Theme VI: plain and reinforced concrete for hydraulic structures

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Plain and reinforced Concrete for hydraulic Structures.

1) *The calculation of arched dams* is usually based on the assumption that the structure is divided into two systems of components, namely horizontal arches and vertical walls. In some cases it may be desirable to take account of the deformability of the ground under the foundation. A more exact calculation has been attempted by assuming the arched dam to consist of elastic shells with a steeply varying moment of inertia, but this is still in the domain of theory and it has not been found possible to apply it in practice. The strains which in fact arise in arched dams depend greatly on the method of construction and on the measures adopted for applying the initial pressure to the construction joints. In cases where the reservoir is filled with water progressively while the dam is being built it is desirable to investigate the effect of the water pressure at different stages of progress.

2) In the *construction of dams and other massive works* the concrete must be not only strong and dense, but above all workable. In such work the use of a wet very plastic concrete has generally superseded that of poured or rammed concrete. Experience on work exposed to unfavourable climatic conditions has shown that a concrete offering resistance to frost is obtained only when the admixture of cement is at least 250 kg/m^3 [421 lbs./cu. y.]. The concreting of large masses calls for special measures in order to avoid the formation of cracks due to cooling, and these precautions become more important in proportion as the speed of construction is increased. The simplest precaution consists of dividing the wall into blocks of relatively small size. In very large works measures for artificial cooling are to be recommended. The amount of heat released in the hardening process may be reduced by a suitable choice of cement or of hydraulic admixtures. In large dams (at least in gravity dams) a system of inspection shafts and tunnels must be provided in order to allow of observation being kept on seepage.

3) The observations made above regarding the application of concrete in the building of dams apply also, *mutatis mutandis,* to hydraulic engineering work for the purposes of navigation (dry docks, locks, etc.).

4) Reinforced concrete pipe lines have been made in very large diameters to resist heavy internal pressures, special measures being taken to reduce the tensile stresses in the concrete. The construction of a hooped pipe of 4.4 m [14′ 6″] internal diameter, as described in the Preliminary Publication, represents a new and promising application of the device of pre-stressing. The use of pre-stressed cables has also been successfully applied to the strengthening of a gravity dam.