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Analysis and Design of Beams

To Find...	Code Reference	Clause No.	Page No.	Remarks
Xu	IS: 456	G.1.1. (a)	96	
Xu-max	SP:16	Table-B	09	
Mu	IS:456	G.1.1. (b)	96	$Xu < Xu\text{-max}$
Mu	IS:456	G.1.1. (c)	96	$Xu > Xu\text{-max}$
Mu-lim	SP:16	Table-C	10	
Pt-limit %	SP:16	Table-E	10	
Mu2	SP:16	2.3.2.	12	
Fsc	SP:16	Table-F	13	Only for Fe 415,500
Fsc	SP:16	2.3.2.	13	Only for Fe 250 ($Fsc = 0.87*fy$)
Fcc	SP:16	2.3.2.	13	$Fsc = 0.446*fck$
Asc	SP:16	2.3.2.	12	$Mu2 = Asc(Fsc-Fcc)(d-d')$
Ast2	SP:16	2.3.2.	12	$Mu2 = Ast2(0.87*fy)(d-d')$
Ast	SP:16	2.3.2.	12	$Ast = pt\text{-lim}*bd/100 + Ast2$
No. of Bars and Diameter	SP:16	Table-95	229	
Ast-min	IS:456	26.5.1.1. (a)	47	$Ast\text{-min}/bd = 0.85/fy$
Ast-max	IS:456	26.5.1.1. (b)	47	$Ast\text{-max} = 0.04*b*D$
Pt % (Ast/bd)*100	SP:16	Table-1,2,3,4	47,48,49,50	Mu/bd^2 (Required)
C1	SP:16	--	10	$C1 = 0.36*fck*b*Xu$
Z1	SP:16	--	10	$Z1 = (d-0.42*Xu)$
C2	SP:16	--	10	$C2 = (Fsc-Fcc)*Asc$
Z2	SP:16	--	10	$Z2 = (d-d')$
C1 + C2 = T	SP:16	--	10	$T = 0.87*fy*Ast$

Notations for Beams

Symbol	Meaning
b	Width of beam
d	Effective depth of beam
D	Overall depth of beam
e	Effective cover (Bottom side) Tensile
d'	Effective cover (Top side) Compression
c	Clear cover of beam (Bottom side)
Ø	Diameter of steel bar
Ast	Area of steel in tension
Asc	Area of steel in compression
Pt	Percentage of steel
Xu	Depth of Neutral axis
Xu-max	Maximum depth of neutral axis
Mu	Ultimate moment (or) Moment of resistance
Z	Lever Arm