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Impact Study: Vibration Station

DC White Consulting Engineers have a wealth of experience from many impact analysis projects across a number of industries. These have included Power Stations, Nuclear Fuel Rods and the manufacturing project detailed below.

We were asked to investigate the mysterious failures occurring repeatedly in a machine which tamped a mix of plaster and glass fibre into a mould used to make 2500x600 wall panels.

It was important that the powder mix was fully tamped to ensure that the finished panel surfaces were of a mirror-like finish, to eliminate post-installation plastering of the completed wall.

This was achieved by gripping the dry-filled mould at a vibration station, weighing over 2 tonnes, shown here in red, and repeatedly lifting and dropping it onto an anvil. The operation worked well but the vibration station itself suffered unacceptable cracking, emanating from a point which did not appear to be a significant stress raiser.

We were asked to investigate and after careful inspection and analysis we were able to rule out simple dynamic stress loading and modal vibration effects.

To find the true cause we turned to explicit finite element procedures, modelling in tiny time steps, each being smaller than the time it took for a stress wave to pass across the smallest element in the model, typically two-millionths of a second.

These analyses clearly showed the cause to be stress wave focussing; the stress wave caused by the impact with the anvil was travelling though the very heavy mould gripper, reflecting off various surfaces and combining at one unfortunate point so that it was seeing stresses comparable with those at the anvil impact point.

Instead of the impact stresses being gently eased as they spread up through the increasing cross sectional area of the gripper shown in the photograph, they were recombining at a seemingly minor geometric discontinuity.

The fix was a small change to the geometry, optimised by analysis, which we were able to show avoided this focussing effect and, most importantly, did not push the problem to some other unfortunate part of the structure.

To get in touch

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