

PROJECT PROFILE

CALCULATION OF BEARING CAPACITY OF HOLLOW CORE PLANKS

PROJECT BACKGROUND

In our previous article "CORE FILL EFFECT ON HOLLOW CORE PLANK BEARING CAPACITY" the experimental bearing capacity of Hollow Core Planks (HCP), provided by Strescon Limited, a precast concrete product manufacturer in Eastern Canada, were presented. HCP is extensively used as floor and roof members expected to carry flexural load. A common HCP is 8" deep and 4' wide in cross section with 6 hollow cores. In total precast concrete and masonry constructions, the HCP floor slabs have to be able to resist and transfer axial loads from all of the above floors to the load-bearing walls below. Usually HCP get partially or fully core-filled at the joints (12" deep) to increase their effective cross-section and bearing capacity. This article uses the experimental results to recommend equations for calculation of load bearing capacity of HCPs.

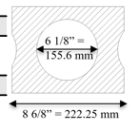
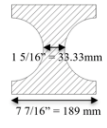
METHODS

The experiments were conducted on full width (4') or section cuts of HCP. The specimens were ungrouted, fully grouted or partially grouted. The section cuts were either one hollow core plus two webs or one web plus two half hollow cores. Considering presence of seven webs in a full-width HCP, the equivalent capacities were calculated for the capacity of section cuts and used for comparison and to propose equations for calculating the bearing capacity.

RESULTS

The test results and the equivalent bearing capacities are presented in the Table. The load-carrying capacity of specimen A2, 2,345 kN was considered as the benchmark, and values in other groups were compared to that. Both partially and ungrouted specimens in Group C have close strengths to A2. The next closest are the ungrouted specimens followed by partially grouted specimens in Group B. However, fully grouted specimens in Group B show a significantly higher equivalent load capacities: an average of 2.5 times higher. The negative effect of partial grouting is

only observed in Group B specimens and not in Group C which could be a result of how much and how well grout was added in each case.

Specimen	Description	Grout	Equivalent Load (kN)	Δ_{load} form A2
A1	Full width	NA	3,363	44%
A2			2,343	0%
Avg			2,852	NA
B1		NA	2,023	-14%
B2			2,168	-7%
Avg			2,095	-11%
B3			7,182	206%
B4	Full	Full	9,322	298%
Avg			8,252	252%
B5			1,898	-19%
B6	Partial	Partial	1,877	-20%
Avg			1,888	-19%
C1		NA	2,287	-2%
C2			2,565	9%
Avg			2,426	4%
C3			2,462	5%
C4			2,472	5%
C5			2,557	9%
C6*	3,865	65%		
Avg	2,497	7%		

* C6 is not considered in the calculations

RECOMMENDATIONS

The experimental strength is compared to the theoretical strength to come up with suitable equations for calculating the load-carrying capacity of HCPs. However, extensive calculations are not presented here. The material strength for concrete was 63.7 MPa and for grout was 28.8 MPa.

- Un-grouted Hollow Core Plank Capacity:

$$P_{ungr} = 0.77 \times f'_c \times A_e$$
- Partially Grouted Hollow Core Plank Capacity:

$$P_{pgr} = 0.53 \times (f'_c \times A_e + f'_{gr} \times A_{gr})$$

$$P_{pgr} = 0.9 \times f'_{gr} \times (A_{gr} + A_e)$$
- Fully Grouted Hollow Core Plank Capacity:

$$P_{fgr} = 0.74 \times (f'_c \times A_e + f'_{gr} \times A_{gr})$$

$$P_{fgr} = 0.92 \times f'_{gr} \times (A_e + A_{gr})$$

The second equations for partially and fully grouted HCPs demonstrate the power of grout strength on the bearing capacity rather than the concrete strength.