

## Strengthening of Parking Garage Slab

Shortly after being built, significant cracking was noticed in the concrete parking garage of an ocean front condominium in Wailea, Maui, Hawaii. An independent forensic engineering investigation



Installation of FRP System through existing MEP

determined that the slab had been designed and built for insufficient live loads and lacked proper detailing to account for slab shrinkage. Additional positive moment capacity was needed to meet design live loads. In addition, the existing cracks needed to be structurally repaired using epoxy pressure injection.

The soffit of the slab was difficult to access due to many pipes, conduits and hangers for the buildings MEP systems. Fiber Reinforced Polymer was chosen as the strengthening method because of its ability to be easily installed around existing obstructions and its overall placement flexibility. The project was publicly bid and Contech Services was awarded the contract work in the summer of 2015.

To meet the strengthening requirement in the bid documents, the FRP was designed to provide the required additional moment capacity with either 50 or 75% coverage of the underside of the slab with restrictions on the allowable spacing between FRP strips. This gave the



Installation of FRP System above finished elevator lobby

crews flexibility to work around pipes and other obstructions. At locations where it was not possible to provide a continuous FRP strip across the slab, a splice detail was designed.

Construction began with pressure injection of the cracks that met the width criteria provided on the project documents. Following crack injection, the concrete surface was prepared for bonding by mechanical abrasion of the surface. During this process, more cracks were uncovered that met the project requirements for repair. Once crack repair was complete, the carbon FRP strengthening system was installed. Continuous inspection ensured that all required cracks were injected and the FRP was installed per contract documents.

The slab has now been structurally repaired and strengthened using epoxy crack injection and FRP Strengthening. The project was completed on schedule, even with the additional crack injection, to allow the garage to reopen before the high season on Maui. Contech looks forward to bringing experience and expertise to other projects throughout Hawaii.