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Engineering Experience Gained from Extensive Testing and Part Successes

Enidine HD Seismic Application

By: Tom Zemanek

Situation Overview

The Gerald Desmond Bridge, a truss bridge owned by the Port of Long Beach, was due for a seismic retrofit and structural upgrade before ownership of the bridge was to be turned over to the State of California. The bridge is built on a series of 22 piers (concrete columns) that support a roadway over the San Padre Harbor. Between each pier is a suspended roadway spanning approximately 50 feet long. These roadway spans are hinged at the piers to allow for thermal expansion and contraction of the bridge. The gap between each roadway span is commonly called an expansion joint. When you drive over a bridge the constant thumping of the tires that you hear occurs when you drive over these expansion joints.

Application Opportunity

The expansion joint creates a gap between the hinged sections in the road, which can vary from two to five inches in width. The gap is designed to change with temperature but this caused a flexibility problem at the hinged sections of the bridge during seismic events.

During an earthquake, the hinged sections of the bridge act like "battering-rams" at these expansion joints. Structural engineers faced a critical problem: How to dampen the kinetic energy generated by the moving roadway spans during the seismic event.

Working With the Customer

ITT Enidine Inc. has many years of experience designing energy absorption products for large moving masses in the steel, lumber and off-shore drilling markets. The use of shock absorbers and viscous dampers for seismic applications on bridges and buildings is a new market for ITT Enidine Inc. The engineers who design these civil structures are now beginning to utilize shock absorbers and viscous dampers as solutions for the violent motions caused by earthquakes.

Viscous dampers are providing more and more solutions in retrofitting structures such as bridges.

Product Solution

Working closely with the Structural engineers, ITT Enidine Inc. stepped through the analysis and installation of modified HD 3x5 viscous dampers. By adding braces to the suspended span and mounting a series of nine ITT Enidine Inc. HD 3x5 viscous dampers (shock absorbers) to each connection at the pier, the energy of the moving roadway span could be dissipated. The same configuration was added to both sides of the suspended span to make the solution symmetric and more effective. The dampers were standard HD 3x5 products which were modified with stainless steel rods, rubber boots and epoxy paint to withstand the salt water environment.

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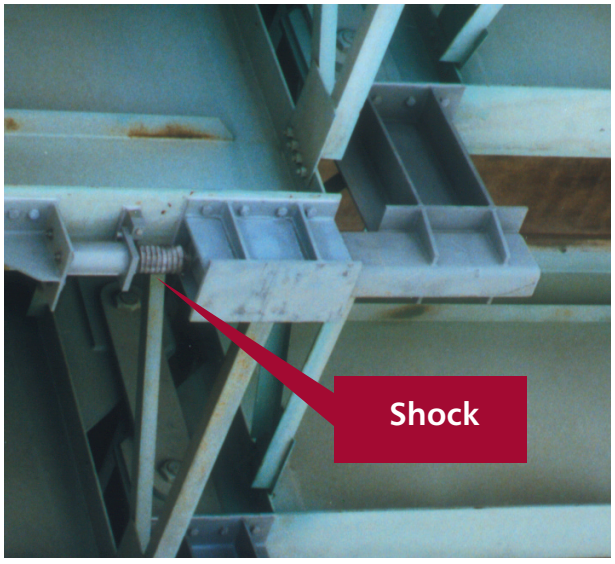
Why ITT Enidine Inc. Proved to be the Right Solution

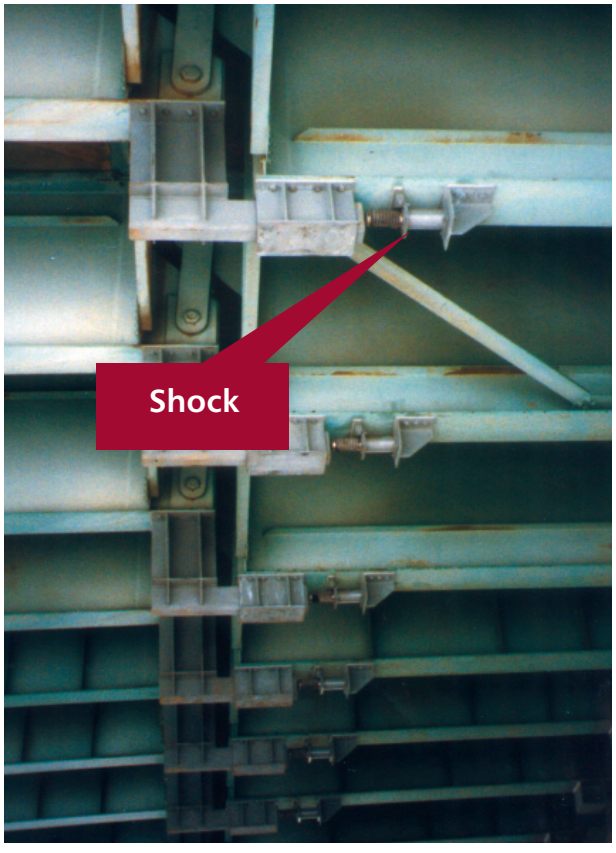
ITT Enidine Inc. engineering had the expertise in fluid and viscous damper technology and dynamic analysis to help the customer's project engineers obtain a successful solution. Nine HD 3x5's and brackets were installed at each connection of the bridget. Together they can dissipate 450,000 inch pounds of energy. The load is spread over nine shock absorbers; therefore, no one point of the bridge will experience a concentrated load from the total energy generated by an earthquake. By using nine shock absorbers, the customer gains substantial component redundancy.

There were a total of 258 viscous dampers and brackets added to the bridge as part of the total retrofit. The customer was very pleased with the solution. Many structural engineers, in California and around the world, are turning to viscous dampers as the answer to retrofitting large structures to protect them from earthquakes.

This application is just one illustration of the large amounts of energy that can be dissipated by ITT Enidine Inc.'s line of standard Heavy-Duty shock absorbers.



Single installation, bracket and shock absorber.



Nine shocks and brackets per connection.

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