Press Information

Report of the C1-2 Experiment Pre-analysis Contest

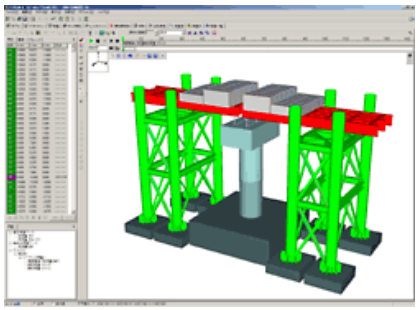
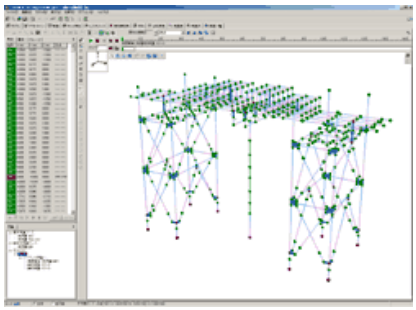
On Thursday 5 March 2009, the C1-2 Experiment Pre-analysis contest of "2007 / 2008 Research presentation of earthquake resistance experiment for piers", sponsored by the National Research Institute for earth Science and Disaster Prevention in Japan, on the third floor of World Trade Center building which locates in Hamamatsu-cho, Minato-ku, Tokyo ,Japan. UC-win/FRAME (3D) analysis support team won the pre-analysis contest (E-defense) in the fiber model class. Following are summary and analysis models of the contest.

13 August, 2008 on the website(http://www.bosai.go.jp/hyogo/) of Hyogo Earthquake Engineering Research Center, National Research Institute for Earth Science and Disaster Prevention, registration applications of the C1-2 Experiment Pre-analysis contest started.

FORUM8 tried to this contest through the UC-win/FRAME (3D), which is popular among many users, Adding Aoto to the team who belongs to Yoshikawa lab of civil engineering course, Tokyo City University.

The C1-2 experiments assume the piers which were constructed in 1970s and have two stepped rebar arrangements in the middle of it. The height of piers not including footings are 7.5 meter and the column parts are 6.0 meter and diameter of the column is 1.8 meter. The contest was divided into two parts of "Pre analysis" and "Post analysis". The former was literally conducted before experiment and in the latter analysis was conducted using the response acceleration spectrum, which was resulted from the experiment.

This contest adopted a blind analysis contest, so we were only told a drawing, weight and test results of materials. The dynamic analysis model based on these materials was modeled as shown in the figure below. The subjected pier of experiment and the total system including neighboring piers and girders. This model was consisting of total nodes number was 585. The number of fiber elements for the pier was 6, and elastic beam elements for other extra material were 735.

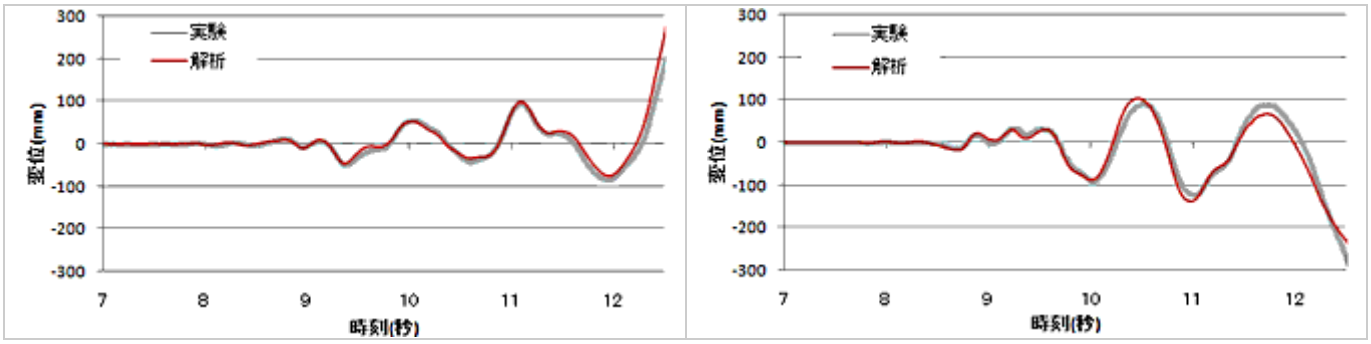




Details about the fiber elements for analysis are as following. The pier was divided into upper and lower parts because material test values of them have a difference value. Frame of concrete hysteresis is a stress-strain curve of concrete considering lateral restraint effects, which is defined on the page 160 of the specifications for highway bridges V seismic design part. Inside history adopted Sakai-Kawashima model. Because it doesn't meet a guideline for reinforcing bar arrangement of current specifications for highway bridges, restraint affected by lateral restraint reinforcements cannot be considered. To differentiate from concrete cover, core concrete is considering the 20 percent of residual strength toward peak strength. Reinforcement hysteresis is bilinear type of framework and inside history consider the Bauschinger effects. About the column which is modeled with fiber elements, the length of material is set to become 0.9 meter as the approximately half diameter.
Damping is stiffness proportional by elements and damping coefficient of fiber elements is set equal to zero.

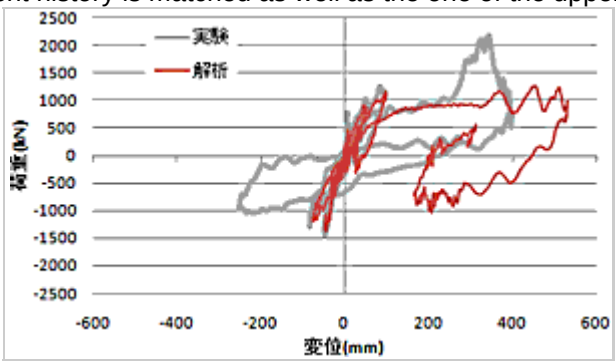
Regarding a bearing, the sliding bearing of the end of the pier is modeled through a bilinear type of spring.
the spring adopts the upper limit, of which friction force is calculated from the coefficient of friction of μ=0.2, and fall-prevention bearing on the targeted pier adopts asymmetric spring, which is only effective to a contact direction.

Here is the result. Following is a displacement history on the top of the pier. It shows the component of vertical direction on the left and the direction to the bridge axis on the right. You can find the red of experimental results

traced better than grey. The graph is cut because collision of a girder and a beam with a guard fence after 12.5 seconds prevent its evaluation.



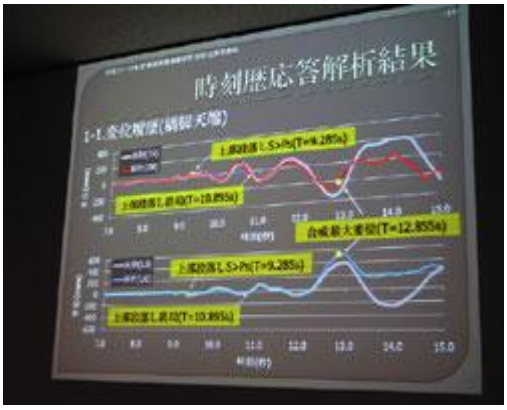
Following shows the relation of the reaction which developed on the fixed bearing of bridge axis direction and displacement of the upper end of the pier. It is conceivable that large deviation after 200mm was caused by above crush. Before crush, displacement history is matched as well as the one of the upper end of the pier.

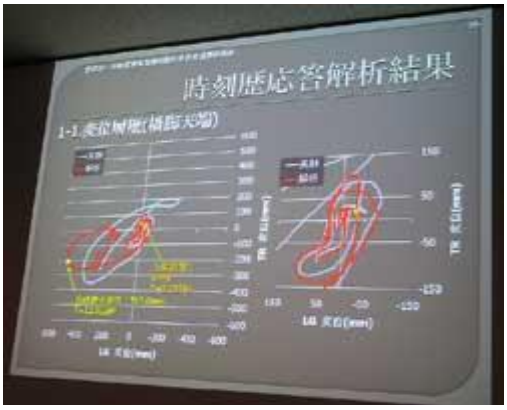


National Research Institute for Earth Science and Disaster prevention (NIED) will disclose the detail of the experimental results. We try to improve the quality of products, reviewing the actual experimental results and the analysis values. We hope your continuous support.

▶ UC-win/FRAME(3D) analysis support team, Development director (right), co-recipient , Mr. Aoto Hiroyuki (second right) of Yoshikawa Hiromichi Laboratory, Tokyo City University (former Musashi Institute of Technology)

>> UC-win/FRAME(3D) Analysis Support Service
[UC-win/FRAME (3D) analysis support team won the pre-analysis contest (E-defense) in the fiber model class]





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