

# Designing of JL bolt application

Only receiving tensile force

## 1. Designing of allowable stress

The allowable tensile strength of JL bolt (hereafter JL anchor bolt and JL Y inserts bolts collectively called "JL bolt") that fixed with concrete building frame is supposed to be calculated by (1) or (2), and either the lower result will be used.

$$p_{a1} = \phi_1 \times \sqrt{F_c} \times A_c \times 0.313209 \dots\dots\dots (1)$$

$$p_{a2} = \phi_2 \times s_{\sigma y} \times s_{ca1} \dots\dots\dots (2)$$

$p_{a1}$  : The allowable tensile strength(N) of JL bolt that decided by the corn shaped destruction.

$p_{a2}$  : Allowable tensile strength (N) of JL bolt that decided by the yield point of the bolt used with JL anchor bolt or JL Y insert bolt.

$\phi_1 \cdot \phi_2$  : Reduction coefficient of allowable tensile strength. Use with table 1 showing in below.

Table 1: Reduction coefficient of allowable tensile strength

	$\phi_1$	$\phi_2$
For long term load	0.4	2/3
For short term load	0.6	1.0

$F_c$  : Strength of standard design for concrete(N/mm<sup>2</sup>)

$A_c$  : This is the effective area of horizontally projected as of the corn shaped destruction of concrete, which is calculated by showing by figure 1.

But if plural number of JL bolt that contiguittly locate with, the effective area of horizontally projected is shown on figure 2. (mm<sup>2</sup>)

Embedded length( $l_e$ ) of JL bolt will be calculated as showing on figure 3.

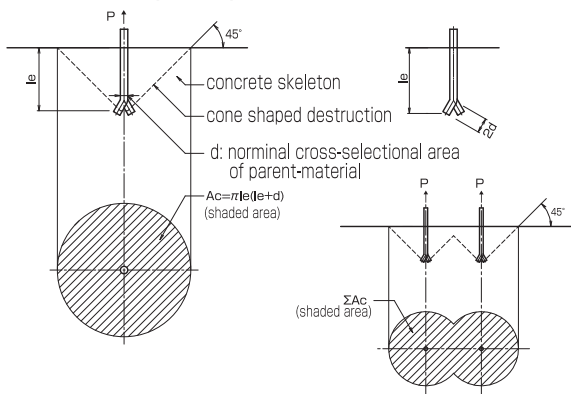
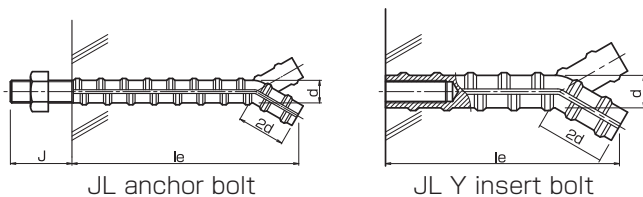


Figure1. Effective area of horizontally projected as for the corn shaped destruction.

Figure2. When the JL bolt at located by contiguittly in Figure 1.



J : Length of projection  $l_e$  : Embedded length of JL bolt d : nominal diameter of parent material

Figure 3. How to calculate the length ( $l_e$ ) of embedded JL bolt

$s_{\sigma y}$  : Yield strength of steel material used for JL anchor bolt or JL Y insert bolt (Same with short-term allowable tensile stress) (N/mm<sup>2</sup>)

$s_{ca1}$  : Effective cross sectional area of the bolt used at JL anchor bolt or JL Y insert bolt.

## 2. Calculation of horizontal proof stress

The tensile strength of fixed JL bolt into concrete skeleton will be the lower result of calculation either (1u) or (2u). But in case of requiring fracture toughness, it will be decided with (2u)

$$p_{u1} = \sqrt{F_c} \times A_c \times 0.313209 \dots\dots\dots (1u)$$

$$p_{u2} = s_{\sigma y} \times s_{ca1} \dots\dots\dots (2u)$$

$p_{u1}$  : The tensile strength(N) of JL bolt that decide by the corn shaped destruction of fixed concrete skeleton

$p_{u2}$  : The tensile strength(N) of JL bolt that decided by the yield point of the bolt used at JL anchor bolt or JL Y insert bolt.

$F_c$  : Please refer to (1)

$A_c$  : Please refer to (1)

$s_{\sigma y}$  : Please refer to (2)

$s_{ca1}$  : Please refer to (2)

## Commentary

1. The destructive mode that decide the allowable tensile strength of JL bolt is as shown in figure(a), there are two types. As for formula(1), ① is the factor to decide, for formula(2), ② is the factor to decide the allowable tensile strength.



Figure(a) Destructive mode

As for the calculated result of "effective cross sectional area of thread" for main JL bolts will be shown at figure 2.

2. (1) As for the formula (1u) and (2u), these are the based on formula (1) and (2) by putting "1.0" to both  $\phi_1$  and  $\phi_2$ .

But for formula(1u), the allowable tensile strength decided by factor of ①, for (2u), they decided by factor of ②.

(2) In order to apply the calculation result of (2u) formula for sure, the pulling force that calculated by (1u) needed to be higher than the result of (2u) but the The embedded length of JL bolt will be decided in order to make above happen.

(3) When JL bolt installed at narrow area such as continuous footing, and if we expect fracture toughness, we will add reinforcement bars in order to do the stress transmission of JL bolt.

But the reinforcement of the axial direction of the material can be used as the flexural reinforcement of at anchorage zone of the concrete as well.