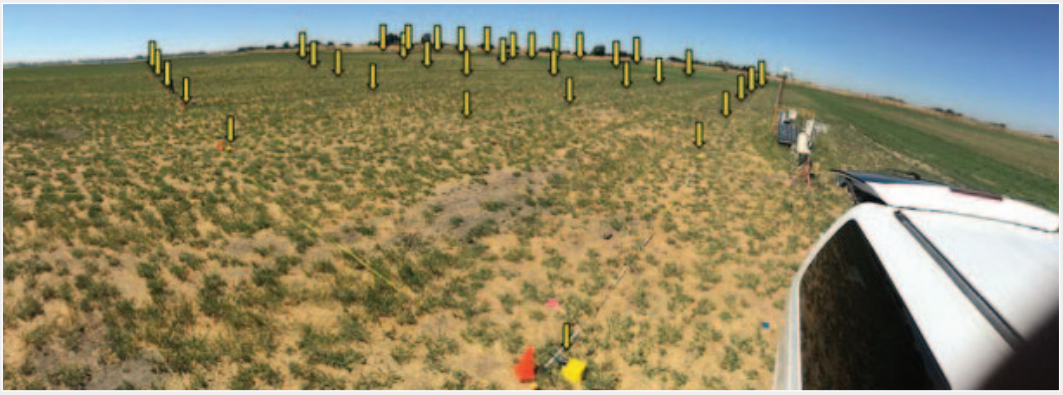
Active and passive S-wave investigation in the Central Valley, CA, USA

CASE STUDY

To evaluate the condition of the levees, some of which are over 150 years old

The California Central Valley is crossed by over 1,100 miles of levees protecting rich farmland, cities, towns, schools, hospitals and people from flooding. The estuary of the Sacramento and San Joaquin rivers, which lie in this area, is comprised of hundreds of miles of waterways and small islands. Any levee failure has the potential to destroy the lives and livelihoods of the people in the region. Fortunately, levee failures are not common, though they have on occasion led to large losses of life and property. This is why maintaining them in proper function is such a large priority among levee owners and disaster management agencies.



3D seismic survey at Twitchell Island.

For this survey, researchers from CSU East Bay and OYO Corporation performed surveys to evaluate levee integrity in the region. They used a novel application of combined active and passive surface wave methods to evaluate the integrity of levees protecting islands in the Sacramento-San Joaquin Delta, California, USA. The region is particularly prone to flooding, as the Delta islands have been undergoing rapid subsidence, estimated up to 28 feet, from groundwater withdrawal from the region. To further exacerbate the problem, farming practices have led to the loss of a thick layer of peat, thus making the area even more prone to flooding. Additionally, the California Central Valley is bound by an active network of faults, and an earthquake on any one of these has the potential to cause levee failures and extensive flooding in the Delta.

To evaluate the condition of the levees, some of which are over 150 years old, the researchers performed surveys using both active and passive methods. They performed active method (2D MASW) seismic surveys near the crests of the levees and passive method surveys (Microtremor Array Method or MAM) along the base of levees. In certain areas, the researchers performed full 3D seismic S-wave surveys to better visualize lateral variations in material density. By combining both the active and passive data from the crests and bases, the researchers create seismic S-wave velocity (VS) profiles. The results from this work reveal a low-velocity peat layer beneath the levee body in some areas that was confirmed by geotechnical borehole logs.