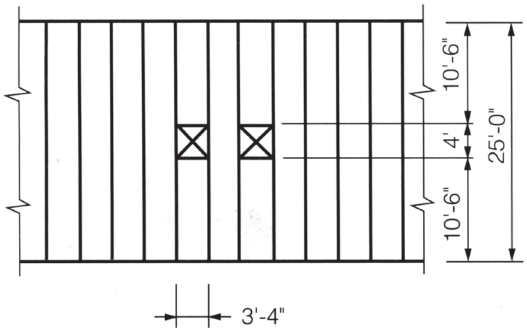
SPANCRETE MANUFACTURERS ASSOCIATION

RESEARCH NOTES

LOAD DISTRIBUTION AROUND MULTIPLE CENTRAL OPENINGS

Tests were conducted to study the lateral distribution of loads in a Spancrete® hollowcore system containing two full plank openings closely spaced at midspan. In the first test, the openings were saw cut after the planks were grouted to evaluate the influence of overcut. For the second test, the openings were created with short slabs supported by angle headers in order to evaluate the distribution of slab weight prior to grouting.



Test Assembly

CONCLUSIONS:

1. The Spancrete planks exhibited sufficient flexural ductility to develop the capacity of the entire system.

2. Overcut adjacent to sawn openings has no adverse affect on performance or ultimate strength.

3. Self weight may be distributed as superimposed load even if headers are used prior to grouting.

4. The previously recommended flexural distribution width of 0.55L is valid for both working load and ultimate conditions. (Distribution factors are listed in the Research Note entitled **"Load Distribution"**)

5. Based on the excellent ductility shown by these tests, the same conclusions may be applied and the results extrapolated for 48" and 60" and 96" Spancrete widths.

A design example is given on the reverse side.

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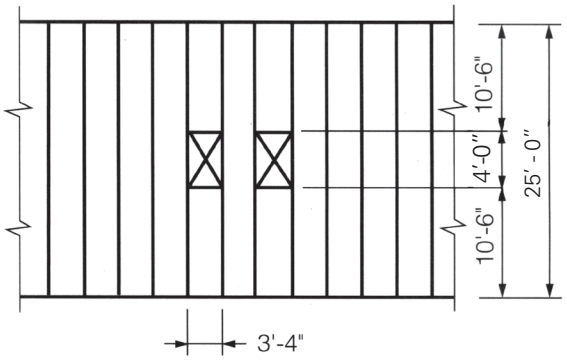
DESIGN EXAMPLE

LOAD DISTRIBUTION AROUND MULTIPLE CENTRAL OPENINGS

GIVEN:

8" Spancrete® hollowcore system shown; plank dead load = 64 psf
Superimposed dead load = 15 psf and live load = 50 psf



PROBLEM:

Select a Spancrete section to support the given loads;
Check working and ultimate conditions based on flexure

SOLUTION:

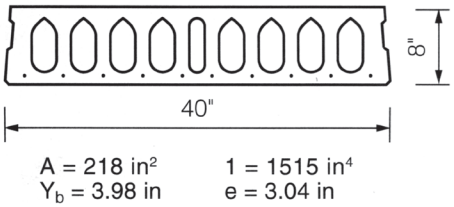
Effective distribution width of midspan =
0.55 (25) + 3.33 = 17.08 ft

Effective self weight $W_D = 64 + \frac{2(3.33)\ 64}{17.08} = 89$ psf

Effective superimposed $W_D = 15 + \frac{2(3.33)\ 15}{17.08} = 21$ psf

Effective live load $W_L = 50 + \frac{2(3.33)\ 50}{17.08} = 70$ psf

Try: 8608 (3/4" clear cover, 8-3/8" 250 ksi strands,
65% initial tension, 20% losses, $f_{PU}\ A_{PS} = 20K$)



A = 218 in² I = 1515 in⁴
Y_b = 3.98 in e = 3.04 in

$M_w = \frac{25^2}{8}$ (.089 + .021 + .070) 3.33 = 46.9 ft-k/slab

Check tension: $f_t = 8 \times 20 \times .65 \times .8\left(\frac{1}{218} + \frac{3.98 \times 3.04}{1515}\right)$

$-\frac{46.9 \times 12 \times 3.98}{1515} = 0.432$ ksi

Check LL deflection: $\Delta = \left(\frac{5}{384}\right)\frac{3.33\ (.070)\ 25^4\ (1728)}{4300 \times 1515} = 0.31" = L/950$

Check ultimate $M_u = \frac{25^2}{8}$ [1.2 (.089 + .021) + 1.6 (.070)] 3.33 = 63.54 ft-k/slab

$\phi M_n \simeq \frac{.9}{12}$ (.98 x 8 x 20)$\left(7.06 - \frac{.98 \times 8 \times 20}{2 \times .85 \times 4 \times 40}\right)$ = 76.25 ft-k/slab (> M_u)

Check slab between openings for headered construction loads of 20 psf before grouting

Header reactions $R = \frac{10.5 \times 3.33}{4}$ (.064 + .02) = 0.74k

$M \simeq \frac{25^2}{8}$ (.064 + .020) 3.33 + 10.5 (2) .74 = 37.4 ft-k/slab (<M_w)

$M_u = (1.2)\ [(.064)\ (3.33)\ (\frac{25^2}{8}) + (10.5)\ (2)\ (.74)] + (1.6)\ (.020)\ (3.33)\ (\frac{25^2}{8}) = 46.96\ \frac{\text{ft-k}}{\text{ft}}$ (<63.54)

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" wide, 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

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China	*Japan*
Denmark	*Russia*
Guatemala	*South Korea*
Hungary	*Switzerland*