Concrete armour units have always been mainly designed for their resistance against wave action: the hydraulic stability. However, severe cracking and breakage of units, part of the breakwaters of Sines (Portugal), Arzew (Algeria) or Tripoli (Libya) revealed the importance of structural integrity. The binding reaction of cement with water is exothermic and an unequal heating and cooling of the massive units can lead to high tensile stresses causing cracking if the actual tensile strength of the concrete is reached. For different concrete mixes, thermal and strength properties were experimentally determined and used as input for a numerical hardening model to estimate the temperature rise, the eigenstress development and to indicate possible cracking trajectories. The influences of hardening circumstances and concrete composition were determined. Eventually, a case-study where armour units show considerable damage is analyzed. The conducted research puts in evidence the importance of maintaining the eigenstresses at low values in order to reduce considerably the risk of cracking. Based on the different findings and conclusions, recommendations are given to civil engineers, contractors and researchers.