



## *Protection of Pier Foundation of Zhongsha Bridge at Zhuoshui River, Taiwan*



### **Background**

The object of the renovation project is Zhongsha Bridge located at Zhuoshui River in central Taiwan. The 2,345m-long bridge sits between Changhua and Yunlin Counties. What makes this project even more challenging is that there are many curves at the job site which are not easy to deal with from the perspective of geotechnical engineering, especially in the presence of water. The entire project mainly consists of renovation of riverbank protections below Zhongsha Bridge as well as repair and reinforcement of submerged-weir ground sill works and aprons downstream. The purpose of this project is to secure the farmland against erosion and, more importantly, to ensure the drivers' safety on the bridge.

### **The Problem**

The river reach near Zhongsha Bridge faced continuous impact of fluvial processes, including erosion and deposition. What's worse, the job site happened to be on the outer concave bank of the river where erosion problem was far more serious and, thus, the foundations of the piers were severely undermined by the flowing water. With the soils being washed away bit by bit, the foundations were exposed. The situation was much more life-threatening during typhoon seasons when large-scale floods with sediments struck the exposed foundations and jeopardized the drivers on the bridge. On the other hand, the muddy floods always submerged the farmland adjacent to the river and put the residents and their property in great danger. Therefore, it was urgent to fortify the pier foundations and enhance the protection of the embankments on the river banks.

### **The Solution**

In this project geotextile tubes ACETube® and geotextile mattresses ACEFormer™ were used to solve the abovementioned problem. The protection was designed to be 5.6m high with four layers of ACETube®. After each layer of ACETube® was filled with in-situ sand, gravel in-situ soil was then placed and leveled on the top to make an even surface for the installation of the following layer. Such procedure was repeated until the four layers were finished.

At the end of construction, the four-layer structure was covered with ACEFormer™ filled with concrete mortar which not merely increased the impact resistance of the structure and kept ACETube® from external damages caused by driftwood or debris coming down the river but, in the meantime, also enhanced the stability of pier foundations and embankments. Furthermore, the mattresses used here were the ones with permeable filter points which allowed the excess water in the structure to discharge into the river and, thus, maintain the structure more stable. The uneven surface of ACEFormer™ also helped reduce flow velocity and slow down the erosion process.

