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Recent earthquakes: Philippines, 1990; Costa Rica, 1991; India, 1991; Turkey, 1992

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ABSTRACT: Events described in this Special Theme Session concern some of the salient earthquakes since the previous World Conference. These papers teach us new lessons and confirm many taught by earthquakes the world over. It is also interesting to speculate what else we can still learn and could have learned from the events described. Such speculations are proposed here.

1 INTRODUCTION

This Special Theme Session describes four important earthquakes that took place since the previous World Conference on Earthquake Engineering, including their outstanding geologic, geophysical, geotechnic, structural and socioeconomic aspects. A report on each event was prepared by a distinguished specialist who visited the affected area soon after the earthquake. Such reports are presented here in the form of summaries written by the editor.

2 LESSONS WE CAN STILL LEARN

The events described can still teach lessons additional to those they have given us, if we make new measurements, analyze them and analyze the records available. Such lessons concern:

2.1 Earthquake generation. Geodetic surveys and analysis of occurrence times of previous earthquakes and aftershocks could throw some light on the probability distribution of interoccurrence times and of magnitudes. Analysis of teleseismic records would help elucidate the generating processes.
2.2 Attenuation. It would be very useful to analyze dependence of wave amplitude on frequency, distance and azimuth during the main shock and its aftershocks. We would then be in a position to improve our predictions of ground motions in the region. Records available also afford the opportunity of refining such techniques as the use of empirical Green functions. The benefits would be enhanced if supplemented with seismic tomography of pertinent portions of the crust.
2.3 Geotechnical phenomena. The many instances of rockslides, landslides and liquefaction observed afford the opportunity to check and improve existing methods for predicting them as well as the extent of lateral displacements. The study would be especially useful if it included sites where one would have feared slides or liquefaction but these did not occur. Exploration, testing and analysis would be required.
2.4 Site effects. To make fuller use of the records obtained there is need for accurate determination of dynamic soil properties and the calibration of methods of analysis. It would equally be desirable to install portable instrumental arrays to calibrate and improve contemporary methods of interpreting microtremor records.
2.5 Structural responses. Field measurement of the dynamic properties of carefully selected undamaged structures would help understand their good performance.

3 LESSONS WE COULD HAVE LEARNED

Although none of the earthquakes of interest could have been accurately predicted they did not come as complete surprises. Some observations and instrumental deployment would have much enriched the lessons taught by these events, if only the required human and monetary resources had been available. The following remarks may orient measures to take prior to future expected earthquakes.

3.1 Earthquake generation. Measurement of precursor phenomena could perhaps have improved existing methods for short and intermediate range earthquake prediction.
3.2 Attenuation. Strategically placed in-

struments would have enhanced our understanding of wave attenuation and our capacity to predict it.

3.3 Geotechnical phenomena. Soil and rock properties determined before failure would have been more instructive than post-event determinations.

3.4 Site effects. Prior deployment of instrumental arrays could have propiciated advances in the knowledge of site effects in general, especially in matters such as coherency of ground motions.

3.5 Structural responses. Had selected structures and near free-field ground been instrumented and their natural modes and periods of vibration measured since before the earthquakes, we would have learned much about structural responses, as was the case in Costa Rica. The most useful structures would have been those for which complete drawings were available to allow trustworthy analyses.