

## ASSESSMENT OF TELECOMMUNICATIONS DAMAGE USING SCENARIO EARTHQUAKES

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Telecommunications networks are mechanically and structurally the most robust of all lifelines, but because of their complexity and socio-economic importance, even minor damage can have significant repercussions. Scenario earthquakes have been used in two main types of applications: to aid the interpretation of damage data collected from post-earthquake reconnaissance, and to assess vulnerability and security of an existing or planned network.

### DAMAGE DATA INTERPRETATION

Because telecommunications damages are not widely reported and facility access after an event is highly restricted, damage data on telecommunications systems are often fragmentary and incomplete. Hence, scenario earthquakes are used in computer simulations to "predict" damage to the system, against which the reconnaissance data can be better interpreted. Figure 1 is an example taken from the Northridge 1994 earthquake. Structural damage to one Central Office (CO) is correlated with simulation; damage to other COs in the vicinity is then inferred from the simulation in the

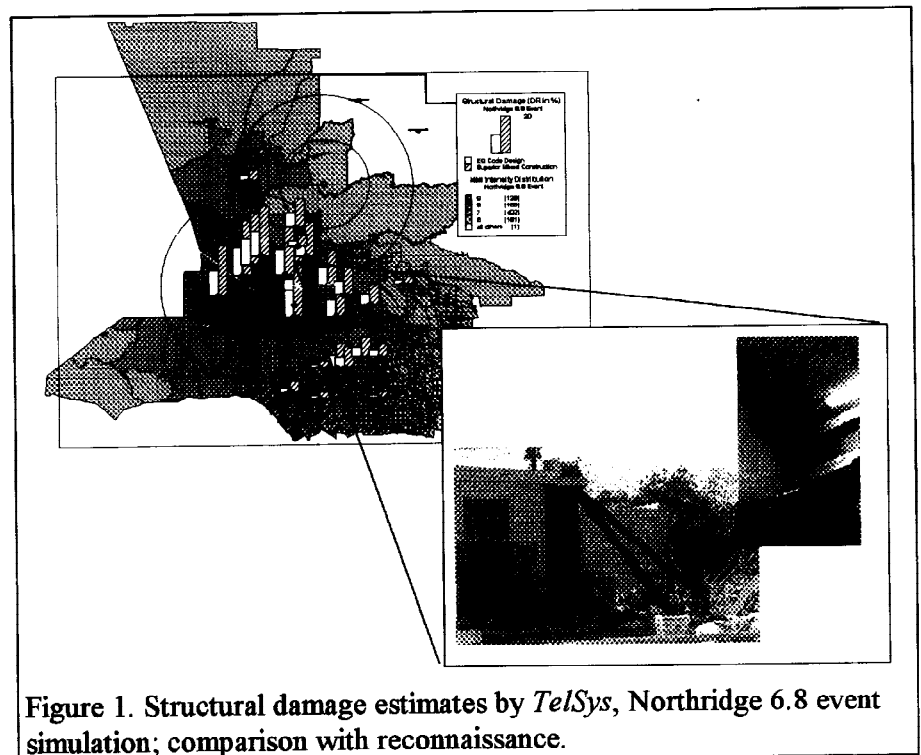


Figure 1. Structural damage estimates by *TelSys*, Northridge 6.8 event simulation; comparison with reconnaissance.

absence of data. Damage to equipment and support systems are enriched using the same approach.

The process is repeated to recreate the San Fernando earthquake of 1971, for the sole purpose of contrasting the extent of damage and performance interruption with those observed at Northridge 1994. The comparison of these two very similar scenarios confirms the effectiveness of anti-seismic measures introduced in the past two decades. Remaining vulnerabilities are traced to indirect effects on inside and outside plants.

## NETWORK SECURITY

The performance of an existing or future network in a seismic environment is important to emergency planning and investment decision, not only for the carriers but also for all others in the region that depend on telecommunication. In this type of application, scenarios corresponding of *all* credible earthquakes in the region are exercised individually or jointly in computer simulations to quantify their impact on regional response of the network. Figure 2 is an example taken from a performance study of the Metro Manila, Philippines, network. The study is undertaken to show that the scenario approach, even when only very crude information on geology, hydrology, seismology and system configuration is available, can yield useful information on performance. When more detailed information becomes available, it will support more detailed models and lead to more refined assessment.

## DEVELOPMENT NEEDS

Development needs include better treatment of lifeline interaction effects which can dominate telecommunications performance.

Fragility of outside plants due to fault rupture and permanent ground displacement due to landslide and liquefaction is not very well-known, and deserves more attention.

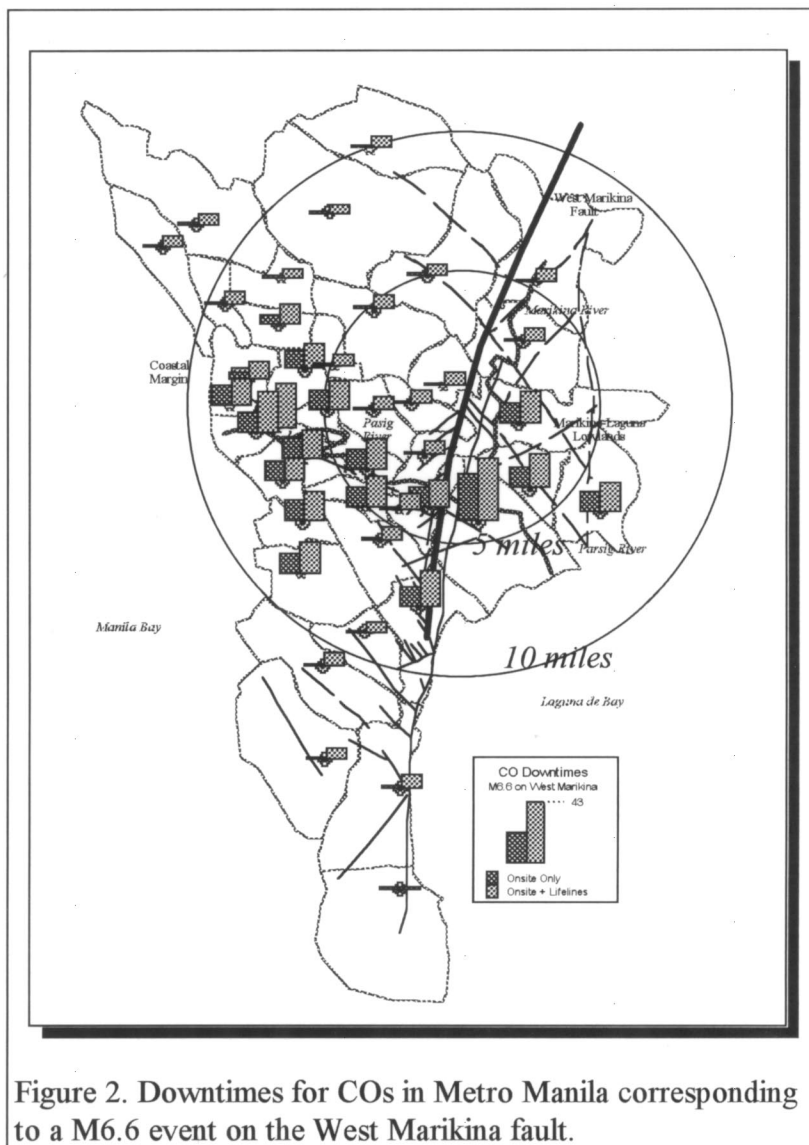


Figure 2. Downtimes for COs in Metro Manila corresponding to a M6.6 event on the West Marikina fault.