



Wave toppled structure in Shetlands

Challenge

A stainless steel support structure for a solar powered minor light at Bullia Skerry (an outcrop of rocks off the coast of the Shetland Isles) collapsed during a storm. The structure was toppled by the coastal force of large waves.

Charles Scott & Partners, an engineering consultancy based in Glasgow, were appointed by the Northern Lighthouse Board to assess the failed structure and design a suitable replacement. To design a replacement structure that would be able to withstand the wave loadings in this notoriously volatile region they required to better understand the forces involved.

Particular problems lay in the height of the structure and whether or not the proposed tripod-style design would be improved by having four legs and which parts of the structure would be sheltered from impact and the magnitude of this reduction in load.

Solution

Dr Cooker, from University of East Anglia's School of Mathematics, is a leading expert on water wave impacts and the forces and pressures generated by them. Dr Cooker developed a mathematical model of the wave impulse loading that the legs of the tripod would be subjected to due to sea wave impact. By using previous research work and experience, the model produced estimates for the loading. This model was used by Charles Scott & Partners to guide their new design. They were able to predict how much force the structure would need to withstand and how design changes might affect the integrity of the structure.

An improved design was developed and has now been manufactured and installed, incorporating many revised features which will increase the structure's durability.