No.

Date

(1) $p = \frac{A_s}{bd} = \frac{2100}{350 \times 500} = 0.012$ 1.2%

(2) $M_{cr} = \frac{f_b I}{h/2} = \frac{6.0 \times \frac{350 \times 550^3}{12}}{550/2} = 1.059 \times 10^8 = 105.9 [kN \cdot m]$
$[N \cdot mm]$

(3) $n = \frac{E_s}{E_c} = 8$

$z_n = pdn\left(-1 + \sqrt{1 + \frac{2}{np}}\right) = 0.012 \times 500 \times 8\left(-1 + \sqrt{1 + \frac{2}{8 \times 0.012}}\right) = 176.3 [mm]$

(4)

$\sigma_s = \frac{M_{cr} \times 2}{A_s(d - z_n/3)} = \frac{1.059 \times 10^8 \times 2}{2100(500 - \frac{176.3}{3})} = 228.5 [N/mm^2]$

(5) $M_y = A_s f_y\left(d - \frac{z_n}{3}\right) = 2100 \times 400\left(500 - \frac{176.3}{3}\right) = 3.706 \times 10^8 [N \cdot mm]$
$= 370.6 [kN \cdot m]$

(6) $\phi_y = \frac{\varepsilon_y}{d - z_n} = \frac{2000 \times 10^{-6}}{500 - 176.3} = 6.179 \times 10^{-6} [mm^{-1}]$

(7) $z = \frac{A_s f_y}{0.8 k f'_c b} = \frac{2100 \times 400}{0.8 \times 0.85 \times 40 \times 350} = 88.24 [mm]$

$M_u = kf'_c \times 0.8 z_n \times b \times 0.6 z_n + (d - z_n) \times A_s \times f_y$
$= 0.85 \times 40 \times 0.8 \times 88.24 \times 350 \times 0.6 \times 88.24 + (500 - 88.24) \times 2100 \times 400$
$= 3.904 \times 10^8 [N \cdot mm] = 390.4 [kN \cdot m]$

(8) $\varepsilon'_u = \phi_u \cdot z_n$
$\phi_u = \frac{\varepsilon'_u}{z_n} = \frac{3500 \times 10^{-6}}{88.24} = 3.966 \times 10^{-5} [mm^{-1}]$

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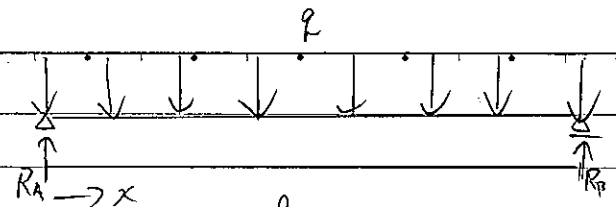
(9)



$R_A = \frac{ql}{2}$　　$R_B = \frac{ql}{2}$

M図

$x = \frac{l}{2}$ のとき

$\Sigma M_x = R_A x - \frac{qx^2}{2}$

$= \frac{ql^2}{4} - \frac{ql^2}{8}$

$\frac{ql^2}{8}$　　$\frac{ql^2}{8}$

$q = 0.35 \times 0.55 \times 2500 \times 9.8 \times \frac{1}{1000} = 4.716$ [kN/m]

$M_{cr} \geq \frac{ql^2}{8}$

$l^2 \leq \frac{M_{cr} \times 8}{q}$

$l \leq \sqrt{\frac{105.9 \times 8}{4.716}}$

$l \leq 13.40$ [m]

鉄筋の断面積2倍

(10) $z_n = \frac{2A_s f_y}{0.8 k f'_c b} = \frac{4200 \times 400}{0.8 \times 0.85 \times 40 \times 350} = 176.5$ [mm]

$M_u = k f'_c \times 0.8 z_n \times b \times 0.6 z_n + (d - z_n) \times 2A_s \times f_y$

$= 0.85 \times 40 \times 0.8 \times 176.5 \times 350 \times 0.6 \times 176.5 + (500 - 176.5) \times 4200 \times 400$

$= 7.214 \times 10^8 = 721.4$ [kN·m]

圧縮強度2倍

$z_n = \frac{2100 \times 400}{0.8 \times 0.85 \times 40 \times 2 \times 350} = 44.12$ [mm]

$M_u = 0.85 \times 80 \times 0.8 \times 44.12 \times 350 \times 0.6 \times 44.12 + (500 - 44.12) \times 2100 \times 400$

$= 4.052 \times 10^8 = 405.2$ [kN·m]

$(A_s \times 2)$　$(f'_c \times 2)$

$721.4 \geq 405.2$

$(A_s \times 2)$の場合の方が曲げ耐力は高くなる。