Yele Asphalt Concrete Core Rockfill Dam

Yele Hydropower Project is located in Mianning County of Liangshan Prefecture and Shimian County of Ya'an city, Sichuan Province. The project includes a rockfill dam of 124.5m high, a diversion tunnel of 7.2km long and an underground power house. The dam crest is 411m long and 14m wide. The catchment area of the project is 323km^2, with 14.5m^3/s of mean annual discharge. The normal pool level of Yele reservoir is 2650m, the corresponding reservoir capacity is 298 million m^3. The installed capacity of the power station is 240MW, with two 120MW Pelton turbine power units. The average annual energy output is 647 kW·h. The layout of the project is shown in Figure 1.

The construction of the project commenced at the end of 2000. In January of 2005, the reservoir started impounding. Two units began to generate power by the end of that year. In August of 2006, the whole project was completed.

On the dam site, the winter will be six to seven months with the snow cover period lasting from November to March. The average annual temperature is 7℃, and the mean annual rainy days reaches 215d. The basic earthquake intensity of the project site is Ⅷ. The thickness of the overburden layer on the right abutment exceeds 420m, and the embedded depth of the relative impervious stratum is more than 200m.

The dam crest elevation is 2654.50m. The dam body consists of a 120m high asphalt concrete core, the upstream and downstream transition layer, the downstream main rockfill zone, and the upstream and downstream secondary rockfill zone. The dam volume is 6.2 million m^3, and the volume of the asphalt concrete core is 23,000 m^3. The typical cross section is shown in Fig. 2.

The upstream dam slope is 1V:2H, with a 4m-wide berm on the elevation of 2620m and a 150m-wide platform (top elevation of 2579m) between the dam and the upstream cofferdam. The downstream dam slope above 2624.50m is 1V:1.8H, and below is 1V:2.2H, with three 4m-wide berms on 2624.50m, 2594.50m and 2564.50m. The downstream toe zone is covered by a 300m-wide sand and gravel blanket, the top elevation is 2560.00m. Asphalt concrete core has a stepped profile, with 0.6m of top width and 1.2m of bottom width. The asphalt core plinth is 3m high, whose top width is 3m. Flexible aseismatic reinforced geo-grid is applied on the 30m thick top part of the dam body.

Under the core plinth, there is a concrete cutoff wall of 54,100m^2 in area, as well as a curtain grouting of 48,200m in total length. On the right abutment, the cutoff wall have two parts. The upper wall and lower wall are connected by a reinforced concrete gallery. The maximum depth of the single wall is 84 meters.

Yele reservoir started impounding on Jan 1st of 2005. In the flood period of 2006, the water level reached about 2642.6m, the leakage through dam body and foundation was about 140L/s, and the bypass seepage flow on the right bank was about 120L/s.

The reservoir features are given in the following table.

Table.1 Main features of Yele Project

Location: Mianning County and Shimian County, Sichuan Province						
Main function: Power generation						
Main Structures	**Retaining Structure**	Dam type	Asphalt conrete core rockfill dam	**Hydrology**	Catchment area	323 km^2
					Mean annual discharge	14.5 m^3/s
		Maximum dam height	124.5m		Mean annual runoff	457×10^6 m^3
		Crest elevation	2654.5m		Mean annual suspended sediment load	31×10^3 ton
		Crest length	411 m		Mean annual sediment concentration	0.0359 kg/ m^3
	Discharge Structure	Inlet floor elevation	2630/2552m	**Power units**	Num. of turbines	2
		Design discharge	203.1 m^3/s		Rated output	122.5MW
		Check discharge	206 m^3/s		Rate rotation speed	375r/min
		Empty discharge	292 m^3/s		Rated head	580.0m
	Headrace Structure	Design discharge	47.24 m^3/s		Num. of generators	2
		Maximum discharge	52.66 m^3/s		Install capacity per unit	120MW
		Cross section	4.6×4.6m	**Construction**	Open excavation	2998×10^3 m^3
		Design head	60～100m		Tunnel excavation	38.29 m^3
		Maximum head	644.8m		Earth and rock filling	672.67 m^3
	Power house	Type	Underground		Concrete	16.88 m^3
		Size（Long×wide×height）	72.14×22.2×38.78m	**Economics**	Static investment	2313.9×10^6 RMB
		Installed elevation of turbines	2005.2m		Total investment	2537.6×10^6RMB
	Switch yard	Type	Ground		Investment per storage capacity	7.765 RMB/m3
		Foundation	Overcast		Power cost	0.394 RMB/kW.h
		Area/floor numbers	1440/1	**Construction stage**		Completed

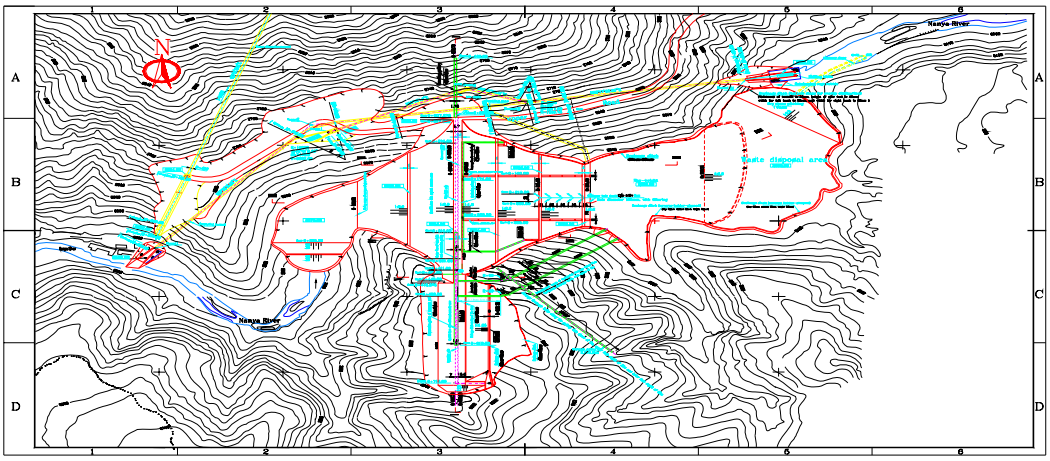

Fig. 1 Project Layout

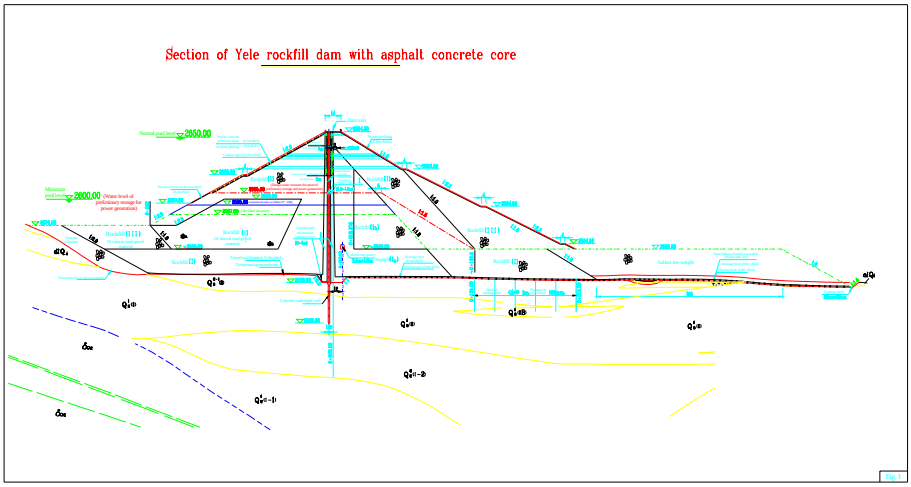

Fig. 2 Cross section of Yele rockfill dam

Fig.3 Downstream view of Yele dam of lower reservoir

Fig.4 Construction of cutoff wall on river bed (Lower Reservoir)

Fig.5 Site construction test of asphalt concrete (Upper Reservoir)

Fig.6 Rockfill construction of dam body (Lower Reservoir)