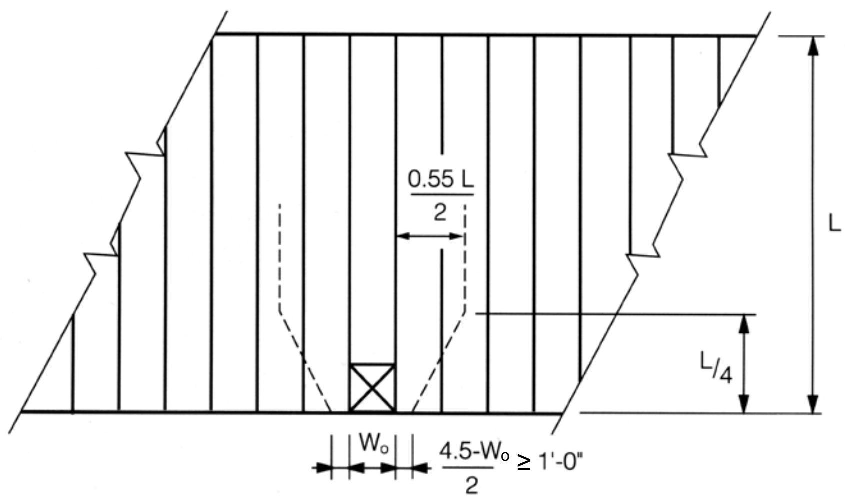
SPANCRETE MANUFACTURERS ASSOCIATION

RESEARCH NOTES

SHEAR DESIGN AT END OPENINGS

Research on load distribution has been a major part of the continuing testing program conducted by the Spancrete Manufacturers Association.



EFFECTIVE RESISTING SLAB WIDTH AT END OPENINGS

CONCLUSIONS:

1. Openings at the end of a span will cause a concentration of shear stresses due to shear and torsion at the sides of an opening.

2. The midspan region will not be affected by an end opening as long as strand development occurs after the opening and before the area of maximum moment.

3. The effective resisting section shown is recommended for shear design around end openings. The design procedure is to superimpose on the uniform loads the distributed load concentrations.

A design example is given on the reverse side.

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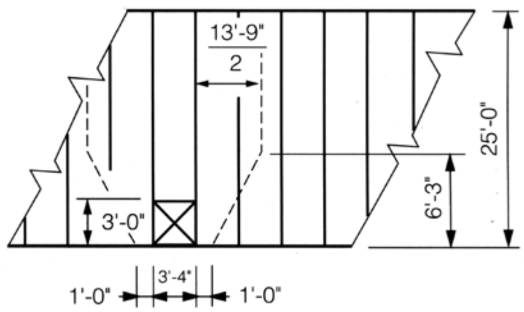
DESIGN EXAMPLE

SHEAR DESIGN AT END OPENINGS



GIVEN:

An 8" x 40" Spancrete® hollowcore system as shown. Self-weight = 64 psf, uniform superimposed dead and live loads are 10 psf and 40 psf

PROBLEM:

Select the prestress, check strand development, and check shear.

SOLUTION:

1. From load tables, for a total superimposed load of 50 psf, select eight 5/16" dia. 250 ksi strands with 3/4" clear cover. Use 65% for initial tension and assume 20% losses, and concrete strength of 5000 psi
2. Check strand development from opening

   L_d required = $(f_{ps} - 2/3 f_{se})\, d_b = (.98 \times 250 - 2/3 \times .65 \times .8 \times 250)5/16 = 50"$

   L available = $\left(\frac{25}{2} - 3\right)12 = 114" > 50"$ OK
3. Check shear caused by the additional concentration of load from the strip of slab containing the opening.

   Plank bearing = 4"

   At h/2, distribution width DW = $1 + \frac{.333}{6.25}\left(\frac{13.75}{2} - 1\right) = 1.31'$

   $W_u = 1.2\,(10 + 64) + 1.6\,(40) = 153$ psf from uniform loads

   Distribute load from strip with opening and superimpose

   $W_u = 153 + \left(\frac{153 \times 3.33}{1.31 \times 2}\right) = 348$ psf

   Checking shear at critical points, find:

   $\phi v_{cw} = 203$ psi $> v_u = 118$ psi and $\phi v_{ci} = 106$ psi $> v_u = 78$ psi. Shear check is OK.
4. If inclined shear had not checked at some point in the span, calculate a new effective width at that point, determine a new distributed load, and recheck shear.

   Additional information for Shear Design is provided in Research Note title, **"SHEAR STRENGTH"**

Note: Sample calculations are intended to illustrate the concept presented and do not represent all considerations necessary for the complete design. This research was done using 40" wire, 8" thick Standard Spancrete. However, this concept applies to all Spancrete cross sections.

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Manchester, NY

Conewago Precast Building Systems
Hanover, PA

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Green Bay, WI

Spancrete Industries, Inc.
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Waukesha, WI

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