Earthquake alarm service

Earthquake Preparation, Alarm & Response

A major fault located adjacent to significant infrastructure in southeastern Australia

- **A service for owners of major structures and emergency organisations**
- **Risk management for lifelines and other assets**
- **Asset vulnerability assessment**
- **Timely provision of alarms**
- **Damage scenario generation**
- **Emergency simulation and training**

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incorporating
seismology research centre

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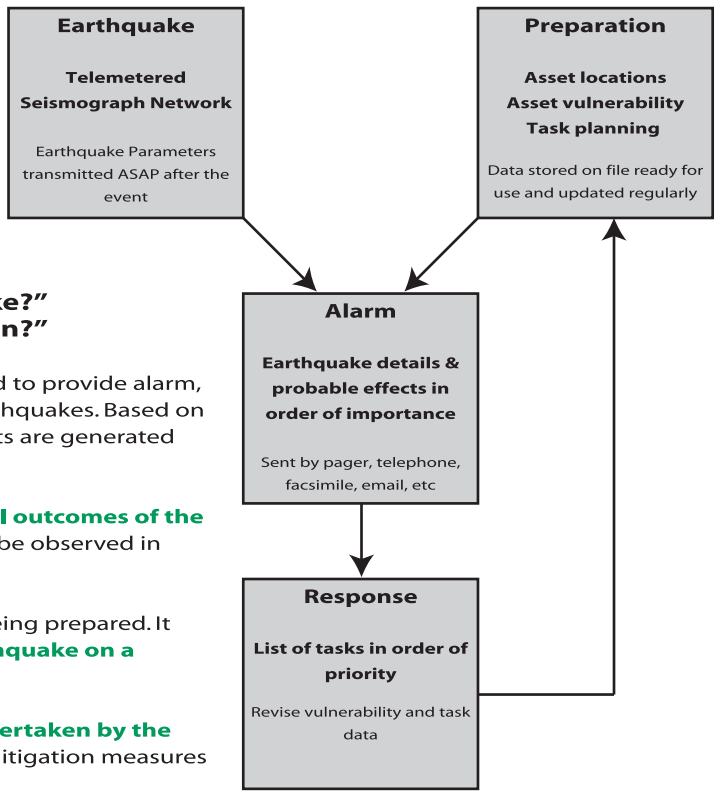

After an earthquake the first task for a seismologist is usually to determine the longitude, latitude, depth and magnitude of the earthquake. This is not necessarily the most useful information for people responsible for managing large assets or emergency services. Of more value to such authorities would be answers to the questions:

"What are the likely effects of this earthquake?"
"What course of action should be undertaken?"

The ES&S Seismology Research Centre has developed a system designed to provide alarm, damage scenario and response information after moderate or large earthquakes. Based on a rapid determination of the earthquake location and magnitude, reports are generated and provided to authorities by phone, fax, email, sms or other means.

The **first** section of the report describes the earthquake and the **general outcomes of the earthquake.** This includes descriptions of the expected effects likely to be observed in towns near the epicentre.

The **second** section is specific to the authority for whom the report is being prepared. It contains descriptions, in order of importance, of the **effects of the earthquake on a predetermined list of assets** for which the authority is responsible.

The **third** and final section comprises a list of **tasks that should be undertaken by the authority**, listed in priority order. The task list contains inspection and mitigation measures to be carried out by staff on site, as well as communication tasks such as informing management, public relations or emergency services.

In the majority of cases the system will be used to confirm that although an earthquake may have been widely felt, and may have caused alarm amongst members of the public, serious damage to major structures is unlikely.

Preparation

A database listing the following parameters is required for each report recipient:
- Asset locations (points, lines or areas)
- Asset vulnerabilities, including the importance of expected earthquake effects
- Planned task list, including priorities

This data base is developed by each authority, possibly after consultation with earthquake engineers and with assistance from seismologists.

Preparation of the data base provides excellent training for staff from the authority. Running hypothetical earthquakes through the system is useful for simulation and training exercises.

Alarm

To rapidly and precisely estimate an earthquake epicentre, depth and magnitude, data from a network of telemetered seismographs is required. The more recordings used, the more precise the location. For most reliable estimates, there should be a telemetered recorder near to the epicentre.

An automatic location and magnitude is determined by the seismic network monitoring computer and an alert is sent to the seismologist on duty. Additional data can is then obtained to manually refine the earthquake parameters, and the emergency response reports are then generated.

Response

After a reliable earthquake location and magnitude has been calculated, these parameters are fed into the earthquake damage scenario program that outputs the three part report described above. This report is generated by the seismic monitoring organisation and then transmitted to the authority for further action. Other customised outputs are also available

Seismic Networks

The approach to a successful earthquake alarm system has been described as a three-legged stool - without one leg, the system falls over. The three legs are **data**, **intelligence**, and a **plan**.

The **plan** aspect of the system is the preparation component of the EPAR system. The **data** comes from a seismic monitoring network which is providing real-time information to seismologists, who apply **intelligence** to the data, who then provide the earthquake alarm report to the client.

To cover an asset with the EPAR service requires that a seismic network is in place around the asset area. A network of at least four telemetered seismic stations is required, with continuous data telemetry from at least one of the stations, and event-based telemetry from the other stations.

Data is telemetered to a seismic observatory computer system that observes these stations for anomalous activity, and automatically associates this activity to determine if an earthquake has occurred. If so, an automatic location and magnitude is calculated for the event, and a notification sent to the seismologist.

ES&S has developed complete instrumentation and software systems for the establishment and operation of an earthquake monitoring and alarm network. The ES&S Seismology Research Centre has three decades of experience in the field of seismic monitoring, and currently monitor much of eastern Australia, covering Tasmania, Victoria, and eastern NSW and Queensland. We have also supplied these systems around the world.