Summary of the Content of Post-18

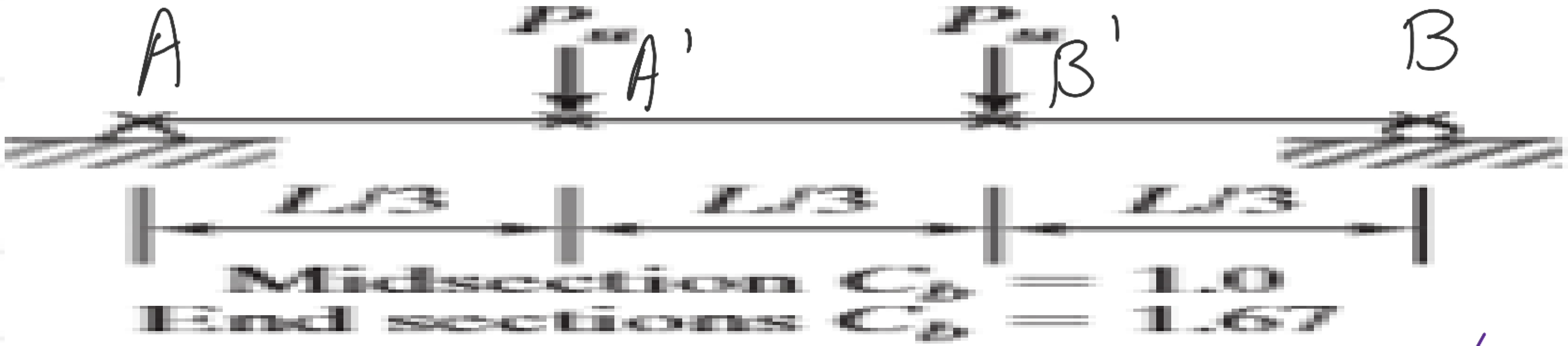
1. Derive the Cb value For a beam Under Two C. Loads at third Points

C. Loads : Concentrated Loads

Bracings at third Points (4 bracings)

2. Find Cb Values For A-A', B-B' & A'-B' Portions

3. Graph of Cb virsus $\frac{M_1}{M_2}$.



(C) This is the Case of beam AB Under Two Concentrated at A', B'.

Bracings are Located at A, A', B' and B

It is required to Find C_b For part A A'

Divide A-A' to Four parts and Find moment values For these parts

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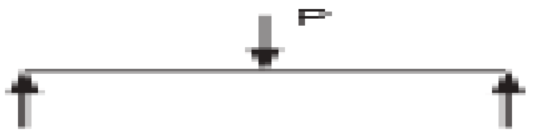
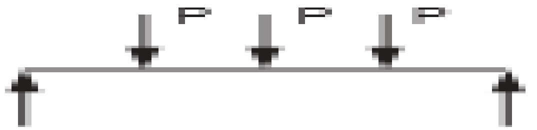
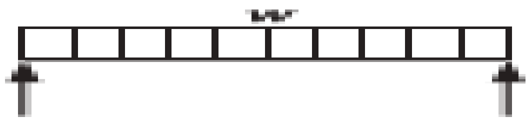
VALUES OF C_b FOR SIMPLY SUPPORTED BEAMS		
LOAD	LATERAL BRACING ALONG SPAN	C_b
	NONE LOAD AT MIDPOINT	1.32
	AT LOAD POINT	1.67 1.67
	NONE LOADS AT THIRD POINTS	1.14
	AT LOAD POINTS LOADS SYMMETRICALLY PLACED	1.67 1.00 1.67
	NONE LOADS AT QUARTER POINTS	1.14
	AT LOAD POINTS LOADS AT QUARTER POINTS	1.67 1.11 1.11 1.67
	NONE	1.14
	AT MIDPOINT	1.30 1.30
	AT THIRD POINTS	1.45 1.01 1.45
	AT QUARTER POINTS	1.52 1.06 1.06 1.52
	AT FIFTH POINTS	1.56 1.12 1.00 1.12 1.56

NOTE: LATERAL BRACING MUST ALWAYS BE PROVIDED AT POINTS OF SUPPORT PER AISC SPECIFICATION CHAPTER F.

Adapted from *Steel Construction Manual*, 14th ed., AISC, 2011.

Table 3-1
Page 3-18

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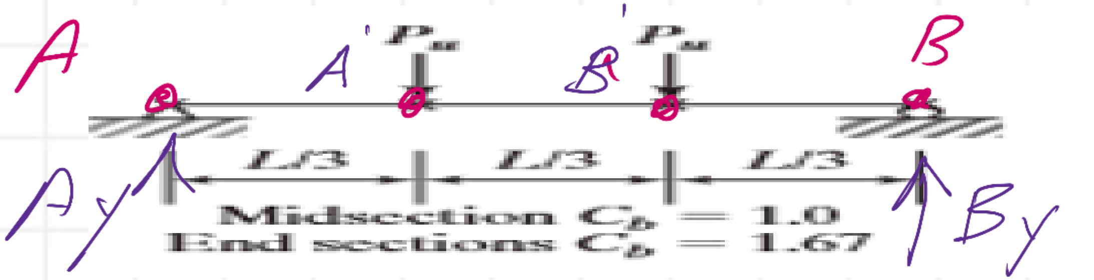
AISC - 360 - 16
CM # 15

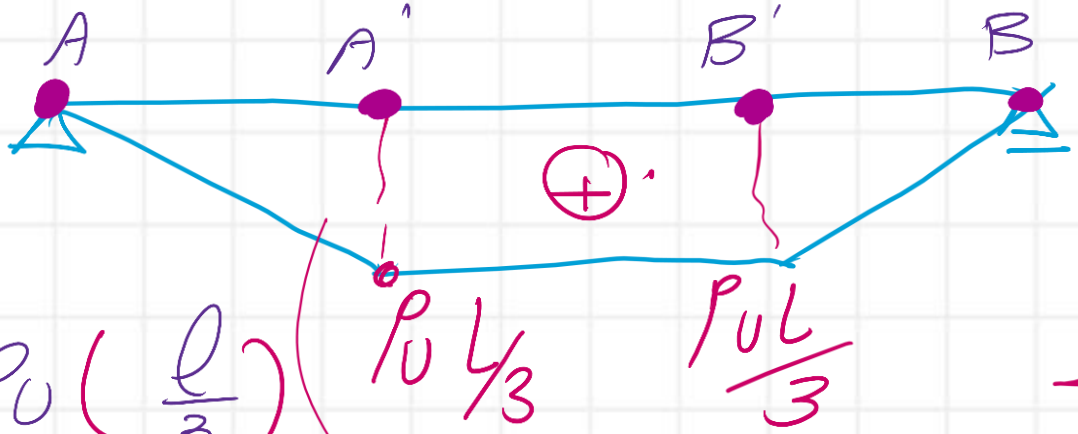


Find A_y reaction at A

B_y reaction at B

$$A_y = \left[P_u\left(\frac{l}{3}\right) + P_u\left(\frac{2L}{3}\right)\right] / L = \frac{P_u}{3} L \frac{(1+2)}{L} = P_u$$

$B_y = A_y$ Due to symmetr



B.M.D at Tension side

$\left.\begin{matrix} M_{A'} \\ M_{B'} \end{matrix}\right\}$ values

$$M_{A'} = P_u\left(\frac{l}{3}\right)$$

$$M_{B'} = P_u\left(l/3\right)$$

Take A-A' portion and divide

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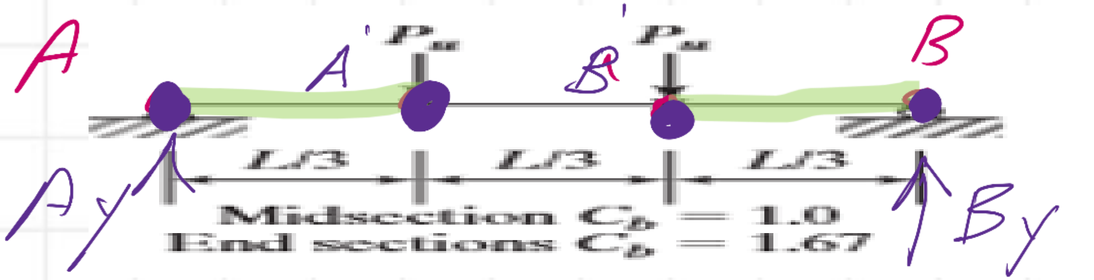
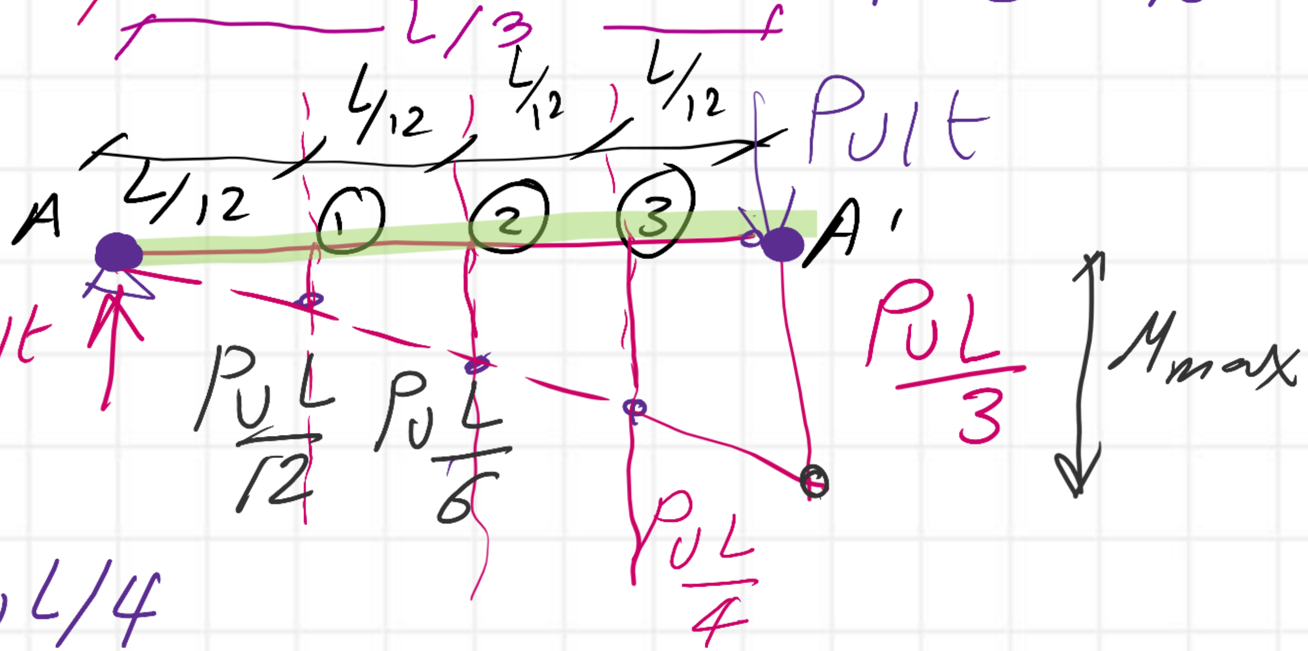


Find moment values at Each quarter

Portion A-A' → implied also For B'B

Divide A-A' → to Four parts Each part $\frac{1}{4}\left(\frac{L}{3}\right) = \frac{L}{12}$



Moment at A'

$= M_{max} = P_u L/3$

$M_1 = P_u \frac{L}{12}$

$M_2 = P_u \frac{L}{6}$, $M_3 = \frac{3}{4} P_u \frac{L}{3} = P_u L/4$

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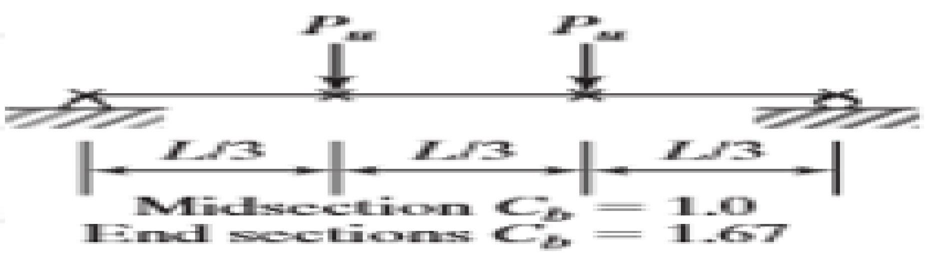
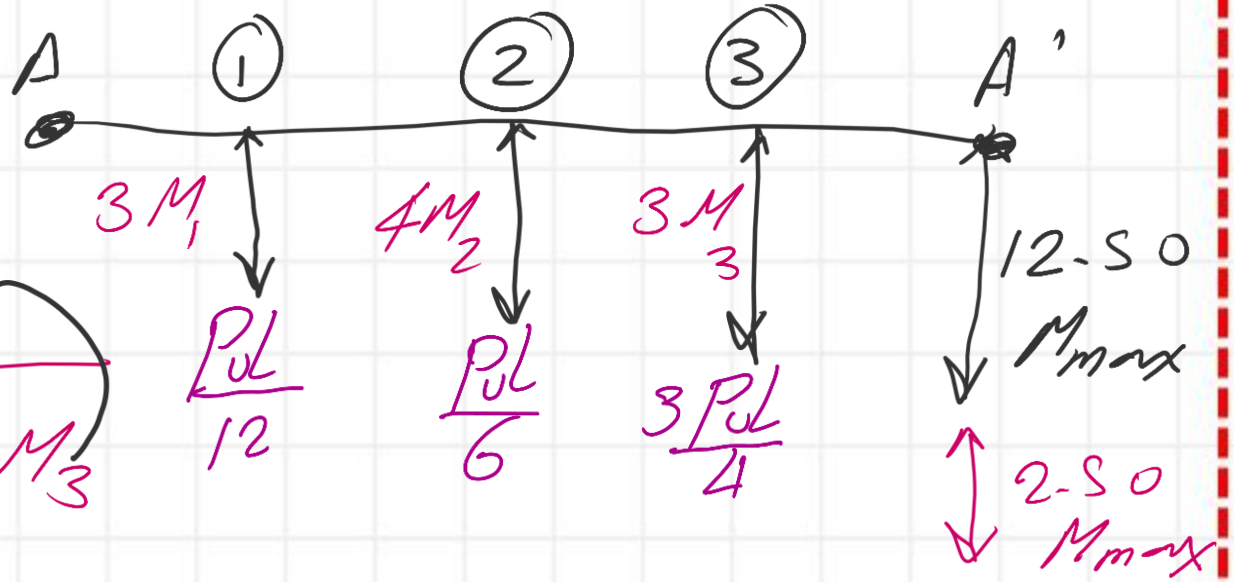
Find C_b For A-A'





$$C_b = \left(\frac{12.50\,M_{max}}{2.5\,M_{max} + 3M_1 + 4M_2 + 3M_3}\right) \Rightarrow$$

$$M_1 = P_U \frac{L}{12} \Rightarrow 3M_1 = P_U \frac{L}{4}$$

$$M_2 = P_U \frac{L}{6} \Rightarrow 4M_2 = P_U \frac{2L}{3}$$

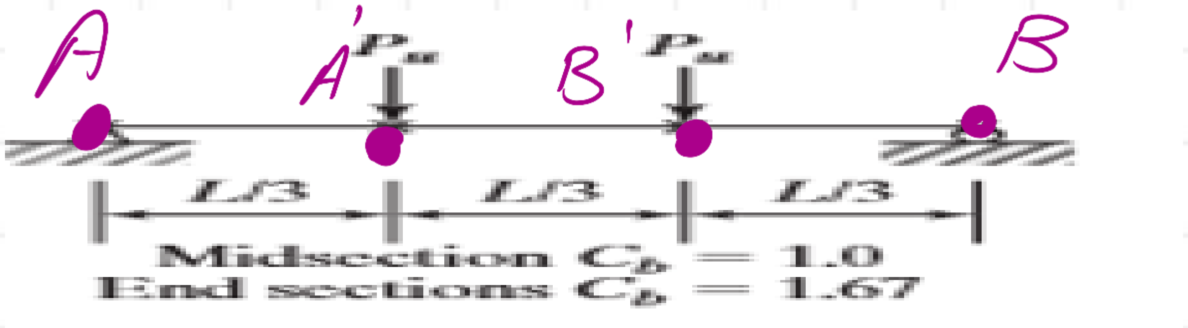
$$M_3 = P_U \frac{L}{4} \Rightarrow 3M_3 = P_U \frac{3L}{4}$$

$$2.5\,M_{max} = 2.5\,P_U \frac{L}{3} = \frac{5}{6} P_U L$$

$$\Sigma = \frac{P_U L}{12}(3 + 8 + 9 + 10)$$

$$\Rightarrow = \frac{P_U L}{12}(30)$$

$$12.50\,M_{max} = \frac{25}{6} P_U L = \frac{50}{12} P_U L$$

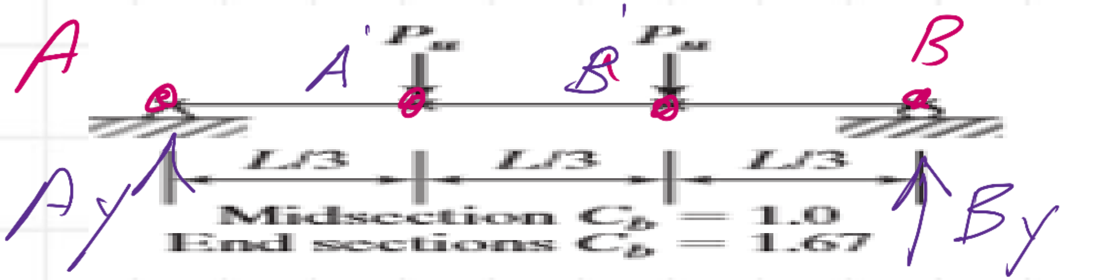


$$C_b = \frac{50}{12} P_u L \Big/ P_u L \left(\frac{30}{12}\right)$$

$$C_b = \frac{50}{30} = 1.67 \quad \left.\begin{matrix} A\text{-}A' \\ B\text{-}B' \end{matrix}\right\} \quad 1.67 \text{ Value}$$

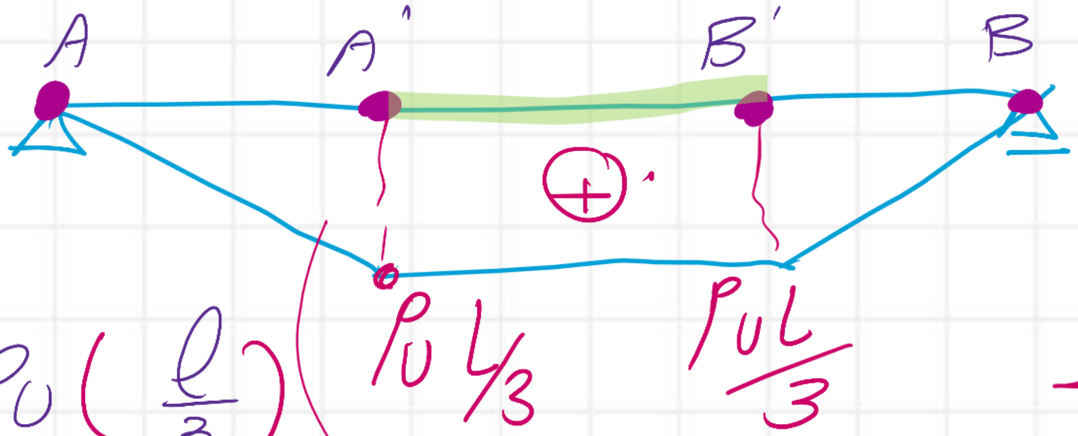
middle third

C_b For A'-B'



$$A_y = \left[P_u(\ell/3) + P_u\left(\frac{2L}{3}\right)\right]/L = P_u\frac{L}{3} \quad (1+2)\,P_u$$

$B_y = A_y$ Due to symmetr



B.M.D
at Tension side

$$M_{A'} = P_u\left(\frac{\ell}{3}\right)$$
$$M_{B'} = P_u\left(\ell/3\right)$$

Take A-A' portion and divide

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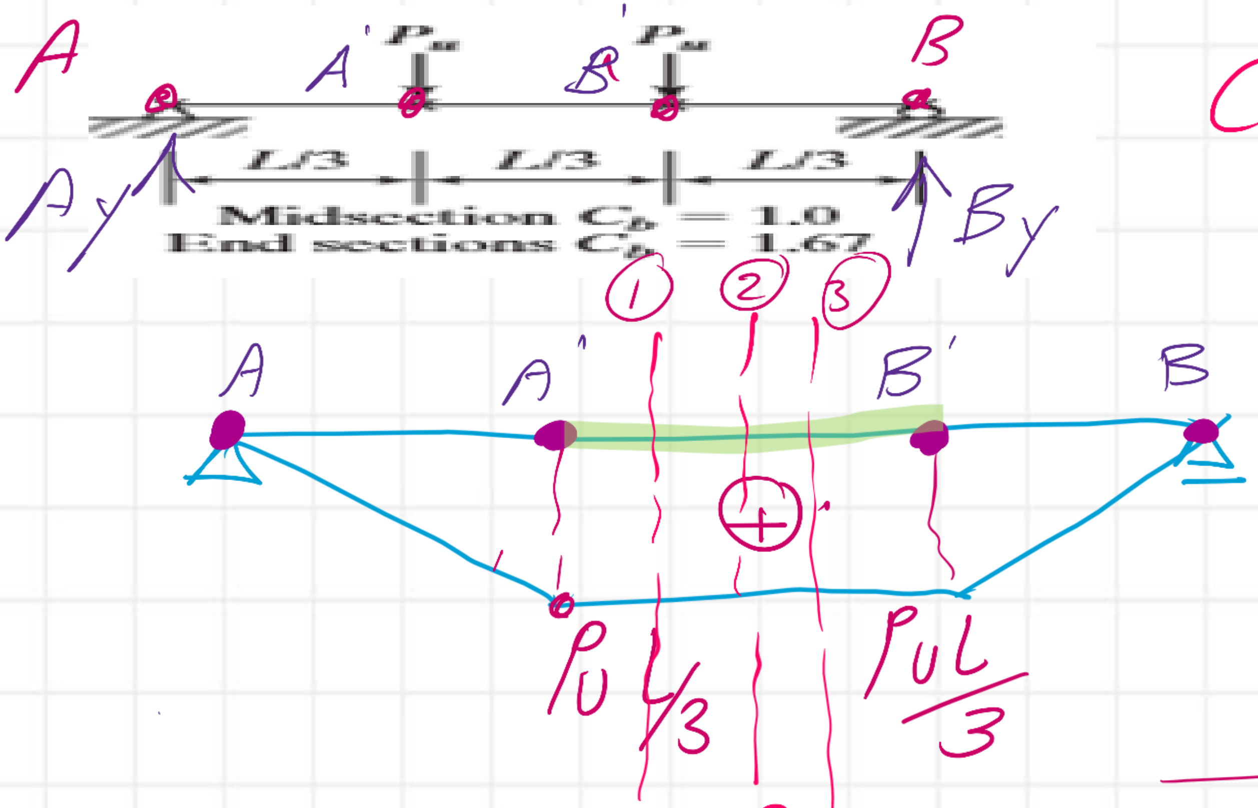
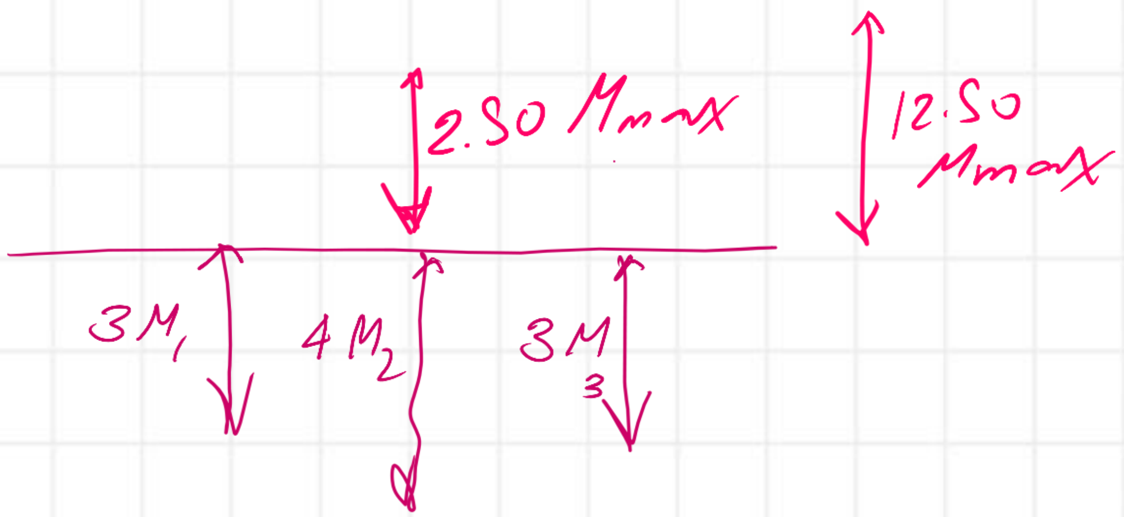
C_b For A'-B'



B.M.D
at Tension side



$$M_1 = P_U \frac{L}{3}$$

$$M_2 = P_U L/3$$

$$M_3 = P_U L/3$$

$$M_{max} = P_U L/3$$

Same valu

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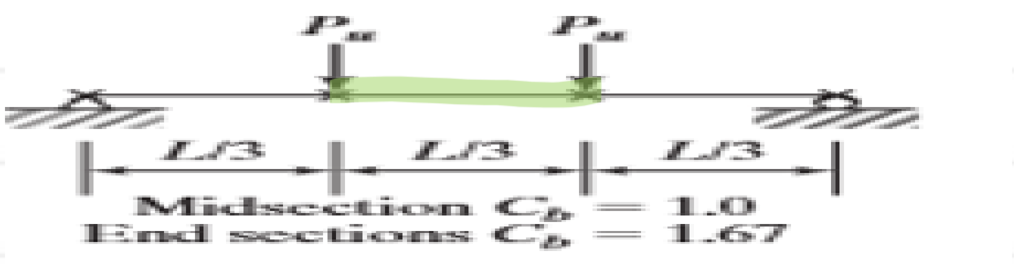
Middle part $\underset{\sim}{A'B'}$



$$C_b = \frac{12.5\, M_{max}}{2.5\, M_{max} + 3M_1 + 4M_2 + 3M_3}$$

$$M_{max} = M_1 = M_2 = M_3 = P_u L/3$$

$$C_b = \frac{12.5\, M_{max}}{M_{max}(2.5 + 3 + 4 + 3)} = \frac{12.50}{12.50} = 1.0$$

Salmon - page

M_1 smaller, M_2 Larger

$$C_b = \left[1.75 + 1.05\frac{M_1}{M_2} + 0.3\left(\frac{M_1}{M_2}\right)^2\right] \le 2.3$$

old

M_1 = smaller moment at an end of the unbraced length of the member, in-kips
M_2 = larger moment at end of the unbraced length of the member, in-kips

where M_1 is the smaller and M_2 is the larger end moment for the unbraced segment of the beam under consideration. If the rotations due to end moments M_1 and M_2 are in opposite directions, then M_1/M_2 is negative; otherwise, M_1/M_2 is positive. Coefficient $C_b = 1.0$ for unbraced cantilevers and for members where the moment within part of the unbraced segment is greater than or equal to the larger segment end moment (e.g., simply supported beams, where $M_1 = M_2 = 0$).

M_2 $\frac{M_1}{M_2} = +ve$

M_1 +ve

M_1 M_2 $\frac{M_1}{M_2} = -ve$

$C_b = 1$

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Old CV Equation

$y\text{-axis} \Rightarrow C_b$

$x\text{-axis} \quad \frac{M_1}{M_2}$

$$C_b = \left[1.75 + 1.05\frac{M_1}{M_2} + 0.3\left(\frac{M_1}{M_2}\right)^2\right] \le 2.3$$

y old

At $\frac{M_1}{M_2} = 0$

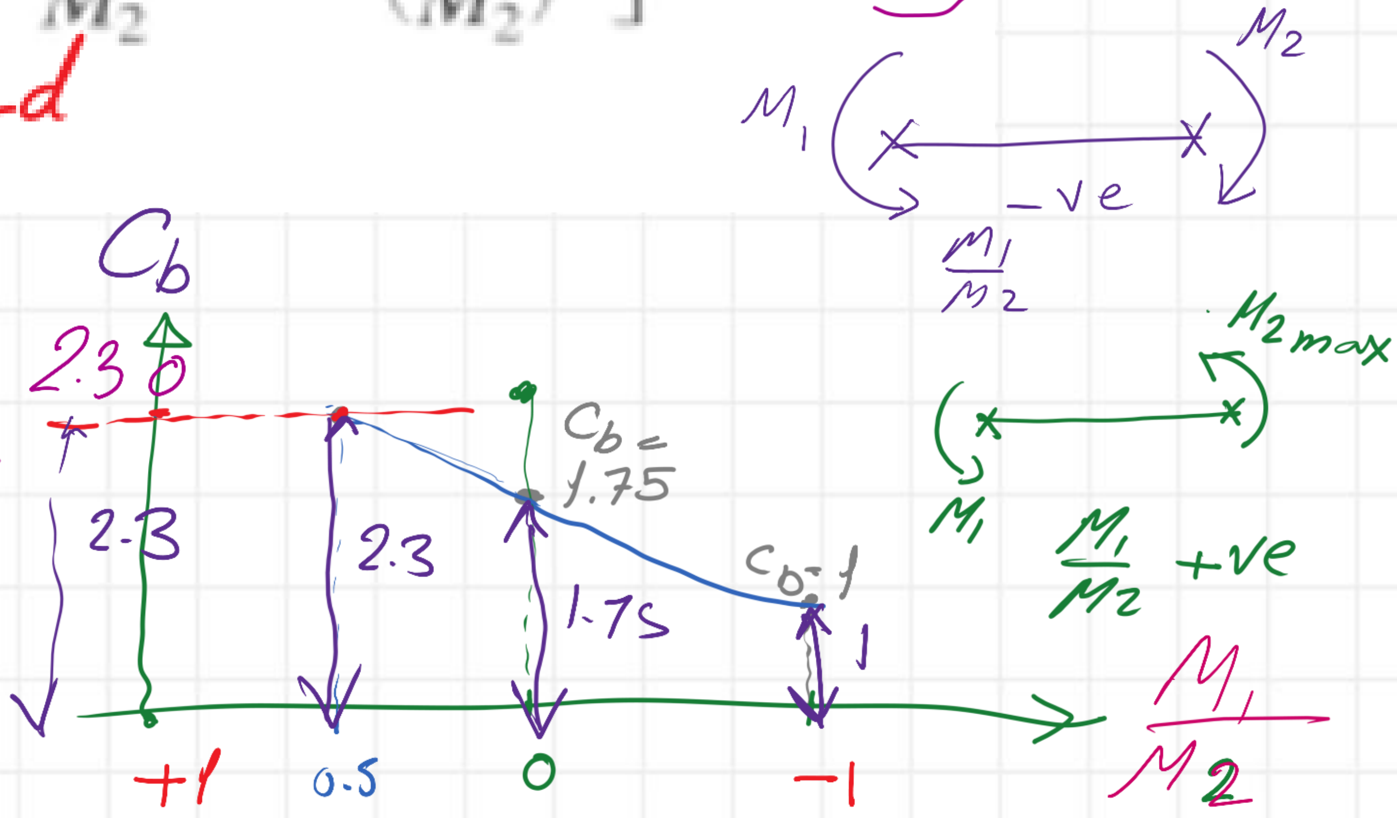
$C_b = 1.75$

At $\frac{M_1}{M_2} = +1$ Equal

$C_b = 3.1 \Rightarrow$ taken $\boxed{2.3}$

At $\frac{M_1}{M_2} = -1$

$C_b = 1.75 - 1.05 + 0.3 = 1.00$



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