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Dr. Chang's research experiences relate to earthquake engineering and multiple hazards for buildings and bridges include seismic behavior and retrofit with fiber reinforced polymers (FRP) of conventional reinforced concrete columns, development of seismic isolation and energy dissipation systems and health monitoring systems, and seismic behavior of precast segmental concrete bridge columns. In addition, he has been involved in the development of design codes and guidelines related to seismic design of buildings, bridges and highways in Taiwan. His current research interests include structural control, innovative bridge bearing systems, innovative structural and geotechnical health monitoring systems with advanced sensor technologies and the seismic behavior of precast bridge columns.

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Bridge Multiple Hazards Monitoring System

Located in the circum-Pacific “Ring of Fire”, Taiwan is frequently exposed to typhoon and earthquake. Multiple hazards, especially earthquake and flooding scour, must be properly considered and constantly monitored for crucial bridges. Technology development for reduction and mitigation against natural disasters is an increasing challenge for civil engineering community. Hydraulic scouring is one of the major factors for bridge failure in Taiwan. Important bridges that are subjected to periodic flooding should be monitored during high-flow seasons for the safety of the public. Multiple bridge hazards monitoring and early warning systems are thus an indispensable implementation. NCREE has been focused on earthquake and bridge scouring problems and developed a series of multiple hazards monitoring systems using the latest sensor network technology.

During flood events, sediments can be washed away and bridge substructures are left inadequately supported. The current design relies on the empirical scour prediction equations generated from laboratory data, which do not adequately predict the actual scour under field conditions. Field monitoring of bridge scour process is necessary to study the scour mechanism, to develop scour resistant design of bridge piers and abutments. NCREE has installed monitoring systems to the No.1 and No.3 highway bridges cross the Da-Chia River in Taichung area of Taiwan. This scour monitoring system is intended to responds in real time the velocity of the flowing water and its corresponding water level, particularly, the bridge scour depth and sedimentation progress. Bridge’s health condition and stability is also evaluated and warning issued during the flooding period from the system.