(N/mm^2) of the reinforcing bar and is the specified yield strength. a_s is the cross-sectional area (mm^2) of one beam main reinforcement, ϕ is the circumference (mm) of one beam main reinforcement, and τ_{bmax} is the bond strength (N/mm^2) of the beam main reinforcement.

[0054]

[Formula 13]

$$L_d = L_p + \frac{f_y \cdot a_s}{\phi \cdot \tau_{b\max}} \qquad (13)$$

[0055]

The joint ineffective length L_p is acquired by using the following Equation (14) when $1 \leq R_b/R_e \leq 2.5\times\gamma + 1$ and is acquired by using the following Equation (15) when $2.5\times\gamma + 1 < R_b/R_e$. In addition, when $L_p > 1.5d$, it is assumed that $L_p = 1.5d$.

[0056]

Here, a is the shear span (mm) of the beam, d is the whole depth (mm) of the beam, and R_d is the design limit member angle (rad). R_e is the yield deformation angle (rad) set in the ACI standard and is acquired by using Equation (8) represented above. D is the effective depth (mm) of the beam when the lower end of the beam in tension. In addition, γ and β are the influence factors according to the shear span ratio (a/D) and are acquired by the following Equations (16) and (17).

[0057]

[Formula 14]

strength. μ is the friction coefficient of the concrete working joint interface and is 1.0 when being processed by a checkered plate. f_{yt} is the yield strength (N/mm^2) of the transverse reinforcement and is assumed to be a specified yield strength. B is the beam width (mm). L is the lap splice length (mm) and is secured to be the required lap splice length L_d or more.

[0066]

[Formula 19]

$$p_{wd} = \alpha \cdot \frac{A_{vf} \cdot 1.25 f_y}{\mu \cdot f_{yt} \cdot B \cdot L} \qquad (19)$$

[0067]

(Checking conformity of lap splice length L with ACI standard)

Next, a result of checking that the lap splice length L set to be the required lap splice length L_d or more is the required lap splice length L_{d2} based on a case of all reinforcement in tension according to the ACI standard or more will be described.

[0068]

L_{d2} is calculated using the following Equation (20).

Here, when $(C_b + K_{tr})/ d_b > 2.5$, it is assumed that $(C_b + K_{tr})/ d_b = 2.5$.

[0069]

Here, f_y is the yield strength (N/mm^2) of the beam main reinforcement and is assumed to be a specified yield strength. f_c' is the cylinder compressive strength (N/mm^2) of placed concrete and is assumed to be a specified strength. d_b is the nominal diameter (mm) of the beam main reinforcement, and λ is the coefficient according to the type of concrete and is assumed to be 1.0 in the case of normal concrete.