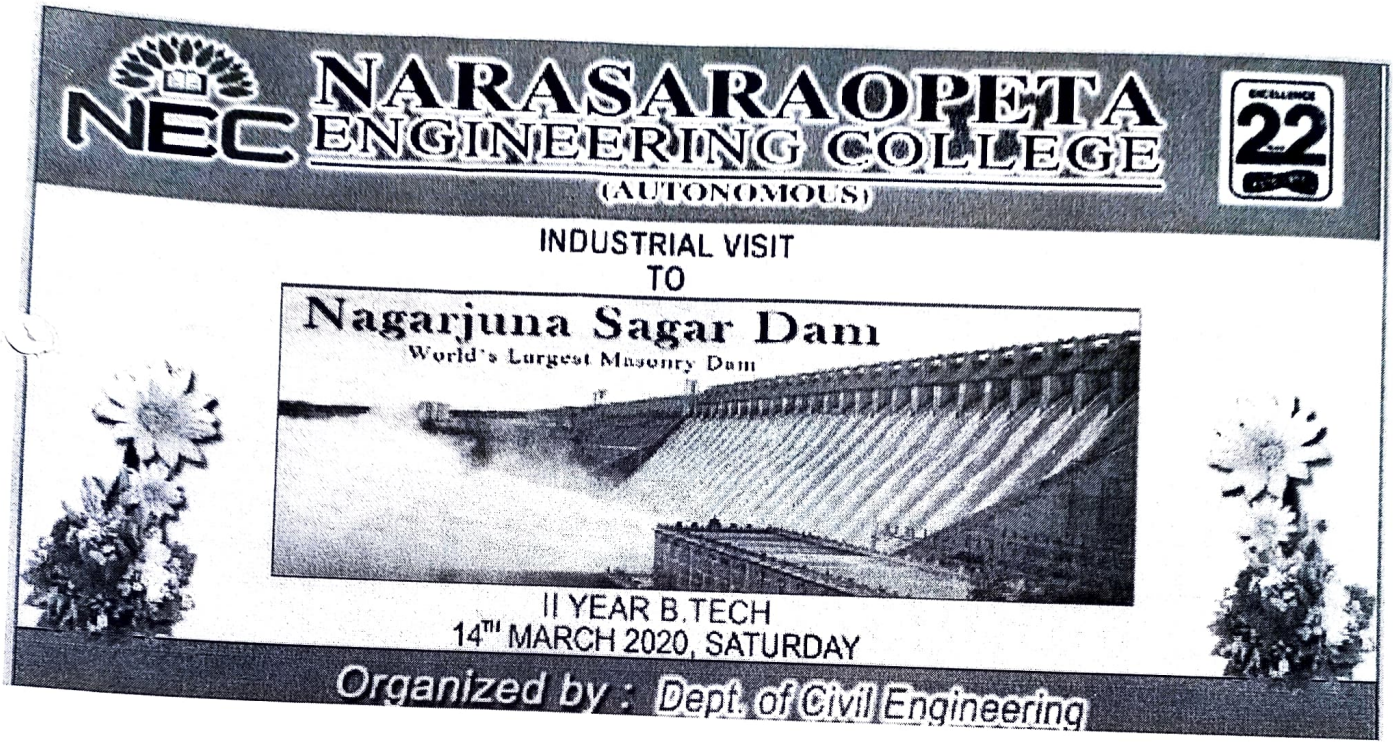
NARASARAOPETA ENGINEERING COLLEGE
(Autonomous)
Accredited by NBA & NAAC with 'A' Grade



By

II YEAR STUDENTS

CIVIL ENGINEERING DEPARTMENT

NARASARAOPETA
NEC ENGINEERING COLLEGE
(AUTONOMOUS)

DATE: 14/03/2020

PLACE: NAGARJUNA SAGAR DAM

A REPORT ON INDUSTRIAL VISIT TO NAGARJUNA SAGAR DAM PROJECT

This is a study report on industrial visit to Nagarjuna Sagar Dam project which is located in the border between Guntur district, Andhra Pradesh and Nalgonda district, Telangana. We started in our campus on 14.03.2020 at 5:00 AM. We, 80 students of II CE along with our faculty members visited Power House Project which is constructed in Left Canal of Nagarjuna Sagar Dam.

Nagarjuna Sagar Dam is a masonry dam across the Krishna river at Nagarjuna Sagar which straddles the border between Guntur district, Andhra Pradesh and Nalgonda district, Telangana. Constructed between 1955 and 1967, the dam created a water reservoir with gross storage capacity of 11.472 billion cubic metres (405.1×10^9 cu ft). The dam is 590 feet (180 m) tall from its deepest foundation and 0.99 miles (1.6 km) long with 26 flood gates which are 42 feet (13 m) wide and 45 feet (14 m) tall.

We had a very good experience and we gained knowledge practically by the properties of dam parts, seeing all those equipment in Power house, Turbines working procedure.

One of the Civil Engineer "K. VIJAYA KUMAR", "DEPUTY EXECUTIVE ENGINEER", gave an idea about the History of dam, Construction materials used at dam site area, he also discussed about the Geology, Hydrology, Flood estimation before construction of dam, irrigation area for various districts, he gave an idea about dimensions of dam, Hydrostatic forces, wind forces and he explained various properties of dam construction of dam based on height from sea level were explained clearly. We feel practical knowledge is more useful to become a skilled engineer. This visit helped a lot and helped us to gain knowledge other than in our books.

Acknowledgement

We take this opportunity to thank our principal "Dr. SRINIVAS RAO" for giving permission to all of us to visit "NAGARJUNA SAGAR DAM" by providing faculty and bus services.

We would like to express our special thanks to Head of the Department (HOD) "Dr. T.Phani Madhavi" for giving us an opportunity for an industrial visit.

Special thanks to our faculty " M. SRINIVAS RAO" , "P. GANESH", "K. NAGA SAI SRAVYA" , " L.V. JAYA MADHURI", K. ANIL KUMAR", "K. VENKATESH" for accompanying with us and guiding during visit.

Our heartfelt gratitude to other faculty members of CE department for encouraging us to gain practical knowledge.

Finally heartfelt gratitude also goes to our classmates for making this trip a memorable one.

INTRODUCTION

Industrial visit to the industry before completing studies i.e., while you are studying in order to understand the reality and get prepared for it.

The concept of industrial visit is as beneficial to the students as it provides a deep understanding about the corporate world. It always helps us in planning if we know how it is going to be once we reach there.

A student's life is very different from those who are working. The change from student's routine to a routine of a working person is made easy when we know what the change and through this industrial visit. This helps students to the daily routine and the responsibilities of a person in an industry.

In books we read about ideas, thoughts and experience of other man the knowledge thus acquired is theoretical. In today's life we cannot be successful with the mere theoretical knowledge. We must also know about the habits, manners and ways of living of the corporate world. We can learn about them by coming in contact with them through the industrial visit. These visits take us from bookish knowledge to the field of practical knowledge.

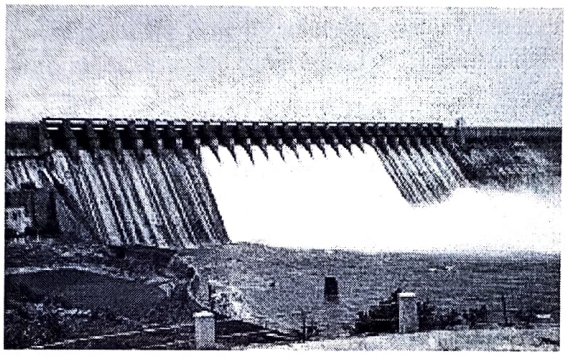
HISTORY

The Nizam made the British engineers begin the survey work for this dam across the Krishna River in the year 1903. But the project construction was officially inaugurated by Prime Minister Jawaharlal Nehru on 10 December 1955 and proceeded for the next twelve years. Raja

Vasireddy Ramagopala Krishna Maheswara Prasad, popularly known as late Muktyala Raja was instrumental in the construction of the Nagarjuna Sagar Dam via active political lobbying, a donation of one hundred million British pounds and fifty-five thousand acres of land. It was the tallest masonry dam in the world at that time, built entirely with local know-how under the able engineering leadership of Kanuri Lakshmana Rao the then Member of Parliament from Vijayawada.

The construction of the dam submerged an ancient Buddhist settlement, Nagarjunakonda, which was the capital of the Ikshvaku dynasty in the 1st and 2nd centuries, the successors of the Satavahanas in the Eastern Deccan. Excavations here had yielded 30 Buddhist monasteries, as well as artworks and inscriptions of great historical importance. In advance of the reservoir's flooding, monuments were dug up and relocated. Some were moved to Nagarjunakonda, now an island in the middle of the reservoir. Others were moved to the nearby mainland village of Anupu.

The reservoir water was released into the left and right bank canals by Prime Minister Indira Gandhi on August 4, 1967. Construction of the hydropower plant followed, with generation increasing between 1978 and 1985, as additional units came into service. In 2015, diamond jubilee celebrations of project's inauguration were held, alluding to the prosperity the dam has ushered into the region.



Nagarjuna Sagar Dam

IRRIGATION

The right canal (Jawahar canal) is 203 km (126 mi) long with maximum 311.5 cumecs capacity and irrigates 1.117 million acres (4,520 km^2) of land in Guntur and Prakasam districts. The left canal (Lalbahadur Shastri canal) is 179 km (111 mi) long with maximum 311.5 cumecs capacity and irrigates 1.008 million acres (4,080 km^2) of land in Nalgonda, Suryapet, Krishna, West Godavari and Khamman districts. The project transformed the economy of above districts. 54 villages (48 in Nalgonda and 6 in Guntur) were submersed in water and 24,000 people were affected. The relocation of the people was completed by 2007.

FISHING IN SAGAR BACKWATERS

Alimineti Madhava Reddy lift irrigation canal draws water from the Nagarjuna Sagar reservoir to irrigate 0.37 million acres (1,500 km^2) of land in Nalgonda district. This lift scheme with pump house located near Puttamgandi village on the left bank of Krishna River also supplies nearly 20 TMC water for the drinking water needs of Hyderabad city. Nearly 80% of the Nagarjuna Sagar water used in Hyderabad city is available for irrigation use in Nalgonda district in the form of regenerated water/treated sewage water. In addition, the high level flood flow canal drawing water from the left side shore of the reservoir also supplies irrigation water in Nalgonda district.

POWER GENERATION

The hydroelectric plant has a power generation capacity of 815.6 MW with 8 units (1x110 MW+7x100.8 MW). First unit was commissioned on 7 March 1978 and 8th unit on 24 December 1985. The right canal plant has a power generation capacity of 90 megawatts (120,000 hp) with 3 units of 30 megawatts (40,000 hp) each. The left canal plant has a power generation capacity of 60 megawatts (80,000 hp) with 2 units of 30 MW each. The tail pond is under advanced stage of construction to put to use the pumped storage features of 7 x 100.8 MW units.

NAGARJUNA SAGAR DAM POWER GENERATION

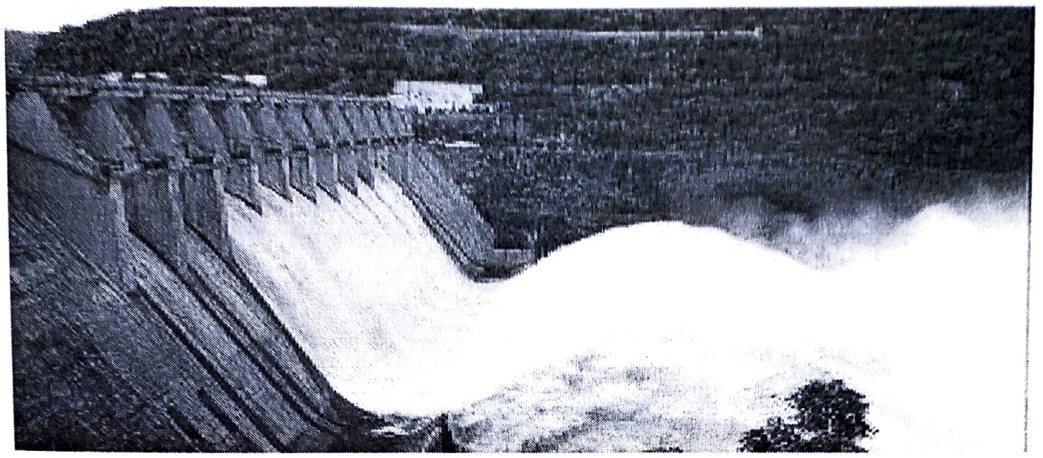
Many times, it happens that power generation from the 150 MW canal based units is not optimised when the Nagarjuna Sagar reservoir is overflowing on its spillway and very less water is required for irrigation from the canals during the monsoon floods. Power generation from canal based hydro units can be optimised by running these units during the flooding period by releasing the water fully into the canals. The unwanted canal water can be released into the natural stream when it is crossing the major stream. Thus run off power can be generated from the water going down unutilised into the river by the canal based power units also.

The water level in the Nagarjuna Sagar reservoir shall be maintained above the minimum level required for these units in most of the time by releasing water from the upstream Srisailam reservoir to optimise the power generation from the canal based units during dry season.

ABOUT DAM

Nagarjuna Sagar was the earliest in a series of large infrastructure projects termed as "modern temples" initiated for achieving the Green Revolution in India. It is also one of the earliest multi-purpose irrigation and hydro-electric projects in India. The dam provides irrigation water to the Nalgonda, Suryapet, Krishna, Khammam, WestGodavari, Guntur and Prakasam districts along with hydro electricity generation. Nagarjuna Sagar dam is designed and constructed to use all the water impounded in its reservoir of 312 TMC gross storage capacity which is the second biggest water reservoir in India.

The Nagarjuna Sagar left canal supplies nearly 130 TMC of water for irrigation needs in Telangana and Andhra Pradesh states. This is a contour gravity canal with gradual downward gradient ($\simeq$ 1:10,000) along the water flow direction. This canal can be used for transferring nearly 80 TMC Godavari river water into the Nagarjuna Sagar reservoir in addition to supplying the Godavari water under its entire command area. Thus a total of 210 TMC of Godavari water can be used in the Krishna basin of Telangana state from Srisailam and Jurala reservoirs for the new projects with 100% water dependability. Godavari water transferred into the Nagarjuna Sagar reservoir and Krishna main river can also be used for the proposed Palamuru lift irrigation and Nakkalagandi lift irrigation schemes in Telangana.



Nagarjunasagar is one of the largest dams in the state of Andhra Pradesh on the River Krishna. About 35.14 lakh acres of irrigated water is required for this multipurpose project. This includes 13.08 lakh acres of Krishna Delta.

The irrigation water at Vijayawada is supplied by the barrage to the Krishna Delta . The river level here is 50 feet above sea level. 7,36,000 acres in Krishna and West Godavari districts and 5,72,000 acres in Guntur and Prakasam districts. However, the storage capacity of the barrage water is very small (3 TMC), so the water coming in must be dumped into the sewers, or dropped into the sea . Therefore, it is mandatory that the delta needs irrigation storage in Nagarjuna Sagar .

However, the construction of the Alamatti Dam in Karnataka and the rainy weather conditions in 2003 and 2004 has reduced the flow of water in the Krishna River. But to Nagarjuna Sagar and Prakasam BarrageThere is no reservoir to hold water from the central catchment into the river. It is in this region that the rivers Munnar, Muza and Paleru merge into Krishna. Due to the lack of storage capacity in the garage, the water must be kept out of the sea. The water is estimated to be 140 tmc. It has 60 TMCs that can be used. If a dam and reservoir can be built to store this water, the delta can be settled and the water from Srisailam and Sagar can be redistributed to other areas.

SAILENT FEATURES OF PROJECT

Location of Nagarjuna Sagar Dam in India:

Location	Guntur district, Andhra Pradesh and Nalgonda district, Telangana
Coordinates	16°34′32″N 79°18′42″ECoordinates: 16°34′32″N 79°18′42″E
Purpose	Hydroelectric & Irrigation
Construction began	December 10, 1955
Opening date	1967
Construction cost	132.32 crore rupees

Dam and spillways:

Impounds	Krishna River
Height	124 metres (407 ft) from river level
Length	1,550 metres (5,085 ft)

Reservoir:

Creates	Nagarjuna Sagar Reservoir
Total capacity	11.56 km^3 (9×10^6 acre·ft) (405 Tmcft)
Active capacity	5.44×10^9 m^3 (4,410,280 acre·ft)
Catchment area	215,000 square kilometres (83,000 sq mi)
Surface area	285 km^2 (110 sq mi)

Power station:

Operator(s)	Telangana State Power Generation Corporation Limited
Commission date	1978–1985
Turbines	1 x 110 MW Francis turbine, 7 x 100.8 MW reversible Francis turbines
Installed capacity	816 MW (1,094,000 hp)

NAGARJUNA SAGAR RIGHT EARTH DAM :

- Catchment Area : 214,185 km^2 (82,697 sq mi)
- Full Reservoir Level (FRL): 179.83 metres (590 ft) msl
- Water spread area at FRL: 285 km^2
- Gross storage capacity at FRL: 312 TMC
- MDDL of river sluices: 137.3 metres (450 ft) msl
- Masonry dam
  - Spillway of dam : 471 m
  - Non-over flow dam : 979 m
  - Length of Masonry dam : 1450 m
  - Maximum height : 125 m
- Earth dam
  - Total Length of Earth dam : 3414 m
  - Maximum height : 128 m
- Power Generation
  - Power Units : 1 No. conventional (110 MW capacity), 7 nos Reversible (100 MW capacity)
- Canal power house
  - Right side : 3 units 30 MW (each)
  - Left side : 2 units 30 MW (each)

Future Potential :

- The left and right bank canals sill level is fixed at 490 feet (149 m) MSL to supply irrigation water to two million acres. The unutilized storage capacity is nearly 180 TMC below the canals sill/bed level. Nagarjuna Sagar reservoir also meets the Krishna delta water requirements to the extent of 80 TMC by letting water down stream into the river. Nearly 1.3 million acres (5,300 km^2) is irrigated under Krishna Delta Canals. There is a possibility to utilize most of this idle dead storage capacity to store the river flood water further and to use as carry over storage. Nearly 150 TMC idle storage up to 380 feet (116 m) MSL, can be used leaving 30 TMC for silt settlement. This is possible by installing Water Powered Pump (WPP) units at the base of the dam.
- It is technically feasible to generate power by the existing hydro turbines from lower head (75 to 50 meters) at lower frequency and the lower frequency power can be upgraded / converted to normal grid frequency (50 Hz) by installing HVDC converters before feeding power into the grid. The unused converter stations of HVDC Sileru–Barsoor transmission link can be relocated and utilised for this purpose. With minor modifications to the electrical systems of hydro power units, nearly 100 TMC water available in the dead storage of the reservoir can be put to use every year.
- The reservoir dead storage water below the 125 m MSL can be released into the downstream river through the existing diversion tunnel which was in use to divert the river flow during the dam construction.

Environmental Aspects :

The artificial lift irrigation based diversion of the river from its natural delta area into Nalgonda district caused erosion of the Fluorine rich volcanic rocks in Nalgonda and contaminated its groundwater supply. It also caused uncertain flows of water into the Krishna river delta area and shrinkage of the natural wonder "The Kolleru Lake". The use of erosion resistant canals interfered with the natural silting process of a river to the deltas and created long-term ecological issues to the health of the delta lands. Reduced flows into the sea resulted in land salination and sea encroachment of coastal lands in Diviseema. The diversion of Krishna water for 200 km to Hyderabad resulted in massive evaporation losses especially in summer and reduced the size of Krishna river. The river water needs to be lifted 1600 ft above its natural flow for it to reach Hyderabad, power consumption that is unjustifiable given that there are cheaper ways to get water to Hyderabad. Nagarjuna Sagar , Srisailam, Almatti and Ujjani dams together successfully halted the flow of Krishna River before it reaches the delta and is good case study of how to kill a mighty river with poor environmental oversight – the fourth largest in the country. Hamsaladeevi the point where Krishna used to meet the ocean does not have Hamsalu (swan) and the Deevi (island) will merge into the ocean in the next decade. Desertification of various flood plains is already recorded. Many forest preserves along the natural Krishna flow are now categorized as "completely degraded" forest areas. Krishna river once home to an ecological wonderland of fresh water fish and aquatic population is now completely depopulated. The river stopped being navigable since the year of Nagarjuna sagar construction.

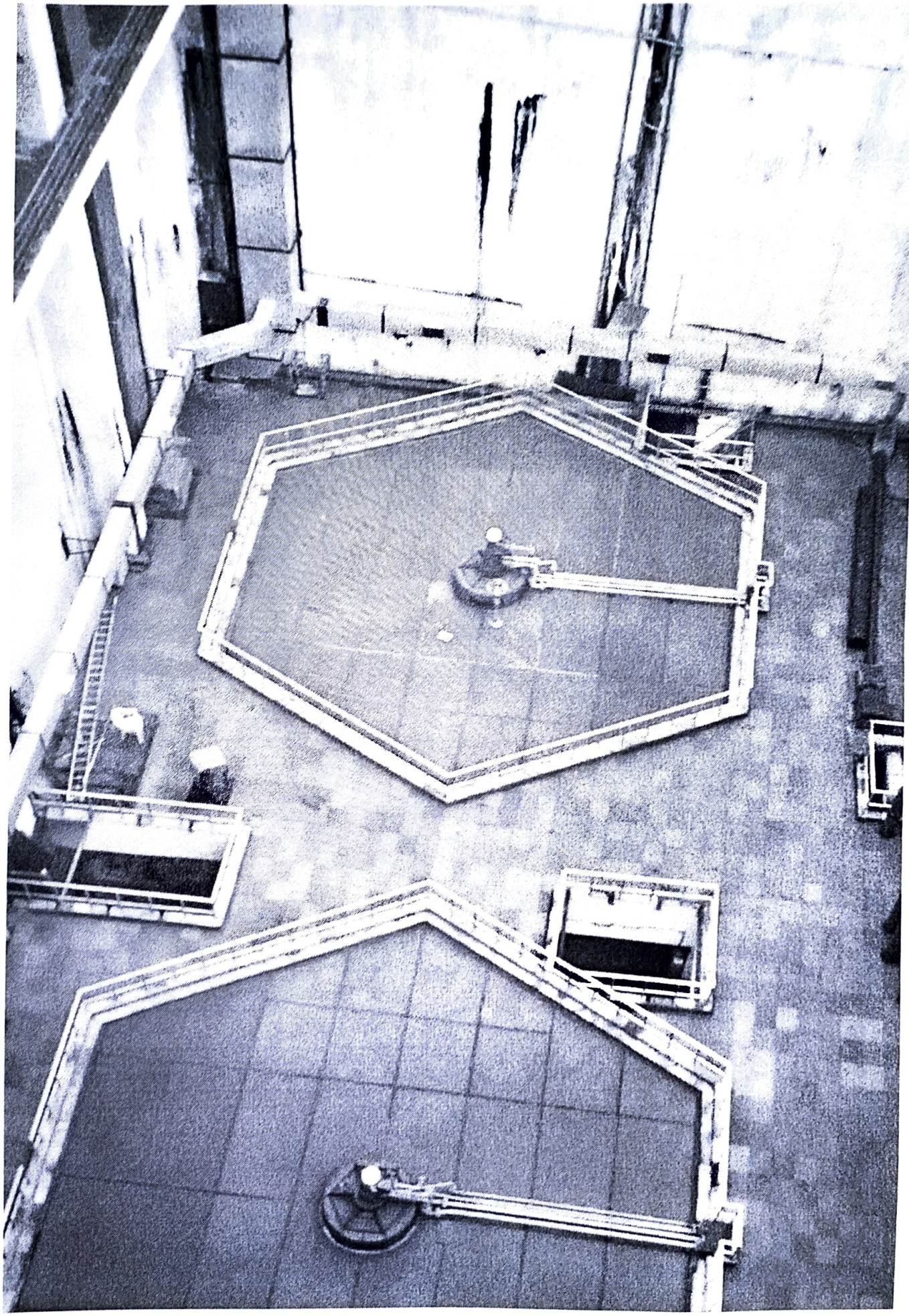
Irrigation

The right canal (Jawahar canal) is 203 km (126 mi) long with maximum 311.5 cumecs capacity and irrigates 1.117 million acres (4,520 km^2) of land in Guntur and Prakasam districts. The left canal (Lalbahadur Shastri canal) is 179 km (111 mi) long with maximum 311.5 cumecs capacity and irrigates 1.008 million acres (4,080 km^2) of land in Nalgonda, Suryapet, Krishna, West Godavari and Khamman districts. The project transformed the economy of above districts. 54 villages (48 in Nalgonda and 6 in Guntur) were submersed in water and 24,000 people were affected. The relocation of the people was completed by 2007.

Nagarjuna Sagar Left Canal Hydroelectric Power Plant :

One of the Electrical Engineer "SIVA PRASAD" , " SUB ENGINEER", gave an idea about the power plant like power generation is 960MW, he gave the basics about the Kaplon Turbine, left canal is 15kms distance from barrage, he explained about potential energy, electrical energy, mechanical energy, Surge pool is the storage tank to store water and produce energy, it is constructed in low head the force of water would not affect the turbine. The turbine can operate manual or automatically. During dry season like summer the turbine works are stopped and cleaning is done due to salination, corrosion etc.

Nagarjuna Sagar Left Canal Hydroelectric Power Plant India is located at Nandikonda Village, Andhra Pradesh, India. Location coordinates are: Latitude= 16.56972635814, Longitude= 79.33885423276. This infrastructure is of TYPE Hydro Power Plant with a design capacity of 60 MWe. It has 2 unit(s).



STUDENTS PARTICIPATED IN VISIT

FACULTY MEMBERS

As a Faculty we motivated Students to participate in field visits. Visiting to Nagarjuna Sagar Dam and Nagarjuna Sagar left canal power house project gave us a good experience and special thanks to our principal sir and Head of the Department for giving permission to visit this project. Students are well cooperated with us. Finally it improvised our knowledge and gained Experience in Field visits.

CONCLUSION

Finally we conclude Field visits are important for engineering students especially for Civil Engineers. We learnt so much from this Field visit and it improved our knowledge and we are hoping to visit many great projects like this.