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Panel discussion summary

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SITE GEOLOGY

There is a wide range of surface geology, from basement crystalline rock to soft soil. The main purpose for the engineering design profession in obtaining a description of the site geology in some detail and to sufficient depth is to assess its possible influence on site amplification during moderate ground shaking (staying elastic), and strong ground shaking (with plastic deformation). Transient amplifications occur during the passage of vertically-propagating shear waves as energy passes from high-modulus material to low. Resonant amplifications in the same soil column can occur if resonances are allowed to build up from repeated oscillatory input at specific frequencies. Detailed site geology investigation might lead to an assessment of the likelihood and extent of amplifications occurring during the next earthquake to affect the site. Are site geology descriptions and subsequent statements on site amplification the responsibility of network management?

Information on site geology can be considered at various levels of difficulty and expense:

A. A brief surface geology study to answer the simple questions: Hard or soft? Crystalline bedrock, hard rock, firm soil, or soft soil?

B. A shear-wave reflection study to provide depth to bedrock, and average shear-wave velocity of softer layers.

C. A complete detailed log of a drilled hole to provide full geologic information including a shear-wave velocity profile.

Can we ask that if this information is available to a net-work's management, that it all be included in the header information with the disseminated time series? Clearly this can become an expensive item. If a commercial research group using a network's data finds it needs expensive site geology information and obtains it at its own expense, this new information is less likely to be transmitted to the network management.

Even though a research project that includes the study of a particular record at a specific site might well make significant use of a complete site-geology description, would this description be useful in predicting site amplification at the site during the next damaging earthquake? What are the actual benefits towards this prediction from an expensive site geology examination? The best that can be done with a full site geology description may be a statement like:

"Amplifications in the range of two to five times the bedrock motion, at frequencies in the range of 1 to 1.3 Hz, corresponding to an intensity of shaking of MM7 can be expected at this site from the specified earthquake." How much more precise and useful is this in practice than could be deduced from a brief surface geology study?

In Italy, the national electrical energy agency's (ENEL's) 300 stations, distributed throughout the country, are being drilled to 50-100 m, or to bedrock. The USGS ground response stations, distributed throughout the US, but most densely in California and the Pacific coast, are being drilled and logged as funding permits.

INSTRUMENT CORRECTION AT HIGH FREQUENCIES FOR FBAs

The FBA sensor does not have a response to ground motion like that of the single-degree-of-freedom mass-spring-damper governed by its corresponding second-order differential equation. Within the frequency range of usual interest, from DC to 25 or 35 Hz, the response is flat. Researchers pushing the response limits of the FBA, and analysts studying high-frequency content in an acceleration record, will desire great detail on specific FBA response, or on the specific values of FBA electronic components. These are not available at the present time, but could be supplied by the manufacturers or labs at some considerable expense. The demand for this information might be expected to increase in the future. At the present time, routine processing does not need to consider the FBA instrument correction in the great detail alluded to above. Novikova and Trifunac, in a paper "Digital Instrument Response Correction for the FBA" (Earthquake Spectra, 8, 3, August 1992, p429-442), describe in detail some of the problems met, and assumptions made, in making this correction.

FLATBED SCANNING

Flatbed scanning using fax machine technology, with the loss of some accuracy and a reduced frequency range, has emerged as a less-expensive alternative digitizing procedure compared with raster scanning or trace-following techniques. Kinemetrics "Scanview" is an example. The fax machine standard density of 300 dots per inch cannot

compare with the high digitizing densities (up to 600 samples per cm) of special purpose digitizers available and in use today. On the other hand, for structural records where amplitudes are high and frequencies are midrange (for example), flat-bed scanning affords a viable alternative. Specifications are available describing the next step up, to line scan and area scan digital cameras with sufficient field of view and densities up to 1200 dpi. There will be noise levels across the entire frequency spectrum associated with each of these devices, and these levels need determining with careful tests that incorporate the digitizing of a straight line. These test noise levels will determine the useful frequency range for any specific signal. Low-amplitude signals will be especially affected, producing in general a narrow useful frequency range.

DATA AND ITS DISSEMINATION.

Few managers of strong-motion networks and data banks can insist successfully that network researchers, working on newly-acquired data from their own network, export this data in some standard format. Each network has its own researchers and graduate students (for example), who have neither the incentive nor the time to follow their own network data management recommendations or the formatting prescribed by outside interests.

Further questions and discussion on this topic followed:

Disseminate data with the same descriptive parameters that you would like to see in data you receive from others.

Don't expect data from a research team till all research is done, and until the team can then find time to prepare it.

Every database and data bank providing a dissemination service to the public, but relying on competitive proposals to remain funded, eventually (or soon) runs out of personnel, interest and funding. Before the database is finally abandoned, it might be a good idea to make a permanent archival version of the data, such as a CD-ROM, as the USGS has recently done.

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