

Subject:— MINOR IRRIGATION PROJECT—CRITERIA FOR PROVIDING OF CUT OFF IN EARTHEN DAMS.

1. Introduction :

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The old practice of providing cut off to half the depth of water to be retained by the earth dam is, it appears still in vogue in some places. This practice is neither rational nor sound; in fact it may even prove dangerous. Instances can be quoted where non judicious use of this rule without considering the local geology and the structural necessity, has led to excessive seepage from under the cut off, leading many a time even to the failure of the dam by piping. No doubt there may be cases when the structures designed on the above criteria have apparently shown no signs of distress but while failures are clear indications of faulty criteria, the successful cases be taken as positively indicative of the adequacy of this criterion. The design of a suitable cut off therefore needs a very careful study.

2. Design Considerations :

Cut off trench in an earth dam is required from two main considerations ; (i) to minimise the loss of water through the foundation and (ii) for the safety of the dam against internal erosion due to high seepage gradients in the foundation.

3. Properties of Foundation Soils :

3.1 One of the very important classification of foundation soils significant from the consideration of the design of the cut off is whether the soil is "residual" or "transported."

3.2 Residual Soils :

3.2.1. Residual soils are the products of weathering of the underlying parent rocks. With increase in depth, the effects of weathering get less pronounced, the strata becoming normally more water tight. A satisfactory positive cut off can be generally attempted for such a strata. Care has no doubt to be taken to check up open faults and fissures in the rocks below. These will need to be sealed by grouting.

3.2.2. *Disintegrated rock* .— is often termed as murum. Depending upon the mineralogical composition of rock and the extent of weathering, this murum can be pervious (1000 to 10,000 ft. per year) or relatively impervious (100 to 500 ft. / year) The latter should be acceptable for ending the cut off.

3.2.3. *Soft rock* :— is also likely to vary in its permeability characteristics within a fairly wide range depending upon its structure, Even in a porous or fissured rock, there is no possibility of internal erosion for relatively smaller heads of water (say upto 50 ft.) The principal criterion to be examined while deciding the cut off in such cases (soft rock) is the limit to which loss due to seepage will be permissible on a particular job. Nature of the treatment necessary, if any, can be also decided from this consideration.

3.3. Transported soils :

3.3.1. In the case of transported soils, one is likely to meet with a great deal of variation in the nature and the characteristics of the strata, which at best can be ascertained only by a carefully planned investigation. In the case of alluvial deposits, one may meet with either alternate layers of pervious and impervious strata or in some cases the impervious stratum may be available at so great a depth as to make the complete (positive) cut off uneconomical. In such soils exploration should be carried out at least to a depth of about one and a half times the depth of water to be retained.

3.3.2. There are also other types of river deposits (alluvial) which are marked by the heterogeneity of soil formation varying from a mixture of sand, silt and clay to open gravel and boulders and absence of clear stratification. These are also called talus soils. They are formed due to slopewash of hills and are generally found near the foot of the hills.

4. Cut off :

4.1. The cut off to be effective, has to be taken down to an impervious stratum. Partial cut off as such has hardly any value (if the deposits are homogeneous). This will be quite evident from a study of table 1 which gives the percentage discharge down stream of the