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EXPERIMENTAL INVESTIGATION OF MIXED SAND AND GRAVEL BEACH MORPHODYNAMICS

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Mixed sand-gravel (MSG) beaches are recognised for the coastal protection they provide, capable of dissipating up to 90% of the incident wave energy. They can be fully mixed or composite (i.e. gravel upper foreshore and sandy lower foreshore) and exhibit a wide range of morphologies. MSG beaches are reported to act morphodynamically different to gravel beaches with a composition 25-40% gravel. Previous flume and field research have, however, been limited to a number of sand-gravel mixtures. This work investigates beach morphodynamics for pure sand to pure gravel, and a range of sand-gravel mixtures.

In a controlled manor, a series of mobile bed experiments were conducted. In each experiment the initial water level, incident wave timeseries, and bed slope were kept the same. The percentage of gravel in the initial bed, however, was increased from 0% to 100%, at 20% intervals, between the experiments. Throughout the experiments water level timeseries, wave-induced pore pressures and near bed wave-induced velocities were recorded. An overhead camera was also used to capture the wave run-up. Bed scans were conducted and sediment samples collected at the start and end of the experiments.

The experimental results demonstrate the influence the proportion of gravel in the bed on the resulting beach morphodynamics, and the effect on the run-up and protection provided by the beach in terms of wave dissipation/reflection. No clear tipping point is observed in the morphodynamic behaviour of the beaches and the beach composition is shown to have a strong influence on the measured run-up.