CONFERENCE SUMMARY

by

K. Muto, Chairman Organizing Committee

The Tokyo Session of the Second World Conference on Earthquake Engineering is now approaching to an end.

About 120 papers have been presented at the Conference. The above plate contains the name of those presenting lectures or papers in the five Tokyo Sessions, arranged in by session groups, I, II, III, IV and V. It is to be noted that the names represent the persons presenting the papers and does not include all authors'names in cases of coauthored papers. If there are any names absent from this plate, please be assured it was unintentional.

After the presentation of two special lectures (S.L.) in the opening session, 74 papers have been presented orally by authors in five separate sessions. Other papers which were not presented orally have been introduced in session summaries by Doctors written in Japanese characters in the plate, that is, Dr. T. Mogami (Session I), Dr. S. Okamoto (Session II, first part), Dr. Y. Tsuboi (Session II, second part), Dr. H. Kawasumi (Session III and V) and Dr. T. Hisada (Session IV).

In addition to these papers, special reports have been given of the earthquake damages in Morocco, Iran and Chile, and a movie show was also presented Tuesday afternoon.

SPECIAL LECTURES RESUME

In the special lecture entitled "On the Oldest Aseismic Iron Bridge in Japan", Dr. Tanaka (Prof. Emeritus, University of Tokyo) explained the construction of the Nijubashi Bridge of the Imperial Palace. His explanation is based on rare documents preserved in the Imperial Household for eighty years. It is quite interesting to know from his lecture that the Nijubashi Bridge is the oldest iron bridge in Japan, and that it has survived safely in spite of severe loading at the Kanto Great Earthquake in 1923. He also explained recent progress in steel bridge construction in Japan.

Dr. Naito (Prof. Emeritus of Waseda University) at first gave us a view of the inner, spiritual struggle that he had to go through on developing his own modern aseismic design method. He proceeded, then, from his experience of designing the Kabuki Theater, to establish a new design method for use in designing the Industrial Bank of Japan Building; that is a method using both reinforced concrete seismic walls and continuous rectangular frames. Another remark was on Dr. Naito's recent work, The Tokyo Tower; he explained that he took 0.2 as the basic seismic coefficient value increasing gradually upward to a value of 1.0

at the top.

Two more special lectures will be disclosed at Kyoto Session; Prof. G. W. Housner on "Design of Nuclear Power Reactors against Earthquakes" and Prof. R. Tanabashi on "Earthquake Resistance of Traditional Japanese Wooden Structures".

SESSION I Soil and Foundation Conditions Related to Earthquake Problems.

In this session 10 papers were presented. Two of them are mostly concerned with the dynamic properties of soil, while others mostly presented studies on the earth pressure acting on quay walls during earthquakes. It is very valuable for us to see how the soil behaves during earthquakes. I am very glad to know that many dynamic tests on this problem are being carried out in many countries. I believe we'll be able to get further knowledge in this field. We really need this to have better design methods for earthquake resistant construction.

SESSION II Analysis of Structural Response and Instruments

In this session equivalent in the First World Conference at Berkeley in 1956, there were only 11 papers presented on this subject. At this Conference there have been 50 papers presented. This shows the growing rate of research in this subject. In this session which was the largest of the conference, there were six sub-groups according to the contents of the paper; the first group of 12 papers was concerned with linear response of building structures, the second group of 6 papers was on instruments and response analyzers, the next 9 papers were on non-linear response of building structures, the next 10 papers were on vibration measurements, etc., the next 4 papers were on statistical treatment, and the last group of 9 papers was on the response of civil structures.

We can see remarkable advances in these fields in the past four years.

One of the most remarkable items in this field is the study on the non-linear response of building structures due to severe earthquakes. This has been performed by the use of computer technique. I will make some observations on this subject later.

SESSION III Seismicity and Earthquake Ground Motion.

In this session, 14 papers were presented. The first three papers presented studies on seismicity, while the rest were mostly concerned with seismic behaviors of specific structures and subsoils.

The presentations in this session were also very important, because

it provided us important knowledge fundamental to earthquake engineering such as seismic regionalization or zoning related to the values of seismic coefficient to be taken in aseismic design.

SESSION IV Earthquake Resistant Design, Construction and Regulations

At the first sub-group of the session IV, 7 papers were presented on building codes and regulations. Relating to this item, the organizing committee made up a pamphlet, "Earthquake Resistant Regulations of the World" and distributed it to you. I hope these papers and the pamphlet will be useful for the future improvement of building regulations, in each country of the world.

Next, there were 12 papers concerned with practical design methods.

They illustrated design methods of small buildings, tall buildings, wooden structures, reinforced concrete structures, and the theory of designing for composite structures. I am sure all these presentations in this conference will contribute to earthquake engineering in the design technique of corresponding types of structures in every country, irrespective of the seismic coefficient value.

In the third sub-group 7 papers presented personal opinions on earthquake resistant design. The opinions on the seismic coefficient value to be taken and detailed design methods for aseismic design will be quite useful for development in earthquake resistant design.

The last sub-group in session IV included 6 papers. As damage to dams made of either concrete or soil is a critical loss, further study on this problem is needed.

SESSION V Recent Strong Motion Earthquake and Resulting Damage

Here 14 papers were included in this session. The reports on the earthquake damages in Mexico, Taiwan, Chile, New Zealand, India, and Japan were presented. In addition to these, special reports were given of the earthquake damage in Morocco, Iran and Chile. These reports will greatly contribute to the future development of earthquake resistant construction.

CONCLUSION

I would like to point out several important features in our earthquake engineering field covered during this Conference.

A. Measurement of Strong Motion Earthquakes

It is very important to obtain records of strong motion earthquakes. As we have already noticed, the recorded strong motion earthquakes in the United States have been analyzed and most effectively used in the research field of earthquake engineering.

It is also important to secure the characteristics of earthquake motion in each district.

I do hope the measurement of strong motion earthquakes will be promoted in every seismically active area in the world.

B. Seismic Intensity Maps

From the view-point of practical aseismic design the following investigations must be made:

a) Study on the Regional Intensity by means of observations and statistical methods

b) Study on the zoning of seismic intensity.

C. Subsoil and Earthquake Ground Motion

In Japan, seismologists, and engineers after the Kanto Earthquake of 1923 found that the effect of the subsoil was an important function of damage results. We have not changed this viewpoint. More and more research into the vibrational behavior of subsoil is being conducted. Microtremor research is developing as a valuable tool in this field. Carder and Cloud showed that the use of underground nuclear explosion results will be most helpful. We know that all future design techniques must consider more and more the vibrational behavior of the subsoil. It is felt that this problem deserves equal attention with the more popular problem of structural response.

In Japan we have installed approximately 75 strong-motion accelerometers in many buildings in many different districts: these accelerometers have been installed in the basement and also in the upper floors of each building.

Analyses have been made of the structural response of these structures to the records made by the instruments installed in that particular building. It has been found that the period at the resonance peak of the spectral response curve of the building corresponds in most cases with the measured proper period of the composite building. It has been found that this phenomena differs for different subsoil districts and the type of structure. We therefore feel that further study is necessary to determine just what limits can be placed on the cross-use of accelerometer records.

D. Response

It has become a prevailing opinion from study on elastic response that structures will be stressed beyond the elastic limit in case of a severe earthquake. Actual structures can resist severe earthquakes because of plastic deformation. So, the elasto-plastic response of the structure has become very important.

In this Conference many papers on this elasto-plastic response have been presented. These papers usually employed the computer technique, either digital or analog. They are using mainly the data obtained by strong motion acceleragraphs in the United States. Several papers (Takahashi, Berg, Skinner) used the same earthquake record, but they have different assumptions and therefore different results.

What we can foresee in elasto-plastic response is the possibility of a new design method which is a "Plastic design" by limitation of the deformation. However, we have to check whether this kind of method can be employed in practical design or not in connection with the property of building materials.

On the other hand another new design method based on energy absorption has been proposed. This is also hopeful in our field, but further detailed study related to the characteristics of earthquake motion would be necessary, especially in a region having soft subsoil layers, like in Japan.

E. Design

Seismic force acting on buildings, stress analyses due to seismic force, and structural design - these three elements make the basis of practical design. And especially, I think we have to make further study on limit analysis and limit strength design, as these techniques are getting more and more recognition.

F. Inspection of Earthquake Damages

No matter how theory and experiment progresses, actual earthquake damages tell us many important facts. From this point of view, it is quite necessary to promote immediate and close examination on those damages. After the recent Chile earthquakes, Chili, Mexico, America and Japan made a co-operative investigation and I believe it a very desired step in the necessary direction. So I hope that the countries which are represented here may have good mutual communication in the future in bringing about better scientific action and results in this field.

At the end of my summary, I wish to express my heartfelt thanks to those participants from whom such a large number of papers were presented to this Conference. I hope the views and knowledges exchanged at this Conference will be promoted further, and consequently be more significant in the development of science in this important fields as well as furthering the welfare of humankind.