Effect of Shear Span on RCC Beam Subjected To Bending And Shear

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Abstract- *Utilization of high strength concrete in construction sector has increased due to its improved mechanical properties compared to ordinary concrete. One such mechanical property, shear resistance of concrete beams is an intensive area of research. To Estimate the shear resistance of beams, standard codes and researchers all over world have specified different formulae considering different parameters into consideration. With the aim of taking into account this large amount of information available and to re-evaluate the current codes of practice extensive research was performed. An artificial neural network was developed to predict the shear strength of reinforced beams and, based on its results; a parametric study was carried out to determine the influence of each parameter affecting the failure shear strength of beams without web reinforcement. Finally, new simple expressions are proposed for the design of high-strength and normal-strength reinforced concrete beams without shear reinforcement. The new expressions correlate with the empirical tests better than any current code of practice does.*

I. INTRODUCTION

Extensive research has been made in last 20 years to understand the shear properties of reinforced concrete beams. The reinforced concrete beams are presently designed with the help of certain provisions of different international building codes, but the latest research has shown that most of these are un-conservative for beams with large sizes and lower values of longitudinal reinforcement. It has also been observed that the stirrups contribution has also been adversely affected in large beams .The shear strength of concrete beams mainly depends on the following variables:

- Depth of member or size effect
- Longitudinal Reinforcement
- Shear span to effective depth a/d or moment to shear ratio
- Axial Force,
- The tensile Strength of concrete

A. OBJECTIVES

1. To calculate shear capacity of beams and understand appropriate mode for shear failures of flexural members using ANSYS
2. To determine the crack propagation path using ANSYS
3. To determine the fracture toughness of beam specimens using ANSYS
4. To prepare the new empirical equation for shear strength this based on fracture Mechanism - Finite Element Analysis.

II. LITERATURE SURVEY

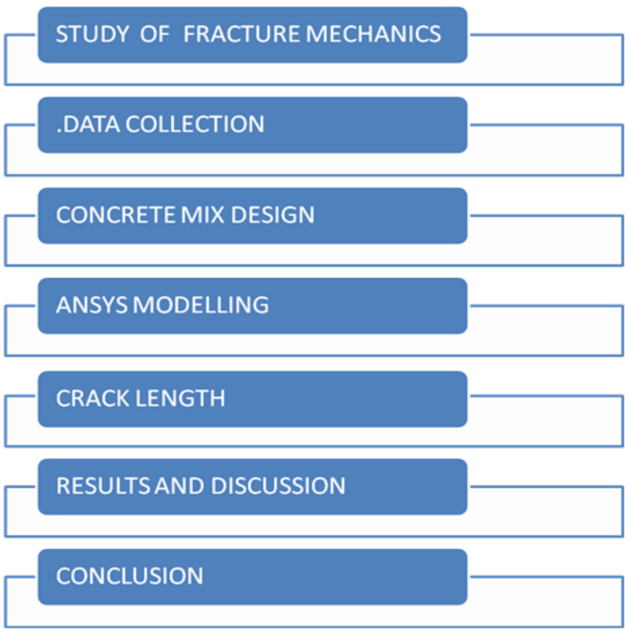
S Ahmad One dial gauge was installed at mid span to record mid span deflection and two gauges were installed at supports to measure settlement. The ANSYS results showed that for all valued of p, the relative flexural strength of beams which is the ratio of ANSYS ultimate moment to theoretical moment capacity decreased for a/d from 2 to 3. Relative flexural strength however increased for the a/d range from 3 to 6 for all values of p. Thus relative flexural strength of beams also depends on a/d besides “ρ". At constant a/d wider cracks were observed at lower steel ratio and smaller cracks at high steel ratio.

Abdul Ghaffar No shear reinforcement is provided in the beams. Beams were tested as simply supported in a reaction frame and load was applied with the help of manually operated hydraulic jack. They concluded that According to ACI contribution of fc’ is about 80 to 90 % of the total shear before any cracking is observed, which is against the Kani's as well as our ANSYS research. Residual shear strength of a beam after shear cracking remains constant as a/d is decreased upto 2.5, then it increases rapidly as a/d is further decreased below 2.5 showing minimum capacity at a/d = 2.5.

Junho Song This paper develops probabilistic shear strength models for reinforced concrete beams without shear reinforcement based on deterministic shear strength models, understanding of shear transfer mechanisms and influential parameters, and ANSYS test results reported in the literature. Using a Bayesian parameter estimation method, the biases of base deterministic models are identified as algebraic functions of input parameters and the errors of the developed models remaining after the bias-correction are quantified in a stochastic manner. The proposed probabilistic models predict the shear strengths with improved accuracy and help incorporate the model uncertainties into vulnerability estimations and risk-quantified designs.

Mohamed M. Hanafythe ANSYS program consisted of twelve simply-supported reinforced concrete wide beams subjected to two concentrated loads at third points. The specimens were divided into 5 groups. All specimens were typically proportioned so that shear failure would preclude flexural failure. Shear strengths at failure recorded in this ANSYS program are compared to the analytical strengths calculated according to some international codes. Test results clearly demonstrate the significance of the web reinforcement in improving the shear capacity the ductility of the shallow wide beams which is consistent with the recognized international codes and standards provisions.

III. METHODOLOGY



IV. RESULTS AND DISCUSSION

A. **ANSYS Modeling Of HSC Beam M50 and M60**

Table 1 Detail of Beams

A/D Ratio	Size Of Beam For M50 And M60 Grade Concrete	No. Of Beams
1	150*150*700	2
1.5	150*150*800	2
2	150*150*1000	2
2.5	150*150*1150	2

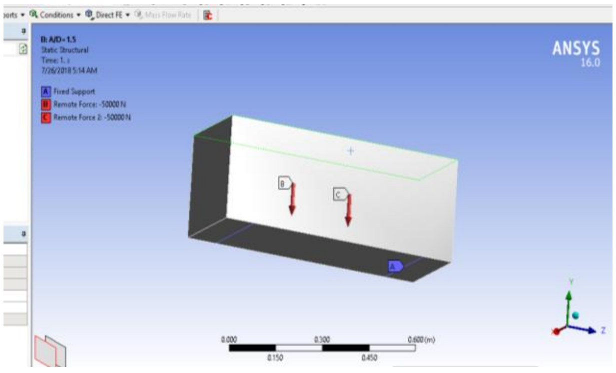


Fig 1 with two points loading

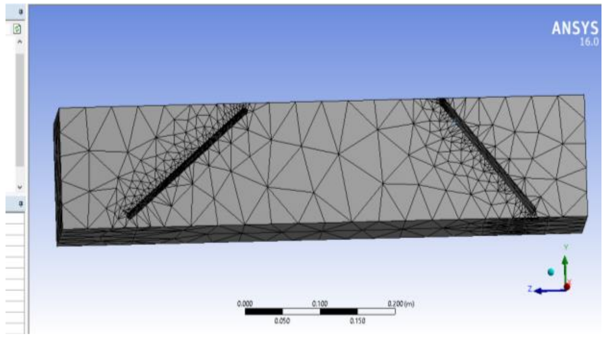
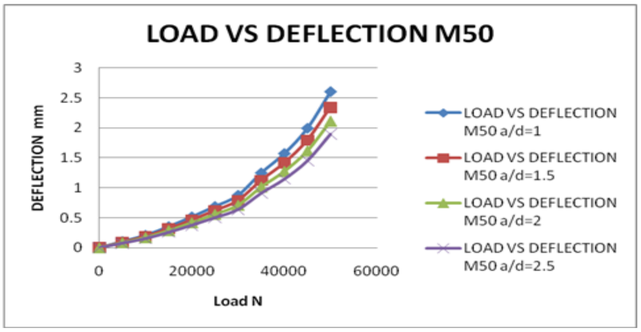


Fig 2 Cracked Specimen of Longitudinal Reinforcement

Table 2 Loading Steps While Testing

Time Step	Load KN
0	0
1	5000
2	10000
3	15000
4	20000
5	25000
6	30000
7	35000
8	40000
9	45000
10	50000



Graph 1 Load V/S Deflection For M50

In figure the normal stresses are shown at the ultimate load of beam specimen, the maximum stress observed under point loading.

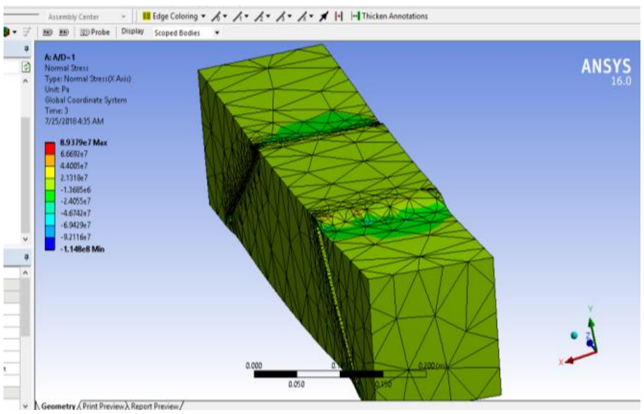


Fig 2 Normal stress

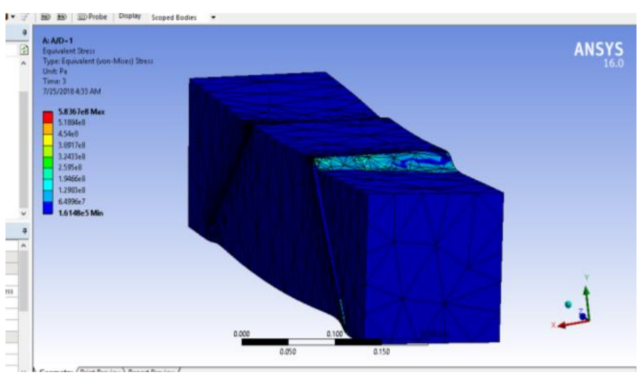
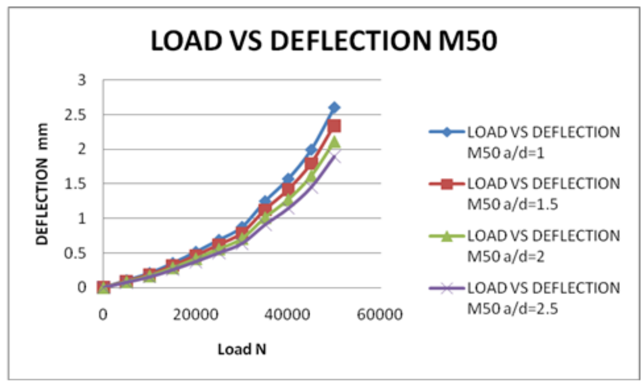


Fig 3 Equivalent stress

By observing above cracked specimens of beams, it is conclude that these beams are under failure that is (tensile stress normal to the plane of the crack) opening mode.

Table 3 Load V/S Deflection For M50

LOAD VS DEFLECTION M50				
Load KN	**a/d=1**	**a/d=1.5**	**a/d=2**	**a/d=2.5**
0	0	0	0	0
5000	0.10482	0.094338	0.084904	0.076414
10000	0.20972	0.188748	0.169873	0.152886
15000	0.35371	0.318339	0.286505	0.257855
20000	0.51563	0.464067	0.41766	0.375894
25000	0.68861	0.619749	0.557774	0.501997
30000	0.87613	0.788517	0.709665	0.638699
35000	1.2486	1.12374	1.011366	0.910229
40000	1.5717	1.41453	1.273077	1.145769
45000	1.9938	1.79442	1.614978	1.45348
50000	2.6039	2.34351	2.109159	1.898243



Graph 2 Load V/S Deflections for M50

V. CONCLUSIONS

1. The shear failure of reinforced beam without stirrups is a very complex fracture process and exhibits the noticed size effect. Hence, the lack of valid physically sound analytical model for the prediction of shear bearing capability of reinforced concrete beams without stirrups need more researches on application of fracture mechanics model to predict shear bearing capability of reinforced concrete members.
2. The new analytical formula can accurately estimate the size effect in shear fracture, the contributions of the shear span-depth ratio, the reinforcement ratio and the concrete quality to shear strength and reasonably interpret the failure mechanism of reinforced concrete beams without stirrups.
3. The equation stated above includes almost all the parameters required to predict the shear capacity beams without shear reinforcement. Therefore a single simplified equation can be used to predict the shear capacity of HSC beams using artificial sand with a/d = 1, 1.5, 2 and 2.5.

4. The longitudinal reinforcement ratio, strength of the concrete, shear span to depth ratio, value and depth of the beam are the most influencing parameters in the deformational and shear behaviour of the HSC beams without shear reinforcement.
5. It is further verified that fracture mechanics can be utilized as a valuable knowledge to analyse the shear failure problems of reinforced concrete members without stirrups.

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