

## CHAPTER 4 LIVE LOADS

### 4.1 General

#### 4.1.1 Definition

Live loads are the vertical loads due to furniture and people, which act randomly and vary with time and space during the lifetime of the building. They are determined for each element of structures considering design limit states, particular use of the building, temporary concentration of people and furniture and dynamic effects of live loads.

### 4.2 Estimation of Live Loads

#### 4.2.1 Basic value of live loads

The basic value  $Q$  ( $\text{N/m}^2$ ) of live loads is estimated from the following equation :

$$Q = k_e k_a k_n Q_0 \quad (4.1)$$

where

$k_e$  : conversion factor to equivalent uniformly distributed load (see 4.2.3)

$k_a$  : area reduction factor (see 4.2.4)

$k_n$  : multi-story reduction factor (see 4.2.5)

$Q_0$  : basic live load intensity ( $\text{N/m}^2$ ) (see 4.2.2)

but  $k_n$  can be used for only calculating axial force of column and vertical loads of foundations.

#### 4.2.2 Basic live load intensity

The basic live load intensity  $Q_0$  is the 99 percentile value of the sustained live load intensity for the particular use, as shown in Table 4.1.

**Table 4.1** Basic live load intensity  $Q_0$

Categories*	①	②	③	④	⑤	⑥	⑦	⑧
$Q_0$ ( $\text{N/m}^2$ )	1,000	500	1,600	2,100	3,500	2,200	4,700	1,800

\*Category means one of the following uses :

- ① residential flats, dwellings
- ② hotel rooms (not including unit bath)
- ③ offices, laboratories
- ④ supermarkets, department stores
- ⑤ computer rooms (not including cables)
- ⑥ lane loads and garage parking spaces
- ⑦ library stack rooms
- ⑧ buildings where loads are produced mainly by people, for example, theaters, movie theaters, halls, assembly rooms, conference rooms, classrooms, etc.

### 4.2.3 Conversion factor for equivalent uniformly distributed load

Conversion factors for equivalent uniformly distributed load  $k_e$  are listed in Table 4.2.

**Table 4.2** Conversion factor to equivalent uniformly distributed load

Categories*	①	②	③	④	⑤	⑥	⑦	⑧
Slab	1.8	2.0	1.6	1.8	1.6	1.8	1.6	1.6
Girder, Column, Foundation	1.2							

### 4.2.4 Area reduction factor

Area reduction factor  $k_a$  can be calculated from the following equations.

(1) For categories ①~⑦ in Table 4.1

$$k_a = 0.6 + \frac{0.4}{\sqrt{A_f/A_{ref}}} \leq 1.0 \quad (4.2)$$

(2) For category ⑧ in Table 4.1

$$k_a = 0.7 + \frac{0.3}{\sqrt{A_f/A_{ref}}} \leq 1.0 \quad (4.3)$$

where,  $A_f$  is the influence area ( $m^2$ ) and  $A_{ref}$  is the basic area ( $=18m^2$ ).

### 4.2.5 Multi-story reduction factor

Multi-story reduction factor  $k_n$  can be calculated from the following equation.

$$k_n = 0.6 + \frac{0.4}{\sqrt{n}} \quad (4.4)$$

where,  $n$  is the number of floors supported.

No reduction shall be permitted for category ⑧ in Table 4.1 and  $k_a k_n > 0.4$  for all categories.

## 4.3 Live Loads Considering Concentration, Deflections or Cracks

In the case that the effects of furniture concentration, deflections or cracks must be considered, it is necessary to determine the appropriate intensity of design live loads considering those effects.

## 4.4 Dynamic Effects of Live Loads

With regard to the dynamic effects of live loads, the effects of movements of people and objects must be considered when it is necessary to evaluate the serviceability performance of buildings in relation to vibrations, such as habitability for occupants, counter-vibration measures for precision equipments, etc. It is also desirable to consider the influence of ambient environments and the source (or sources) of vibrations located on other floor slabs inside the buildings.