



REPORT OF EDUCATIONAL VISIT TO PAVNA DAM, LONAVALA PUNE

Class- TE (CIVIL)

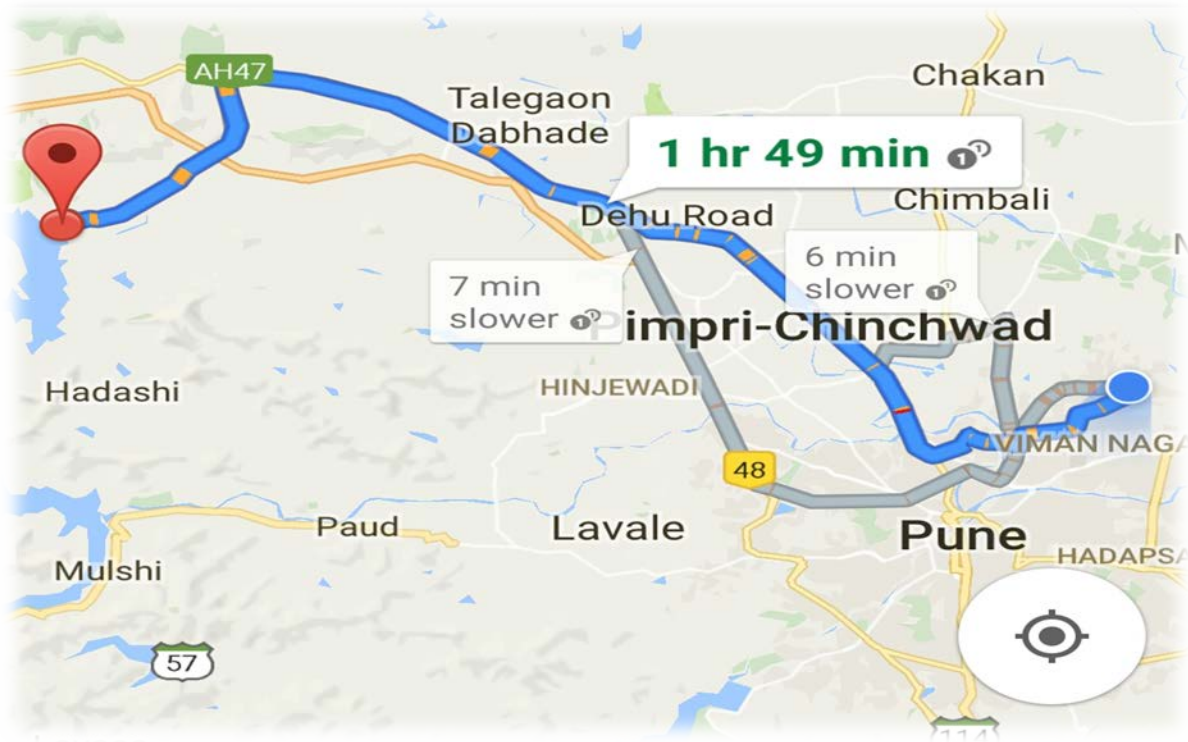
Date :-21 Sept. 2016

Time :- 9:30-4:00 pm



[VISIT TO PAVNA DAM]

LOCATION OF PAVNA DAM



[VISIT TO PAVNA DAM]

The department of Civil Engineering, Dr. D.Y. Patil School of College of Engineering organized a one days long educational visit to pavna Dam on 21th of September 2016 for T.E. Civil Engineering students. Visit was organized as per Pune university guidelines and recommendations regarding syllabus of T.E. Civil Engineering .

Visit was organized with the prior permission and guidance of honourable principal of DYPSOE Lohegaon , Dr. S.S.Sonavane sir (**Director, D Y Patil Technical Campus**), by the initiative and hard efforts of Prof. Bijiwe Sir & Prof Katdare Sir along with one non-teaching staff members Mr. Maruti Sir, Dam Assistant Engineer of guide the students during visit. Along with the staff members, students of TE Civil .

Students leave the college for visit on 21th September at 8.00 am. The breakfast was served to all staff members and students in the bus.The first



[VISIT TO PAVNA DAM]

'Pavna Dam, Lonavala'

Contact details

Pawana Dam, Lonavala Mr. K.J Hande

Mr. R.D More Mob. 992183349

☐ SPECIFICATION:

PAWANA DAM		
Tal. Maval Dist. Pune		
SAILENT FEATURES		
Features	Existing	Revised
Longitude	18-21-30 (N)	18-21-30 (N)
Latitude	73-40-30	73-40-30
Catchment Area	113.36Sq.km.	113.36Sq.km.
Gross Storage	305.00 Mcum.	317.58 Mcum.
Live Storage	274.00 Mcum.	286.44 Mcum.
Dead Storage	31.14 Mcum.	31.14 Mcum.
Submergence Area	23.94 Sq.km.	23.94 Sq.km.
T.B.L	617.52 M.	617.52 M. + Parapet wall
F.R.L	614.48 M.	614.98 M.
Crest level	610.21 M.	610.21 M.
M.W.L	615.09 M.	615.89 M.
M.D.D.L	584.35 M.	584.35 M.
River Bed Level	579.42 M.	579.42 M.
Deepest Foundation level	575.16 M.	575.16 M.
Total length of Dam	1329.00 M.	1329.00 M.
Masonry	424.00 M.	424.00 M.
Earthen	905.00 m.	905.00 M.
Free Board	2.44 M.	2.44 M.
Max.ht. of dam	38.10 M.	38.10 M.
Length of spillway	90.22 m.	90.22 M.
No. of gates	6	6
Size of gates	12.19 X 4.27 M.	12.19 X 4.77 M.
Flood	1250 Cum/Sec	5209.33 Cum/Sec
Average annual runoff	410.00 Mcum.	410.00 Mcum.
75% Dependable runoff	345.00 Mcum.	345.00 Mcum.

☐ PURPOSE:

[VISIT TO PAVNA DAM]

- **Irrigation** - The construction of this dam was started in 1996. The major purpose of this dam is the supply of water to the agriculture, industries, and for drinking. Water supply is majorly done for Wai, Phaltan, Khandala, Bhore, Panchgani - Mahabaleshwar and the surrounding villages on the bank of the dam. This dam supplies water to agricultural land of the Wai, Koregaon, Satara, Javli and Khandala talukas. The catchment area (42.77 km²) dams the Krishna River and forms the Dhom Lake which is approximately 20 km (11 miles) in length. Completed in 2002, it is one of the largest civil engineering projects commissioned after Indian independence. The Dhom Balkawadi electricity project is run by the Maharashtra State Electricity Board. Storage capacity of Dhom dam is 4.16 T.M.C
- **Hydroelectricity** - The Dhom generates electricity of 4 MW from the basement electricity house.

HYDRO ELECTRIC POWER PLANT

□AIM:- TO STUDY ABOUT HYDRO ELECTRIC POWER PLANT.

□INTRODUCTION :-

Hydroelectric Power -- what is it? It's a form of energy ... a renewable resource. Hydropower provides about 96 percent of the renewable energy in the United States. Other renewable resources include geothermal, wave power, tidal power, wind power, and solar power. Hydroelectric powerplants do not use up resources to create electricity nor do they pollute the air, land, or water, as other powerplants may. Hydroelectric power has played an important part in the development of this Nation's electric power industry. Both small and large hydroelectric power developments were instrumental in the early expansion of the electric power industry. Hydroelectric power comes from flowing water ... winter and spring runoff from mountain streams and clear lakes. Water, when it is falling by the force of gravity, can be used to turn turbines and generators that produce electricity. Hydroelectric power is important to our Nation. Growing populations and modern technologies require vast amounts of electricity for creating, building, and expanding. Hydropower is an essential contributor in the national power grid because of its ability to respond quickly to rapidly varying loads or system disturbances, which base load plants with steam systems powered by combustion or nuclear processes cannot accommodate. Reclamations 47big hydro powerplants throughout the india produce an average of 25556.5MWh (megawatt-hours) per year, enough to meet the residential needs of more than 25 million people. This is the electrical energy equivalent of about 150 million barrels of oil. Hydroelectric powerplants are the most efficient means of producing electric energy. The efficiency of today's hydroelectric plant is about

90 percent. Hydroelectric plants do not create air pollution, the fuel--falling water--is not consumed, projects have long lives relative to other forms of energy generation, and hydroelectric generators respond quickly to changing system conditions. These favorable characteristics continue to make hydroelectric projects attractive sources of electric power.

□HOW HYDROPOWER WORKS :-

Hydroelectric power comes from water at work, water in motion. It can be seen as a form of solar energy, as the sun powers the hydrologic cycle which gives the earth its water. In the hydrologic cycle, atmospheric water reaches the earth=s surface as precipitation. Some of this water evaporates, but much of it either percolates into the soil or becomes surface runoff. Water from rain and melting snow eventually reaches ponds, lakes, reservoirs, or oceans where evaporation is constantly occurring.

Moisture percolating into the soil may become ground water (subsurface water), some of which also enters water bodies through springs or underground streams. Ground water may move upward through soil during dry periods and may return to the atmosphere by evaporation. Water vapor passes into the atmosphere by evaporation then circulates, condenses into clouds, and some returns to earth as precipitation. Thus, the water cycle is complete. Nature ensures that water is a renewable resource.



❖ GENERATING POWER :-

In nature, energy cannot be created or destroyed, but its form can change. In generating electricity, no new energy is created. Actually one form of energy is converted to another form.

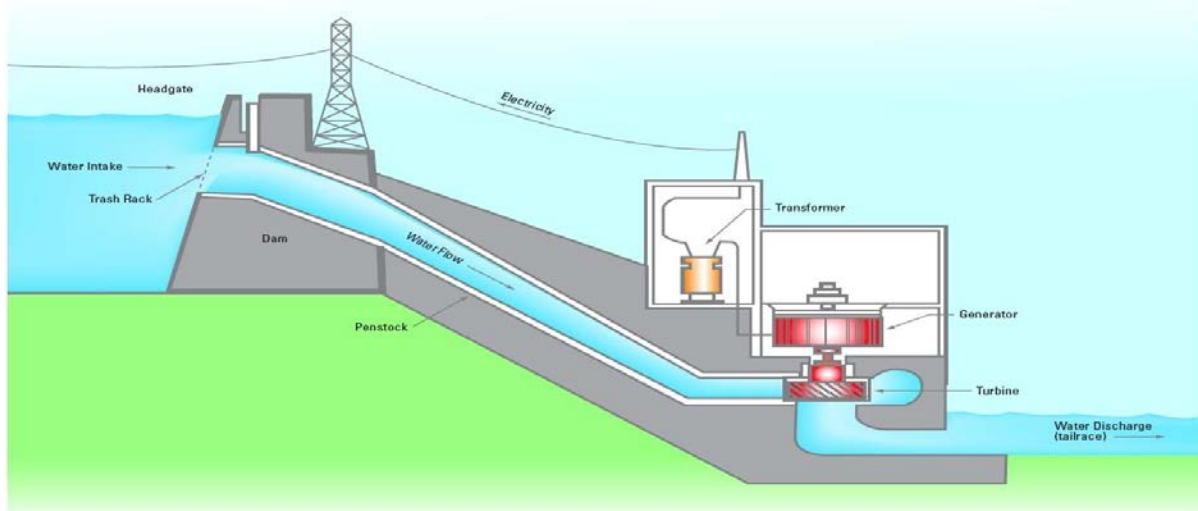
To generate electricity, water must be in motion. This is kinetic (moving) energy. When flowing water turns blades in a turbine, the form is changed to mechanical (machine) energy. The turbine turns the generator rotor which then converts this mechanical energy into another energy form -- electricity. Since water is the initial source of energy, we call this hydroelectric power or hydropower for short.

At facilities called hydroelectric powerplants, hydropower is generated. Some powerplants are located on rivers, streams, and canals, but for a reliable water supply, dams are needed. Dams store water for later release for such purposes as irrigation, domestic and industrial use, and power generation. The reservoir acts much like a battery, storing water to be released as needed to generate power.

The dam creates a height from which water flows. A pipe (penstock) carries the water from the reservoir to the turbine. The fast-moving water pushes the turbine blades, something like a pinwheel in the wind. The water's force on the turbine blades turns the rotor, the moving part of the electric generator. When coils of wire on the rotor sweep past the generator's stationary coil (stator), electricity is produced.

[VISIT TO PAVNA DAM]

This concept was discovered by Michael Faraday in 1831 when he found that electricity could be generated by rotating magnets within copper coils. When the water has completed its task, it flows on unchanged to serve other needs



□TRANSMITTING POWER :-

Once the electricity is produced, it must be delivered to where it is needed -- our homes, schools, offices, factories, etc. Dams are often in remote locations and power must be transmitted over some distance to its users. Vast networks of transmission lines and facilities are used to bring electricity to us in a form we can use. All the electricity made at a powerplant comes first through transformers which raise the voltage so it can travel long distances through powerlines. (Voltage is the pressure that forces an electric current through a wire.)

At local substations, transformers reduce the voltage so electricity can be divided up and directed throughout an area. Transformers on poles (or buried underground, in some neighborhoods) further reduce the electric power to the right voltage for appliances and use in the home. When electricity gets to our homes, we buy it by the kilowatt-hour, and a meter measures how much we use. While hydroelectric power plants are one source of electricity, other sources include power plants that burn fossil fuels or split atoms to create steam which in turn is used to generate power. Gas-turbine, solar, geothermal, and wind-powered systems are other sources. All these power plants may use the same system of transmission lines and stations in an area to bring power to you. By use of this "A power grid," electricity can be interchanged among several utility systems to meet varying

demands. So the electricity lighting your reading lamp now may be from a hydroelectric power plant, a wind generator, a nuclear facility, or a coal, gas, or oil-fired power plant ... or a combination of these.

COMPONENTS:-

The water flowing in the river comprises of kinetic energy & potential energy. In hydroelectric power plant the potential energy of water is utilized to produce electricity. There are 8 important components of hydroelectric power plant as below.

- ☐ Dam
- ☐ Water reservoir
- ☐ Intake or control gate
- ☐ The penstock
- ☐ Water turbine
- ☐ Generators
- ☐ Transformer
- ☐ Tailrace

☐ DAM:-

The dam is the most important component of hydroelectric power plant. In fact the name 'Dam' is considered to be synonymous to the 'Hydroelectric power plant'. The dam is built on a large river that has abundant quantity of water throughout the year. The dam is built at location where the height of the river is sufficiently high so as to get maximum possible potential energy from water

☐ WATER RESERVOIR:-

Water reservoir is the place behind the dam where the dam where water is stored. The water in the reservoir is located at the height

above the rest of the dam structure. The height of water in the reservoir decides how much potential energy water possesses. Higher the height of water more is the potential energy. The high position of water in the reservoir also enables it to move downwards effortlessly due to gravity. The height of water in the reservoir is higher than the natural height of water flowing in the river, hence water in reservoir is considered to be altered equilibrium. This also help to increase the overall potential energy of water, which helps ultimately produce more electricity in the power generation unit.

□INTAKE OR CONTROL GATES:-

These are the gates built on the inside of the dam. The water from reservoir is released and controlled through these gates. These are called inlet gates because water enters the power generation unit through these gates. When the control gates are opened the water flows due to gravity through penstocks and towards the turbines. The water flowing through the gates possesses potential as well as kinetic energy.

□THE PENSTOCK:-

the penstock is the long pipe or the shaft that carries the water flowing from the reservoir towards the power generation unit that comprises of the turbines and generator. The water in the penstock possesses kinetic energy due to its motion and potential energy due to its height. The total amount of power generated in the hydroelectric power plant depends on the height of the water reservoir and the amount of water flowing through the penstock. The amount of water flowing through the penstock is controlled by the control gates.

□WATER TURBINES:-

The water flowing from the penstock is allowed to enter the power generation unit that comprise of the turbines and generator. When water falls on the blades of the turbines the kinetic and potential energy converts into the rotational motion of the blades of the turbines. Due to rotation of blades the shaft of the turbine also rotates. The turbine shaft is enclosed inside the generator. In most of

the hydroelectric power plants there are more than one power generation units comprising of the turbine and generator.



There is the large differences in height between the level of turbine and level of water in the reservoir. This difference in height, also called as head of water, decides the total amount of power that can be generated in the hydroelectric power plant.

□GENERATORS:-

It is in the generator where the electricity is produced. The shaft of the water turbine rotates in the generator, which produces alternating current in the coils of the generator. It is the rotation of the shaft inside the generator that produces magnetic field which is converted into electricity by electromagnetic field induction. Hence the rotation of the shaft of the turbine is crucial for the production of electricity and these achieved by the kinetic and potential energy of water. Thus in hydroelectricity powerplants potential energy of water is converted into electricity.

□TRANSFORMER:-

The electricity generated inside the generator is not of sufficient voltage. The transformer converts the alternating current produced from within the generator to the high voltage current. Current is

supplied to the supplied coil, from where it passes to the outlet coil. The power supply from the transformer is connected to the nation grid, from where the power is distributed for the domestic and industrial use.

☐TAILRACE:-

The water that has been used to rotate the turbine blades and turbines shaft levels the power generation unit entering the pipeline called as the tailrace. From here the water flows into the main river. The height of water in the tailrace is much below the height of water in the water reservoir behind the dam. The potential energy of water in the tailrace has been used to generate electricity. The water flowing out from the tailrace joins the natural flow of water. During the rainy seasons when there is excess water in the dams, it is allowed to overflow through the gates in water reservoir to the low level natural flow of water. If the river is very large, then in multiple dams can be constructed across the river at various locations.

☐RUN OF RIVER POWERPLANTS:-

1) Run off river hydroelectric plants without pond-

In the run off river type of hydroelectric powerplants the running water of the river is used for the generation of electricity. There is no facility for storing the water.

2) Run off river hydroelectric plants with pond-

This type of run off river hydroelectric power plants usually produce the power during peak loads. During the day time and off peak periods they don't produce power and the water is stored in large pond.

☐PUMPED STORAGE POWERPLANTS:-

These plants supply the peak load for the base load powerplant and pump all or a portion of their own water supply.

☐SELECTION OF SITE FOR A HYDRO-ELECTRIC POWERPLANT:-

Some point that should be given importance while selecting a site for hydroelectric power stations given below.

☐ **Availability of water:-**

Since the primary requirement for a hydroelectric power station is the availability of huge amount of water such a plant should be built at a place (ex. River and Canal) where adequate water is available at a good head.

☐ **Storage of water:-**

There are wide variations in water supply from a river or canal during the year. This makes it necessary to store water by constructing a dam in order to insure the generation of power throughout the year. The storage helps in equalizing the flow of water so that any excess quantity of water at a certain period of the year can be made available during times of very low flow in the river. This leads to the conclusion that site selected for hydroelectric plant should provide adequate facility for erecting a dam and storage of water.

☐ **Cost and type of land:-** The land for the construction of plant should be available at the reasonable price. Further the bearing capacity of the soil should be adequate to withstand the installation of heavy equipment.

☐ **Transportation facilities:-**

The site selected for the hydroelectric plant should be accessible by rail and road so that necessary equipment and machinery could be easily transported. It is clear from the above mentioned factors that ideal choice of site for such a plant is near a river in hilly areas where dam can be conventionally built at large reservoir can be obtained.

☐ **ADVANTAGES AND DISADVANTAGES OF HYDRO POWERPLANT:-**

☐ **ADVANTAGES:-**

- 1) Renewable source of energy there by saves scarce fuel reserves.
- 2) Economical source of power.
- 3) Non-polluting and hence environment friendly
- 4) Reliable energy source with approximately 90% availability.

[VISIT TO PAVNA DAM]

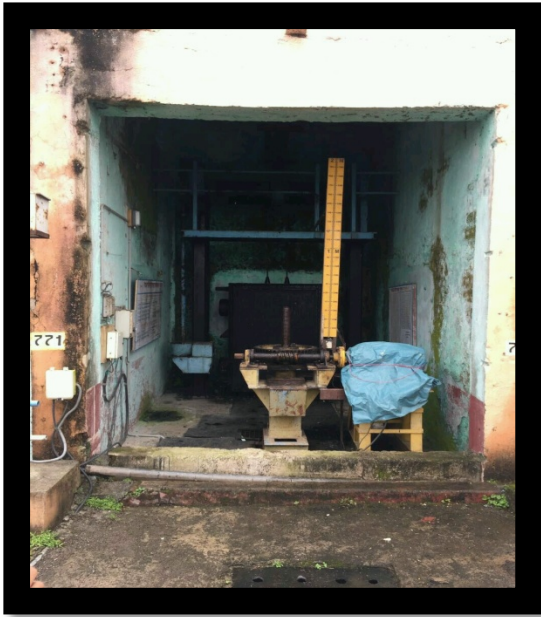
- 5) Low generation cost compare with other energy sources.
- 6) Indigenous inexhaustible perpetual and renewable energy source.
- 7) Low operation and maintenance cost.
- 8) Possible to build power plant of high capacity.
- 9) Plant equipment is simple.
- 10) Socio economic benefits being located usually remote areas.
- 11) Higher efficiency, 95%-98%.
- 12) Fuel is not burned so there is minimal pollution.
- 13) Water to run the power plant is provided free by nature.
- 14) Its renewable rainfall renews the water in the reservoir, so the fuel is almost always their.

□DISADVANTAGES:-

- 1) Susceptible to vagaries of nature such a draught.
- 2) Longer construction period and high initial cost.
- 3) Lose of large land due to reservoir.
- 4) Non availability of suitable size of sites for the construction of time.
- 5) Displacement of large population from reservoir area and rehabilitation.
- 6) Environment takes aspect reservoir verses river ecology.
- 7) High cost of transmission system for remote site.
- 8) They use up valuable and limited natural resources.
- 9) They can produce a large of pollution.
- 10) Companies has a dig up the earth or drill wells to get the coal, oil, and gas.
- 11) For nuclear power plants there are waste disposal problems.

Department of Civil Engineering Dr. D.Y. Patil College of Engineering, organized one day educational visit to Pavna Dam, Pune, Maharashtra on 121th September 2016 for 68 T.E. Civil Engineering students .

[VISIT TO PAVNA DAM]



[VISIT TO PAVNA DAM]



PHOTOGRAPH OF STUDENTS DURING VISIT

[VISIT TO PAVNA DAM]



QUESTIONARIES:

- 1) What are the major components of a Hydroelectric Power Plant?
- 2) How is energy generated in a hydroelectric power plant?
- 3) What are the of construction of a hydroelectric power plant?
- 4) What are the disadvantages of construction of a hydroelectric power plant?
- 5) What is the significance of Dam ?
- 6) What is Hydrograph and its significance?
- 7) What is Mass Curve?
- 8) What is the use of Spillway?
- 9) What is Penstock?
- 10) What is water hammering phenomenon?
- 11) What is the function of surge tank?
- 12) What is meant by water hammer?
- 13) How are hydro power plants classified?
- 14) Name the major parts of a hydro power plant?
- 15) Which type of Turbine was used where u visited and why?
- 16) What was the Hydro Power generation capacity of plant which you visited?