In order to investigate the phase-resolved mechanical response of portland cement based composites (i.e. mortar and concrete), x-ray methods developed for the determination of residual stress states have been applied to study residual strains and strains due to mechanical loading in hydrated portland cement paste. Synchrotron x-rays were used to measure strains by means of peak shift in the calcium hydroxide (CH) phase of hydrated neat portland cement. Mechanical stresses were applied by uniformly distributed, uniaxial in-situ loading and diffraction measurements were made using the \( \sin^2 \psi \) technique to determine the strain states. Although the coarse-grained nature of the material presents challenges to strain determination and interpretation, recent work has shown that it is possible to make measurements that are both accurate and repeatable, with sufficient resolution to identify changes in strain state of the CH phase on the order of 10 microstrain. Elements of this technique may also be applied to micro-scale strain measurements on single crystallite grains. Portions of this work were performed at the Oak Ridge National Laboratory (ORNL) synchrotron beamline X-14A operated by the High Temperature Materials Laboratory (HTML) at the National Synchrotron Light Source (NSLS).