2007-08

Field Training Report

Report submitted to-

Superintending Engineer,

Power House Circle, CDO, Nashik

(07/07/2008-13/07/2008)

अधिक्षक अभियंता,
विद्युत गृह, मध्यवर्ती संकल्पचित्र संघटना,
नाशिक

Superintending Engineer,
Power House Circle,
Central Design Organization,
Nashik .

सरळ सेवा भरतीने नियुक्ती दिलेल्या सहाय्यक कार्यकारी अभियंता श्रेणी–१ अधिकाऱ्यांसाठी क्षेत्रीय प्रशिक्षण कार्यक्रम, जलसंपदा विभाग

Field Training for Direct Recruits - Assistant Executive Engineer (Grade 1) of Water Resource Department.

कालावधी: ०७~१४ जुलै २००८

Duration: 07~14 July 2008

"क्षेत्रीय प्रशिक्षण अहवाल"
"FIELD TRAINING REPORT"

सादरकर्ता–

प्रविण कोल्हे, बी.ई.(सिव्हिल), एम.टेक. (आय. आय. टी.– कानपूर)

(सहाय्यक कार्यकारी अभियंता)

Submitted by-

Pravin Kolhe, BE (Civil), MTech (IIT-Kanpur)

(Assistant Executive Engineer)

Executive Summary

Maharashtra Engineering Training Academy (META), Nashik organized training program for direct recruits - Assistant Executive Engineer & Assistant Engineer (Class I) of Water Resource Department (WRD), in accordance with Maharashtra Engineering Service Examination-2004. As per schedule of training program, we were directed to undergo training under the guidance of Superintending Engineer- **Shri. B.A. Puri** saheb, Power House Circle, Central Design Organization, Nashik.

The training program was scheduled for one week and started on 07th July 2008 and we were directed to study preparation of General Layout & design of Power Houses. The designs include Large/ Small/Mini Hydroelectric Power Houses having generation capacities ranging from 0.20 Mw to 80Mw for single unit. Further designs include all the locations viz. Underground, Dam foot, Canal drop etc. & for all types of machines viz. Francis, Kaplan, Tubular etc

We also studied the General Layout & designing of Lift Irrigation Schemes. Till now this circle had completed design of Vishnu-Puri, Mhaisal, Takari, Janai & Shirsai lift Irrigation Schemes in state of Maharashtra. Mhaisal Lift Irrigation Scheme contemplates lifting of 37.71 cumecs discharge to 168 m height through 5 stages of lifting to irrigate 45049 ha land. Sophisticated software named `STAAD-III/Pro' is available with in this circle to analyze & design the complex framed structure of Pump House.

This report includes the day-to-day details of training program at Power House Circle, Central Design Organization, Nashik. While writing this report, I had gone through various design standards like Design Process Manual, IS Codes, Central Design Organization, Nashik Standards, CWC Standards etc and I had given these references in the appropriate locations. The report also contains the study and observations performed by me. I learned valuable knowledge regarding Design Procedure of Power House and Lift Irrigation Schemes through guidance by officers as well as reference material.

Acknowledgement

I take this opportunity to express my gratitude to those whose active help and support makes this report possible in the present form.

First of all, I express my sincere gratitude to **Shri. B.A. Puri Saheb**, Superintending Engineer, Power House Circle, Central Design Organization, Nashik for insisting in me the drive to work hard and for inculcating in me the discipline to think clearly.

It is the endless guidance and constant encouragement of Executive Engineer's: **Shri. R.S. Soundankar, Shri. V.A. Ghate, Shri. A.B. Chakor**; Sub-Divisional Engineer's: **Shri. A.M. Ajari, Shri. P.B. Varade, Shri. P.K. Ninawe**, Assistant Engineer-II: **Shri. Yeole** and all the staff of circle and division office and I would like to express my heartfelt gratitude to them for providing me necessary technical information.

Definitely the knowledge, I received during this training session was a lifetime experience and it will serve as a foundation for my career in Water Resources Department.

Last, but not least, I wish to express my gratitude towards my parents- Shivaji and Rohini, my grandparents- Rangnath and Sitabai, my uncle Raosaheb and aunty Radhika who sacrificed a lot to give me a good education.

- Pravin Kolhe BE (Civil), MTech (IITK)
(Assistant Executive Engineer)

Table of Content

Chapter 1. About Central Design Organization, Nashik

1.1 Establishment of Central Design Organization, Nashik

Development programme to harness the available irrigation potential and also to increase the power resources were undertaken by the state of Maharashtra, India on a larger scale after independence by construction of dams and hydro power projects. To cope up with the need of providing designs of earth and gravity dams. Central Designs Organization (C.D.O) was established in 1957 by the Government of Maharashtra.

The CDO at that time had to start from scratch, but because of continuing efforts of the Engineers working in the CDO, the Organization is now recognized nationwide as a pioneer Design Organization in the field of Dam Design. Organization was strengthened for undertaking design of Hydro Electric Projects. It has now established its own design practices from the experience gained from the designs prepared and executed for last 51 years which has stood the test of the time and which are commensurate with the relevant BIS Code and USBR provisions.

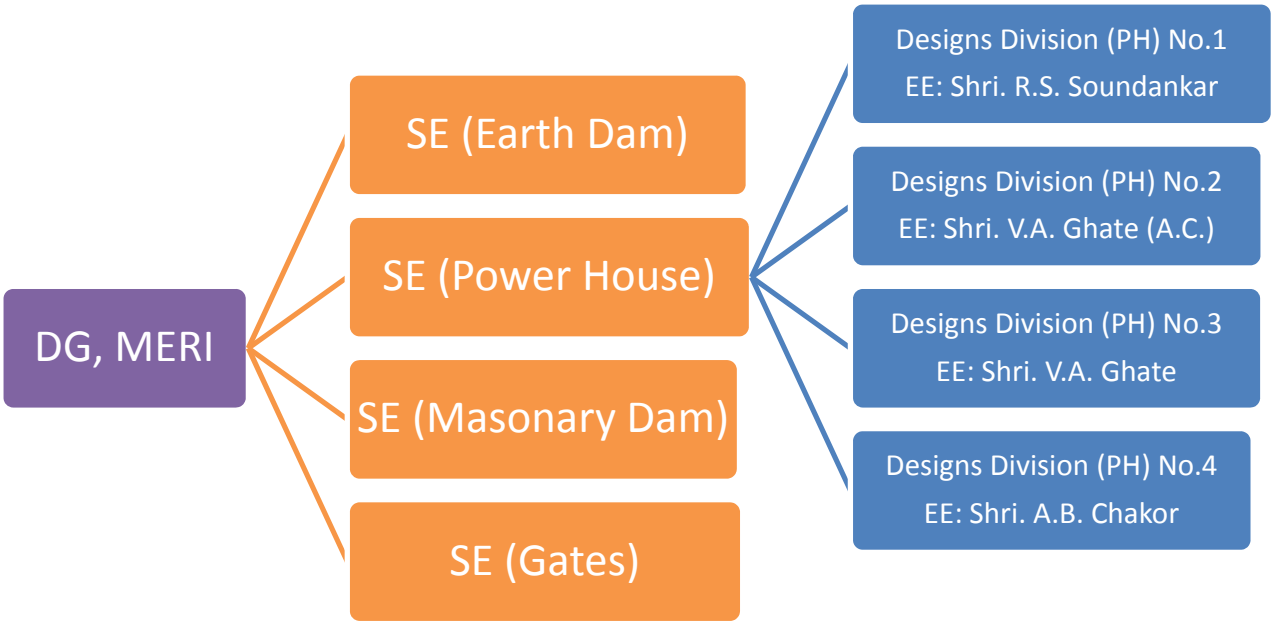
CDO is located at Nashik a central place connected with rail and road. It has its own building and residential quarters for the staff. The pioneer research institute of the state, Maharashtra Engineering Research Institute (MERI) is located in the same premises, which is complementary for the Design.

1.2 Activities of CDO

- Design of irrigation project /Design of Hydro Electric Project / Design of Lift Irrigation Scheme.
- Hydrology, Yield, Flood, Simulation studies and Flood routing.
- Detailed design of Earth dam, Gravity dam and its junctions.
- Design of different types of spillways / Energy dissipation arrangements.
- Instrumentation.
- Design of various types of Outlets.
- Design of all types of Gates.
- Design of various types of Major Canal Structures.
- Design of Hydro Electric Projects.
- Design of lift Irrigation Schemes.
- Review of old dams and suggesting remedial measures, if required.
- Scrutiny of Project Report for C.W.C. Clearance.
- Working on different Committees of BIS for preparation of various standards.
- Consultancy services for Semi Government / Private Sectors.

1.3 Organizational Structure

Maharashtra State is one of the developed states in India in agriculture sector. The policy makers have given due importance for the creation of irrigation potential for which construction of Major, Medium and Minor projects is taken up on a large scale. There are 1427 large completed dams in the state and many more are coming up. Central Designs Organization (CDO) is the state owned Organization under the Irrigation Department of the state entrusted with the activity of designing dams and other allied structures.



CDO was formed in the year 1957. It has four design circles headed by Superintending Engineer. Design units in each circle are headed by Executive Engineers which are assisted by Deputy Engineers and Assistant Engineers.

- All the staff is quite experienced and attained certain degree of expertise.
- All the key software's are indigenously developed to suit the needs of the design.
- Nearly 200 trained Engineers are working in this organization.
- It has its own building.
- The reputed Maharashtra Engineering Research Institute (MERI) is also located in the same premises. The model studies and other material testing work are carried out in the Institute which timely corroborates/supplements design needs.
- The organization has enormous amount of collection of various technical literature and fulfills needs of the time by adding on the latest.
- The organization has published number of papers in various1 national and international seminars.

Chapter 2 Power House Circle

2.1 Role of Power House Circle

Power House circle deals with designs of Lift Irrigation schemes and few Hydroelectric Projects.
The following designs are carried out in this circle:

1) Lift Irrigation schemes:
   a) Preparation of general layout
   b) Rising main & pumping capacity details
   c) Design of all civil components of L.I. Schemes as per general layout.
   d) Preparation of general layout of rising main and design of its allied components, such as anchor blocks, manifold, delivery chamber etc.
2) Hydro Electric schemes.
   a) Preparation of general layout of power houses.
   b) Design of water conductor system, tunnel, surge tank etc.
   c) Design of all civil components of power house structure.
   d) Design of TRT/TRC, design of DT gates and its allied components.
3) Vetting of the designs proposal by the private consultants for hydro electric projects and lift irrigation schemes is also carried out.

2.2 Major achievement of Power House Circle

Designs Division (PH) No.1

1) Banewadi Kharsing LIS - Pumping machinery note and general layout.
2) Dongarwadi LIS - Pumping machinery note and general layout.
3) Lower Chulband LIS - Pumping machinery note
4) Borghat LIS - Final General layout.
5) Haldipurani LIS - Final General layout.
6) Haranghat LIS - R.C.C. details of valve floor, pump floor etc.
7) Birwadi LIS - Pumping machinery note and general layout.

Designs Division (PH) No.2

1) Dahigaon L.I.S. Stage -II : Details at valve floor level to pump floor level and pump floor level to roof level.
2) Jakhapur Agalgaon LIS : C.D.O. has suggested 3 options. It is expected from field, to study these options and communicate CDO 1 appropriate and economical option.
3) Gosi (BK) LIS : Revised study general layout was prepared & sent to mechanical organization for comments, which are pending.

4) Akot LIS : Study general layout.
5) Regadi Vikaspalli LIS : Anchor block for rising main.
6) Mokhabardi LIS : General layout revision-2 and RCC components
7) Khadakpurna LIS Stage-I : RCC details of brace beams and columns
8) Khadakpurna LIS Stage-II : General layout and balancing tank were completed.

Designs Division (PH) No.3

1) Ekrukh Lift Irrigatrion Scheme Stage -I: Pumping machinery & rising main & General layout.
2) Ekrukh Lift Irrigatrion Scheme Stage -II: Pumping machinery & General layout.
3) Sina Mehekari Lift Irrigation Scheme: Pumping machinery and general layout of pump house.
4) Rajegaon Kati Lift Irrigation Scheme: Forebay portion, approach channel, pump house footing, manifold, R.C.C. details of pump house and control room

Designs Division(PH) No.4

1) Janai Shirsai L.I.S. Janai stage III: Pump house footing and R.C.C. details of pump floor to roof.
2) Shiradhon LIS: Pumping capacity, rising main pipe diameter & thickness and general layout
3) Ranjangaon Deshmukh stage I: Manifold and R.C.C. details of pump house.
4) Ranjangaon Deshmukh stage II: Mnifold and R.C.C. details of pump house
5) Karanjkheda L.I.S.: Folded roof slab R.C.C. details
6) Sondyatola L.I.S.: R.C.C. details of pump floor to roof
7) Ambhora stage II: RCC details from foundation to valve floor further upto pump floor and delivery chamber, revised general layout of forebay.
8) Mokhabardi L.I.S.: Pumping machinery, revised general layout of pump house, forebay retaining wall & RCC details of pump house (out of programme) In the old approved layout of Mokhabardi LIS modifications are suggested considering recent developed procedure followed in planning and design and layout of LIS in Power House Circle. Accordingly revised general layout (revision no 3) is submitted to Chief Engineer, Gosikhurd Project (WRD), Nagpur, for approval. Due to this modifications approximately Rs 3 crores is likely to be saved.
9) Satrapur L.I.S.: Study layout of pump house
10) Dhapewada L.I.S. : Pumping machinery note

2.3 Commissioned Hydro Electric Projects by Power House Circle

Sr.No.	Name of Scheme	Location(district)	Installed Capacity in M.W.	Completion Year	Type of Machine
1	Yeldari	Parbhani	3x7.5	1968	
2	Vir	Satara	2x4.50	1975	Vertical Kaplan
3	Bhatgar	Pune	1x16.00	1977	Vertical Kaplan
4	Vaitarna	Nashik	1x60.00	1977	Horizontal
5	Paithan Dam Foot	Aurangabad	1x12.00	1984	Vertical Francis
6	Pench	Nagpur	2x80.00	1986	Vertical Francis
7	Tillari	Kolhapur	1x60.00	1986	Kaplan
8	Bhira	Raigad	2x40.00	1987	Vertical Francis
9	Vaitarna Dam Foot	Nashik	1x1.50	1987	
10	Pawana	Pune	1x10.00	1988	Vertical Francis
11	Yevateshwar	Satara	1x0.075	1988	
12	Bhatsa	Thane	1x15.00	1991	Vertical Francis
13	Kanher	Satara	1x4.00	1991	Vertical Kaplan
14	Khadakwasala	Pune	1x8.00	1991	Vertical Francis
15	Panshet	Pune	1x8.00	1991	Vertical Francis
16	Vir Baji Pasalkar (varasgaon)	Pune	1x8.00	1991	Vertical Kaplan
17	Dhom	Satara	2x1.00	1992	Horizontal Tubular
18	Ujani	Solapur	1x12.00	1994	Vertical Francis
19	Manikdoh	Pune	1x6.00	1995	Vertical Kaplan
20	Dimbhe	Pune	1x5.00	1998	Vertical Kaplan
21	Surya R.B.Canal	Thane	1x0.75	1998	Horizontal

	Drop				Francis
22	Terwanmedhe	Sindhudurg	1x0.20	1998	Bulb
23	Warna	Kolhapur	2x8.00	1998	Vertical Francis
24	Bhandardara II	Ahmednagar	1x34.00	1999	Vertical Francis
25	Surya Dam Foot	Thane	1x6.00	1999	Kaplan
26	Dudhganga	Ratnagiri	2x12.00	2000	Vertical Kaplan
27	Bhandardara I	Ahmednagar	1x12.00	2001	Vertical Francis
28	Karanjwan	Nashik	1x3.00	2001	Vertical Francis
29	Majalgaon	Beed	3x0.75	2002	Vertical Francis
30	Radhanagari	Kolhapur	4.80		

Chapter 3 Power Houses

3.1 Preliminary Field Data Required For Design of Power House

Following data will be required from Site.
{Ref: I.S.4247 (part-1) --- 1993 ---Code of practice for Structural design of surface Hydroelectric Power Stations --- part 1: Data for design}

1. A contoured plan of site on a 1:1000 scale with appropriate contour interval including the location of intake structure, Water Conductor system , Surge Tank , if any , Power House ,Switch yard(Substation), Tail Race & any other relevant features.
2. A complete longitudinal section of water conductor system , from the intake up to Tail Race with maximum & minimum water levels at both ends, Hydraulic particulars of the water conductor system and any other salient features occurring in the system.
3. A chart showing the strata below foundation level approximately to a depth equal to the width of the Power House, in addition exploratory boring may be taken to deeper levels , in case of doubtful strata refer to I.S.10060-1981.
4. Properties of soil or rock from surface to foundation level and at lower levels, if weaker strata exist, and preliminary characteristics of overburden.
5. The results of load test & dynamic characteristics of foundation strata for the foundation of various structures.
6. Maximum electrical resistivity of foundation strata observed every month over a period of one year.
7. The coefficient of friction between concrete and soil or rock and cohesion of unit shear strength under dry and submerged conditions and also of foundation material along weak shear zones and bedding planes.
8. Maximum and minimum ground water levels based on available data.
9. Physical characteristic of the back fill material i.e. cohesion, angle of internal friction, density in dry and saturated conditions, permeability etc.
10. Geophysical characteristics of the soil or rock (geological information such as presence of solution cavities, faults, seams, bedding planes, seismic status with parameters and possibility of rock falls)
11. Meteorological data: This may include
    - i) Monthly minimum and maximum temperature of water
    - ii) Monthly minimum and maximum temperature of ambient air
    - iii) Average monthly rainfall and its maximum intensity
    - iv) Area of Catchment which will drain water through power house site
    - v) Values and directions of wind velocity
    - vi) Maximum depth of snow fall
12. Characteristic and leads of construction materials
13. Gauge & discharge data carrying observed flood at tail race exit.

3.2 List of Tentative Design Notes & Drawings For Power Housetop be Taken Up On Consultancy basis

3.2.1 Civil component : Structural Drawings

Sr.No.	Name of Component	No. of Design notes	No. of Drawings
A)	General		
1	General layout of Power House including Water conductor system.	1	3
B)	Drawings pertaining to Power House Circle:		
2	Power House--- Design of Gantry structure	1	2
3	Service bay, Staircase, Drainage & Dewatering pit etc.	1	2
4	M.I.V. Foundation details	1	1
5	Details of roof structure	1	1
6	Tail channel details	1	1
7	Flood protection measures(if required)	1	1
8	*Machine foundation Details:(Details attached below)		
	---Horizontal shaft machine	2	4
	---vertical shaft machine	5	6
C)	Drawings pertaining to Gate Circle:		
1	Details of intake structure, Trash rack structure, Concrete around penstock etc.	1	3
2	Service gate leaf, embedded parts & Hoisting arrangement & trash rack with embedded parts details	1	3
3	Draft Tube gate leaf, embedded parts & Hoisting arrangement details	1	3
D)	Drawings pertaining to Masonry Dam Circle:		
1	Details of OF/NOF, key wall etc.	1	3
2	EDA (bucket, apron etc), baffle, guide wall etc.	1	3
	Total For Vertical Shaft Machine	17	33
	Total for horizontal Shaft Machine	14	31

Note: 1] The list of design notes & drawings is tentative & requirement of design note & Drawings for particular component will be decided on the basis of

provision in General layout.

2] The size of drawing shall be 750x500mm.

3.2.2 Details of Machine Foundation Design Notes & Drawings

A)	**Horizontal Shaft Machine:**		
1	Details around D.T. box	1	2
2	Scroll case & Generator foundation details	1	2
	Total	2	4
B)	Vertical Shaft Machine:		
1	Loading intensity on various floors	1	0
2	Zero stage & First stage concrete details	1	1
3	Second stage concrete details	1	2
4	Third stage concrete details	1	2
5	Fourth stage concrete details (if required)	1	1
	Total	5	6

3.2.3 Mechanical & Electrical Components Inside The Pump House

Design Note	Drawings	Details to be Covered
Design note of pumping machinery and equipments	1]Layout plan of pumping equipment 2] System resistance curves for pumps with parallel operation.	1]Details regarding selections of pumps -nos, types, accessories, pumps speed based on hydraulic parameters duty head , frictional losses, discharge, efficiency , head , R .P.M., head range , column-delivery pipe dia.,and details, shaft dia., sole plate dimensions 2]Details of system resistance Curves for Pumps with different conditions of operation
Design note on allied mechanical equipments - valves ,expansion /dismentling joint, EOT crane, pumping lubricating water	Layout plan of allied mechanical equipments.	Design details and layout indicating relative positions on allied mechanical equipments, testing methods, spares and tools.
{Note: the size of drawing shall be 750x500 mm.}		

Design note on electrical motors and power factor improvement etc.		Type and selection of motors, with minimum KW rating. Operating voltage , insulation classification ,cooling system, enclosure type , and other specifications, testing methods, (including details of K.W. capacity, operating voltage, KVAR rating of capacitors) along with a system for improvement of power factor, of the pump house & sub station installations during working as well as idle period
Design Note on allied electrical equipments	1] Cable Layout of pump house equipments HT, LT, & Control Cables, including cable schedules & wiring diagrams. 2] Layout details of Earth mat for pump house.	1]HT, LT, DC panel, battery unit & charger including fixtures of switches, breaks, Auxiliary transformers instrumentation with capacity rating, fault level etc. Temperature indicators, pump recorder panel with data logger, cable trenches layout, Electronic water level indicator etc. including note as Auxiliary transformers, earthing, spares & tools. Vector group of transformers, HV/LV & earthing layout, remote control panel, water level indicator, Temperature scanner, frictional requirements, inter-locks, indications, annunciation faces etc. 2]Design details of earth mat for pump house
Total design notes = 4	Drawings = 4	

Chapter 4. Lift Irrigation Schemes

4.1 General Field Data Required for Design of Lift Irrigation Scheme:

1) Index map
2) Contour map of the Pump House Site showing contours @ 10 x 2 m interval on the village map covering the Approach Channel, Pump House, Rising Main manifold etc.
3) General layout of scheme.
4) Number of pumping station proposed in scheme.
5) Detailed project report.
6) Details of power supply available at nearest location & distance from the pumping station.

4.2 Discharge Data Required for Design of Lift Irrigation Scheme:

1) Total design discharge of the scheme.
2) Fortnightly crop water requirement as per modified Pennman method
3) Minimum discharge required

4.3 Various Control Level Data

1) Full reservoir level [F.R.L.] for each stage
2) Minimum draw down level [M.D.D.L.] for each stage
3) Discharging point level in delivery chamber for each stage of scheme
4) High flood level
5) Motor floor & Valve floor level

4.4 Rising Main Data Required for Design of Lift Irrigation Scheme:

1) Number & length of rising Main for each stage
2) Rising Main material to be used
3) Number of pumps to be connected to each rising Main

Chapter 6. Conclusion

The training session at Power House Circle, Central Design Organization, Nashik, was the most enjoyable session for me. I joined Circle office on 07th July 2008 under the guidance of Superintending Engineer – **Shri. B.A. Puri Saheb**. Training session ended on 14th July 2008 and this report includes the summary of the training.

I learned the design procedure for preparation of General Layout & design of Power Houses. The designs include Large/ Small/Mini Hydroelectric Power Houses having generation capacities ranging from 0.20 Mw to 80Mw for single unit.

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It was nice experience for me since I could realize the importance of Power House Circle

At last, I am thankful to Superintending Engineer- **Shri. B.A. Puri Saheb** and all the staff of circle office for providing me an opportunity to enjoy the thrill of design and providing all the necessary documents and related procedure.

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