ABSTRACT

The design of a passive component to provide combined spring and damping output is strongly driven by scaling issues for the discrete mechanical elements used to provide the required output forces. Multiple design concepts and technologies are available to provide damping and/or spring forces. However, consideration of the relative force requirements, life cycle, operative environment, and space envelope available usually will result in a specific type of damper and a specific type of spring being optimum.

Long-span bridges provide unique challenges in shock and vibration control for the design team and component manufacturers. Bridges of this type are normally intended for a long service life in the range of 30-100 years, with current trends favoring a 50-75 year life. A typical bridge of this type can periodically expect shock and vibration inputs comprised of the following events within its life:

1. Windstorms
2. Hurricanes/typhoons
3. Earthquakes
4. Impact shock to support piers or deck
5. Truck/car braking loads or accident loads
6. Traffic vibration
7. Synchronous traffic or pedestrian vibration

The functionally upgraded spring-damper isolator described was designed and manufactured for use on the world's largest cable stayed bridge-the Sutong Bridge over China's Yangtze River, completed in 2008. Analysis indicated that added viscous damping would reduce seismic deck motions substantially. During the other events listed, analysis determined that the most cost-effective solution was to incorporate a snubbing type spring element in parallel with the damper that would only engage (become active) when the damper was approaching its end of travel in either extension or compression. The spring-damper isolators for Sutong Bridge were installed in late 2007.