

Thank you all for your help

Yes , indeed as you said PCA notes contained the same stress strain curve model used which adapted by the ACI, however as you said I don't see any benefit from using it on behalf of Whitney block, since whiney block is tested to give the same result(as you said it may be only for marketing purposes).

Now, what I found in pca notes is attached, also the table attached here demonstrate the flange and web calculations manually but they are couple of differences ,

1. Factor of 0.85 are not use in excel sheet
2. In excel sheet he introduce  $\epsilon_{max}$  as 0.002 and  $\epsilon_{max}$  0.003, pca notes introduce only 0.003(And form here I will open new discussion which is related, the sheet introduce  $f$ (curvature as 0.005/cc compression ,,assumed as tension control for bottom steel , then he use this to calculate  $e_i$  which will never reach 0.003, which contradict with aci assumption, what also make me crazy that sheet calculate  $c_c$  not form equilibrium (by one method which I don't know, since he can't calculated from equilibrium because he need in to calculate forces in concrete first, so eventually the value of  $\epsilon_s$ ,  $\epsilon_{max}$  ,and  $c_c$  ,0.005,0.003 and  $c_c$  are not matched in a linear strain as it should be. Also if you lock at  $c_c/d$  it should be 0.375 if you assume  $\epsilon_s$  0.005, however it always less??

The sheet excel for flange and web respectively are

t	y top	$y_i$	b	$e_i$	$E_i/\epsilon_{cmax}$	$f_{ci}$	$p_i$	$m_i$	
$\min(t_f, c_c)$	$y - t/2$	$c_c - y_{top}$	b	$Y_i * f$	$e_i/\epsilon_{cmax}$	$f_c * (2e_i/\epsilon_{cmax} - (e_i/\epsilon_{cmax})^2)$ or 0 if $e_i/\epsilon_{max} > 1$	$*b * t * f_{ci}$	$P_i * y_i$	

For web

t	y top	$y_i$	b	$e_i$	$E_i/\epsilon_{cmax}$	$f_{ci}$	$p_i$	$m_i$	
$\max(c_c - t_f, 0)$	$y - t/2$	$c_c - y_{top}$	b	$Y_i * f$	$e_i/\epsilon_{cmax}$	$f_c * (2e_i/\epsilon_{cmax} - (e_i/\epsilon_{cmax})^2)$ or 0 if $e_i/\epsilon_{max} > 1$	$*b * t * f_{ci}$	$P_i * y_i$	

Where  $c_c$  is the distance from top compression fiber to neutral axis

$T_f$  "thickness of the flange

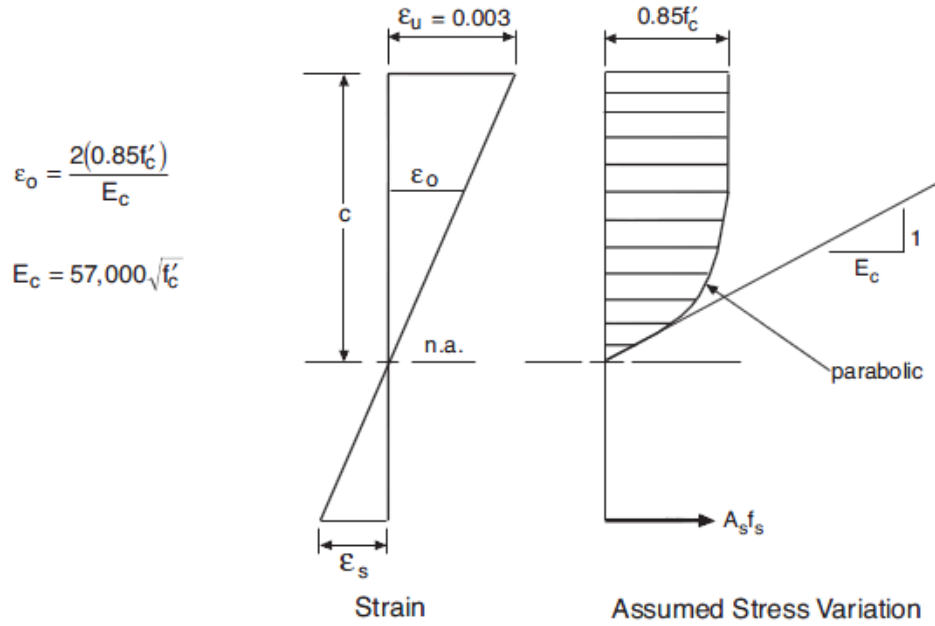
$f$  curvature 1/m

$\epsilon_{cmax} = 0.002$

$\epsilon_{max}$  0.003

$f_c=42 \text{ mpa}$

$b$  :beam width



Concrete	Steel
$0 < \epsilon_c < \epsilon_o : f_c = 0.85f'_c \left[ 2 \left( \frac{\epsilon_c}{\epsilon_o} \right) - \left( \frac{\epsilon_c}{\epsilon_o} \right)^2 \right]$	$\epsilon_s \leq \epsilon_y : f_s = \epsilon_s E_s$
$\epsilon_c \geq \epsilon_o : f_c = 0.85f'_c$	$\epsilon_s > \epsilon_y : f_s = f_y$
	$E_s = 29,000,000 \text{ psi}$

Figure 6-8 Historic PCA Stress-Strain Relationship