CLAIMS

1.

An RC member joining structure in which one RC member is formed by extending main reinforcement from a joining end face to the outer side, and the other RC member is a column and is formed by having sheath pipes buried to open to the joining end face in parallel with the main reinforcement,

wherein the main reinforcement of the one RC member is inserted into the sheath pipe, a grout material is filled inside the sheath pipe, and the main reinforcement of the one RC member and a main reinforcement of the other RC member are connected by a non-contact lap splice with each other, having a gap therebetween, and

wherein the required lap splice length L_d of the non-contact lap splice is set in accordance with Equations (1) to (6) below:

[Formula 1]

$$L_d \geq \max(L_{d1}, L_{d2}) \qquad (1)$$

[Formula 2]

$$L_{d1} = \left\{ \frac{\frac{L_b - h_b}{d_b} \cdot \tau_{b\max} + \frac{1}{4} \cdot \sigma_y \cdot \left(1 - \frac{h_b}{H}\right)}{\tau_{b\max} + \frac{d_b}{4H} \cdot \sigma_y} \right\} \cdot \frac{1}{1-\gamma_t} \cdot d_b \quad (2)$$

[Formula 3]

$$L_{d2} = \left(\frac{1}{4} \cdot \frac{\sigma_y}{\tau_{sb\max}} \cdot \frac{d_b}{D_s} + \frac{L_b - h_b}{d_b} \right) \cdot \frac{1}{1-\gamma_t} \cdot d_b \quad (3)$$

[Formula 4]

$$L_b = 0.26\left(R_d - R_y\right) \cdot d_{cy} \quad (4)$$

[Formula 5]

$$\tau_{b\max} = \alpha \cdot 0.658\sqrt{f_c} \quad (5)$$

[Formula 6]

$$\tau_{sb\max} = \alpha \cdot 0.366\sqrt{f_c} \quad (6)$$

wherien L_d is the lap splice length (mm), d_b is the nominal diameter (mm) of the main reinforcement of the column, L_b is the joint lower ineffective length (mm) and is acquired by Equation (4), and σ_y is the yield strength (N/mm^2) of the main

reinforcement of the column;

wherein H is the shear span (mm) of the column, h_b is the grout thickness at bottom of joint (mm), D_s is the sheath pipe outer diameter (mm), τ_{bmax} is the bond strength (N/mm^2) of the main reinforcement of the column and is acquired by Equation (5), and τ_{sbmax} is the bond strength (N/mm^2) of the sheath pipe and is acquired by Equation (6);

wherein γ_t is the ratio of the joint upper ineffective length to the lap splice length, R_d is the design limit member angle (%), R_y is the yield member angle (%), and d_{cy} is an effective depth (mm) of the column and is the distance from the compressive stress fiber at the cross-section of a pedestal portion to the centroid position of the steel reinforcement (joint reinforcement) in tension; and

α is the bond reduction coefficient, and f_c is the concrete specified strength (N/mm^2).

2. The RC member joining structure according to claim 1,

wherein a yield moment M_Y at the cross-section based on arrangement of main reinforcement of the other RC member arranged on the inner side of the sheath pipe is above an acting bending moment M_{LE} at the joint end point, and the required lap splice length L_d is set so as not to yield in failure at the cross-section of the joint end point of

the non-contact lap splice by satisfying a condition of Equation (7) below;

[Formula 7]

$$M_{LE} = \phi_e \cdot M_{cy} \cdot \frac{H - L_d - h_b}{H - L_b} < M_Y \qquad (7)$$

wherein M_Y is the yield moment (kN·m) at the cross-section according to the column main reinforcement at the joint end point and is acquired by Equation (8) below, M_{LE} is the moment (kN·m) acting on the joint end point, M_{cy} is the yield moment (kN·m) at the cross-section of the pedestal and is acquired by Equation (9) below, and ϕ_e is the coefficient of bending moment and is 1.0; and

wherein A_s is the total cross-sectional area (mm^2) of the steel reinforcement in tension, d_Y is the effective depth (mm) of the column and is the distance from the compressive fiber stress of the joint end point cross-section to the centroid of the steel reinforcement in tension, a is the stress block depth (mm) of concrete and is calculated by Equation (10) from the balance at the cross-section, and f_c is the concrete specified strength (N/mm^2), f_y is the specified yield strength (N/mm^2) of the main reinforcement of the column, and b is member width (mm).

[Formula 8]

$$M_Y = A_s \cdot f_y \cdot (d_Y - 0.5 \times a) \cdot 10^{-6} \quad (8)$$

[Formula 9]

$$M_{cy} = A_s \cdot f_y \cdot (d_{cy} - 0.5 \times a) \cdot 10^{-6} \quad (9)$$

[Formula 10]

$$a = \frac{A_s \cdot f_y}{0.85 \cdot f_c \cdot b} \quad (10)$$

3. The RC member joining structure according to claim 1 or 2,

wherein the required transverse reinforcement amount p_{wd} in a lap splice section is set in accordance with Equation (11) and Equation (12);

[Formula 11]

$$p_{wd} \geq \frac{C_S}{C_S + D_S} \cdot \frac{\sigma_{td}}{f_{wy}} \quad (11)$$

[Formula 12]

$$\sigma_{td} = \frac{1}{\alpha}\max\left(0.78 \cdot {}^{\tau_b}/_{\sigma_{td}}, 1.6 \cdot {}^{\tau_{sb}}/_{\sigma_{t0}}\right) \times \sigma_{tav} \quad (12)$$

wherein C_s is the smaller value of a gap (mm) between sheath pipes and twice the minimum covering thickness (mm) of the sheath pipe, D_s is the sheath pipe outer diameter (mm), and p_{wd} is the required transverse reinforcement ratio, and f_{wy} is the specified yield strength (N/mm^2) of the transverse reinforcement;

wherein σ_{td} is the design splitting stress intensity (N/mm^2), σ_{t0} is the reference splitting strength (N/mm^2), and σ_{tav} is the average stress intensity (N/mm^2) acting on a splitting face when concrete is failed in splitting and is acquired by Equation (13);

wherein α is the bond reduction coefficient, τ_b is the working bond stress (N/mm^2) of the main reinforcement of the column and is acquired by Equation (14) below, and τ_{sb} is the working bond stress (N/mm^2) of the sheath pipe and is acquired by Equation (15) below; and

wherein f_t is the splitting strength (N/mm^2) of concrete and is acquired by Equation (17) below.

[Formula 13]

$$\sigma_{tav} = \frac{\left(\frac{C_S}{D_S}+2\right)\cdot f_t}{\left(\frac{C_S}{D_S}+1\right)^2 +1+\left\{\left(\frac{C_S}{D_S}+1\right)^2 -1\right\}\cdot\frac{f_t}{f_c}} \quad (13)$$

[Formula 14]

$$\tau_b = \frac{d_b}{4}\cdot\frac{\sigma_y}{L_d + h_b - L_t - L_b}\left(1-\frac{L_d + h_b - L_t}{H}\right) \quad (14)$$

[Formula 15]

$$\tau_{sb} = \frac{d_b^{\,2}}{4D_S}\cdot\frac{\sigma_y}{L_d + h_b - L_t - L_b} \quad (15)$$

[Formula 16]

$$L_t = 0.13 \times L_d \quad (16)$$

[Formula 17]

$$f_t = 0.56\cdot\sqrt{f_c} \quad (17)$$