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**LINING OF THE HAVELI
MAIN LINE CANAL**

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By

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The lining of Haveli canal is an attempt to avoid water logging and save water. Its cost is estimated at Rs. 57.4 lakhs, while saving in cost of excavation, land and masonry works amounts to Rs 5.9 lakhs. The net cost of lining of Rs. 51.5 lakhs would be recovered in 16 years through revenue accruing to the government on the anticipated saving of 330 cusecs of water due to less percolation.

To determine the percolation losses through various types of lining, experiments were conducted by Gupta, on the left bank of the Lahore Branch of UBDC. These showed that "Sandwich" lining made of two layers of brick tiles in cement sand mortar with an intermediate layer of cement plaster was comparatively efficient and cheap. The concrete lining would require mixing machinery and better supervision. The cost of 1 : 3 : 6 concrete with brick ballast is also higher by Rs. 8.50 per % Cft than "Sandwich" type. Sandwich lining as finally decided consists of a lower course of tiles 12" x 5.875" x 2.5" in 1 : 6 cement mortar, bedded on 1/2" layer of same mortar. Top is covered by 1/2" layer of 1 : 3 cement sand plaster to enclose longitudinal and transverse reinforcement of 1/4" bars. On top of the plaster is the upper course of tiles in 1 : 3 mortar.

The Haveli canal would be lined from RD 2,000 to RD 227,800 in length of 41.56 canal miles. There are 31 kilns for brick burning. The basic rate of tiles was fixed at Rs. 15/- per 1000. A kiln was located in each reach of 7500 of canal and was required to produce 3.5 to 4 lac tiles per month as per agreement. Five more kilns were later added in order to finish all the lining by the end of March 1939.

An overseer is in charge of a "heading" or working site and looks after the kiln excavation and other masonry work in his reach. Entire project comprises five Sub-Divisions which fall in the jurisdiction of two Divisions. S.D.O's are responsible for supervising and maintaining quality control in manufacture of tiles and works. Cement is supplied by Punjab Portland Cement co. (Wah) at Rs. 5 per ton, sand is obtained mostly from canal excavation and steel reinforcement is supplied by Indian Steel and Wire Product Ltd. Tatanagar.

The plant comprises steel tanks for soaking bricks, wooden scaffolding for building the masonry on slopes, templates for dressing the side slopes, and G.I. pipes for water supply etc. A water course runs along the outer toe of the canal bank to serve the headings. For reaches where no canal supply is available and for canal closure, some tube-wells have been sunk. The cost of running the pumps for the whole job is estimated at Rs. 9000.

Well rammed puddle in 6" layer is put behind the lining above the natural surface to minimize subsequent settlement of earth backing. The templates give correct profile of the canal where the outer edge of the vertical scantling is truly vertical over the tangent point given on the brick in the bed. Three templates give two spaces of 25 feet each for the dressers work. Dressing of side slopes and bed is done first with kassis and then with scrapers for an accurate smooth surface that serves as a base for the masonry lining. The dressing of bed and sides is kept 2 to 3 chains ahead of masonry work.

Half an inch of fairly wet 1 : 6 cement sand mortar is spread over the bed on which masons start laying transverse rows of tiles and retreat longitudinally. For the joints to be continuous in straight lines for making straight grooves for reinforcement, masons lines are stretched longitudinally from the grooves. The masonry on side slope is laid from scaffolding. The 12 feet planks enable a 10 feet length of masonry to be laid between two supports of scaffolding. For side slope mortar is to be richer than the bed mortar and requires more sprinkling of the formation. the hollow joints are detected with a broad chisel shaped iron bar weighted at the middle. The weight of the bar breaks the upper crust of the hollow joint. The bottom course of the tiles is scraped on the 3rd day with wire brushes. The reinforcement is laid allowing an overlap of 40 diameters and a cover of 3 inches at the top of

side slope without being cut. The plaster 3/8" thick in the bed is laid on the scraped course. The plaster in the bed is cleared and scraped on 5th day and top layer of tiles is laid on 1/8" layer of 1 : 3 mortar. On 7th day hollow joints are detected and repaired. On 8th day the area is flooded after making earthen cross bunds. On the side slopes tiles are laid on 4th day after spreading over 1/2" layer of slushy mortar on bottom course. At least 6" depth of water is maintained over the bed masonry for 2 or 3 months by making small earth cross bunds and this pond is extended every day to include new masonry work for watering. The watering of side slopes covered with mats or cement bags is done with buckets by labourers for 30 days.

At least 1000 of fully excavated canal reach should be available ahead of lining. The ideal programme for heading is to line upstream half of the reach working downstream and vice versa for downstream half. Experiments performed in tanks to study whether 1 : 3 plaster 1/2" thick should be laid separately or in combination with top course of tiles, revealed that two methods of laying plaster are equally good. However separate layer method was adopted for the reason of water resistance. To test the as built lining, two earth bunds spaced 1000' apart were made across the finished lined canal. The inside slopes of the bunds were lined with standard type of lining. The tank was filled to a depth of 10 feet. The percolation rate in November, was determined to be 0.1 cusec per million square feet of wetted perimeter.

Note :

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