

**Câu 1c**

M=	1000 KNm	
b=	300 mm	
h=	700 mm	
b'f=	500 mm	
h'f=	100 mm	
b'f=	600 mm	
Bê tông	B40	
Rb=	22 MPa	
γb=	1	
Cốt thép	CB400-V	
Rs=	350 MPa	
Rsc=	350 MPa	
Es=	200000 MPa	
n	D	KHCT
10	25	33.33
0	25	(-)
n	D	KHCT
3	25	187.50
0	0	(-)
a <sub>bv</sub> =	25 mm	
KHCT tr	30 mm	
KHCT d	25 mm	

Giả sử TTH qua cánh:  $x = \frac{A_s R_s - A'_s R_{sc}}{\gamma_b R_b b'_f} = 109.331$  mm

(x <= h'f => Chữ nhật lớn/T) **TTH qua sườn-TD Chữ T**

As= 4908.739 mm<sup>2</sup> a= 37.500 mm

A's= 1472.622 mm<sup>2</sup> a'= 37.500 mm

h<sub>0</sub> = h - a<sub>gt</sub> = 662.50 mm, ε<sub>s,el</sub> = R<sub>s</sub>/E<sub>s</sub> = 0.0018

ε<sub>b2</sub> = 0.0035, ξ<sub>R</sub> =  $\frac{0.8 \text{ or } 0.7}{1 + \varepsilon_{s,el}/\varepsilon_{b2}} = 0.533$

**TD chữ T** (2a')/h<sub>0</sub> = 0.113

ξ =  $\frac{A_s R_s - \gamma_b R_b (b'_f - b) h'_f - A'_s R_{sc}}{\gamma_b R_b b h_0} = 0.174$

Lấy: ξ = 0.174 α<sub>m</sub> = ξ(1 - 0.5ξ) = 0.159

M<sub>gh</sub> = α<sub>m</sub> γ<sub>b</sub> R<sub>b</sub> b h<sub>0</sub><sup>2</sup> + γ<sub>b</sub> R<sub>b</sub> (b'f - b) h'f (h<sub>0</sub> - 0.5h'f) + A's R<sub>sc</sub> (h<sub>0</sub> - a') = 1052.823 KNm  
**Tiết diện đủ KNCL**

**Câu 2a**

b=	300 mm	
h=	500 mm	
a <sub>gt</sub> =	60 mm	
a' <sub>gt</sub> =	35 mm	

M=	450 kNm	
N=	250 kN	

Bê tông	B40	
R <sub>b</sub> =	22 MPa	
γ <sub>b</sub> =	1	

Cốt thép	CB400-V	
R <sub>s</sub> =	350 MPa	
R <sub>sc</sub> =	350 MPa	
E <sub>s</sub> =	200000 MPa	

a <sub>bv</sub> =	25 mm	
KHCT.T=	30 mm	
KHCT.D=	25 mm	

h<sub>0</sub> = h - a<sub>gt</sub> = 440.000 mm  
e<sub>0</sub> = M/N = 1800.000 mm  
y<sub>a</sub> =  $\frac{h}{2} - a = 190.000$  LTL

ε<sub>b2</sub> = 0.0035 ε<sub>s,el</sub> = R<sub>s</sub>/E<sub>s</sub> = 0.0018

ξ<sub>R</sub> =  $\frac{0.8 \text{ or } 0.7}{1 + \varepsilon_{s,el}/\varepsilon_{b2}} = 0.533$  2a' = 70.000 mm

ξ<sub>R</sub>h<sub>0</sub> = 234.667 mm Chọn x = 70.000 mm

e = e<sub>0</sub> -  $\frac{h}{2} + a = 1610.000$  mm Z<sub>a</sub> = h<sub>0</sub> - a' = 405.000 mm

A's =  $\frac{1}{R_{sc} Z_a} [N e - \gamma_b R_b b x (h_0 - 0.5x)] = (> 0) = 1519.506$  mm<sup>2</sup>

n	D	A' <sub>s,tk</sub>	μ <sub>tk</sub>	a' <sub>tk</sub>	ΔA' <sub>s</sub>	KHCT.T
5	20	1570.796	1.19%	35.00	3.38%	37.50
0	20			Thỏa		(-)

Khi A's > 0: A<sub>s</sub> = (N + γ<sub>b</sub>R<sub>b</sub>bx + R<sub>sc</sub>A's)/R<sub>s</sub> = 3605.082 mm<sup>2</sup>

n	Ø	A <sub>s</sub> <sup>tk</sup>	μ <sub>tk</sub>	a <sub>tk</sub>	ΔA <sub>s</sub>	KHCT.D
5	25	3926.991	2.97%	56.25	8.93%	31.25
3	25			Thỏa		87.50

**Câu 3a**

M =	<b>2200</b> kNm
N =	<b>2500</b> kN
M <sub>dh</sub> =	<b>1500</b> kNm
N <sub>dh</sub> =	<b>1500</b> kN

L =	<b>6</b> m
b =	<b>600</b> mm
h =	<b>900</b> mm

<b>BT:</b>	<b>B40</b>
R <sub>b</sub> =	<b>22</b> MPa
γ <sub>b</sub> =	<b>0.85</b>
E <sub>b</sub> =	<b>36000</b> MPa

<b>CT:</b>	<b>CB400-V</b>
R <sub>s</sub> =	<b>350</b> MPa
R <sub>sc</sub> =	<b>350</b> MPa
E <sub>s</sub> =	<b>200000</b> MPa

a <sub>gt</sub> =	<b>75</b> mm
a' <sub>gt</sub> =	<b>75</b> mm
Z <sub>a</sub> =	<b>750</b> mm
2a' <sub>gt</sub> =	<b>150</b> mm

a <sub>bv</sub> =	<b>25</b> mm
KHCT =	<b>50</b> mm

Liên kết: **Ngàm không xoay – Tự do**

$$h_0 = h - a_{gt} = \mathbf{825} \text{ mm}, \quad \varepsilon_{b2} = \mathbf{0.0035} \quad \varepsilon_{s,e1} = \frac{R_s}{E_s} = \mathbf{0.0018}$$

$$\xi_R = \frac{0.8 \text{ or } 0.7}{1 + \varepsilon_{s,e1}/\varepsilon_{b2}} = \mathbf{0.533} \quad \xi_R h_0 = \mathbf{440.000} \text{ mm}$$

Hệ: **Tĩnh định**      ψ = **2**      L<sub>0</sub> = ψL = **12000** mm

\_ Độ lệch tâm tĩnh học:      e<sub>1</sub> = M/N = **880.000** mm

\_ Độ lệch tâm ngẫu nhiên:      e<sub>a</sub> ≥ max(  $\frac{L}{600}$ ;  $\frac{h}{30}$ ; 10 ) = **30.000** mm

\_ Độ lệch tâm tính toán: ( T.định: e<sub>0</sub> = e<sub>1</sub> + e<sub>a</sub> ; S.tĩnh: e<sub>0</sub> = max(e<sub>1</sub>, e<sub>a</sub>) )      e<sub>0</sub> = **910.000** mm

\_ Trường hợp chịu nén:      L<sub>0</sub>/h = **13.333**      Kết luận: **Nén lệch tâm**  
(Đúng tâm: e<sub>0</sub> ≤ h/30 và L<sub>0</sub>/h ≤ 20)

\_ Độ mảnh cầu kiện:      λ<sub>i</sub> =  $\frac{L_0}{i} = \frac{L_0}{0.288h} = \mathbf{46.296} \text{ (}\eta > 1\text{)}$   
(λ<sub>i</sub> ≤ 14 → η = 1)  
(λ<sub>i</sub> > 14 → η > 1)

\_ Tính hệ số uốn dọc:      I<sub>b</sub> = (bh<sup>3</sup>)/12 = **3.65E+10** mm<sup>4</sup>

μ<sub>t</sub><sup>gt</sup> = **2.70%**      I<sub>s</sub> = μ<sub>t</sub><sup>gt</sup> b h<sub>0</sub> (0.5h - a)<sup>2</sup> = **1.88E+09** mm<sup>4</sup>

φ<sub>L</sub> =  $1 + \frac{M_{dh} + N_{dh}(h/2 - a)}{M + N(h/2 - a)} (\leq 2) = \mathbf{1.657}$       k<sub>s</sub> = **0.7**

[0.15 ≤ δ<sub>e</sub> = e<sub>0</sub>/h ≤ 1.5] = **1.011**      k<sub>b</sub> =  $\frac{0.15}{\varphi_L(0.3 + \delta_e)} = \mathbf{0.069}$

D = k<sub>b</sub>E<sub>b</sub>I<sub>b</sub> + k<sub>s</sub>E<sub>s</sub>I<sub>s</sub> = **353703.410** kN.m<sup>2</sup>

N<sub>cr</sub> =  $\frac{\pi^2 D}{L_0^2} = \mathbf{24242.450} kN,      η =  $\frac{1}{1 - N/N_{cr}} = \mathbf{1.115}$$

\_ Chiều cao vùng nén, giả thuyết:      2a' ≤ x ≤ ξ<sub>R</sub>h<sub>0</sub> khi      R<sub>s</sub> = R<sub>sc</sub>

x<sub>1</sub> = N/(γ<sub>b</sub>R<sub>b</sub>b) = **222.816** mm      Trường hợp nén LT: **TH2**

\_ **TH2: Lệch tâm lớn** (2a' ≤ x<sub>1</sub> ≤ ξ<sub>R</sub>h<sub>0</sub>)      e = ηe<sub>0</sub> +  $\frac{h}{2} - a = \mathbf{1389.634} mm$

A'<sub>s</sub> = A<sub>s</sub> =  $\frac{N(e + x/2 - h_0)}{R_{sc}Z_a} = \mathbf{6438.497} mm<sup>2</sup>      μ<sub>min</sub> = **0.16%**$

μ<sup>tt</sup> = **1.30%** (μ<sub>tt</sub> > μ<sub>min</sub>) - **Thỏa**,      μ<sub>t</sub><sup>tt</sup> = 2μ<sup>tt</sup> = **2.60%** μ<sub>t</sub>.gt OK

**Câu 3b**

Bố trí cốt thép PA1:

n	Ø	A <sub>s</sub> <sup>tk</sup>	μ <sub>tk</sub>	a <sub>tk</sub>	ΔA <sub>s</sub>	KHCT
<b>8</b>	<b>25</b>	<b>6872.234</b>	1.39%	69.64	6.74%	50.00
<b>6</b>	<b>25</b>			<b>Thỏa</b>		80.00

Bố trí cốt thép PA2:

n	Ø	A <sub>s</sub> <sup>tk</sup>	μ <sub>tk</sub>	a <sub>tk</sub>	ΔA <sub>s</sub>	KHCT
<b>7</b>	<b>25</b>	<b>6872.234</b>	1.39%	75.00	6.74%	62.50
<b>7</b>	<b>25</b>			<b>Thỏa</b>		62.50