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Study of Change in Width to Depth Ratio of RCC Beam in Shear for M-25 Grade of Concrete

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***Abstract*: In this study focused member with typically b/d ratio of members once a parameter of depth constant and another parameter is width constant. Additional consideration should be given to member having b/d ratio of about its analyzing and designing resistivity, which are also representative of wide beams used in industry. Each of these geometric relationships should be considered in the context of member with web reinforcement.**

***Keywords*: Shear, Width/Depth ratio.**

1. Introduction

The importance of accounting for the longitudinal reinforcement, the flexibility and flexibility requirements, and the impact of concrete strength have also been identified as appropriate for accurately predicting shear strength.

However, it is not widely agreed whether the width of the member is an important parameter, and whether it minimizes the influence of other parameters. For example, ACI 318-05 construction code allows for very high levels of shear pressure application on the basis of the width of the members, but does not require a variety of analytical methods to predict shear requirements for these same components. Conversely, some design standards work by providing uniformity regardless of member type or scope. There is concern that different strengths based on the full member's range will produce different levels of safety throughout the range of possible designs.

Much of the research published for members containing web reinforcement is also focused on younger, younger members. These studies seek to confirm the important structural parameters within the context of the widely accepted concrete beams method. These sub-components can be represented by the three systems, with the key influences provided, the amount of consolidation, and the long-term fragmentation of the web consolidation. Shear pressure barriers have been established to accomplish a "fuse action" to allow for web reinforcement, in addition to sub-ductile processes such as concrete strut barking. For a small member, a limited number of web reinforcements will be successfully 'anointed' in the cross section where they are placed, because the distance between the largest concrete and the web reinforcement leg is very small. Leonhardt and Walther (1964) found the need to look at the three-dimensional energy flow for a wide variety of major components, but a few studies have focused on this analogy using analysis of species with geometry and a number of reinforcement showing current construction methods. Therefore, no detailed specification requirements have not been established for broader members that allow for the consistent addition of smaller beam models to larger, wider operational beams. It is important to identify the limitations of the spaces that ensure that the impact of reinforcement on the wider member can be better represented by shaving power models.

There were main principal objectives in this study:

- To investigate whether wide members subject to transverse loading behave identically in shear to narrower members, on a unit width basis, for members with web reinforcement.
- To determine the influence on shear capacity of the distribution of web reinforcement across the member width.
- To estimate the impact of the loaded-width-to-member-width ratio (and supported-width-to-member-width ratio) on the capacity of shear critical members.

2. Literature Review

A large proportion of the published research on shear in structural concrete has focused on small, narrow specimens. Additionally, many of the shear-critical specimens from the literature contain high levels of flexural capacity relative to the flexural demand at the force corresponding to shear failure. For example, in formulating the IS 456:2000 expression for shear capacity in members without and with web reinforcement described in Section 40.2, 40.3 and 40.4, A lack of "wide" members is evident. Thus, there was no direct test evidence to suggest that wide members behave in similar or different respects than narrow members. Furthermore, longitudinal reinforcement ratios in the data set were much higher than the

Table 1
As-built properties of beam specimen (with constant overall D)

Grade of concrete	L (mm)	b (mm)	D (mm)	d (mm)	A_{st} (mm^2)	0.04bD (mm^2)	f_y	f_{ck}
M-25	6	250	500	457	1892	5000	415	25
M-25	6	300	500	457	1957	6000	415	25
M-25	6	350	500	457	2021	7000	415	25
M-25	8	250	500	457	3132	5000	415	25
M-25	8	300	500	457	3219	6000	415	25
M-25	8	350	500	457	3307	7000	415	25
M-25	10	250	500	457	4703	5000	415	25
M-25	10	300	500	457	4821	6000	415	25
M-25	10	350	500	457	4938	7000	415	25

Table 2
As-built properties of beam specimen (with constant overall b)

Grade of concrete	L (mm)	b (mm)	D (mm)	d (mm)	A_{st} (mm^2)	0.04bD (mm^2)	f_y	f_{ck}
M-25	6	500	250	207	4030	5000	415	25
M-25	6	500	300	257	3267	6000	415	25
M-25	6	500	350	307	2818	7000	415	25
M-25	8	500	250	207	7054 (redesign)	5000	415	25
M-25	8	500	300	257	5645	6000	415	25
M-25	8	500	350	307	4794	7000	415	25
M-25	10	500	250	207	10917 (redesign)	5000	415	25
M-25	10	500	300	257	8677 (redesign)	6000	415	25
M-25	10	500	350	307	7312 (redesign)	7000	415	25

reinforcement ratios consistent with flexure-critical designs.

A sectional analysis of member's subject to shear was presented in this paper. This chapter provides an overview of additional relationships that are unique to wide to depth ratio of members. Examines research directed at establishing a relationship between member cross section (width to depth ratio) and the shear stress at failure, for members with web reinforcement. When web reinforcement is provided, the appropriate distribution of the stirrup legs over the member cross-section is considered. Finally, wide beams may be supported on wall segments that are narrower than the member. In this paper considers the influence of this width difference on the shear capacity of beams.

3. Methodology

An extensive analytically this program was developed to provide analyses the results for use in correlating the main shear performance parameters in the study. Consistent with the objectives of the research program, these included specimens that varied principally in width, specimens providing similar web reinforcement quantities but utilizing different transverse distribution strategies, and wide specimens with narrow and full-width load and simply support conditions. A range of member depths were evaluated, consistent with member dimensions used in practice. Specimens contained various flexural reinforcement ratios, including ratios approaching the levels needed to achieve flexure-critical conditions.

A total of fifty-four large-scale (*b= 250mm, 300mm and 350mm with constant D=500, then change the section constant b=500mm with varying depth d= 250mm, 300mm and 350mm each cross section of clear span 6m, 8m, and 10m M-25 grade of concrete so total of fifty-four* specimens where nominal dimension.

Beam Configuration:

A large wide specimen, designated Beams, was designed and analyses according to the provisions of IS 456:2000. Once an effective width was selected as comparable to overall depth of the section analyzed beams and there after an overall depth has chosen as comparable to width of the section.

Beam analyses design procedures,

The specimen was analyses and design by the two different methods:

1. By the manual analysis using code of practice IS 456: 2000.
2. The beam design by the STADD.Pro

The specimen was loaded by uniformly distributed load of about 30 kN. This allowed proper seating of the load and support, and permitted an initial check of the analysis set-up.

Design of doubly reinforced simple supported beam (by anylysis):

1. Clear Span = 6.00 m (6000 mm)
2. Wall width = 0.50 m (500 mm)
3. Size of Beam (restricted) = 0.50 m X 0.30 m (500 mm X 300 mm)
4. External load = 30.00 kN/m (30000 N/m)
5. Concrete = M-20 (Unit weight concrete = 25000N/m^3)
6. Steel f^y = 415 N/mm^2
7. Tensile stress = 230 N/mm^2
8. Bottom Main reinforcement 1st tier = 25 mm ϕ
9. Top Main reinforcement = 20mm ϕ
10. 2 - lgd. Stirrups = 8 mm ϕ
11. Cover = 25 mm ϕ

4. Result

This study has examined significant parameters for predicting shear capacity in narrow and wide reinforcement concrete members. This included the influence on the shear stress at failure from member depth, longitudinal reinforcement ratio, and the longitudinal spacing of web reinforcement. For wide member, additional parameters were considered, including the member width the distribution of web reinforcement across the width, and the influence of load. The investigation focused on width and depth of the section, where sectional capacity model is traditionally used in design. This chapter summarizes the result of these findings, by providing the recommended sectional shear provision for use in the design and analysis of wide and narrow reinforced concrete member shows as in fig.

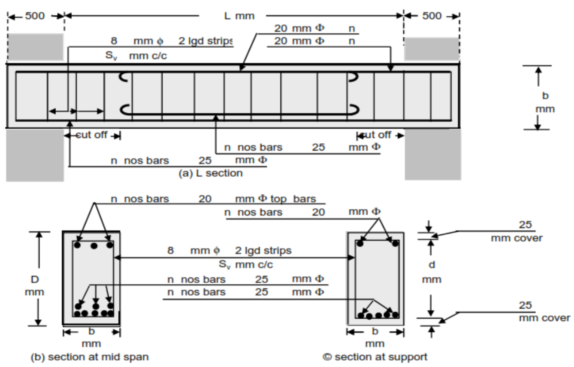

Fig. 1. Sectional view of member

A. Member with web Reinforcement

Parameter significant to predicting sectional two-way problem for shear capacity for member with web reinforcement were described in Chapter 4. The methodology that is that is recommended from this study makes no distinction between shear capacities in narrow beam, and in wide beams. A common set of equation should apply to all three types.

The recommended design and analysis provision were adapted from the current IS 456:2000. These provisions were found to provide more consistent predictions of member capacity for a range of member capacity for a range of member geometries, including members of varying width to depth, than the IS 456:2000 provision. Further a restriction on the maximum spacing of web reinforcement across the member width was proposed. The notation in the model has been changed from its width to depth to reflect notation used in this thesis.

The shear capacity for model in member with web reinforcement was developed and the models is shear is tabulated in below as the section shown in fig.

Table 3
Shear and strain in section in same overall depth

Concrete Grade	LENGTH (m)	WIDTH (m)	DEPTH (m)	f_{sc} (N/mm^2)	τ_v (N/mm^2)	τ_c (N/mm^2)
M-25	6 m	0.25	0.5	0.00281	352	1.11
		0.3	0.5	0.00281	352	0.94
		0.35	0.5	0.00281	352	0.82
	8 m	0.25	0.5	0.00281	352	1.54
		0.3	0.5	0.00281	352	1.31
		0.35	0.5	0.00281	352	1.14
	10 m	0.25	0.5	0.00281	352	1.98
		0.3	0.5	0.00281	352	1.68
		0.35	0.5	0.00281	352	1.46

Table 4
Shear and strain in section in same width

Concrete Grade	LENGTH (m)	WIDTH (m)	DEPTH (m)	ε_{sc}	f_{sc} (N/mm^2)	τ_v (N/mm^2)	τ_c (N/mm^2)
M-25	6 m	0.5	0.25	0.002	325	1.34	0.83
		0.5	0.3	0.00229	325	1.08	0.7
		0.5	0.35	0.00248	343	0.9	0.62
	8 m	0.5	0.25	minimum reinforcement exceeds (> .04bD)			
		0.5	0.3	0.00229	325	1.47	0.85
		0.5	0.35	0.00248	343	1.24	0.74
	10 m	0.5	0.25	minimum reinforcement exceeds (> .04bD)			
		0.5	0.3	minimum reinforcement exceeds (> .04bD)			
		0.5	0.35	minimum reinforcement exceeds (> .04bD)			

Table 5
Comparison the result of manual calculation and the STADD pro result (constant D)

Concrete Grade	LENGTH (m)	WIDTH (m)	DEPTH (m)	By Manual calculation	By STADD pro
M-25	6 m	0.5	0.25	Permissible for designing	Permissible for analysis
		0.5	0.3	Permissible for designing	Permissible for analysis
		0.5	0.35	Permissible for designing	Permissible for analysis
	8 m	0.5	0.25	Permissible for designing	Permissible for analysis
		0.5	0.3	Permissible for designing	Permissible for analysis
		0.5	0.35	Permissible for designing	Permissible for analysis
	10 m	0.5	0.25	Permissible for designing	fails while detailing
		0.5	0.3	Permissible for designing	Permissible for analysis
		0.5	0.35	Permissible for designing	Permissible for analysis

Table 6
Comparison the result of manual calculation and the STADD pro result (constant b)

Concrete Grade	LENGTH (m)	WIDTH (m)	DEPTH (m)	By Manual calculation	By STADD pro
M-25	6 m	0.5	0.25	Permissible for designing	Permissible for analysis
		0.5	0.3	Permissible for designing	Permissible for analysis
		0.5	0.35	Permissible for designing	Permissible for analysis
	8 m	0.5	0.25	Min. reinforcement exceed (>0.04bD)	fails while detailing
		0.5	0.3	Permissible for designing	fails while detailing
		0.5	0.35	Permissible for designing	Permissible for analysis
	10 m	0.5	0.25	Min. reinforcement exceed (>0.04bD)	fails while detailing
		0.5	0.3	Min. reinforcement exceed (>0.04bD)	fails while detailing
		0.5	0.35	Min. reinforcement exceed (>0.04bD)	fails while detailing

Table 7
For M-25, Fe- 415, and Clear Span- 6m

S. No.	Section Width B(in m)	Section Depth D(in m)	Section (in m×m)	B/D ratio
1	0.38	0.5	0.38×0.5	Doubly not required ($M_{uD} < M_{u.lim}$)
2	0.37	0.5	0.37×0.5	0.74
3	0.09	0.5	0.09×0.5	0.18
4	0.08	0.5	0.08×0.6	minimum reinforcement exceeds (> 0.04bD)

Table 8
For M-25, Fe- 415, and Clear Span- 8m

S. No.	Section Width B (in m)	Section Depth D(in m)	Section (in m×m)	B/D ratio
1	0.73	0.5	0.73×0.5	Doubly not required ($M_{uD} < M_{u.lim}$)
2	0.72	0.5	0.72×0.5	1.44
3	0.15	0.5	0.15×0.5	0.3
4	0.14	0.5	0.14×0.6	minimum reinforcement exceeds (> 0.04bD)

Table 9
For M-25, Fe- 415, and Clear Span-10m

S. No.	Section Width B(in m)	Section Depth D(in m)	Section (in m×m)	B/D ratio
1	1.33	0.5	1.33×0.5	Doubly not required ($M_{uD} < M_{u.lim}$)
2	1.32	0.5	1.32×0.5	2.64
3	0.24	0.5	0.24×0.5	0.48
4	0.23	0.5	0.23×0.6	minimum reinforcement exceeds (> 0.04bD)

Comparison the result of manual calculation and the STADD pro result:

The comparison of the analysis by manual and Programming by STADD pro is tabulated below were the following members was similar and some member were dissimilarity are shown.

5. Conclusion

In this study also focused member with typically b/d ratio of members once a parameter of depth constant and another parameter is width constant. Additional consideration should be given to member having b/d ratio of about its analyzing and designing resistivity, which are also representative of wide beams used in industry. Each of these geometric relationships should be considered in the context of member with web reinforcement. The details are tabulated in table 7, 8 and 9.

B/D ratio (for same over all depth, D)

The section has been consider as in above tabulation are failed in section 0.38×0.5 and above by doubly not required ($M_{uD} < M_{u.lim}$) and 0.08×0.5 and below by minimum reinforcement exceeds (> 0.04bD) as consider by IS 456:2000.

The section has been consider as in above tabulation are failed in section 0.73×0.5 and above by doubly not required ($M_{uD} < M_{u.lim}$) and 0.14×0.5 and below by minimum reinforcement exceeds (> 0.04bD) as consider by IS 456:2000.

The section has been consider as in above tabulation are failed in section 1.33×0.5 and above by doubly not required ($M_{uD} < M_{u.lim}$) and 0.23×0.5 and below by minimum reinforcement exceeds (> 0.04bD) as consider by IS 456:2000.

References

[1] Engindeniz, Murat, Kahn, Lawrence F., and Zureick, Abdul-Hamid, "Repair and Strengthening of Reinforced Concrete Beam-Column Joints: State of the Art", ACI structural journal, March-April 2005, pp. 1-14.
[2] Frosch, Robert J., "Behaviour of large-scale reinforced concrete Beams with Minimum shear reinforcement", ACI structural journal, November-December 2000, pp. 814-820.
[3] Hadi, M.N.S., and Jeffry, R., "Effect of different confinement shapes on the behaviour of reinforced HSC beams", Asian journal of civil engineering (Building and Housing) Vol. 11, No. 4 (2010), pp. 451-462.
[4] Kaliluthin, A.K., Kothandaraman, S.K., and Ahamed T. S. Suhail., "A Review on Behavior of Reinforced Concrete Beam-Column Joint", International Journal of Innovative Research in Science, Engineering and Technology, Vol. 3, Issue 4, April 2014, pp. 11299-11312.
[5] Matta, F., Nanni, A., Galati, N., and Mosele, F. (2007), "Size Effect on Shear Strength of Concrete Beams Reinforced with FRP Bars," Proc. 6th Int. Conf. on Fracture Mechanics of Concrete and Concrete Structures (FraMCoS-6), Catania, Italy, June 17-22, 2007, Balkema/Taylor & Francis, 8 pp.
[6] Muttoni, Aurelio, and Ruiz, Miguel Fernández, "Shear strength of members without transverse reinforcement as function of critical shear crack width", ACI Structural Journal, March-April 2008, 163-172.
[7] Ragab, Khaled S., and Zaki, S. I., "Stress strain behavior of concrete columns with rectangular sections confined by different types of hoops", International Conference on sustainable Built Environment

Infrastructures in Developing Countries ENSET Oran (Algeria) – October 12-14, 2009, pp. 291-299.
[8] Raju, "Review on Shear Behaviour of Reinforced Concrete Beamwithout Transverse Reinforcement", Raju Int. Journal of Engineering Research and Applications, Vol. 4, Issue 4 (Version 8), April 2014, pp. 116-121.
[9] S., Ramadass, and Thomas, Job, "Shear strength prediction of concrete beams reinforced with FRP bars using IS: 456-2000", American Journal of Engineering Research (AJER), 2013, pp. 43-48.
[10] Said, M. and Elrakib, T.M., "Enhancement of shear strength and ductility for reinforced concrete wide beams due to web reinforcement", Housing and Building National Research Center, HBRC Journal, February 2013, pp. 235–242.
[11] Yasser, and Parung, Herman, and Tjaronge, Muhammad W., and Djamaluddin, Rudy, "Flexural Characteristics of Reinforced Concrete Beam Using Styrofoam Filled Concrete (SFC) in Tension Zone", IACSIT International Journal of Engineering and Technology, vol. 7, no. 1, February 2015, pp. 1-7.
[12] IS 456:2000. "Indian standard practice for plain and reinforced concrete (IS 456:2000)", Bureau of Indian standards, New Delhi, July 2000, pp. 100.
[13] ACI committee 318, 1963. "building code requirements for structural concrete (ACI 318- 05)", American concrete Institute, Farmington Hills, MI, pp. 144.
[14] ACI committee 318, 1963. "building code requirements for structural concrete (ACI 318- 63)", American concrete Institute, Farmington Hills, MI, pp. 144.
[15] ACI committee 318, 1971. "building code requirements for structural concrete (ACI 318- 71) and commentary (ACI318R-71)", American concrete Institute, Farmington Hills, MI, pp. 104.
[16] Indian Standard code for practice of design of reinforced concrete structures (IS 456:2000).