

# The Assessment of Lifeline Serviceability after Major Earthquakes

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**Abstract:** Lifelines consist of electric power, water, sewage, gas and liquid fuels, telecommunication and other utility systems. They play as the pivotal supporting infrastructures in the daily lives of people in modern societies. There are several shared features among lifeline systems. Firstly, they are spatially distributed networks with many interconnected components. The performance of a damaged lifeline system is largely affected by the configuration and redundancy of the system's networking. Also, in order to realize the functionality of a lifeline system, a hierarchy of various subsystems and components is indispensable. The system resilience to catastrophic conditions will be decided by the integrity, resistance and durability of the corresponding subsystems and components. Finally, lifeline systems are interdependent upon one another. This interdependence will be exaggeratedly increased in disastrous situations. Due to these reasons, the assessment of performance and safety of lifeline systems after major earthquakes or other hazardous events is nothing like the assessment for buildings, bridges or else entities that are counted individually. On the other hand, to take into account the distinct characteristics of routine/emergency operation of each lifeline system is also indispensable. For example, the generation and demand of an electric power system has to be balanced rigorously. Automatic shutdown of gas supply is always prioritized by gas utilities due to the safety concern.

The damage in lifeline systems will inevitably result in huge direct and indirect losses. The indirect losses include both the utility business interruption loss and the derived community socioeconomic loss due to loss of lifeline services. As a result, not only the physical damage but also the serviceability loss of lifelines after major earthquakes or other hazardous events has to be assessed. The assessment of serviceability of lifelines should consider both the component failures and the system flow issue. Regarding the system flow issue, one needs to take into account the physical laws governing the natures of system functionality and the limitations imposed upon the system/component performances. Usually, the employment of professional computer codes is advised for dealing with the system flow computation.

*Key words: lifelines, serviceability, scenario simulation, risk assessment*