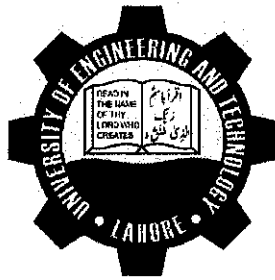


# OPTIMAL DESIGN OF HEADRACE TUNNEL

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by

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## ABSTRACT

Headrace tunnel is an important civil structure in any hydro-electric power project. Optimization of the headrace tunnel diameter is a challenging and complex problem due to large number of variables, its dynamic behaviour, excessive computations, and non-linearity of the objective function. Tunnel diameter greater than optimum one will be helpful in achieving more power generations due to minor hydraulic losses. However, it will result in higher construction cost. Contrary to it, tunnel diameter smaller than optimum one involves less construction cost, but it will increase hydraulic losses and as consequence less power generation. For the computation of optimal diameter of headrace tunnel many empirical relations are available in the literature. These empirical relations give different values of headrace tunnel diameter for the same site conditions.

This study has addressed many critical parameters involved in the calculation of optimal diameter of headrace tunnel. A new model was developed keeping in view the variables involved in the optimization of headrace tunnel which were not used before. The newly developed model was used to compute the diameter of headrace tunnel based on minimum cost of headrace tunnel. Newly developed model was validated using the data of various hydropower projects. The result showed that for same design discharge, diameter for an unlined tunnel is 8.75% higher as compared to the lined tunnel. The results also indicate that a minor percentage difference ranging from 1.43 to 4.26 % in diameter was found. It showed that newly developed model may be used for the optimal diameter of headrace tunnel of any hydropower project.