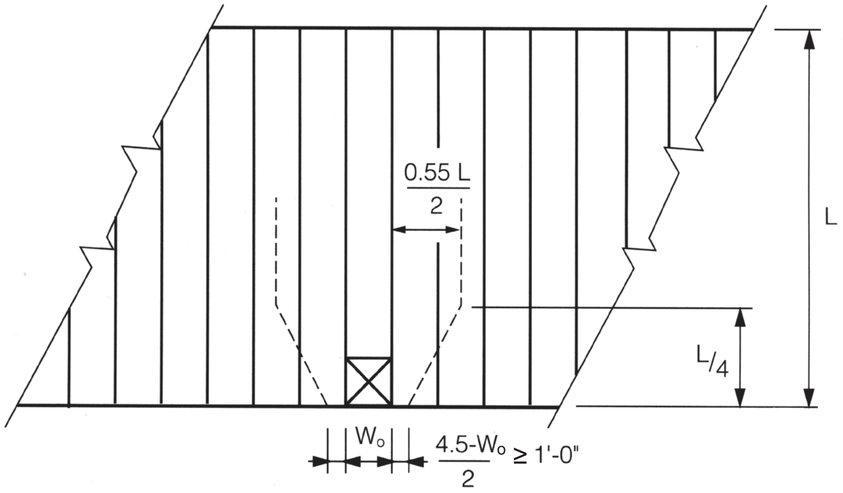
SPANCRETE
MANUFACTURERS ASSOCIATION

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.

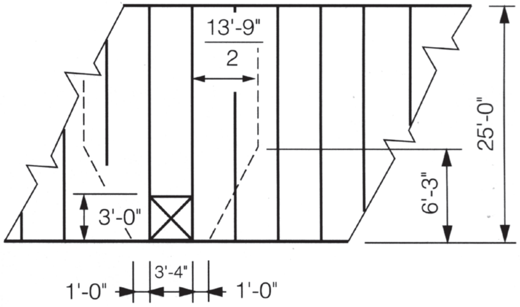
SPANCRETE®
MANUFACTURERS ASSOCIATION

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:

   $\varnothing v_{cw} = 203 \text{ psi} > v_u = 118$ psi and $\varnothing v_{ci} = 106 \text{ psi} > v_u = 78$ 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.

MIDWEST
Hanson Structural Precast Midwest, Inc.
Maple Grove, Minnesota

Spancrete, Inc.
Green Bay, Wisconsin

Spancrete Industries, Inc.
Waukesha, Wisconsin

Spancrete of Illinois, Inc.
Arlington Heights, Illinois

Wells Concrete
Wells, Minnesota

WEST
Hanson Structural Precast Pacific, Inc.
Irwindale, California

KIE-CON
Division of Kiewit Pacific Co.
Anitoch, California

Owell Precast
Sandy, Utah

SOUTHWEST
Manco Structures, Ltd.
Schertz, Texas

SOUTH
Cement Industries, Inc.
Fort Myers, Florida

Florida Precast Industries, Inc.
Sebring, Florida

EAST
Mid-Atlantic Precast, LLC.
King George, Virginia

EGYPT
Samcrete Eqypt
Ahram, Giza

MEXICO
ITISA
Mexico City, Mexico

Spancrete Noreste
Monterrey, Mexico

CROATIA
Mucić & Co
Dugopolje, Croatia

CARIBBEAN
Preconco Limited
Barbados, West Indies

TURKEY
Yapi-Merkezi
Camlica-Istanbul, Turkey

UAE
Hi-Tech Concrete Products LLC
Abu Dhabi, UAE

MACHINE MANUFACTURER
Spancrete Machinery Corporation
N16 W23415 Stoneridge Drive
Waukesha, WI 53188
Telephone: 414-290-9000
Fax: 414-290-9130
www.spancrete-machinery.com

SPANCRETE IS ALSO MANUFACTURED IN:

Armenia
China
Denmark
Guatemala
Hungary
Ireland
Japan
Russia
South Korea
Switzerland

Spancrete® hollowcore is a registered trademark

SPANCRETE MANUFACTURERS ASSOCIATION MEMBERS