

August 2023

Sardar Sarovar Dam

Civil Engineering Department PDEU
Industrial Orientation Report
Date 28-08-2023



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About Civil Engineering @ PDEU Gandhinagar

Civil Engineering is considered to be the most versatile branch among all the engineering branches. The Department of Civil Engineering since its formation is committed to research and development in civil engineering. The vision of the department is to give exposure to budding technocrats to various challenges in the profession.

The department offers courses at the undergraduate level, graduate level, and Ph.D. doctorate level. The main areas of research include Project Management, Construction Management, Geotechnical Engineering, Structural Engineering, Hydrology, GIS and GPS systems, Environmental Engineering, Concrete Technology, and Transportation Engineering. The department also handles consultancy works and projects in the above-mentioned areas.

Mission and Vision

To prepare competent Civil Engineers through technovations, research and excellence in education for serving evolving human needs and infusing sustainable developments.

Mission

1. To ignite and energize young minds and arm them with the Roots of Knowledge and Wings of Creativity.
2. To excel as a Problem Solver by promoting and supporting cutting-edge research, innovations, and excellence in education.
3. To Unfold new realms of Civil Engineering addressing the needs of the Industry and Society for sustainable development.

Sardar Sarovar Dam

The Sardar Sarovar Dam, a monumental hydraulic engineering project located in the Indian state of Gujarat, stands as a testament to the prowess of modern infrastructure development. This colossal structure, built on the Narmada River, serves a multifaceted purpose, ranging from water storage to electricity generation and irrigation.

With a height of 138 meters and a length of 1.2 kilometers, the dam has a staggering capacity to store 9.67 billion cubic meters of water. This reservoir not only caters to the agricultural needs of the region but also quenches the thirst of millions of people living in the arid zones of Gujarat, Rajasthan, and Madhya Pradesh.

The installed hydroelectric power plant can produce 1,450 megawatts of electricity, contributing significantly to India's energy grid. The construction of the Sardar Sarovar Dam was not without its share of controversies and environmental concerns, mainly related to displacement of local communities and ecological impacts. However, it has undeniably transformed the region's socio-economic landscape.

Event Summary

Date: 28th August 2023

Departure Time: 6:45 AM

Location: Sardar Sarovar Dam, Gujarat

Participants:

- 70 students
- 3 faculty members (Dr. Rajesh Gujar, Dr. Debasis Sarkar, Dr. Vasudeo Chaudhari)
- 2 research scholars (Md Faizan Ansari and Ranpura Pranjal k.)

Sardar Sarovar Dam at a Glance:

- Main Dam - 1,210 m long, 163 m high from the deepest foundation level
- Designed Live Storage Capacity of the Reservoir 5860 MCM (4.75 million acre-feet)
- Irrigation - 1.905 million Ha (1.8 million Hectar in Gujarat benefitting 1 million farmers)
- Drinking Water - 9490 villages and 173 towns (30 million people)
- Hydropower - 1,450 MW installed capacity (1 billion kWh every year)
- Canal Network - Approximately 75,000 km length within Gujarat

Power Sharing by States:

- **Madhya Pradesh: 57%**
- **Maharashtra: 27%**
- **Gujarat: 16%**

Additional Information:

- The power generated by these powerhouses will provide valuable peaking power to the western grid of the country.
- The western grid has limited hydel power production at present. There are plans to establish a series of micro hydel power stations on branch canals where suitable waterfalls are available.
- The Sardar Sarovar Project is one of the largest water resources projects in India covering four major states - Maharashtra, Madhya Pradesh, Gujarat, and Rajasthan. The dam's spillway discharging capacity (30.7 lakhs cusecs) would be the third highest in the world.
- With 1133 cumecs (40000 cusecs) capacity at the head regulator, and 532 km. length, the Narmada Main Canal would be the largest irrigation canal in the world.
- The dam will be the third highest concrete dam (163 meters) in India, the first two being Bhakra (226 meters) in Himachal Pradesh and Lakhwar (192 meters) in Uttarakhand. In terms of the volume of concrete involved in gravity dams, this dam will be ranked as the second largest in the world with an aggregate volume of 6.82 million cu.m.

Event Summary

The Reservoir:

The reservoir would occupy an area of 37,000 ha. and would have a linear stretch of 214 kilometer of water and an average width of 1.77 kilometer. The Full Reservoir Level (FRL) of the Sardar Sarovar Dam is fixed at RL 138.68 meters (455 feet). The Maximum Water Level is 140.21 meters (460 feet.) while minimum draw down level is 110.64 meters (363 feet.). The normal tail water level is 25.91 meters (85 feet.).



Student Photos at the Dam Site

SARDAR SAROVAR DAM (NARMADA) PROJECT	
<p>1. Location</p> <p>(1) State : Gujarat (2) District : Narmada (3) Taluka : Nandod (4) River : Narmada (5) Longitude : 72° 45' E (6) Latitude : 21° 50' N</p>	
<p>2. Submergence details</p> <p>(1) State : Gujarat (2) District : Narmada (3) Taluka : Nandod (4) River : Narmada (5) Longitude : 72° 45' E (6) Latitude : 21° 50' N</p>	
<p>3. Reservoir</p> <p>(1) Water shade area : 88000 Km² of the area : (33770 Sq. miles) (2) Mean annual rainfall : 1120 mm (44.10 inch) (3) Annual run off at the dam site at different percent 50 percentage : 4.10 M haem (33.20 Mafm) 75 percentage : 3.36 M haem (27.22 Mafm) 90 percentage : 2.44 M haem (19.77 Mafm) (4) Allocation of water : 75 % (responsibility) M.P. Gujarat : 0.50 MAF Maharashtra : 0.25 MAF Total : 0.75 MAF</p> <p>(5) River : From Amarkantak to sea : 1312 km From Amarkantak to Dam site : 1163 km Minimum flow : 200 cumecs (8.0 cumecs) Average bed level of River at Dam site : RL 18.0 m (59 ft.)</p> <p>(6) NWD : 30 major dams 130 minor dams 3000 minor dams</p>	
<p>4. Full Reservoir level</p> <p>(1) Full Reservoir level : 138.68 m (455 ft.) (2) Maximum water level : 140.21 m (460 ft.) (3) Minimum draw : 119.54 m (393 ft.) (4) Normal full water level : 25.81 m (85 ft.) (5) Gross storage : 0.95 M haem capacity (6) Live storage : 0.37 M haem capacity (7) Dead storage : 0.28 M haem capacity (8) Annual Evaporation : 0.26 m haem (0.5 Mafm)</p> <p>(9) Submergence at FRL : 34867 ha. 138.68 m (455 ft.) : 95088 acres Length of reservoir : 214.00 km Maximum width : 16.10 km. Average width : 1.77 km.</p>	
<p>5. Dam</p> <p>(1) Type : Concrete Gravity (2) Length of Main Dam : 1210.02 m (3970 ft.) (3) Top R. L. of Dam : 145.00 m (475.7 ft.) (4) Maximum height above the deepest foundation level : 153.00 m (503.6 ft.)</p> <p>(5) Spillway : Open (6) Type : Silling Beam-arrangement with sloping apron (7) Crest level of spillway : RL 141.40 m</p> <p>(8) Type : Roller (9) Number & size : 7 Nos. 18.30m x 18.30m (60 ft. x 60 ft.) (1) size 30 Nos. 18.30m x 16.76m (60 ft. x 55 ft.) (2) Nos. 4 Nos. 4.00 m x 13.01 m (13.01 ft. x 42.68 ft.)</p> <p>(6) Clear waterway at crest : 30 lakh cumecs (7) Spillway capacity : 84949.25 cumecs 30 lakh cumecs</p> <p>(8) Construction sluice : 19 Nos. (1) Block no 35 & 36 : 2.10 m X 2.74 m (7 ft. x 9 ft.) (2) Block no 37 : 119.24 m (392 ft.) (3) Discharge : 265.20 cumecs (9485 cu. sec)</p> <p>(9) River Sluice Number & location : 4 Nos. (1) Block No. 44, 45, 48 & 50 : 2.50 m X 4.00 m (2) Size : 53.00 m (3) Discharge : 244 cumecs At FRL 138.68 m</p>	
<p>6. Power installation</p> <p>(1) Location : River Bed Canal Head Power House Power House 150 m in CG of Dam of Vajrapur Saddle Dam (2) No. of unit : 6 (3) Rated capacity of each set : 200 MW (4) Installed capacity : 1200 MW (5) Type of Turbine : Francis (6) Type of Power House : Vertical (Reversible) Unitor ground (7) Rated speed : 136.36 RPM (8) Dia of runner : 5.7 m (9) Min. head race level : 110.94 m (10) Min Tail water level : 20.80 m (11) Power allocation : 57 Maharashtra 27 Gujarat 16 (12) 1977 million kWh in surplus year & 856 million kWh in deficit year relating to Rs. 6000 to 1000 million</p> <p>(1) F.S.L. at H. R. : 91.45 m (300 ft.) (2) Main Canal : 1261 (3) Length : 457 Km. (274.20 mile) (4) Base width : 76 m (248 ft.) (5) Head reach : 7.6 m (25 ft.) (6) Discharge capacity in head reach : 1132.85 cumecs (7) Discharge capacity at Gujarat Rajasthan : 140,000 cumecs (8) Type of Canal : Lined (9) Crest level of H.R. : 84.74 m (10) Bed level of Canal : 73.14 m</p> <p>(1) No. of H.R. Gate : 5 nos (2.20 m x 13.50 ft.) (2) Gross command area (G.C.A.) : 34,285 lakh ha (84.72 lakh acres) (3) Culturable command area (CCA) : 21.19 lakh ha (52.36 lakh acres) (4) Annual irrigation : 17.85 lakh ha (44.25 lakh acres) (5) Annual irrigation : 380 stages of 51 Talukas of 14 Districts. 85,598 km At Price Level : 1986.87 2009-09 : 819.47 3495.4 : 316.71 4894.45 : 83.27 543.68 : 1719.45 8030.53 : 1189.54 974.28 : 165.87 83.24 : 236.42 970.54 : 143.13 1880.35 : 979.95 2719.89 : 3918.1 21201.84 : 8436.54 35240.45</p> <p>(1) Cost of Unit-6 : 126.8 : 130.25 (2) Gujarat : 65,566 : 18 (3) Maharashtra : 21,977 : 57 (4) Rajasthan : 15,547 : 27 (5) Rajasthan : 2.31 : 10.312</p> <p>(1) Schematic Zone : II (2) Hill Slope coefficient : 0.125 (3) Richter magnitude : 6.5 (4) Epicentre Distance : 12 kms (5) Focal Depth : 19 kms</p>	

Sardar Sarovar Dam at a Glance

Travel Itinerary:

The group departed from our institution at 7:00 AM on two buses. The buses were comfortably arranged to accommodate all participants. Along with the students, faculty members Dr. Debasis Sarkar, Dr. Rajesh Gujar, Dr. Vasudeo Chaudhari led the trip. Additionally, two research scholars, Md Faizan Ansari and Ranpura Pranjal k, were part of the expedition.

Halt for Breakfast:

Around 9:00 AM, we made a pit stop for breakfast at Jagdish Hotel. This break allowed everyone to rejuvenate and prepare for the exciting day ahead.

Glimpse of the Statue of Unity:

En route to the Sardar Sarovar Dam, we had the opportunity to witness the awe-inspiring "Statue of Unity," which stands as the world's tallest statue. It was a remarkable sight that left all participants in awe.

Official Permissions:

Dr. Rajesh Gujar, one of our faculty members, had previously secured the necessary official permissions for our visit to the Sardar Sarovar Dam. However, upon our arrival at the dam around 12:30 PM, we learned that a governmental meeting was in progress, which prevented us from visiting the inspection roadways. Despite this setback, we were granted permission to explore the tunnel of penstocks.

Exploring the Penstock Tunnel:

Our buses were allowed to enter the tunnel of penstocks, providing us with a unique opportunity to observe the ongoing concreting work. Inside the tunnel, the engineering marvel was evident as we marveled at the intricate details of the construction.

Penstock Function Demonstration:

Within the penstock area, we observed six turbines in full operation. To help us understand the functioning of the penstocks, a large LCD screen was set up. It displayed an animated explanation, allowing participants to grasp the intricate mechanics behind the dam's energy generation process.



Students at the Dam Penstock Tunnel

Return Journey:

After an informative visit to the Penstock tunnel, we commenced our return journey to our institution around 2:45 PM. To ensure that everyone had ample time to rest and refresh, we made a dinner halt at 6:45 PM.

Conclusion:

The industrial visit to the Sardar Sarovar Dam was a highly educational and enriching experience for all participants. Despite the setback of not being able to access the inspection roadways, the opportunity to explore the penstock tunnel and witness the functioning of the turbines was a valuable learning experience for our students. The trip not only broadened their horizons but also instilled a sense of wonder and appreciation for the marvels of engineering.

