd	OK
	7.499	2.00	-52.68	0.00	U1 All	OK	2.00	52.68	35.91	U1 Odd	OK

STRUCTUREPOINT - spBeam v10.00 (TM)
 Licensed to: StructurePoint, LLC. License ID: 00000-0000000-4-1C985-1C985
 C:\StructurePoint\spBeam\DE-One-Way-Slab-ACI-14.slbx

Page | 11
 10/7/2025
 12:03 PM

Span	x ft	Top				Status	Bottom				
		$A_{s,top}$ in ²	ΦM_n^- kip-ft	M_u^- kip-ft	Comb Pat		$A_{s,bot}$ in ²	ΦM_n^+ kip-ft	M_u^+ kip-ft	Comb Pat	Status
6	7.500	2.00	-52.68	0.00	U1 All	OK	2.00	52.68	35.91	U1 Odd	OK
	7.501	2.00	-52.68	0.00	U1 All	OK	2.00	52.68	35.91	U1 Odd	OK
	8.501	2.00	-52.68	-0.46	U1 Even	OK	1.60	42.35	34.66	U1 Odd	OK
	9.575	2.00	-52.68	-2.60	U1 Even	OK	1.60	42.35	30.43	U1 Odd	OK
	14.417	2.00	-52.68	-43.01	U1 S5	OK	1.60	42.35	0.00	U1 All	OK
	15.000	2.00	-52.68	-54.56	U1 S5	---	1.60	42.35	0.00	U1 All	OK
	0.000	2.00	-52.68	-54.56	U1 S5	---	1.60	42.35	0.00	U1 All	OK
	0.583	2.00	-52.68	-43.01	U1 S5	OK	1.60	42.35	0.00	U1 All	OK
	5.425	2.00	-52.68	-2.60	U1 Odd	OK	1.60	42.35	30.43	U1 Even	OK
	6.499	2.00	-52.68	-0.46	U1 Odd	OK	1.60	42.35	34.66	U1 Even	OK
	7.499	2.00	-52.68	0.00	U1 All	OK	2.00	52.68	35.91	U1 Even	OK
	7.500	2.00	-52.68	0.00	U1 All	OK	2.00	52.68	35.91	U1 Even	OK
	7.501	2.00	-52.68	0.00	U1 All	OK	2.00	52.68	35.91	U1 Even	OK
	8.501	2.00	-52.68	-0.45	U1 Odd	OK	1.60	42.35	34.59	U1 Even	OK
7	9.575	2.00	-52.68	-2.59	U1 Odd	OK	1.60	42.35	30.29	U1 Even	OK
	14.417	2.00	-52.68	-43.16	U1 S6	OK	1.60	42.35	0.00	U1 All	OK
	15.000	2.00	-52.68	-54.72	U1 S6	---	1.60	42.35	0.00	U1 All	OK
	0.000	2.00	-52.68	-54.72	U1 S6	---	1.60	42.35	0.00	U1 All	OK
	0.583	2.00	-52.68	-43.15	U1 S6	OK	1.60	42.35	0.00	U1 All	OK
	5.425	2.00	-52.68	-2.36	U1 Even	OK	1.60	42.35	30.42	U1 Odd	OK
	6.499	2.00	-52.68	-0.07	U1 Even	OK	1.60	42.35	34.63	U1 Odd	OK
	7.499	2.00	-52.68	0.00	U1 All	OK	2.00	52.68	35.88	U1 Odd	OK
	7.500	2.00	-52.68	0.00	U1 All	OK	2.00	52.68	35.88	U1 Odd	OK
	7.501	2.00	-52.68	0.00	U1 All	OK	2.00	52.68	35.88	U1 Odd	OK
8	8.501	2.00	-52.68	0.00	U1 All	OK	1.60	42.35	34.54	U1 Odd	OK
	9.575	2.00	-52.68	-1.77	U1 Even	OK	1.60	42.35	30.23	U1 Odd	OK
	14.417	2.00	-52.68	-42.61	U1 S7	OK	1.60	42.35	0.00	U1 All	OK
	15.000	2.00	-52.68	-54.14	U1 S7	---	1.60	42.35	0.00	U1 All	OK
	0.000	2.00	-52.68	-54.14	U1 S7	---	1.60	42.35	0.00	U1 All	OK
	0.583	2.00	-52.68	-42.67	U1 S7	OK	1.60	42.35	0.00	U1 All	OK
	5.425	2.00	-52.68	-2.29	U1 Odd	OK	1.60	42.35	29.34	U1 Even	OK
	6.252	2.00	-52.68	-0.36	U1 Odd	OK	1.60	42.35	32.44	U1 Even	OK
	7.252	2.00	-52.68	0.00	U1 All	OK	2.00	52.68	33.83	U1 Even	OK
	7.253	2.00	-52.68	0.00	U1 All	OK	2.00	52.68	33.83	U1 Even	OK
9	7.254	2.00	-52.68	0.00	U1 All	OK	2.00	52.68	33.83	U1 Even	OK
	7.500	2.00	-52.68	0.00	U1 All	OK	1.90	50.15	33.78	U1 Even	OK
	8.254	2.00	-52.68	0.00	U1 All	OK	1.60	42.35	32.64	U1 Even	OK
	9.575	2.00	-52.68	-1.56	U1 Odd	OK	1.60	42.35	27.12	U1 Even	OK
	14.417	2.00	-52.68	-42.82	U1 S8	OK	1.60	42.35	0.00	U1 All	OK
	15.000	2.00	-52.68	-54.36	U1 S8	---	1.60	42.35	0.00	U1 All	OK
	0.000	2.00	-52.68	-54.36	U1 S8	---	1.60	42.35	0.00	U1 All	OK
	0.583	2.00	-52.68	-42.81	U1 S8	OK	1.60	42.35	0.00	U1 All	OK
	2.200	2.00	-52.68	-19.92	U1 Even	OK	1.60	42.35	0.82	U1 Odd	OK
	3.200	1.60	-42.35	-11.72	U1 Even	OK	1.60	42.35	12.59	U1 Odd	OK

STRUCTUREPOINT - spBeam v10.00 (TM)
Licensed to: StructurePoint, LLC. License ID: 00000-0000000-4-1C985-1C985
C:\StructurePoint\spBeam\DE-One-Way-Slab-ACI-14.slbx

Page | 12
10/7/2025
12:03 PM

Span	x ft	Top					Bottom				
		A _{s,top} in ²	ΦM _n ⁻ kip-ft	M _u ⁻ kip-ft	Comb Pat	Status	A _{s,bot} in ²	ΦM _n ⁺ kip-ft	M _u ⁺ kip-ft	Comb Pat	Status
	7.248	0.00	0.00	0.00	U1 All	OK	2.00	52.68	34.00	U1 Odd	OK
	9.087	0.00	0.00	0.00	U1 All	OK	2.00	52.68	29.79	U1 Odd	OK
	9.349	0.00	0.00	0.00	U1 All	OK	2.00	52.68	28.49	U1 Odd	OK
	10.349	1.60	-42.35	0.00	U1 All	OK	2.00	52.68	21.88	U1 Odd	OK
	11.050	1.60	-42.35	0.00	U1 All	OK	2.00	52.68	15.84	U1 S8	OK
	12.050	2.00	-52.68	0.00	U1 All	OK	2.00	52.68	6.71	U1 S8	OK
	13.666	2.00	-52.68	-18.40	U1 Odd	OK	2.00	52.68	0.00	U1 All	OK
	14.333	2.00	-52.68	-29.92	U1 Odd	---	2.00	52.68	0.00	U1 All	OK
	0.000	2.00	-52.68	-0.57	U1 S9	---	0.00	0.00	0.00	U1 All	OK
	0.334	2.00	-52.68	-0.16	U1 S9	---	0.00	0.00	0.00	U1 All	OK
10	0.667	2.00	-52.68	0.00	U1 All	OK	0.00	0.00	0.00	U1 All	OK

2.8. Slab Shear Capacity

Span	b in	d in	V _{ratio}	ΦV _c kips	V _u kips	X _u ft
1	120.00	6.00	1.000	68.31	0.00	0.00
2	120.00	6.00	1.000	68.31	17.77	13.25
3	120.00	6.00	1.000	68.31	17.76	1.08
4	120.00	6.00	1.000	68.31	17.81	13.92
5	120.00	6.00	1.000	68.31	17.79	1.08
6	120.00	6.00	1.000	68.31	17.79	13.92
7	120.00	6.00	1.000	68.31	17.81	1.08
8	120.00	6.00	1.000	68.31	17.76	13.92
9	120.00	6.00	1.000	68.31	17.77	1.08
10	120.00	6.00	1.000	68.31	0.00	0.00

2.9. Material TakeOff

2.9.1. Reinforcement in the Direction of Analysis

Top Bars	745.8 lb	<=>	6.22 lb/ft	<=>	0.622 lb/ft ²
Bottom Bars	671.8 lb	<=>	5.60 lb/ft	<=>	0.560 lb/ft ²
Stirrups	0.0 lb	<=>	0.00 lb/ft	<=>	0.000 lb/ft ²
Total Steel	1417.6 lb	<=>	11.81 lb/ft	<=>	1.181 lb/ft ²
Concrete	700.0 ft ³	<=>	5.83 ft ³ /ft	<=>	0.583 ft ³ /ft ²

3. Deflection Results: Summary

3.1. Section Properties

3.1.1. Frame Section Properties

Notes:

M+ve values are for positive moments (tension at bottom face).

M-ve values are for negative moments (tension at top face).

Span Zone	M _{+ve}			M _{-ve}		
	I _g in ⁴	I _{cr} in ⁴	M _{cr} kip-ft	I _g in ⁴	I _{cr} in ⁴	M _{cr} kip-ft
1 Left	3430	0	38.74	3430	416	-38.74
Midspan	3430	0	38.74	3430	416	-38.74
Right	3430	0	38.74	3430	416	-38.74
2 Left	3430	343	38.74	3430	416	-38.74
Midspan	3430	343	38.74	3430	0	-38.74
Right	3430	343	38.74	3430	416	-38.74

STRUCTUREPOINT - spBeam v10.00 (TM)
Licensed to: StructurePoint, LLC. License ID: 00000-0000000-4-1C985-1C985
C:\StructurePoint\spBeam\DE-One-Way-Slab-ACI-14.slbx

Page | 13
10/7/2025
12:03 PM

Span Zone	M _{ve}			M _{ve}		
	I _g in ⁴	I _{cr} in ⁴	M _{cr} kip-ft	I _g in ⁴	I _{cr} in ⁴	M _{cr} kip-ft
3 Left	3430	343	38.74	3430	416	-38.74
Midspan	3430	343	38.74	3430	416	-38.74
Right	3430	343	38.74	3430	416	-38.74
4 Left	3430	343	38.74	3430	416	-38.74
Midspan	3430	343	38.74	3430	416	-38.74
Right	3430	343	38.74	3430	416	-38.74
5 Left	3430	343	38.74	3430	416	-38.74
Midspan	3430	343	38.74	3430	416	-38.74
Right	3430	343	38.74	3430	416	-38.74
6 Left	3430	343	38.74	3430	416	-38.74
Midspan	3430	343	38.74	3430	416	-38.74
Right	3430	343	38.74	3430	416	-38.74
7 Left	3430	343	38.74	3430	416	-38.74
Midspan	3430	343	38.74	3430	416	-38.74
Right	3430	343	38.74	3430	416	-38.74
8 Left	3430	343	38.74	3430	416	-38.74
Midspan	3430	343	38.74	3430	416	-38.74
Right	3430	343	38.74	3430	416	-38.74
9 Left	3430	343	38.74	3430	416	-38.74
Midspan	3430	343	38.74	3430	0	-38.74
Right	3430	343	38.74	3430	416	-38.74
10 Left	3430	0	38.74	3430	416	-38.74
Midspan	3430	0	38.74	3430	416	-38.74
Right	3430	0	38.74	3430	416	-38.74

3.1.2. Frame Effective Section Properties

Span Zone	Weight	Load Level					
		Dead		Sustained		Dead+Live	
		M _{max} kip-ft	I _e in ⁴	M _{max} kip-ft	I _e in ⁴	M _{max} kip-ft	I _e in ⁴
1 Right	1.000	-0.24	3430	-0.24	3430	-0.42	3430
Span Avg	----	----	3430	----	3430	----	3430
2 Middle	0.850	12.00	3430	12.00	3430	20.93	3430
Right	0.150	-21.33	3430	-21.33	3430	-37.21	3430
Span Avg	----	----	3430	----	3430	----	3430
3 Left	0.150	-21.33	3430	-21.33	3430	-37.21	3430
Middle	0.700	9.65	3430	9.65	3430	16.83	3430
Right	0.150	-19.84	3430	-19.84	3430	-34.60	3430
Span Avg	----	----	3430	----	3430	----	3430
4 Left	0.150	-19.84	3430	-19.84	3430	-34.60	3430
Middle	0.700	10.19	3430	10.19	3430	17.78	3430
Right	0.150	-20.25	3430	-20.25	3430	-35.31	3430
Span Avg	----	----	3430	----	3430	----	3430
5 Left	0.150	-20.25	3430	-20.25	3430	-35.31	3430
Middle	0.700	10.06	3430	10.06	3430	17.54	3430
Right	0.150	-20.11	3430	-20.11	3430	-35.08	3430
Span Avg	----	----	3430	----	3430	----	3430
6 Left	0.150	-20.11	3430	-20.11	3430	-35.08	3430
Middle	0.700	10.06	3430	10.06	3430	17.54	3430
Right	0.150	-20.25	3430	-20.25	3430	-35.31	3430
Span Avg	----	----	3430	----	3430	----	3430
7 Left	0.150	-20.25	3430	-20.25	3430	-35.31	3430
Middle	0.700	10.19	3430	10.19	3430	17.78	3430

STRUCTUREPOINT - spBeam v10.00 (TM)
Licensed to: StructurePoint, LLC. License ID: 00000-0000000-4-1C985-1C985
C:\StructurePoint\spBeam\DE-One-Way-Slab-ACI-14.slbx

Page | 14
10/7/2025
12:03 PM

Span Zone	Weight	Load Level					
		Dead		Sustained		Dead+Live	
		M _{max} kip-ft	I _e in ⁴	M _{max} kip-ft	I _e in ⁴	M _{max} kip-ft	I _e in ⁴
Right	0.150	-19.84	3430	-19.84	3430	-34.60	3430
Span Avg	----	----	3430	----	3430	----	3430
8 Left	0.150	-19.84	3430	-19.84	3430	-34.60	3430
Middle	0.700	9.65	3430	9.65	3430	16.83	3430
Right	0.150	-21.33	3430	-21.33	3430	-37.21	3430
Span Avg	----	----	3430	----	3430	----	3430
9 Left	0.150	-21.33	3430	-21.33	3430	-37.21	3430
Middle	0.850	12.00	3430	12.00	3430	20.93	3430
Span Avg	----	----	3430	----	3430	----	3430
10 Left	1.000	-0.24	3430	-0.24	3430	-0.42	3430
Span Avg	----	----	3430	----	3430	----	3430

3.2. Instantaneous Deflections

3.2.1. Extreme Instantaneous Frame Deflections and Corresponding Locations

Span	Direction	Value	Units	Live				Total	
				Dead	Sustained	Unsustained	Total	Sustained	Dead+Live
1	Down	Def	in	---	---	---	---	---	---
		Loc	ft	---	---	---	---	---	---
	Up	Def	in	-0.003	---	-0.002	-0.002	-0.003	-0.005
		Loc	ft	0.000	---	0.000	0.000	0.000	0.000
2	Down	Def	in	0.024	---	0.018	0.018	0.024	0.042
		Loc	ft	6.591	---	6.591	6.591	6.591	6.591
	Up	Def	in	---	---	---	---	---	---
		Loc	ft	---	---	---	---	---	---
3	Down	Def	in	0.017	---	0.013	0.013	0.017	0.030
		Loc	ft	7.500	---	7.500	7.500	7.500	7.500
	Up	Def	in	0.000	---	0.000	0.000	0.000	0.000
		Loc	ft	0.194	---	0.194	0.194	0.194	0.194
4	Down	Def	in	0.019	---	0.014	0.014	0.019	0.033
		Loc	ft	7.500	---	7.500	7.500	7.500	7.500
	Up	Def	in	---	---	---	---	---	---
		Loc	ft	---	---	---	---	---	---
5	Down	Def	in	0.019	---	0.014	0.014	0.019	0.032
		Loc	ft	7.500	---	7.500	7.500	7.500	7.500
	Up	Def	in	---	---	---	---	---	---
		Loc	ft	---	---	---	---	---	---
6	Down	Def	in	0.019	---	0.014	0.014	0.019	0.032
		Loc	ft	7.500	---	7.500	7.500	7.500	7.500
	Up	Def	in	---	---	---	---	---	---
		Loc	ft	---	---	---	---	---	---
7	Down	Def	in	0.019	---	0.014	0.014	0.019	0.033
		Loc	ft	7.500	---	7.500	7.500	7.500	7.500
	Up	Def	in	---	---	---	---	---	---
		Loc	ft	---	---	---	---	---	---
8	Down	Def	in	0.017	---	0.013	0.013	0.017	0.030
		Loc	ft	7.500	---	7.500	7.500	7.500	7.500
	Up	Def	in	0.000	---	0.000	0.000	0.000	0.000
		Loc	ft	14.806	---	14.806	14.806	14.806	14.806
9	Down	Def	in	0.024	---	0.018	0.018	0.024	0.042
		Loc	ft	7.742	---	7.742	7.742	7.742	7.742
	Up	Def	in	---	---	---	---	---	---
		Loc	ft	---	---	---	---	---	---

STRUCTUREPOINT - spBeam v10.00 (TM)
Licensed to: StructurePoint, LLC. License ID: 00000-0000000-4-1C985-1C985
C:\StructurePoint\spBeam\DE-One-Way-Slab-ACI-14.slbx

Page | 15
10/7/2025
12:03 PM

Span	Direction	Value	Units	Dead	Live			Total	
					Sustained	Unsustained	Total	Sustained	Dead+Live
10	Down	Def	in	---	---	---	---	---	---
		Loc	ft	---	---	---	---	---	---
	Up	Def	in	-0.003	---	-0.002	-0.002	-0.003	-0.005
		Loc	ft	0.667	---	0.667	0.667	0.667	0.667

3.3. Long-term Deflections

3.3.1. Long-term Deflection Factors

Notes:

Deflection multiplier, Lambda, depends on moment sign at sustained load level and Rho' in given zone.
Rho' is assumed zero because Compression Reinforcement option is NOT selected in Solve Options.

Time dependant factor for sustained loads = 2.000

Span Zone	M ₊ ve					M ₋ ve				
	A _{s,top} in ²	b in	d in	Rho' %	Lambda	A _{s,bot} in ²	b in	d in	Rho' %	Lambda
1 Right	----	----	----	0.000	2.000	----	----	----	0.000	2.000
2 Midspan	----	----	----	0.000	2.000	----	----	----	0.000	2.000
3 Midspan	----	----	----	0.000	2.000	----	----	----	0.000	2.000
4 Midspan	----	----	----	0.000	2.000	----	----	----	0.000	2.000
5 Midspan	----	----	----	0.000	2.000	----	----	----	0.000	2.000
6 Midspan	----	----	----	0.000	2.000	----	----	----	0.000	2.000
7 Midspan	----	----	----	0.000	2.000	----	----	----	0.000	2.000
8 Midspan	----	----	----	0.000	2.000	----	----	----	0.000	2.000
9 Midspan	----	----	----	0.000	2.000	----	----	----	0.000	2.000
10 Left	----	----	----	0.000	2.000	----	----	----	0.000	2.000

3.3.2. Extreme Long-term Frame Deflections and Corresponding Locations

Notes:

Incremental deflections due to creep and shrinkage (cs) based on sustained load level values.

Incremental deflections after partitions are installed can be estimated by deflections due to:

- creep and shrinkage plus unsustained live load (cs+lu), if live load applied before partitions,
- creep and shrinkage plus live load (cs+l), if live load applied after partitions.

Total deflections consist of dead, live, and creep and shrinkage deflections.

Span	Direction	Value	Units	cs	cs+lu	cs+l	Total
1	Down	Def	in	---	---	---	---
		Loc	ft	---	---	---	---
	Up	Def	in	-0.005	-0.007	-0.007	-0.010
		Loc	ft	0.000	0.000	0.000	0.000
2	Down	Def	in	0.049	0.067	0.067	0.091
		Loc	ft	6.591	6.591	6.591	6.591
	Up	Def	in	---	---	---	---
		Loc	ft	---	---	---	---
3	Down	Def	in	0.034	0.047	0.047	0.064
		Loc	ft	7.500	7.500	7.500	7.500
	Up	Def	in	0.000	0.000	0.000	0.000
		Loc	ft	0.194	0.194	0.194	0.194
4	Down	Def	in	0.038	0.052	0.052	0.071
		Loc	ft	7.500	7.500	7.500	7.500
	Up	Def	in	---	---	---	---
		Loc	ft	---	---	---	---
5	Down	Def	in	0.037	0.051	0.051	0.069
		Loc	ft	7.500	7.500	7.500	7.500
	Up	Def	in	---	---	---	---
		Loc	ft	---	---	---	---

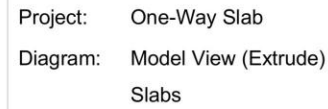
STRUCTUREPOINT - spBeam v10.00 (TM)
Licensed to: StructurePoint, LLC. License ID: 00000-0000000-4-1C985-1C985
C:\StructurePoint\spBeam\DE-One-Way-Slab-ACI-14.slbx

Page | 16
10/7/2025
12:03 PM

Span	Direction	Value	Units	cs	cs+lu	cs+ll	Total
6	Down	Def	in	0.037	0.051	0.051	0.069
		Loc	ft	7.500	7.500	7.500	7.500
	Up	Def	in	---	---	---	---
7	Down	Def	in	0.038	0.052	0.052	0.071
		Loc	ft	7.500	7.500	7.500	7.500
	Up	Def	in	---	---	---	---
8	Down	Def	in	0.034	0.047	0.047	0.064
		Loc	ft	7.500	7.500	7.500	7.500
	Up	Def	in	0.000	0.000	0.000	0.000
9	Down	Def	in	0.049	0.067	0.067	0.091
		Loc	ft	7.742	7.742	7.742	7.742
	Up	Def	in	---	---	---	---
10	Down	Def	in	---	---	---	---
		Loc	ft	---	---	---	---
	Up	Def	in	-0.005	-0.007	-0.007	-0.010
		Loc	ft	0.667	0.667	0.667	0.667

Page | 17
10/7/2025
12:03 PM

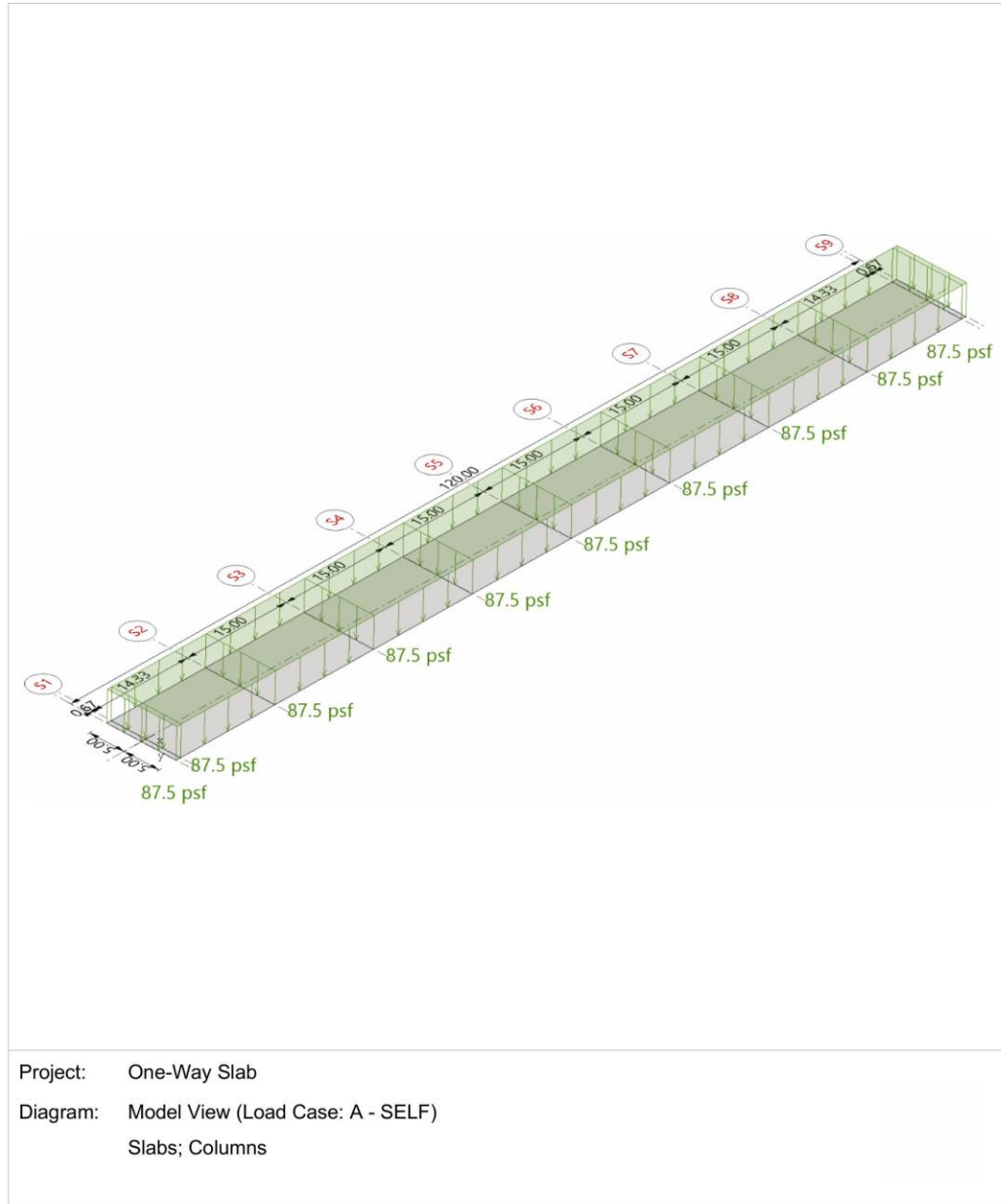
4.1. Extrude 3D view



STRUCTUREPOINT - spBeam v10.00 (TM)
Licensed to: StructurePoint, LLC. License ID: 00000-0000000-4-1C985-1C985
C:\StructurePoint\spBeam\DE-One-Way-Slab-ACI-14.slbx

Page | 18
10/7/2025
12:03 PM

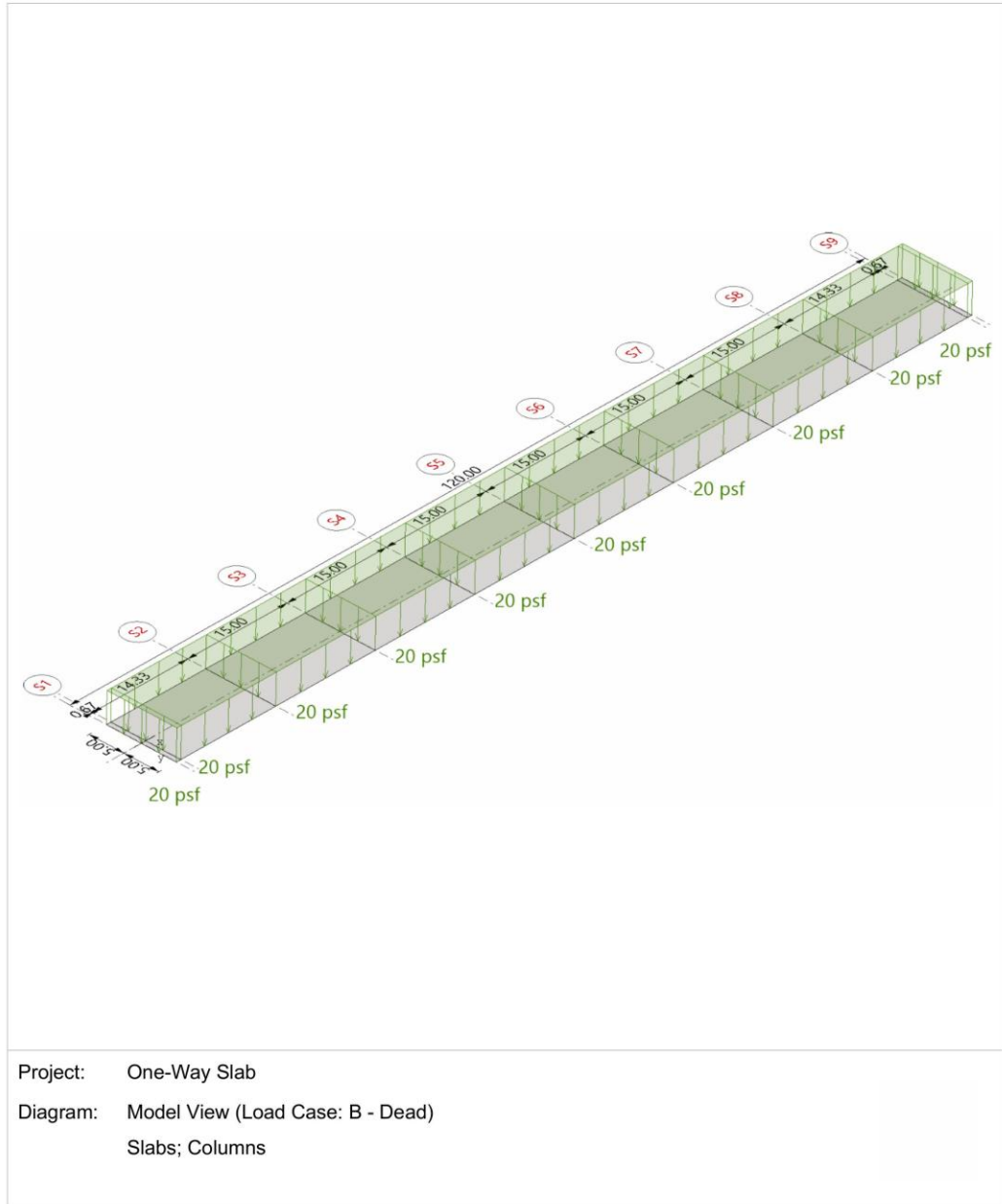
4.2. Loads - Case A - SELF



STRUCTUREPOINT - spBeam v10.00 (TM)
Licensed to: StructurePoint, LLC. License ID: 00000-0000000-4-1C985-1C985
C:\StructurePoint\spBeam\DE-One-Way-Slab-ACI-14.slbx

Page | 19
10/7/2025
12:03 PM

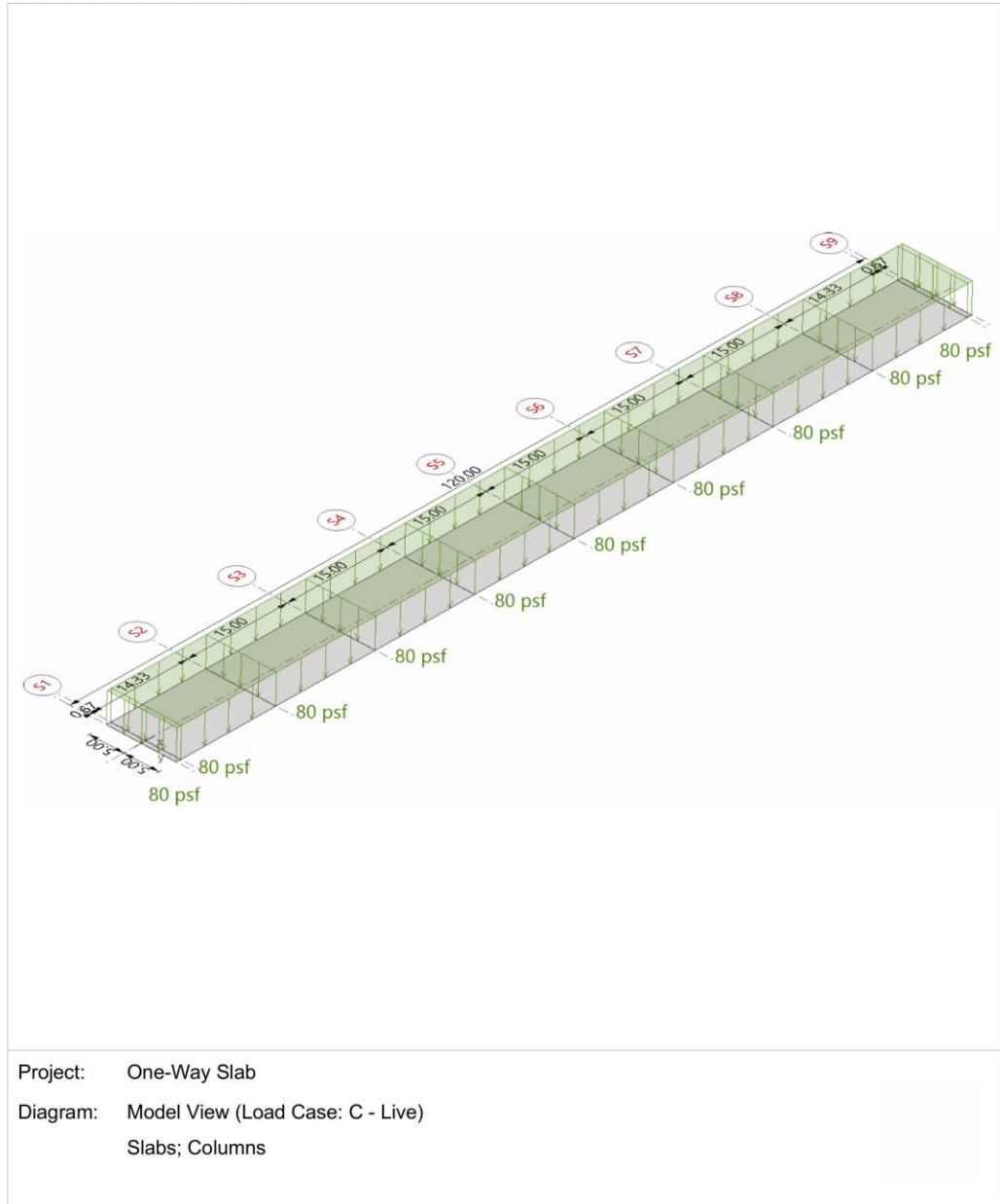
4.3. Loads - Case B - Dead



STRUCTUREPOINT - spBeam v10.00 (TM)
Licensed to: StructurePoint, LLC. License ID: 00000-0000000-4-1C985-1C985
C:\StructurePoint\spBeam\DE-One-Way-Slab-ACI-14.slbx

Page | 20
10/7/2025
12:03 PM

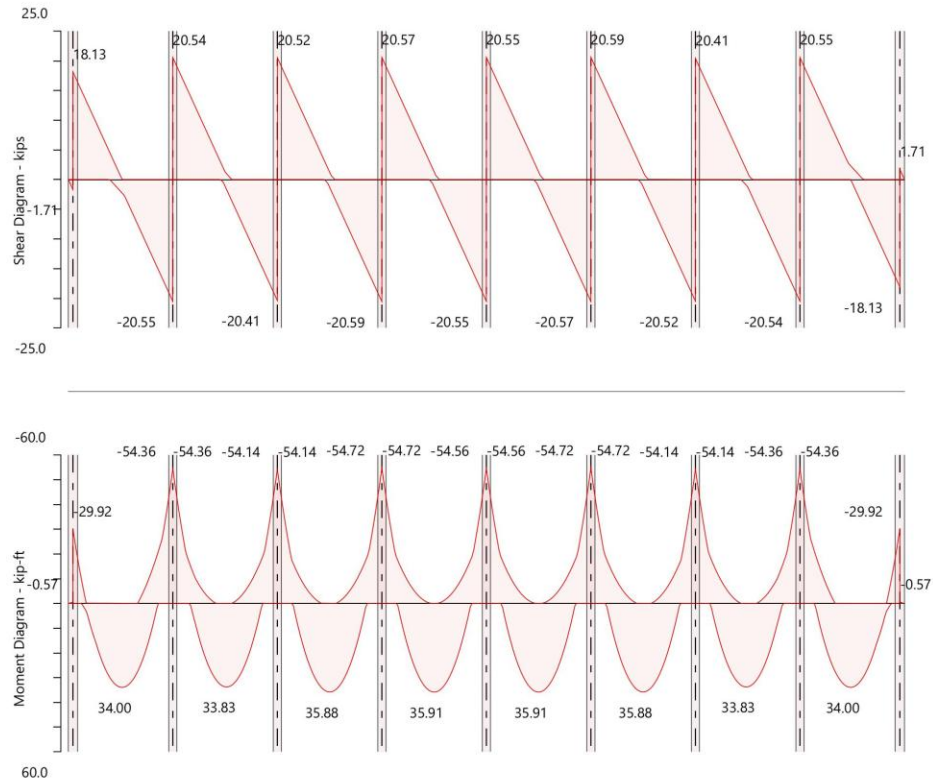
4.4. Loads - Case C - Live



STRUCTUREPOINT - spBeam v10.00 (TM)
Licensed to: StructurePoint, LLC. License ID: 00000-0000000-4-1C985-1C985
C:\StructurePoint\spBeam\DE-One-Way-Slab-ACI-14.slbx

Page | 21
10/7/2025
12:03 PM

4.5. Internal Forces

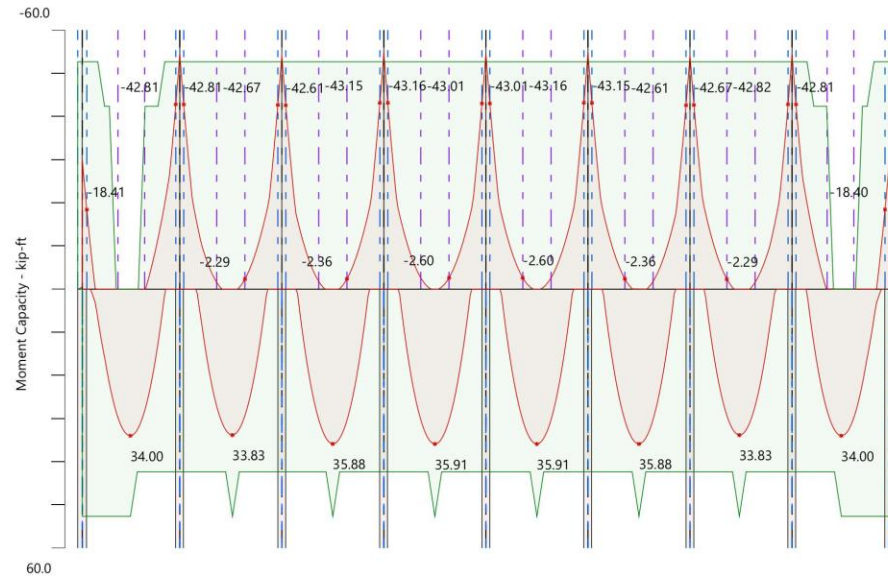


Project: One-Way Slab
Diagram: Internal Forces

STRUCTUREPOINT - spBeam v10.00 (TM)
Licensed to: StructurePoint, LLC. License ID: 00000-0000000-4-1C985-1C985
C:\StructurePoint\spBeam\DE-One-Way-Slab-ACI-14.slbx

Page | 22
10/7/2025
12:03 PM

4.6. Moment Capacity

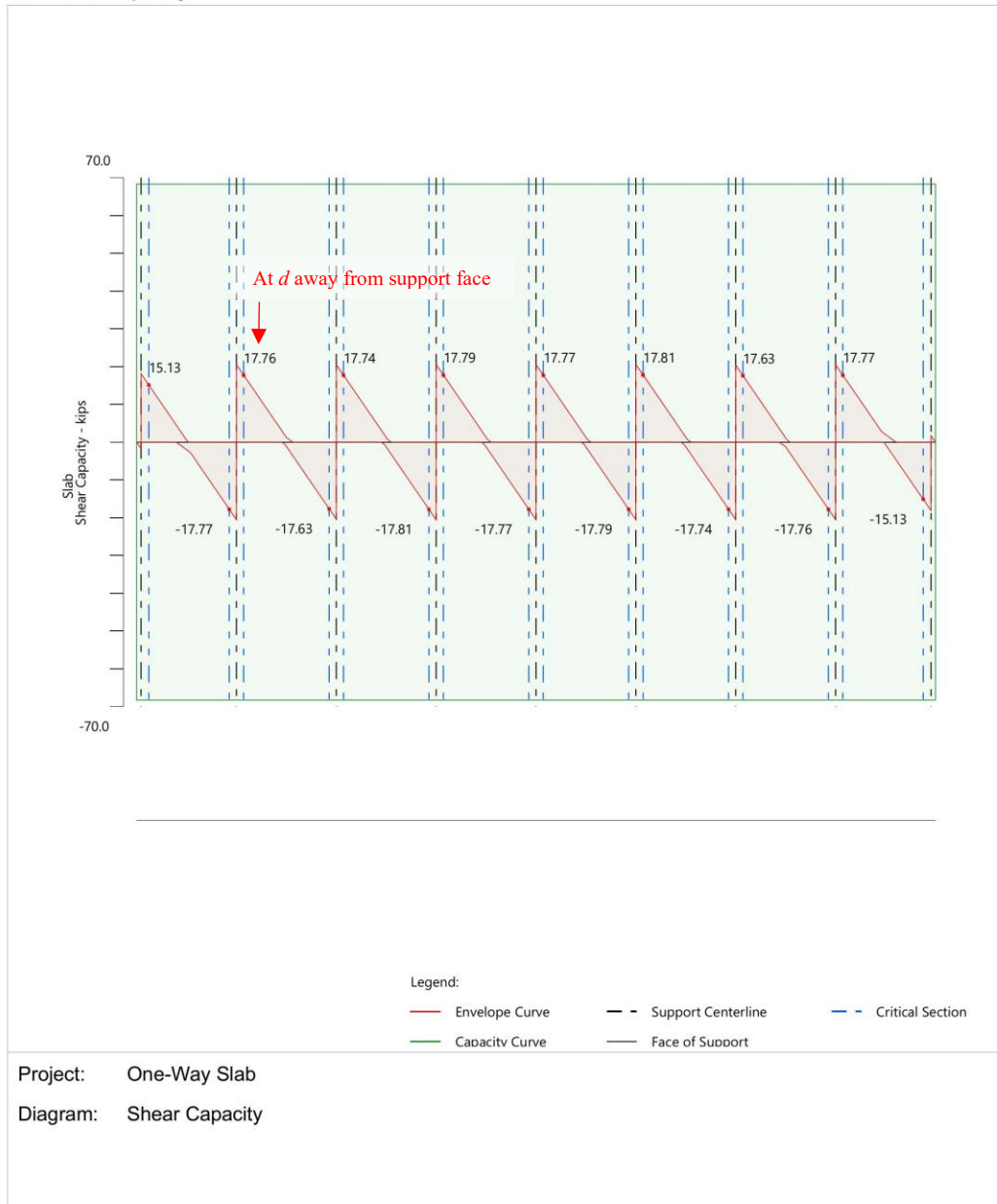


Project: One-Way Slab
Diagram: Moment Capacity

STRUCTUREPOINT - spBeam v10.00 (TM)
Licensed to: StructurePoint, LLC. License ID: 00000-0000000-4-1C985-1C985
C:\StructurePoint\spBeam\DE-One-Way-Slab-ACI-14.slbx

Page | 23
10/7/2025
12:03 PM

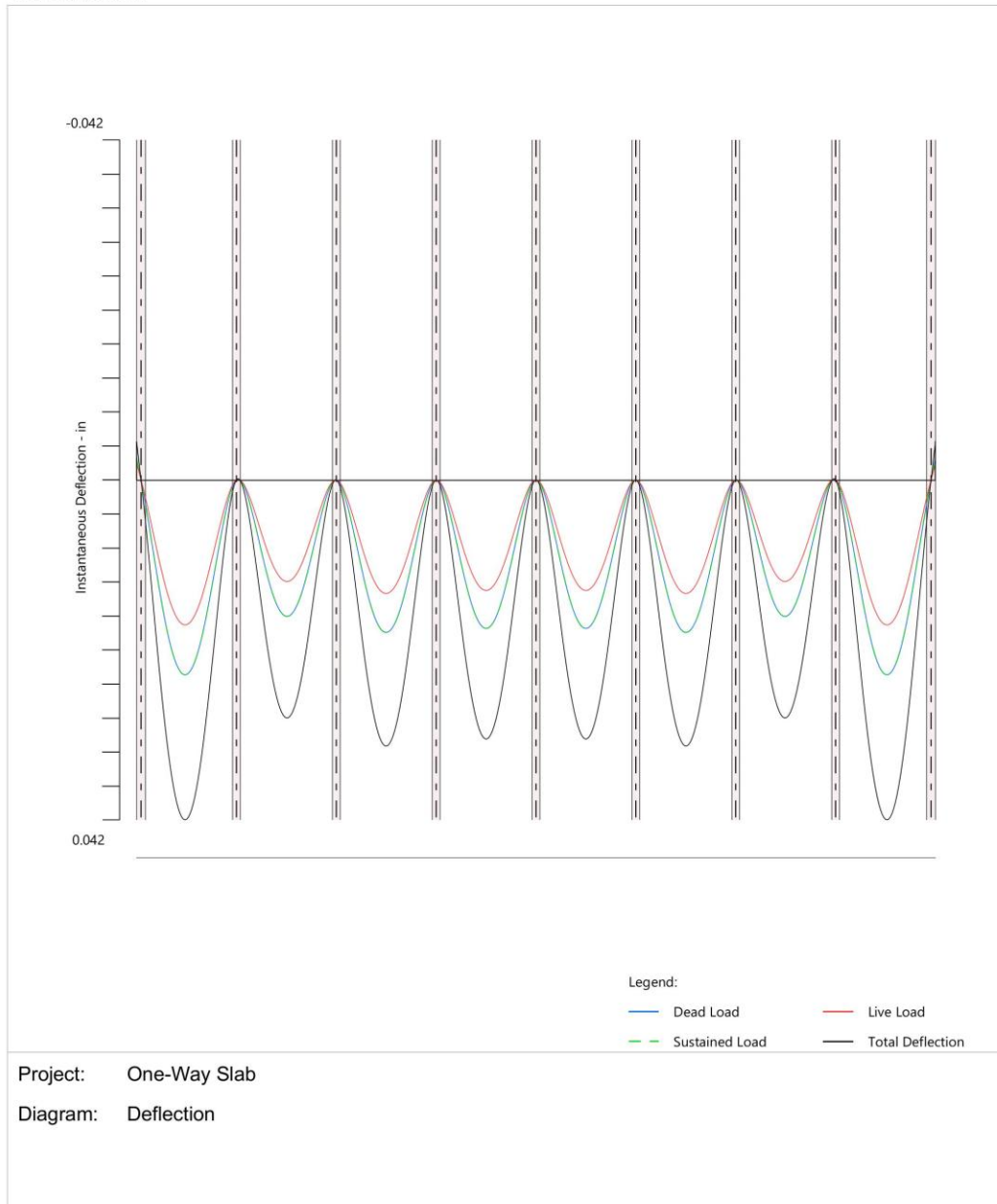
4.7. Shear Capacity



STRUCTUREPOINT - spBeam v10.00 (TM)
Licensed to: StructurePoint, LLC. License ID: 00000-0000000-4-1C985-1C985
C:\StructurePoint\spBeam\DE-One-Way-Slab-ACI-14.slbx

Page | 24
10/7/2025
12:03 PM

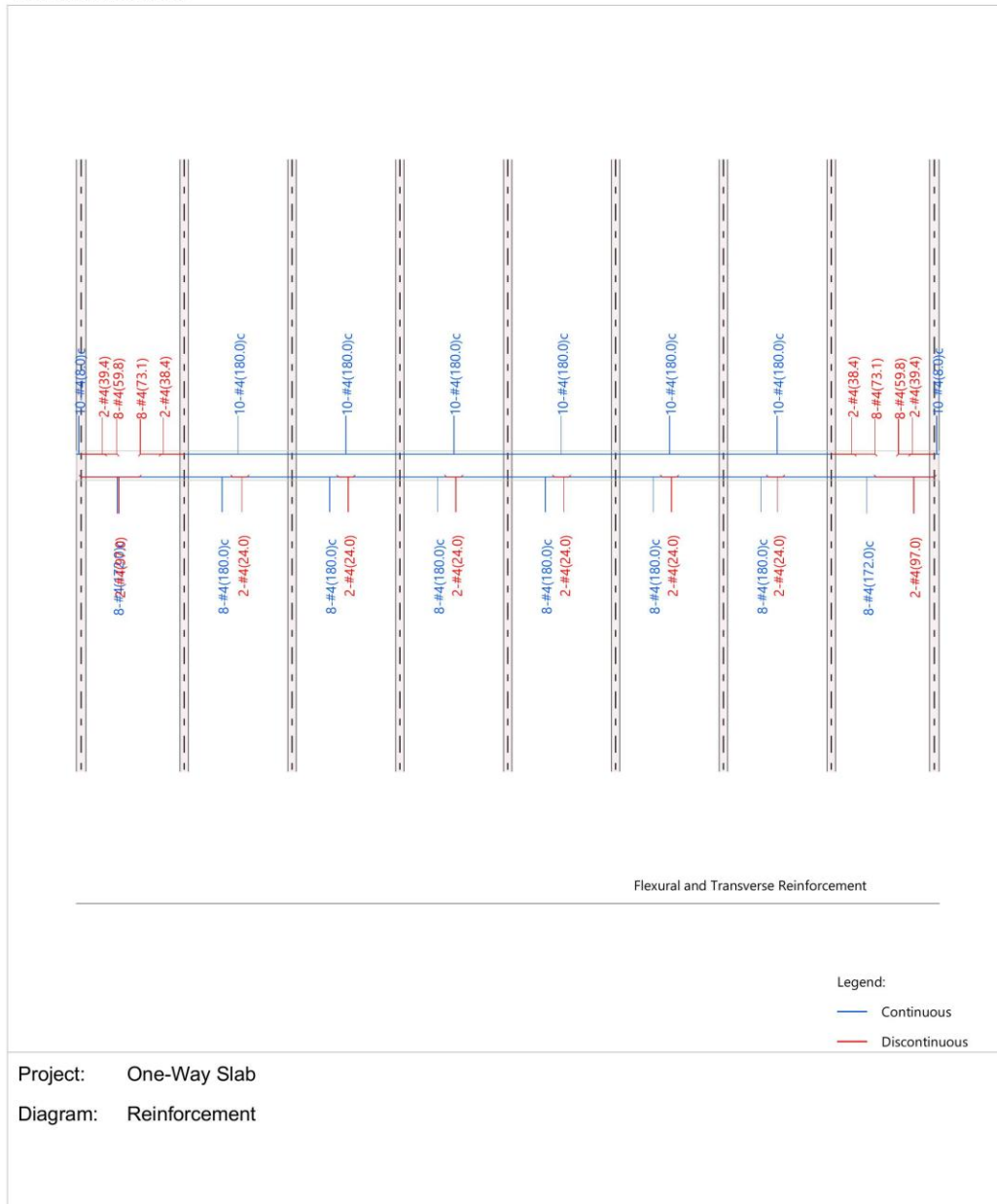
4.8. Deflection



STRUCTUREPOINT - spBeam v10.00 (TM)
Licensed to: StructurePoint, LLC. License ID: 00000-0000000-4-1C985-1C985
C:\StructurePoint\spBeam\DE-One-Way-Slab-ACI-14.slbx

Page | 25
10/7/2025
12:03 PM

4.9. Reinforcement



10. Comparison of Design Results

Table 4 - Comparison of Design Moment Values (kips-ft/ft)			
Span Location	Reference	Hand	spBeam [†]
Exterior Span			
Exterior Negative*	1.84	1.83	1.84
Positive	3.16	3.14	3.40
Interior Negative*	4.70	4.65	4.28
Interior Span			
Interior Negative*	4.47	4.47	4.28
Positive	3.51**	3.07	3.38
* Negative moments are taken at the faces of supports ** Reference used 1/14 incorrectly instead of 1/16 for interior midspan moment coefficient † Moment values are divided by strip width (10 ft) to convert units from kips-ft to kips-ft/ft			

Table 5 - Comparison of Shear Values (kips/ft)			
	Reference	Hand	spBeam
V_u (At face of support)	1.94	1.93	1.91
V_u (At d from support face)	N.A.*	N.A.*	1.78
ϕV_c	6.83	6.83	6.83
* <u>ACI 318-14 (Table 6.5.4)</u> provides only the approximate shear values at the support face, making it difficult to calculate V_u at the critical section (distance d from support face). See Section 11.3 or more information.			

Table 6 - Comparison of Reinforcement Results									
Span Location	$A_{s,required}$ (in. ² /ft)			$A_{s,min}$ (in. ² /ft)			Reinforcement		
	Reference	Hand	spBeam	Reference	Hand	spBeam	Reference	Hand	spBeam
Exterior Span									
Exterior Negative	0.070	0.068	0.069	0.151	0.151	0.151	No. 4 at 12 in.	No. 4 at 12 in.	No. 4 at 12 in.
Positive	0.120	0.118	0.128	0.151	0.151	0.151	No. 4 at 12 in.	No. 4 at 12 in.	No. 4 at 12 in.
Interior Negative	0.178	0.176	0.162	0.151	0.151	0.151	No. 4 at 12 in.	No. 4 at 12 in.	No. 4 at 12 in.
Interior Span									
Interior Negative	0.169	0.169	0.162	0.151	0.151	0.151	No. 4 at 12 in.	No. 4 at 12 in.	No. 4 at 12 in.
Positive	0.133	0.115	0.127	0.151	0.151	0.151	No. 4 at 12 in.	No. 4 at 12 in.	No. 4 at 12 in.

In all of the hand calculations and the reference illustrated above, the results are in close or exact agreement with the automated analysis and design results obtained from the [spBeam](#) model.

11. Observations & Discussions

11.1. Modeling End Supports Conditions

In continuous one-way concrete slabs, the moment values along the exterior spans vary based on the rotational resistance offered by the exterior support. Engineers typically encounter two common exterior support conditions:

1. **Unrestrained exterior support:** In this condition, the exterior support is not built integrally with the slab and thus offers no resistance to rotations at the slab end. The support provides bearing resistance to carry the vertical loads and is considered a pin support. When employing [spBeam](#) to model a continuous one-way slab, this condition is the default setting when utilizing an exterior pin support, with the rotational stiffness (K_r) is set to zero by default.
2. **Integral exterior support:** In this condition, the exterior support is built integrally with the slab and thus offers resistance to rotations at the slab end. The support provides bearing resistance along moment resistance and is considered a semi-rigid connection. When employing [spBeam](#) to model a continuous one-way slab, rotational stiffness can be used to simulate this end support condition. For this example, the end support is a spandrel girder integral to the external span end, the ACI code approximates the moment at spandrel girder end support to be $(w_u \times l_n^2)/24$ (*ACI 318-14 (Table 6.5.2)*). This can be used as one method to estimate the rotational stiffness of the spandrel girder by trial and error.

11.2. Modeling Transverse Beams

In [spBeam](#) the user can incorporate the physical dimensions of the transverse beams/girders to incorporate the added stiffness provided at the support locations. This takes advantage of any additional beam stiffness derived from increased depth and reduces the length of the span segment attributed to just the slab thickness. Modeling these additional support details produces a model with closer representation of the design conditions and potentially removes some conservatism. Engineering judgment is required to determine whether to include transverse beams/girders in the one-way slab modeling as it increases the parameters involved in determining both analysis and design results. The following figure shows the effect of modeling the transverse beams on the design moment values as compared with a simple pin support at the support center.

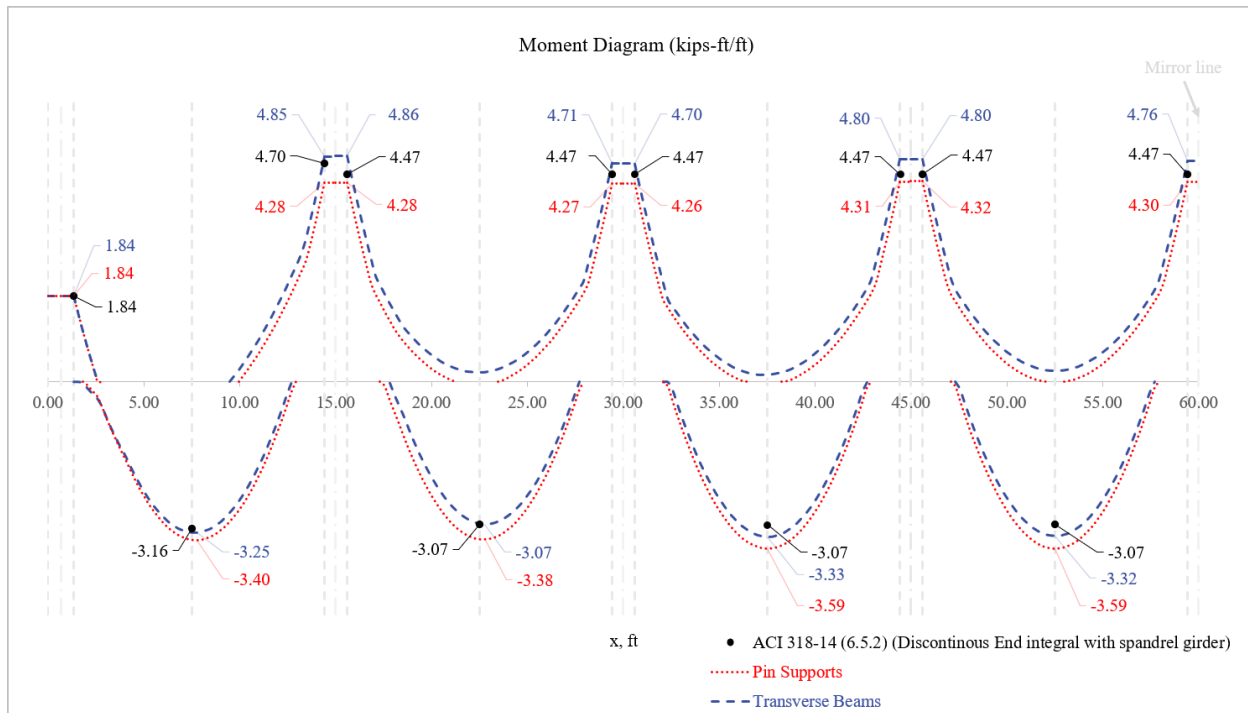


Figure 4 – Moment Diagram Comparison

11.3. One-Way (Beam Action) Shear Critical Section

Using the ACI shear coefficients, the one-way shear is calculated and checked at face of support for simplicity. When using [spBeam](#), the one-way (beam action) shear is checked at a critical section (d away from support face) as permitted by [ACI 318-14 \(7.4.3.2\)](#) ([Figure 5](#)). Nevertheless, the shear force at any location along the span (including the support face) can be acquired from the “Internal Forces: M-V-Envelopes” section under “Detailed Results” as required by the user ([Figure 6](#)).

2.8. Slab Shear Capacity

Span	b in	d in	V_{ratio}	ΦV_c kip	V_u kip	X_u ft
1	120.00	6.00	1.000	68.31	0.00	0.00
2	120.00	6.00	1.000	68.31	17.77	13.25
3	120.00	6.00	1.000	68.31	17.76	1.08
4	120.00	6.00	1.000	68.31	17.81	13.92
5	120.00	6.00	1.000	68.31	17.79	1.08
6	120.00	6.00	1.000	68.31	17.79	13.92
7	120.00	6.00	1.000	68.31	17.81	1.08
8	120.00	6.00	1.000	68.31	17.76	13.92
9	120.00	6.00	1.000	68.31	17.77	1.08
10	120.00	6.00	1.000	68.31	0.00	0.00

Figure 5 – Slab Shear Capacity ([spBeam](#))

Detailed Results - Internal Forces: M - V - Internal Forces: M - V - Envelopes

Span	x	M-	Comb.	M+	Comb.	V-	Comb.	V+	Comb.
	ft	k-ft		k-ft		kip		kip	
Face of	13.256	-33.71	U1	0.00	U1	-17.79	U1	0.00	U1
Support	13.503	-38.18	U1	0.00	U1	-18.42	U1	0.00	U1
	13.750	-42.81	U1	0.00	U1	-19.05	U1	0.00	U1
	13.750	-42.81	U1	0.00	U1	-19.05	U1	0.00	U1
	13.944	-46.56	U1	0.00	U1	-19.55	U1	0.00	U1
	14.139	-50.41	U1	0.00	U1	-20.05	U1	0.00	U1

Figure 6 – Shear at the Support Face ([spBeam](#))