THESIS

PHYSICAL MODEL STUDY FOR ENERGY DISSIPATION PHENOMENON AT VERTICAL FALL (RD 27+000) OF LGBC

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ABSTRACT

A fall or drop in irrigation structure constructed across a canal to lower down its water level and destroy the surplus energy of falling water which may otherwise scour the bed and banks of the canal. When a canal crosses an area that has a larger natural surface slope than design slope the canal drop has to be provided suitably at certain intervals.

The location of a fall has to be judiciously worked out such that there should be a balance between the quantities of excavation and filling. Further the height of the fall has to be decided, since it is possible to provide larger falls at longer intervals or smaller falls at shorter intervals.

Many devices are used for energy dissipation and to stabilize the flow in downstream of the vertical fall. Friction blocks are the most effective of all the devices and simplest to construct. With the blocks scouring is reduced d/s of the falls. Lower Chenab Canal (L.C.C.) Irrigation System is one of the oldest systems in the Punjab Province. L.C.C. originates from Head Khanki, which is situated at the Chenab river in the Gujrat district. Some distributaries coming out of Lower Chenab are the Jhang Branch, the Rakh Branch and the Gugera Branch Canal. Lower Gugera Branch Canal (LGBC) of said system has the vertical fall at RD 27+000, 65+000 and 120+000. The vertical fall structure at RD 27+000 of Lower Gugera was remodeled in year 2009 under Rehabiliting Lower Chenab Canal (LCC) System "Part B". At the d/s of vertical fall canal bed is facing the erosion problem due to partial energy dissipation of the falling water. For complete energy dissipation and to avoid the bed scouring, there is need to relocate the position of friction blocks or to use other available options.

Physical model study of the vertical fall structure at RD 27+000 of Lower Gugera were carried out in model testing hall of center of excellence in water resource engineering. The model was made up of brick lined plastered with cement, sand mixture. A weir was installed at upstream eight feet before the model for the calculation of discharge. Friction blocks and pier was installed in model with scale. Model was tested at design discharge of 2.44 cusec by changing the location and number of rows of the friction blocks in stilling basin and also by using the option of end sill with friction blocks.

At the maximum discharge of 2.44 ft^3/sec, the increase in number of rows of friction blocks from two to three decreased the bed erosion up to 3% as compared to site. While increase in spacing between rows of friction blocks and number of rows from two to three decreases the bed erosion up to 7%. On using endsil without friction blocks the depth of erosion further decreased to 44%. In this case minimum depth of erosion among all options was noted.

The model study concludes that d/s bed erosion depends on the spacing and number of rows of friction blocks. The increase in spacing between friction blocks increases the d/s bed erosion while increase in number of rows decreases the bed erosion.

Study recommends the option of end sill without rows of friction blocks to minimize the d/s bed erosion problem at RD 27+000 of LGBC.