

**Câu 1b**

M=	KNm	
b=	300	mm
h=	750	mm
b'f=		mm
h'f=		mm
b <sub>f</sub> =		mm
Bê tông	<b>B40</b>	
R <sub>b</sub> =	22	MPa
γ <sub>b</sub> =	1	
Cốt thép	<b>CB400-V</b>	
R <sub>s</sub> =	350	MPa
R <sub>sc</sub> =	350	MPa
E <sub>s</sub> =	200000	MPa
n.A <sub>s</sub>	D	KHCT
5	25	31.25
5	25	31.25
n.A' <sub>s</sub>	D	KHCT
3	25	87.50

$$A_s = 4908.739 \text{ mm}^2$$

$$a = 62.500 \text{ mm}$$

$$A'_s = 1472.622 \text{ mm}^2$$

$$a' = 37.500 \text{ mm}$$

$$h_0 = h - a_{gt} = 687.50 \text{ mm}, \quad \varepsilon_{s,el} = R_s/E_s = 0.0018$$

$$\varepsilon_{b2} = 0.0035, \quad \xi_R = \frac{0.8}{1 + \varepsilon_{s,el}/\varepsilon_{b2}} = 0.533$$

$$\xi = \frac{A_s R_s - A'_s R_{sc}}{\gamma_b R_b b h_0} = 0.265 \quad (\text{CN: TH2})$$

$$\text{Lấy: } \xi = 0.265 \quad \alpha_m = \xi(1 - 0.5\xi) = 0.230$$

$$M_{gh} = \alpha_m \gamma_b R_b b h_0^2 + A'_s R_{sc} (h_0 - a') = 1052.265 \text{ KNm}$$

**Câu 1c**

M=	-780 kNm	
b=	300	mm
h=	750	mm
b'f=		mm
h'f=		mm
b <sub>f</sub> =	300	mm
Bê tông	<b>B40</b>	
R <sub>b</sub> =	22	MPa
γ <sub>b</sub> =	1	
Cốt thép	<b>CB400-V</b>	
R <sub>s</sub> =	350	MPa
R <sub>sc</sub> =	350	MPa
E <sub>s</sub> =	200000	MPa
Giả thiết		
a <sub>gt</sub> =	60	mm
a' <sub>gt</sub> =		mm
a <sub>bv</sub> =	25	mm
KHCT tr=	30	mm
KHCT d=	25	mm

$$\varepsilon_{b2} =$$

$$\varepsilon_{s,el} = R_s/E_s =$$

$$\xi_R = \frac{0.8}{1 + \varepsilon_{s,el}/\varepsilon_{b2}} =$$

$$\alpha_R = \xi_R(1 - 0.5\xi_R) = 0.391$$

$$h_0 = h - a_{gt} = 690 \text{ mm}$$

$$\alpha_m = \frac{M}{\gamma_b R_b b h_0^2} = 0.248 \text{ Cốt đơn}$$

Cốt đơn:

$$\xi = 1 - \sqrt{1 - 2\alpha_m} = 0.290$$

$$A_s = \frac{\gamma_b R_b}{R_s} \xi b h_0 = 3778.428 \text{ mm}^2$$

$$\mu_{tt} = 1.83\% \quad \mu_{\max} = \xi_R \frac{\gamma_b R_b}{R_s} = 3.35\% \text{ Thỏa}$$

n	D	A <sub>s</sub> <sup>tk</sup>	μ <sub>tk</sub>	a <sub>tk</sub>	ΔA <sub>s</sub>	KHCT
5	25	3926.991	1.90%	58.13	3.93%	31.25
3	25			Thỏa		87.50

**Câu 2**

M =	800	kNm
N =	4000	kN
M <sub>dh</sub> =	500	kNm
N <sub>dh</sub> =	3000	kN
L =	3.8	m
b =	450	mm
h =	700	mm
<b>Bê tông B40</b>		
R <sub>b</sub> =	22	MPa
γ <sub>b</sub> =	0.85	
E <sub>b</sub> =	36000	MPa
<b>Cốt thép CB400-V</b>		
R <sub>s</sub> =	350	MPa
R <sub>sc</sub> =	350	Mpa
E <sub>s</sub> =	200000	MPa
n	Ø	KHCT
6	25	50.00
0	25	(-)
A <sub>s.tk</sub>	μ <sub>tk</sub>	a <sub>tk</sub>
mm <sup>2</sup>	%	mm
2945.243	0.99%	37.50
n	Ø	KHCT
6	25	50.00
0	25	(-)
A' <sub>s.tk</sub>	μ' <sub>tk</sub>	a' <sub>tk</sub>
mm <sup>2</sup>	%	mm
2945.243	0.99%	37.50
Z <sub>a</sub> =	625.00	mm
2a' <sub>gt</sub> =	75	mm
a <sub>bv</sub> =	25	mm
KHCT =	50	mm

Liên kết: **Ngàm không xoay – Tự do**

$$h_0 = h - a_{gt} = 662.50 \text{ mm} \quad \text{Hệ: **Tĩnh định**}$$

$$\varepsilon_{b2} = 0.0035 \quad \varepsilon_{s.el} = \frac{R_s}{E_s} = 0.0018 \quad \xi_R = \frac{0.8}{1 + \varepsilon_{s.el}/\varepsilon_{b2}} = 0.533$$

$$\xi_R h_0 = 353.333 \text{ mm} \quad \psi = 2 \quad L_0 = \psi L = 7600 \text{ mm}$$

$$\text{Độ lệch tâm tĩnh học: } e_1 = M/N = 200.000 \text{ mm}$$

$$\text{Độ lệch tâm ngẫu nhiên: } e_a \geq \max\left(\frac{L}{600}; \frac{h}{30}; 10\right) = 23.333 \text{ mm}$$

$$\text{Độ lệch tâm tính toán: } e_0 = 223.333 \text{ mm}$$

(Tĩnh định:  $e_0 = e_1 + e_a$ ; Siêu tĩnh  $e_0 = \max(e_1, e_a)$ )

$$\text{Kiểm tra trường hợp chịu nén: } L_0/h = 10.857 \quad \text{Nén lệch tâm}$$

(Đúng tâm:  $e_0 \leq h/30$  và  $L_0/h \leq 20$ )

$$\text{Độ mảnh cầu kiện: } \lambda_i = \frac{L_0}{i} = \frac{L_0}{0.288h} = 37.698 \quad (\eta > 1)$$

( $\lambda_i \leq 14 \rightarrow \eta = 1$ )  
( $\lambda_i > 14 \rightarrow \eta > 1$ )

$$\text{Tính hệ số uốn dọc: } k_s = 0.7 \quad I_b = bh^3/12 = 1.29E+10 \text{ mm}^4$$

$$I_s = A_s(0.5h - a)^2 + A'_s(0.5h - a')^2 = 5.75E+08 \text{ mm}^4$$

$$\left[0.15 \leq \delta_e = \frac{e_0}{h} \leq 1.5\right] = 0.319 \quad k_b = \frac{0.15}{\varphi_r(0.3 + \delta_e)} = 0.142$$

$$\varphi_L = 1 + \frac{M_{dh} + N_{dh}(h/2 - a)}{M + N(h/2 - a)} (\leq 2) = 1.701$$

$$D = k_b E_b I_b + k_s E_s I_s = 146487.019 \text{ kN.m}^2$$

$$N_{cr} = \frac{\pi^2 D}{L_0^2} = 25030.625 \text{ kN}, \quad \eta = \frac{1}{1 - N/N_{cr}} = 1.190$$

Chiều cao vùng nén, giả thuyết:  $2a' \leq x \leq \xi_R h_0$ , khi  $R_s = R_{sc}$

$$x_1 = \frac{N + R_s A_s - R_{sc} A'_s}{\gamma_b R_b b} = 475.342 \text{ mm} \quad \text{TH nén: **TH3**}$$

**TH3: Lệch tâm bé**

$$\text{Tính lại x: } x = \frac{N + R_s A_s \frac{1 + \xi_R}{1 - \xi_R} - R_{sc} A'_s}{\gamma_b R_b b + \frac{2R_s A_s}{h_0(1 - \xi_R)}} = 421.401 \text{ mm}$$

**Vẫn TH3**

$$e = \eta e_0 + h/2 - a = 578.311 \text{ mm} \quad Ne = 2313.244 \text{ kNm}$$

$$[Ne]_{gh} = \gamma_b R_b b x \left(h_0 - \frac{x}{2}\right) + R_{sc} A'_s Z_a = 2246.394 \text{ kNm}$$

**TD không đủ KNCL**