

5 MW DEWAL HEP

The original design of water conductor was a RCC box of size 2.8 M x 2.8 M and a length of about 2.5 Kms. When civil works were started at site it was found that the geological conditions were very poor and the terrain was too steep having fragile and unstable slopes. Moreover the RCC box was to cross several gulleys, valleys and nallas. Heavy cutting would have posed danger to a pucca road running on upper side due to the imminent risk of collapses and slips. The villagers on the downstream objected to the construction of the channel due to the danger of flooding in case of any failure because the area falls within a high seismic active zone. Finally after detailed examination the installation of an M S Pipe of 2.4 M dia meter was found to be cheaper and expedient and the same has been installed without any serious problem.

5 MW BRAHAMGANGA HEP

The feeder pipe of this project was originally designed as an open RCC channel of size 2.4 M x 4.5 M (avg.) of 175 M length. However when the excavation was started large scale slips started taking place. When the work could not proceed any further it was decided to raise the levels elevation to reduce cutting and to modify the design which would be easy to construct because of inaccessibility by any land route and all materials were required to be transported by rope-way system. The locations, levels and alignment of the structures were changed and a M S Pipe feeder pipe of 1.6 M diameter and 175 M long has been installed with an ease.

12 MW KHAULI HEP

The case of water conductor of the Khauli HEP is a classic example from which lessons can be learnt. The inadequacy of design to cater to the extra-ordinary geo-logical conditions posed serious problems of delay and infructuous expenditure on this project. The water conductor of this project is having two designs. For the first part it is an M S Pipe of which crosses valleys and ridges. The second part was designed as an RCC cut and cover box of size 1.5 M x 2.0 M having a length of 643 M. Some of the stretches of the RCC box channel are located in geologically unstable zones. When the excavation in such three zones was undertaken it was observed that the whole hill slope was moving downwards and wide cracks appeared on the upper side which also caused cracks in one of the house. The soil was found to be over saturated and due to its peculiar characteristics no amount of dewatering and shoring was of any help. This region experiences heavy summer and winter rains with occasional snowfall which aggravates the problems. Due to slips the shuttering and reinforcement of 30 RM stretch was buried under semi-liquid mud and it took considerable time and vigorous efforts to remove the same. Finally when all efforts failed to yield any tangible results the RCC box was replaced with an M S Pipe in three stretches of 220 M length which needed minimum excavation and exposure time to lay and was completed satisfactorily.

5 MW LOHARKHET HEP AND 3 MW ALEO-MANALI HEP

The design of the water conductor system for these projects were thoroughly discussed before start of the works. The M S Pipe water conductor of the Aleo-Manali project which falls in

rocky terrain which experiences heavy snow falls was successfully completed within the time schedule and the project is under operation. As far as Loharkhet HEP is concerned this project is located in a high seismic zone and the geological conditions of the terrain are liable to slips and collapses. The heavy rains and snowfall causes serious stability and approachability problems. Accordingly a M S Pipe water conductor was selected and is nearing completion.

5 MW DOODHGANGA SHEP AND 5 MW BADYAR HEP

The construction work of these projects is to start shortly. Keeping in view the site conditions, duration of execution, cost and ease of construction it has been decided to adopt M S Pipe water conductor for these projects.

The salient features of the water conductors described are shown in the table below:-

Table –1: Salient Features of Water Conductor For Selected Small Hydro Electric Projects

S. No	Name of project	Water conductor system	Percentage cost of total cost of civil works (approx.)	SAVINGS AS COMPARED WITH OPEN / RCC BOX CHANNEL		
				Cost per meter (Rs)	Construction time in months	Land requirement in hectares
1.	3 / 4.9 MW Baragran SHEP, Distt. Kullu (HP)	M S Pipe diameter 1.4 M D, Length = 1568 M	40	1500	3	0.50
2.	5 MW Dewal SHEP, Distt. Chamoli (Uttaranchal)	M S Pipe diameter= 2.4 M, Length= 1790 M	55	6500	6	0.55
3.	5 MW Brahamganga SHEP, Distt. Kullu (HP)	M S Feeder Pipe diameter =1.6 M, Length = 175 M	--	5000	3	0.05
4.	12 MW Khaulī SHEP, Distt. Kangra (HP)	M S Pipe diameter= 1.5 M, Length =220 M	NA	1550	3	0.10
5.	3 MW Aleo-Manali SHEP, Distt. Kullu (HP)	M S Pipe diameter = 1.0 M, Length= 950 M	30	1000	6	0.30

6.	5 MW Loharkhet SHEP, Distt. Bageshwar, Uttaranchal	M S Pipe diameter =1.60 M, Length = 1995	44	1650	9	0.60
7.	5 MW Badyar SHEP, distt. Uttaranchal	M S Pipe diameter= 1.7 M Length = 4200 M	50	2000	12	1.25
8.	5 MW Doodhganga SHEP, Distt. Budgam, Jammu & Kashmir	M S Pipe diameter=1.5 M Length = 3655 M	50	1500	12	1.10

The disadvantages of having an open channel or an RCC box channel for a water conductor for a small hydro power project are shown in TABLE –II.

TABLE –II: DEMERITS OF OPEN CHANNEL OR RCC BOX WATER CONDUCTOR SYSTEM FOR SMALL HEPs

1.	Ultimately costlier than the M S Pipe water conductor/
2.	Involves longer construction period and costly logistics
3.	Needs more land and felling of more number of trees
4.	Requires heavy and costlier protection works.
5.	Involves costly cross drainage work of aqueducts and siphons.
6.	Prone to flooding, overflowing and seepage problems.
7.	Loss of water leading to reduced power generation.
8.	Increased risk of slips and slides of hill slopes
9.	Difficult and costly maintenance and repairs leading to longer shut down of power plant.
10.	Likely to be choked due to slides and rolling debris & stones.
11.	Quality of water likely to be deteriorated.
12.	Prone to damage due to uplift pressure and collapses.
13.	Ecologically unfriendly. Risk to wild life.
14.	Involves heavy blasting operations.
15.	Opposed by villagers, land and house owners.
16.	Pilferage of water and sabotage possible.
17.	Weakens the geophysical conditions due to seepage, leakage and flooding.
18.	Likely to suffer serious damage due to earthquake.

The advantages of having an M S Pipe water conductor for a small HEP are shown in Table –III.

TABLE –III: MERITS OF M S PIPE WATER CONDUCTOR SYSTEM FOR SMALL HYDRO ELECTRIC POWER PROJECTS

1.	Finally cheaper than other systems.
2.	Involves lesser time to install thus enabling earlier commissioning of the project.
3.	Needs lesser land and felling of fewer numbers of trees.
4.	No loss of water being water-tight therefore increased power output.
5.	Involves easy and cheaper cross- drainage works because the pipe itself can bridge gaps of moderate span.
6.	Reduced blasting operations needed and reduced protection works required.
7.	Easy to repair and maintain.
8.	No water pilferage and reduced risk of sabotage.
9.	No possibility of choking due to blockage therefore leading to higher power generation.
10.	Water quality not prone to deterioration.
11.	No damage to fragile geophysical conditions and therefore no damage to the WCS.
12.	Ecologically friendly.
13.	No risk to wild life.
14.	Not opposed by locals because no risk to their fields and houses due saturation, failure and flooding.
15.	Overall reduced shutdown period and generation of more power.
16.	Reduced risk due to earthquakes, slips and slides.

CONCLUSIONS AND RECOMMENDATIONS

The installation of M S Pipe water conductor system for a small hydro power project is the best option because of its given merits such as :-

- Cost reduction = 15 to 20%
- Duration for installation is reduced by = 20 to 25%
- Requirement of land is reduced by = 30 to 35%
- Down time of power generation is reduced by = 50%
- Maintenance problems = Almost Nil
- Eco-friendliness = 100%