

Three-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. Only the responses in X-direction should be computed.

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 $j = 4$ are the responses on the upper surface of the roof, and the values corresponding to $j = 0$ are the responses on the face 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 face of the shaking table.

The weight W_j of 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 value of relative displacement from base at each floor

The relative displacement from the base at j th floor is obtained by

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

The maximum value in time history is defined as $\max|d_j(t)|, j = 2, \dots, 4$.

Maximum value of drift angle in each story

The drift angle in 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 $\max|R_i(t)|, i = 1, \dots, 3$.

Residual drift angle in each story

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

Maximum value of absolute acceleration at each floor

The maximum value of absolute acceleration in time history is given as $\max|\ddot{u}_j(t)|, j = 2, \dots, 4$.

Maximum value of story shear at each story

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

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

Here, g is the acceleration of gravity (= 9.81 m/sec).

The story shear of the j th story is obtained by

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

for which the maximum value in time history is given as $\max|Q_i(t)|$, $i = 1, \dots, 3$.

Maximum value of overturning moment at each floor

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

$$M_{OVT,j}(t) = \sum_{k=j+1}^4 (F_k(t) \times \sum_{i=j}^{k-1} h_i) = \sum_{i=j}^3 (Q_i(t) \times h_i) \quad (5)$$

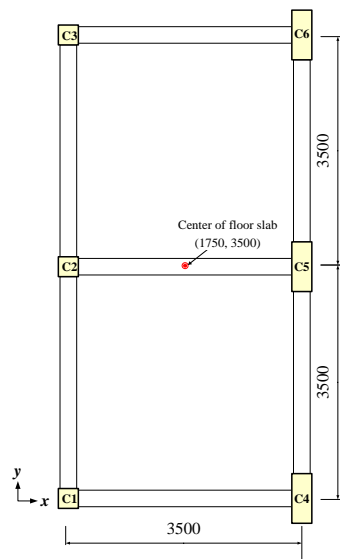
for which the maximum value in time history is given as $\max|M_{OVT,j}(t)|$, $j = 1, \dots, 3$.

Average strain at a specified point in elastic range

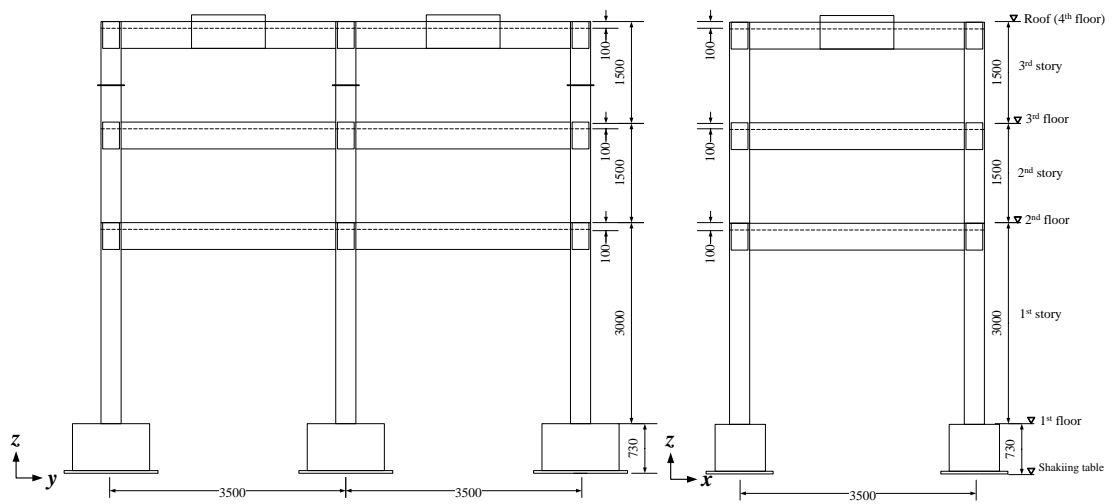
The maximum of the absolute value of the average axial strain in time history is to be evaluated at C1 column in the 1st story) that is assumed to be in elastic range. The strain to be reported is that due to the dynamic response, that is, it does not contain the initial strain due to dead load. In the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

Time at which the drift angle of a story reaches 0.015 or -0.015 rad

The time at which the maximum drift angle in any story defined by Eq. (2) first reaches 0.015 or -0.015 rad. is to be reported. Here, t is measured from the beginning of the analysis at the inelastic level.



(a) plan



(b) elevation

Figure 1 Definition of floor and story (unit: mm)

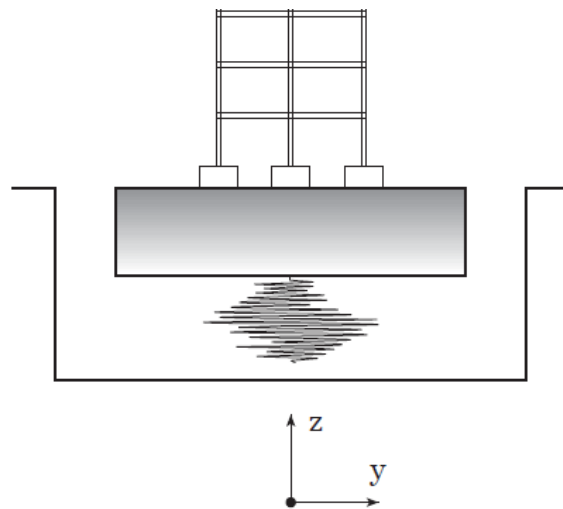


Figure 2 Global coordinate

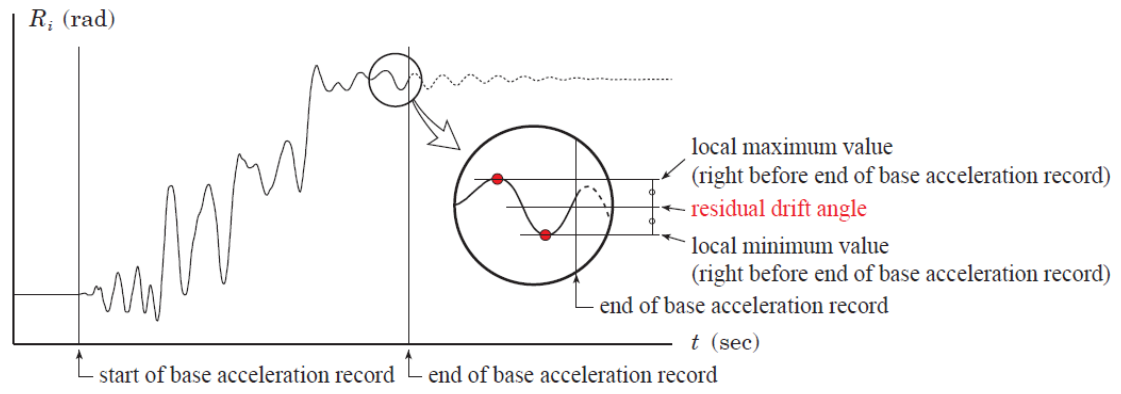


Table 1 Floor weight and story height

Floor number j	Floor weight W_j (kN)	Story number i	Story height h_i (mm)
4	170.988	3	1500
3	193.257	2	1500
2	205.225	1	3000