

7-Story RC Building Time History Analysis

Blind Prediction

Appendix: Instruction for Preparation of Analysis Results for Judgment

GENERAL REMARKS

In this document, analysis results (e.g., displacement, acceleration, story shear, overturning moment, and so on) are defined.

The absolute displacement $u_j(t)$ and the absolute acceleration $\ddot{u}_j(t)$ of the j th floor are to be evaluated on the upper surface at the center $((X, Y) = (1750, 3500))$; see Fig. 1) of the floor slab. Here, "absolute" means the value measured with respect to the global coordinate as shown in Fig. 2. The values corresponding to $j=8$ are the responses on the upper surface of the roof, and the values corresponding to $j=0$ are the responses on the surface of the shaking table. The time t is measured from the beginning of analysis at each seismic level. The base acceleration records, which are distributed by the organizing committee, are the absolute accelerations on the surface of the shaking table.

The weight W_j of the j th floor and the height h_i of the i th story (see Fig. 1) are given in Table 1.

Predictions must be in SI units only (mm, kN, sec, rad) as indicated in the submitted answer sheets.

Conversions: 1 inch = 25.4 mm, 1 kip = 4.448 kN.

Maximum relative displacement with respect to the shaking table surface on each floor

The relative displacement from the table surface on the j th floor takes the form:

$$d_j(t) = u_j(t) - u_0(t) \quad (1)$$

in which, the maximum value in time history is defined as $\max|d_j(t)|$, $j = 2, \dots, 8$; $u_0(t)$ is the displacement history measured on the table surface.

Maximum interstory drift angle on each story

The interstory drift angle on the i th story is obtained by

$$R_i(t) = \frac{u_{i+1}(t) - u_i(t)}{h_i} \quad (2)$$

The maximum value in time history is defined as $\max|R_i(t)|$, $i = 1, \dots, 7$.

Residual interstory drift angle on each story

For inelastic level, the residual interstory drift angle on the i th story ($i = 1, \dots, 7$) is to be obtained as the average value between the absolute values at the local maximum and minimum at the end of the table acceleration record as shown in Fig. 3.

Maximum absolute acceleration on each floor

The maximum value of absolute acceleration in time history is given as $\max|\ddot{u}_j(t)|$, $j = 2, \dots, 8$.

Maximum story shear of each story

The story shears from the experiment will be calculated. The inertia force on the j th floor is obtained by

$$F_j(t) = \frac{w_j}{g} \ddot{u}_j(t) \quad (3)$$

in which, g is the acceleration of gravity ($= 9.81$ m/sec); w_j is the weight of the j th floor including its slab and slab payload, $\ddot{u}_j(t)$ is the measured acceleration history on the j th floor.

The story shear of the i th story is obtained by

$$Q_i(t) = \sum_{j=i+1}^8 F_j(t) \quad (4)$$

for which the maximum value in time history is given as $\max|Q_i(t)|$, $i = 1, \dots, 7$.

Maximum overturning moment on each floor

The overturning moments from the experiment will be calculated. The overturning moment on the j th floor is obtained by

$$M_{OVT,j}(t) = \sum_{k=j+1}^8 (F_k(t) \times \sum_{i=j}^{k-1} h_i) = \sum_{i=j}^7 (Q_i(t) \times h_i) \quad (5)$$

for which the maximum value in time history is given as $\max|M_{OVT,j}(t)|$, $j = 1, \dots, 7$.

Maximum absolute rotational angle

The maximum absolute rotational angle θ_z as defined shown in Fig. 4 in time history is to be evaluated at the slab of the 2nd floor. The positive direction of rotation is counterclockwise. The rotational angle to be reported is that resulted from the dynamic excitation.

Average strain at a specified point in elastic range

The maximum absolute value of the average axial strain in time history is to be evaluated at C1 column of the 1st story) that is assumed to be in elastic range. The strain to be reported is that resulted from the dynamic excitation; i.e., it does not contain the initial strain due to dead load at the beginning of the test. In the shaking table test, the axial deformation will be measured using a string displacement transducer.

Time at which the interstory drift angle of a story reaches **0.05** or **-0.05** rad

The time at which the maximum interstory drift angle of a story defined by Eq. (2) first reaches **0.05** or **-0.05** rad. is to be reported. Here, t is measured from the beginning of the analysis at the inelastic level.

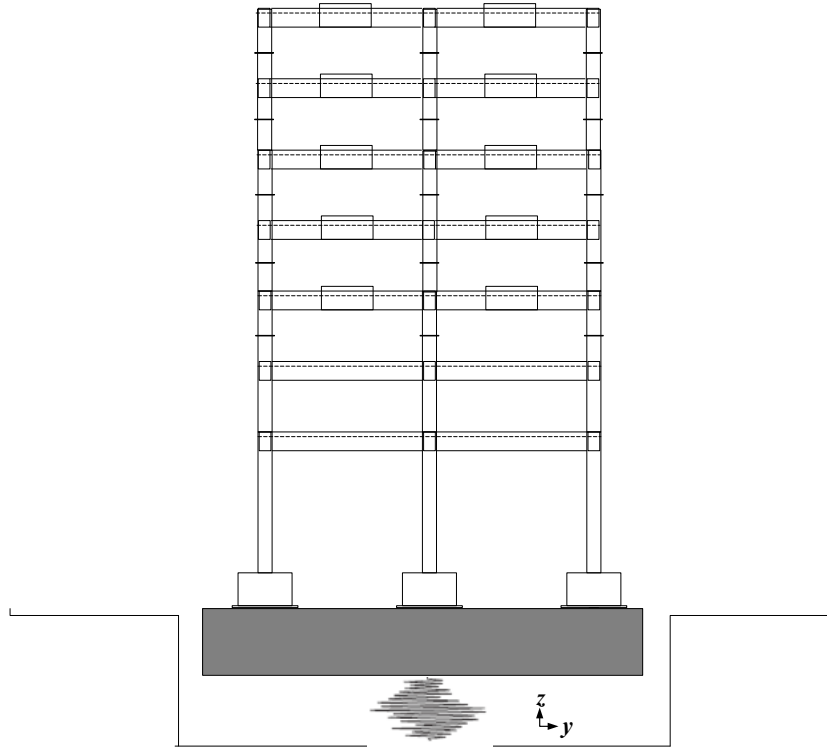


Figure 2 Global coordinate

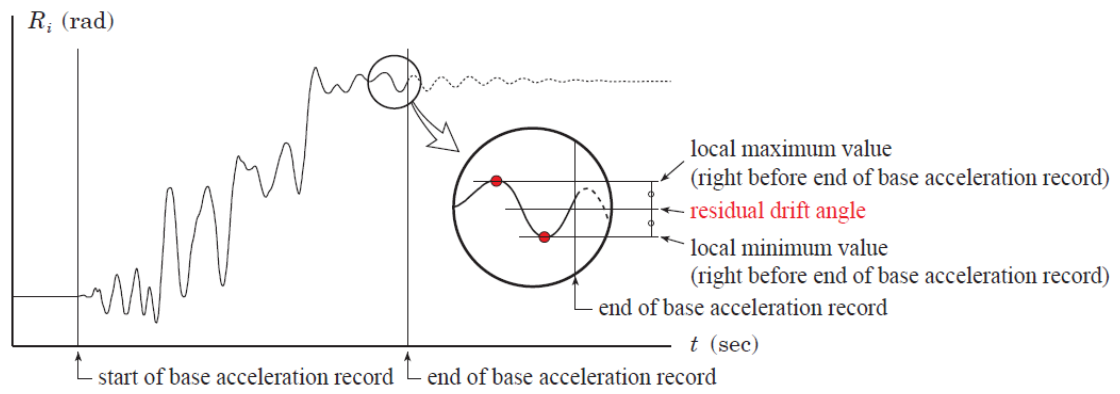


Figure 3 Definition of residual drift angle

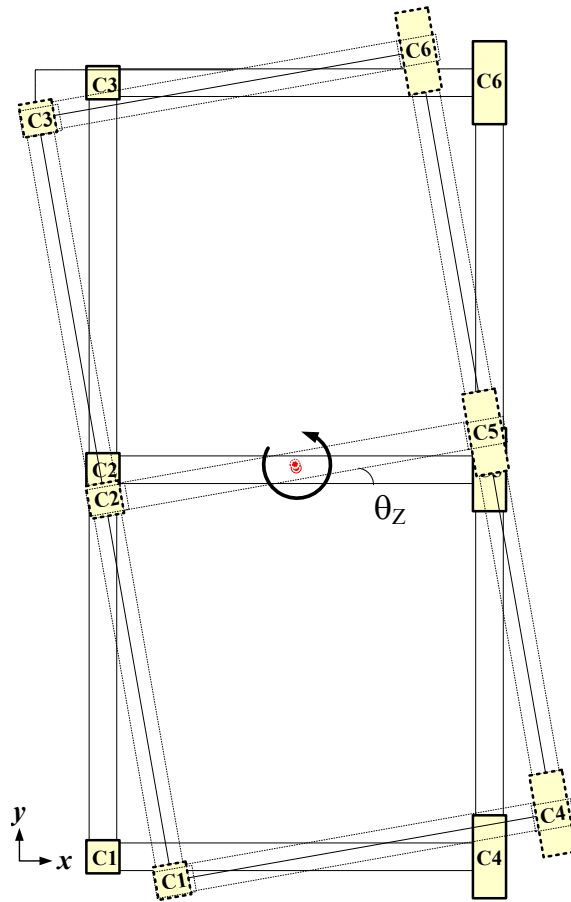


Figure 4 Definition of rotational angle of floor slab

Table 1 Floor weight and story height

Floor number j	Floor weight W_j (kN)	Story number i	Story height h_i (mm)
8	152.43	7	1500
7	181.58	6	1500
6	181.58	5	1500
5	181.58	4	1500
4	181.58	3	1500
3	169.14	2	1500
2	173.40	1	3000