One-way Shear Strength of Voided Flat Slabs

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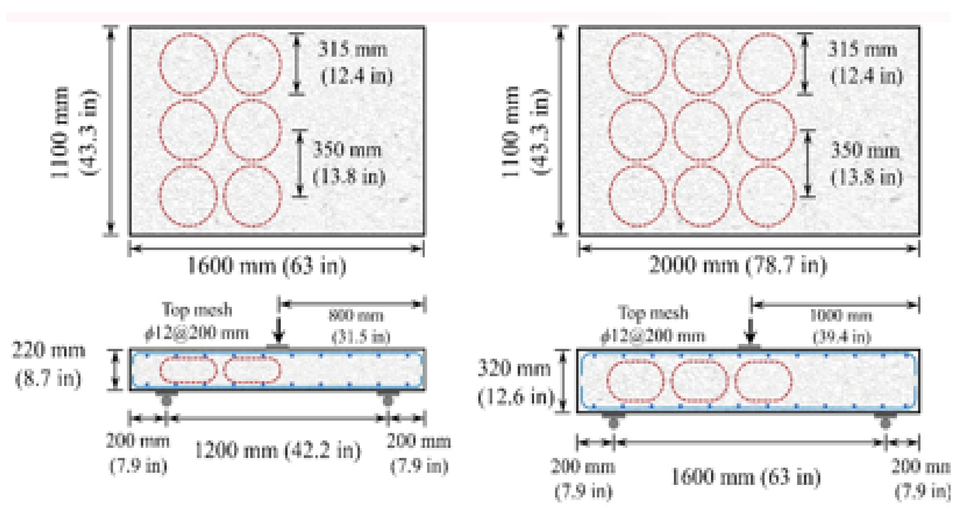
Introduction

Voided slabs are a specific type of flat slab system was introduced in 1990 to address the issue of excessive self-weight produced by thick slabs. The basic concept is to replace ineffective concrete in the middle of the slab with void formers to reduce self-weight.

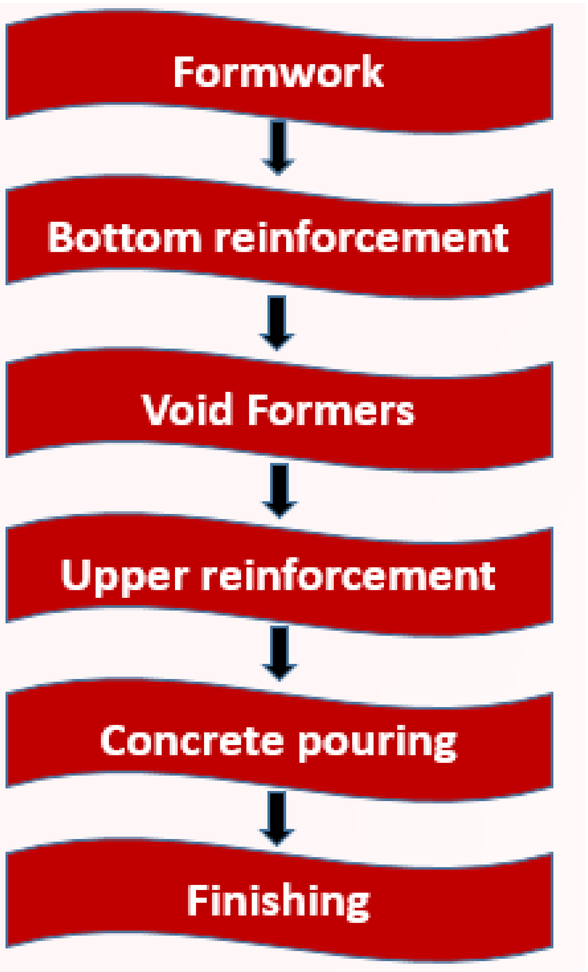
The one-way shear capacity of the voided slab is significantly different from solid reinforced slab. This because the shear loads are carried through the full cross–sectional concrete area. So, the shear capacity is decreased when the voids are present. Thus, this thesis aims to investigate the shear capacity of voided slabs and provide design recommendations for such structures. The research resulted in a proposed Shear Capacity Reduction Factor for Voided Slabs.

Specimens Design

The study included five samples. Three of these examples had measurements of 220 in height, 1100 in width, and 1600 in length. The remaining two samples measured 320 in height, 1100 in width, and 2000 in length. The slabs were casted with ready mix concrete with cylinder compressive strength (f'c) for all specimens was 35 MPa.

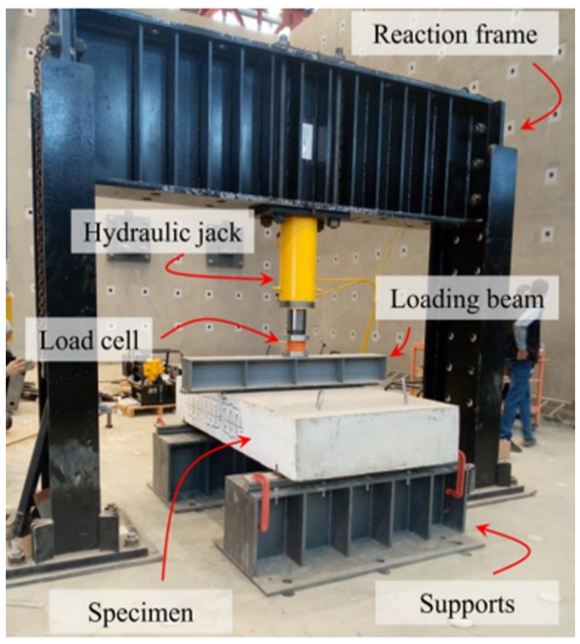


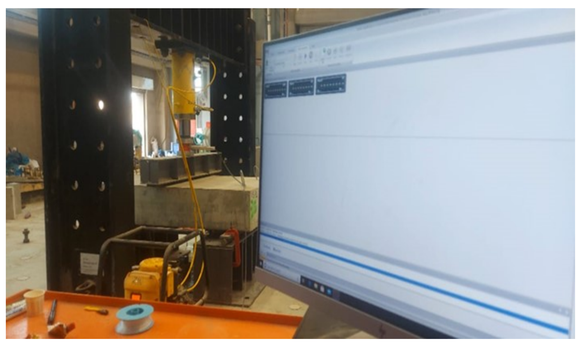
Specimens Construction



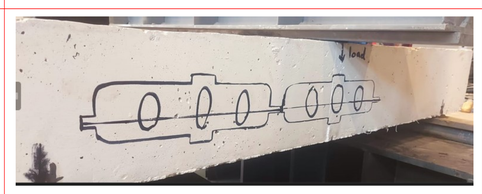
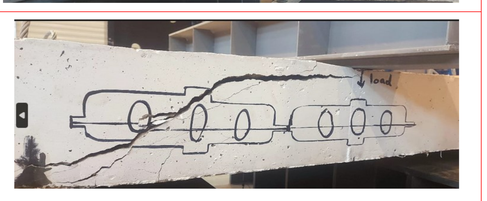
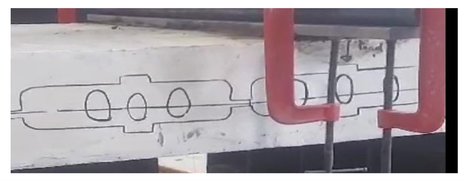
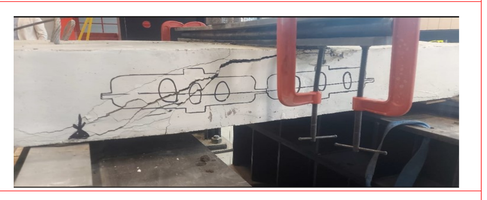
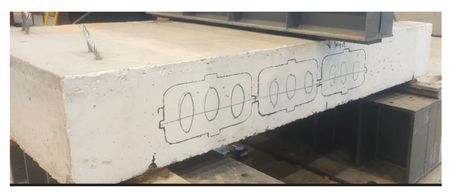
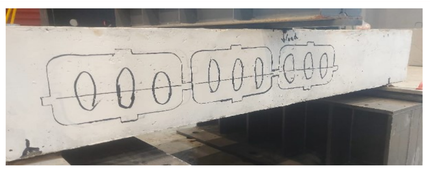
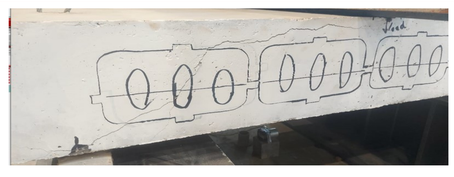
The Experimental Test Setup

Specimens were tested in a three-point loading configuration with simple supports. The loading force was applied to a loading beam by a hydraulic jack with a maximum loading capacity of 2000 kN The deflection of the slabs under the loading point was measured using a Potentiometer. The load cell was connected to the data acquisition system throughout the testing duration.





The Experimental Result

Sample	Before test	After test
Control slab		
VS-22-1		
VS-22-2		
VS-32-1		
VS-32-2		

The experimental results showed that the solid slabs had a shear capacity of 210 kN. In comparison, the voided flat slab specimens with the same thickness had a maximum shear capacities of 175 kN and 169 kN, which correspond to approximately 83% and 80% of the shear capacity of the solid slab, respectively. For voided specimens with a thickness of h=320 mm, the shear capacities were 253 kN and 236 kN

Analysis Result

The proposed shear capacity reduction factor ($\lambda void$) for voided slabs based on the ($hvoid/h$) ratio were developed. $\lambda void = (1-0.7(hvoid/h))$

The height of the void former can be selected based on the shear load exhibited and the required shear strength