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The Behaviour of Difference Locations Opening Shapes in Deep Beam.

Ashraf M.L.Milad[1], Nori.S.A.Ateig [2*], Juhaynah .S.Alshukri[3]
Department of civil Engineering , College of Engineering /Bain Waleed-University, Libya
*Crosspnding author: nuriwerfali@gmail.com

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Abstract: The aim of this study is to examine the deep beam opening behavior of lightweight reinforced concrete (LWC) beams with or without web openings, analyzed by ansys19 software. The analysis included five samples of different shapes, deep solid beam, deep beam containing two square holes with sides length of 80 mm and the horizontal spacing between the two holes is 220 mm, deep beam containing two holes Square with side lengths of 80 mm and the maximum distance between the two holes is 420 mm, a deep beam contains two round holes with a diameter of 80 mm and the distance between the two holes is 220 mm, a deep beam contains two round holes with a diameter of 80 mm and the distance between the two holes is 420 mm. Each sample was subjected to one point load. The effect of distances between the gaps on the behavior of the sample was analyzed and compared. The results indicated that the distances between the gaps affect the The behavior of the deep beam, where it was found that the deep beams with gaps spaced from the edges of the beams are the closest behavior to the deep beams without gaps, except that the results showed that the difference is not significant, but it is noteworthy and noteworthy and must be taken care of.

Keywords: LWC, BWOH, BSHmS, BSHeS, BCeHS, BCmHs.

Introduction

Lightweight foam concrete is a new type of lightweight concrete, with the advantages of ordinary concrete, aerated concrete and self-compressing concrete, as through it the natural aggregate is partially replaced by polystyrene foam, and this leads to reducing the weight of the concrete unit as well as maintaining the required strength. This reduces the dead load by 15 to 20%, reduces the size of columns, bases and other bearing elements, and reduces the total cost. Deep beams are members that are loaded on one side and supported on the opposite face so that stress supports can develop between the loads and the supports, and have either clear spans (Ln), at, equal to, or less than four times the depth of the total member (H). Or that the areas of concentrated loads (a) be within twice the depth of the member (d) from the support face. In some facilities, deep beams with different openings and shapes are required, and this affects the behavior of the deep beams and the basic services of the deep beams. In such cases, it is important to know the behavior of these beams and their ultimate strength. There are many previous studies that studied the behavior of deep beams that contain and do not contain gaps, and also studied the behavior of the sample in the presence of gaps of different shapes and distances including that: Amr H. Zaher, Wael Montaser and Mohamed Ramadan studied the shear behavior of simple, continuous beams of light concrete with openings. The testing program included seven simple deep beams of light concrete, and the most important variables studied Simple beam test is the size of the holes, the location of the holes, the design pressure resistance of the concrete and the percentage of accidental reinforcement for the bunch. The results showed that when the side openings are present at the beam height equal to 02% to 22%, respectively, of the total height of the beam, this leads to a decrease in the final shear strength of the simple deep beams by about 15% to 62% compared to the deep beam that has no side openings [1].

(Nishitha Nair, Kavitha PE), University of Kerala, India, studied the effect of loads on seven different samples of deep beams (Deep beam without hole , deep beam with a circular hole one at centre , deep beam with a rectangular hole one at centre , deep beam with one circular hole one at side, deep beam with one square hole one at side, Deep beam with circular hole at two sides and Deep beam with rectangular hole at two sides) with ansys 14. It was found that the maximum tolerance was in the deep beam without hole, and the lowest tolerance was in the deep beam with rectangular hole at two sides [2]. (Hawraz Karim M. Amin, V.C .Agarwal and Omar Q. Aziz) studied the effect of different volumes and locations of holes in deep hollow beams. By comparing the numerical results shown, deep beam models without gaps were studied and were created by (An-sys + CivilFEM) to study the effect of openings compared to a beam without openings but with the same size to show the effect of creating openings in the actual beam with variable sizes of gaps. Shear causes a sharp decrease in final shear by about (53.6%) and when opening is located in the reinforced area supports an average decrease in stress (23.93%) but between the mid-range a small effect, as the average decrease in stress (8%), when creating square openings with dimensions (0.45 h x 0.45 h), the average decrease in shear stress was approximately (45.78%) and dimensions (0.30 h x 0.30 h).Less effect where the average reduction in shear stress is (11.55%) [3]. Khattab Salim Abdel-Razzaq, Haider Ali and Mays Mohamed Abdel-Karim studied the effect of different forms of gaps in deep beams. The study was carried out on thirteen deep beams under the effect of point load with rectangular, square, circular, horizontal and vertical openings. Choose two holes per beam, one in each cut-out. Creating square, circular, horizontal, and vertical rectangular openings reduced the final capacity by about 20.5%, 18.3%, 24.7%, and 31.7%, respectively, compared to the reference solid beam. In general, the opening size was found to be inversely proportional to the maximum capacity of the deep beam and the mid-section deviation because the reduction of the opening size resulted in less interruption in the compressive support connecting the loading and support points [4].

EXPERIMTAL PROGRAM

The pilot study consisted of five simply supported reinforced concrete girders with mesh and no openings, and made of lightweight concrete. The packages were tested under the influence of a single concentrated payload by applying them to ANSYS19 software. All tested samples have the same geometry and the main upper and lower longitudinal reinforcement. The research sample was taken from the study (Amr Hassan Zahir, Wael Montaser and Muhammad Ramadan) entitled (An experimental study of the behavior of lightweight reinforced concrete deep beams with mesh holes)[1].

Conclusion

A conclusion must include advantages, limitations, and applications and don't repeat the abstract, delete and type)

Geometry of the Deep Beam:

The geometry of the full size beam is 1100mm x 400mm x 80mm. The beam is supported simply by providing a plate support on both sides. Single point loads are applied at the center of the beam. The concrete grade was 28.9 MPa and yield strength 550 MPa.

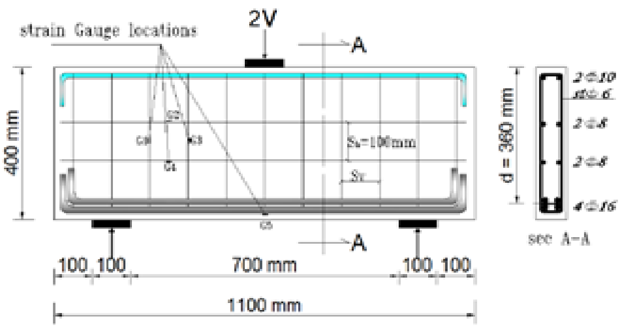
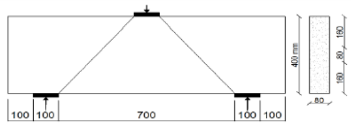
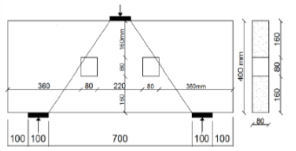
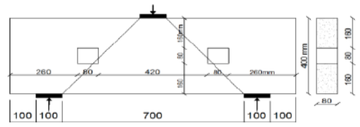
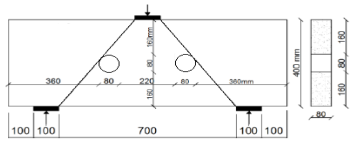
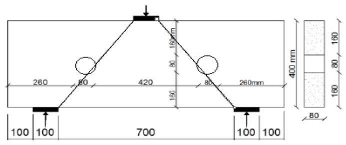


Figure (1): Reinforcement detail

Test Specimens

Table (1) shows samples of deep beams for treatment by research, its dimensions and the dimensions of the gaps in it.

Table (1): Typical dimensions of tested beams

Name	shape of specimen
BWOH	
BSHmS	
BSHeS	
BCmHS	
BCeHS	

Elements used for Modeling:

Table (2): shows the characteristics and identifications of the selected ANSYS finite element type representative of the main components for all beams.

Table (2): Characteristics and identifications of the selected ANSYS finite element types representative of the main components for all beams. (12)

Beam components	Selected from ANSYS library	Element characteristics
Reinforced Concrete Structural Solid	SOLID65	8-node Brick Element (3 Translation DOF per node).
1-Reinforcing bars (main, horizontal and vertical stirrups).	LINK180	2-node Discrete Element (3 Translation DOF per node).
Layered Structural Solid	SOLID186	20-node Brick Element (3 Translation DOF per node).

RESULTS:

Evolutions of Crack and Load Capacity for RC.

Deep Beam:

The appearance of cracks begins when the samples are exposed to excessive loads or to more than they can bear, as when increasing loads more the samples reach the final breaking point and that varies from one sample to another due to the difference in the shapes of gaps, their dimensions and the distance between them.

First crack:

The five samples were subjected to an Aries point, and as the load increased, primary cracks appeared in the samples. It turned out that the BSHmS sample was the one that showed cracks first among the four hollow samples, so it started to crack when subjected to a load of 60 kN, while it was the last one that showed the first cracks among the four experimental samples. The cracks started when subjected to a load of 70 kN. The result is closer to the BWOH reference, the sample starting to flex under a load of 92 kN. The following figure shows all the results of five samples from the first part:

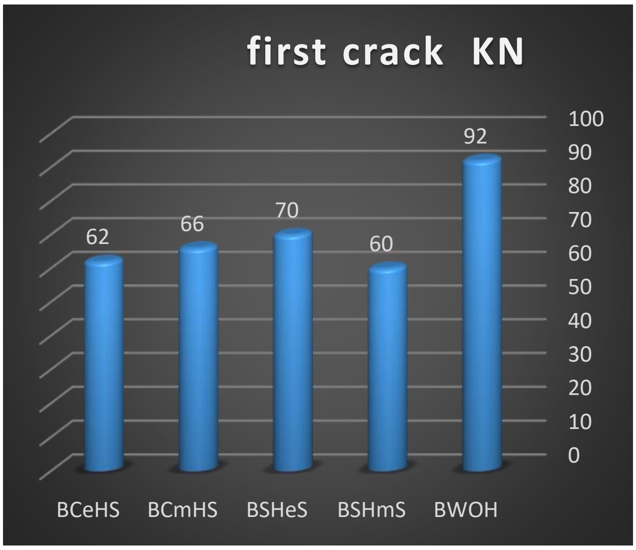


Figure (2): First Crack

final load:

The samples reached collapse mode when subjected to excessive loads.

In the BWOH reference sample, which collapsed at an exposure load of 213 kN, the BCmHS sample was closest to the reference sample, and collapsed at a load of 205.25 kN, which means that it requires behavior very close to 96% steel. The BSHeS sample was the furthest in behavior compared to the BWOH reference sample, and it collapsed at a load of 197 kN, this indicates that it possesses 92% of the strength reference sample. The following figure (3) shows all the results of the five samples in terms of final load:

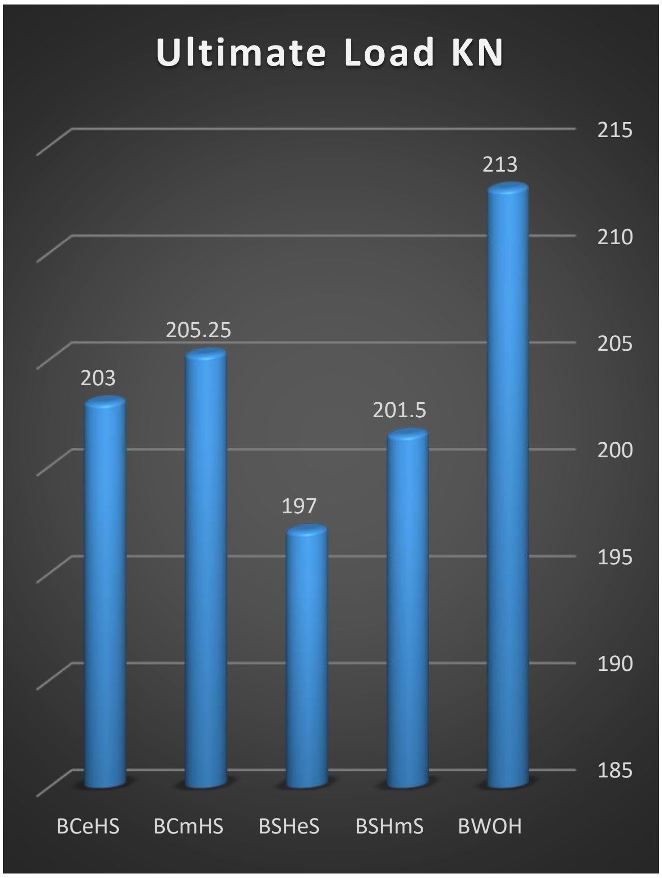
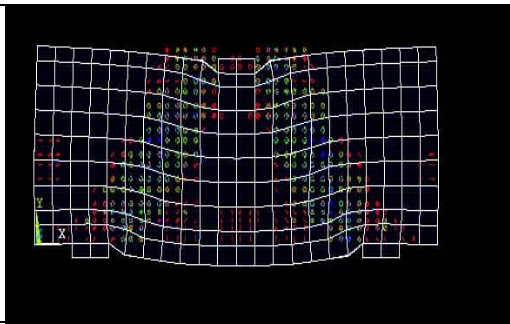
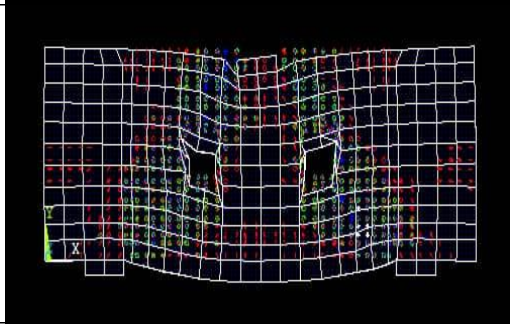
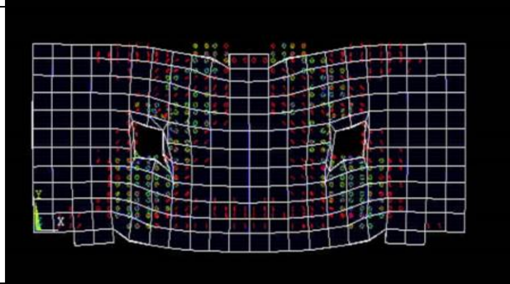
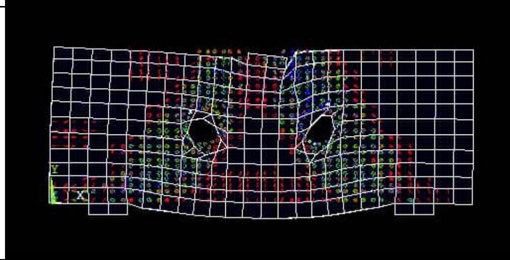
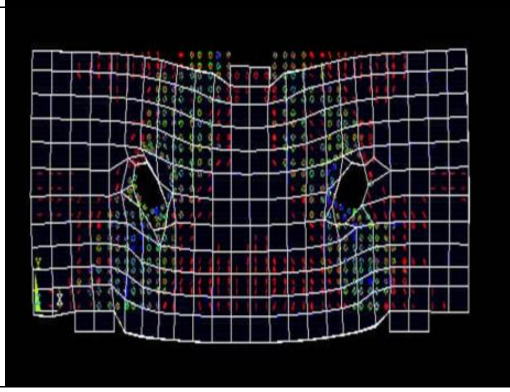


Figure (3): Ultimate load

Cracking Pattern and Mode of Failure:

The ANSYS program crack pattern records a crack pattern at each load step evolution of crack pattern developing for each beam at last loading step. ANSYS program display circles at locations of cracking or crushing in concrete elements. Cracking is shown with a circle outline in the plane of the crack, and crushing is shown with an octahedron outline the first crack at an integration point is shown with a red circle outline, second crack with green outline, and third crack with a blue outline (ANSYS manual version 10.0).

Table (3): shows the evolution of cracks in the five experimental samples.

Name	Cracks develop in the sample
BWOH	
BSHmS	
BSHeS	
BCmHS	
BCeHS	

Load Deflection Curve:

The following figure shows the deflection results for the five samples as a result of exposure to different loads:

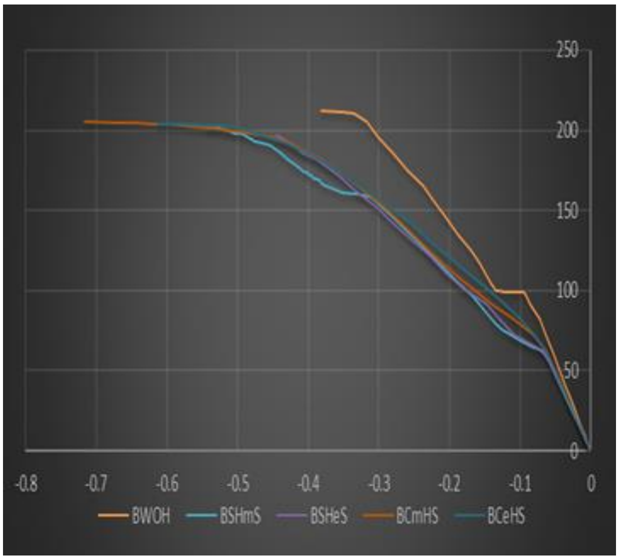


Figure (4): Comparison of load-deflection curve for specimens with different web opining type.

CONCLUSION:

1- Behavior of deep hollow beams With different distances between the gaps gaps.

2- It contains a cavity containing damage containing chemicals containing the closest.

3 - the ray that contains part of this form of the shape that contains the shape of the saviors.

4- Deep beams that contain two square gaps with a distance of 220 mm between them.

5- The closer the gaps are to the end of the deep beam, the more danger will be posed to the behavior of the sample.

6- Deep beams with a circular cavity and the gaps between them are 220 mm The most flexible of the five samples.

7- Deep beams with a square cavity and a distance of 420 mm is the least flexible among the five samples.

Recommendations:

1- Testing the behavior of the deep beam with one gap, but with different positions.

2- Testing the behavior of the deep beam with two gaps of the same shape and size and with different distances, not just two.

3- Testing the behavior of the deep beam, so that its dimensions are in meters or centimeters, so that there is more room for spacing between the gaps.

4- Testing the behavior of the deep beams that contain gaps, so as to change the location of the gaps in the vertical form, not the horizontal one.

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