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Ductility Performance of Heavily Steel Reinforced Concrete Flexural Members with High Strength Concrete

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ABSTRACT

The nature of fracture in reinforced high strength concrete (HSC) members is brittle and therefore in the seismic areas the ductility investigation of heavily reinforced HSC members is important. Six reinforced HSC beams with different percentage of tensile and high compression bars with attaching electrical strain gauges cast and loaded experimentally up to failure. During the test, the strains on the concrete middle face and on the tension and compression bars along with deflection at different points of the span length measured. Ductility of doubly reinforced members was compared with the singly reinforced members. The theoretical results based on ACI and CSA codes have been compared with the experimental results. In this paper, the displacement and curvature ductility of such members are also reported.

KEYWORDS

Ductility, HSC, heavily reinforced members, codes

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	f'c (MPa)	d (mm)	d' (mm)	A _s	ρ(%)	A's	ρ′ (%)
BC13	/			Φ	/	Φ	/
B6	/		-	Φ	/	-	-
BC7	/			$\Phi + \Phi$	/	$\Phi + \Phi$	/
B7	/		-	$\Phi + \Phi$	/	-	-
BC8	/			$\Phi + \Phi$	/	$\Phi + \Phi + \Phi$	/
B8	/		-	$\Phi + \Phi$	/		-

NO.BEAM

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NOTE:

NO.BEAM: BC 7







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BC13			$\Delta_{u} \Delta_{y} (\mu_{d}) \qquad \qquad :()$							
	BC13									
(mm)			/		/		/		/	
(mm)			/		/		/			
			/	/				/		
BC7				$\Delta_{\rm u}$ $\Delta_{\rm y}$ ($\mu_{\rm d}$) :()						
	BC7									
(mm)	(mm) /		/	/		/		/		
(mm)			/	1		/		/		
	1			1		/		/		
BC8				$\Delta_u \Delta_y (\mu_d) \qquad \qquad :(\)$						
BC8										
(mm)	(mm) /			/						
(mm) /			/	/		1		1		
/			1				1	1		
						(-):		-		
				(ACI)			(CSA))	
	φ _y ×	$\varphi_u \times$	μ_{ϕ}	φ _y ×	$\phi_u \times$	μ_{ϕ}	φ _y ×	$\varphi_u \times$	μ_{ϕ}	
BC13	/	/	/	/	1	1	/	/	/	
B6	/	/	/	/		/	/	/	/	
BC7	/			/	/	1	/	/	/	
B7	/	/	/		/	/	/	/	/	
BC8	/	/	/		/	/	/	/	/	
B8	/	/	/		1	-	-	/	-	

$$(\mu = \phi_u / \phi_y)$$

(µ_d)

(

(φ_u)

ε_{cu} X_u

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) $\phi_u \qquad \phi_y$ (

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 $\mu = \frac{\varphi_u}{\varphi_y} = \frac{\varepsilon_{cu} (\alpha \beta_1 f_c') E_s (1 + \rho n (2\rho n + \rho^2 n^2)^{1/2})}{\rho f_y^2}$ ()

 $\begin{array}{cccc} : Kd & : d & : f_{y} \\ & : \varepsilon_{cu} (X_{y}) \end{array}$ ()

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BC7

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$$n = \frac{E_s}{E_c} \qquad \rho = \frac{A_s}{bd} \quad .(X)$$

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$$k = \left[n^{2} (\rho + \rho')^{2} + 2n \left(\rho + \frac{\rho' d'}{d} \right) \right]^{1/2} - n (\rho + \rho')$$
 ()

$$\mu = \frac{\alpha \beta_1 f_c' \varepsilon_{cu} E_s (1-k)}{f_y^2 (\rho - \rho')}$$
()

$$X_{u} = \left[\frac{(\rho' E_{s}\varepsilon_{cu} - \rho f_{y})^{2} d^{2}}{(2\alpha f_{c}^{\prime})^{2} \beta_{1}^{2}} + \frac{\rho' E_{s}\varepsilon_{cu} dd'}{(\alpha f_{c}^{\prime}) \beta_{1}}\right]^{1/2} - \frac{(\rho' E_{s}\varepsilon_{cu} - \rho f_{y})d}{(2\alpha f_{c}^{\prime}) \beta_{1}}$$

$$(\texttt{f})$$

$$u = \varphi_{u} - E_{s}\varepsilon_{cu}(1-k)d$$

$$(\texttt{f})$$

$$\mu = \frac{\varphi_u}{\varphi_y} = \frac{E_s \varepsilon_{cu} (1 - k) a}{f_y X_u} \tag{2}$$







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 $: X_u$



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