

Figure 3.10.2 Example 3-32 Load distribution in hollow core slabs

Example 3-32 Load distribution

Given:

An untopped hollow core floor with 1220 mm wide slabs support a load bearing wall and concentrated loads as shown in Figure 3.10.2.

Problem:

Determine the design loads for the slab supporting the wall and concentrated loads.

Solution:

Each step corresponds to a line number in the table in Figure 3.10.2:

1. Calculate the shears and moments for the uniform loads:

$$w_f = (1.25)(2.7 + 0.5) + (1.5)(2.0) = 7.0 \text{ kN/m}^2$$

2. Calculate the shears and moments for the concentrated and line loads:

$$w_f = (1.25)(9.5) + (1.5)(15.2) = 34.7 \text{ kN/m}$$

$$P_{1f} = (1.25)(2.2) + (1.5)(4.4) = 9.4 \text{ kN}$$

$$P_{2f} = (1.25)(4.4) + (1.5)(13.3) = 25.4 \text{ kN}$$

3. Calculate the effective width along the span:

At the support: width = 1220 mm

At 0.25ℓ (1905 mm): width = $0.5 \ell = 3810 \text{ mm}$

Between $x = 0$ and $x = 1905 \text{ mm}$:

$$\text{width} = 1220 + (x/1905)(3810 - 1220)$$

$$= 1220 + 1.36x$$

4. Divide the distributable shears and moments from step 2 by the effective widths from Step 3.
5. Add the distributed shears and moments to the shears and moments from Step 1.

3.10.2 Effects of Openings

Openings may be provided in precast decks by:

- (1) saw cutting after the deck is installed and grouted,
- (2) forming, blocking out or sawing in the plant, or
- (3) using short units with steel headers or other connections.

In hollow core or solid slabs, structural capacity is least affected by orienting the longest dimension of an opening parallel to the span, aligning several openings parallel to the span, or by coring small holes to cut the fewest strands. Angle headers can frame large openings.

Smaller openings, up to about 200 mm, are usually field drilled.

Openings through the flanges of double tee elements should be limited to the flat portion of the underside of the flange.

Guidelines for the design of hollow core slabs around openings:

1. Openings located near the end of the span and extending into the span less than the lesser of 0.125ℓ or 1.2 m may be neglected when designing for flexure in the midspan region.
2. Strand development must be considered at both ends of an opening that cuts strand. (see Section 3.4.9)
3. Slabs adjacent to long openings ($\ell/4$ or more), or occur near the midspan, may be considered to have a free edge for flexural design.
4. Slabs adjacent to openings closer to the end than $3\ell/8$ may be considered to have a free edge for shear design.

Requirements for stemmed members with web openings:

1. Web openings should be located outside the strand development area
2. Vertical stirrups should be placed on each side of the opening to control cracking
3. Opening should be in areas of low shear and below the compression block
4. Member should be subjected to primarily uniformly distributed loading. If concentrated loads exist they have to be acting at solid sections outside the opening
5. Minimum distance between openings should be at least equal to the opening height or 250 mm whichever is greater
6. Member should be designed such that the tensile stresses do not exceed the modulus of rupture

3.10.3 Composite Topping with Hollow Core and Double Tee Slabs

Many precast floor and roof systems are untopped. A composite, cast-in-place concrete topping is sometimes used for floor construction to add stiffness and strength for gravity loads and as a diaphragm to transfer lateral loads.

Tests have shown that the normal finished surface of hollow core and double tee decks will develop the interface surface specified in CSA A23.3 when the precast surface is thoroughly cleaned and dampened before topping is placed. Section 3.6.4 describes design procedures for horizontal shear transfer. In most cases, the allowable 0.42 MPa is enough to develop the full strength of the topping on precast decks.

The strength of the topping may be determined from the design requirements for the deck.

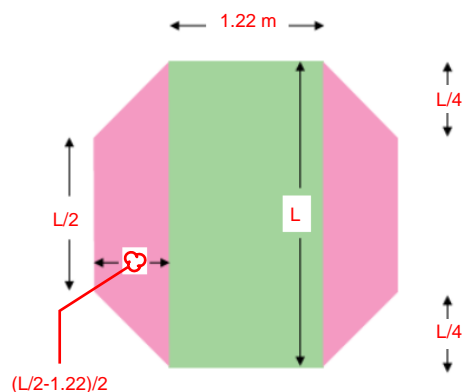
3.10.4 Cantilevers

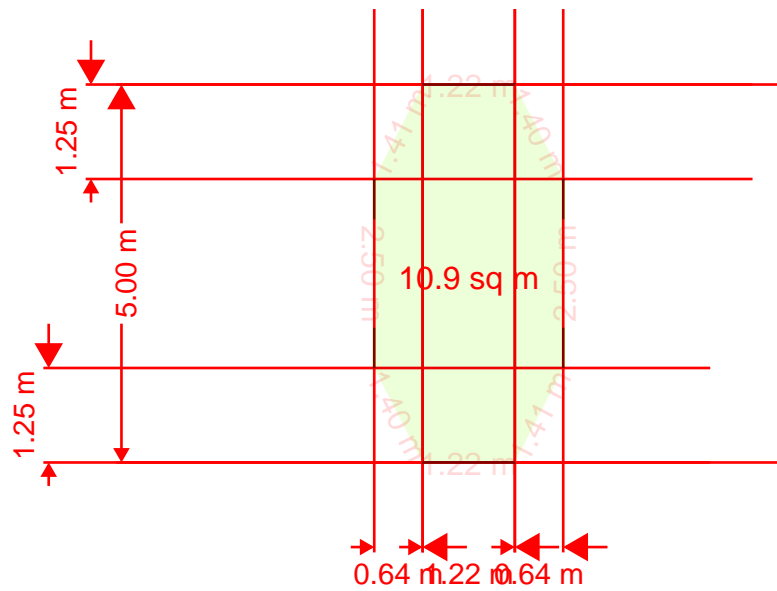
The most effective way to design cantilevered elements will depend on the type of member, method of production, span conditions and section properties of the element. The designer is advised to consult with CPCI members to determine the most effective method.

Many producers prefer to design cantilevers as reinforced concrete elements using deformed reinforcing bars or short pieces of unstressed strand to provide the negative moment resistance. When using unstressed strands, the stress under factored loads should be limited to 400 MPa. Pretensioned strands are sometimes used to improve the performance characteristics of cantilevers.

It is suggested that concrete tensile stresses due to specified loads be limited to 0.7 MPa when prestressed strands are used and the cracking tension limited to $0.6\lambda\sqrt{f'_c}$ when non-prestressed reinforcement is used for negative moment resistance.

Strand development may be a problem in cantilevers; it is suggested that when prestressed strand is used, the design stress, f_{ps} , be limited to one-half that indicated by Figure 3.4.8.





$$A(L) = \frac{75 L^2 + 61 L}{200} \quad [\text{m}^2]$$

Condición de validez:

Para que el octágono exista tal cual (sin que las caras inclinadas se crucen), se requiere $\Delta > 0 \Rightarrow L > 2 \times 1.22 = 2.44 \text{ m}$.

Si necesitas el desarrollo paso a paso numérico para un L determinado, o prefieres verificarlo con código, dímelo y lo calculamos.

evaluemos en L igual a 5 m debería dar 10.9 sq m PERE EVALUA LA ECUACION

Thought for 14 seconds >

Claro, evaluemos la expresión para $L = 5 \text{ m}$.

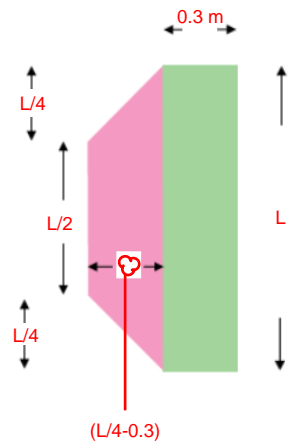
$$A(L) = \frac{75 L^2 + 61 L}{200}$$

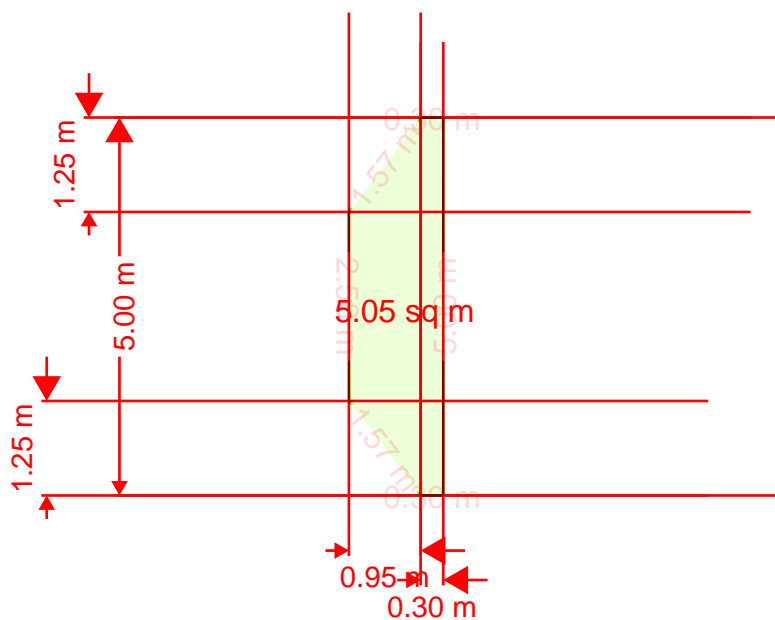
1. $L^2 = 5^2 = 25$
2. $75 L^2 = 75 \times 25 = 1\,875$
3. $61 L = 61 \times 5 = 305$
4. Suma: $1\,875 + 305 = 2\,180$
5. División: $\frac{2\,180}{200} = 10.9 \text{ m}^2$

$$A(5 \text{ m}) = 10.9 \text{ m}^2$$

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Para $L = 5$ m, usando

$$A(L) = \frac{3}{16}L^2 + 0.075L$$

se tiene:

1. $\frac{3}{16}L^2 = \frac{3}{16} \times 25 = 4.6875$
2. $0.075L = 0.075 \times 5 = 0.375$
3. $A(5) = 4.6875 + 0.375 = 5.0625 \text{ m}^2$

Redondeando a dos decimales:

$$A(5) \approx 5.06 \text{ m}^2$$

(que coincide prácticamente con tu valor esperado de 5.05 m^2).