Design Office Practice

By

MOHI-UD-DIN KHAN*

The design office practice in West Pakistan is based on centralisation of design work. Before the formation of a Central Design Office in West Pakistan, Executive Engineers incharge of construction divisions used to undertake designs and get these approved by tne Chief Engineer through the Superintending Engineers. In a major project, Executive Engineers could not find sufficient time to work out economical designs with the result that delays occurred and quality of the design was not satisfactory. Considering these difficulties, the first time a Central Design Office was opened was for the Sukkur Barrage Project in 1926. It is of interest in this connection to state that Sukkur Barrage Project commands the largest area under any barrage in the world *viz.* 7·5 million acres. The Central Design Office was found to be of considerable help in the systematic completion of Sukkur Barrage and canals and it is mentioned in Volume III, page 23 of the Sukkur Barrage Report that "any large irrigation project to be taken up in future should make provision for the centralisation of design work and the organisation proposed for this purpose should be among the first to be created on the commencement of actual construction."

Centralisation of the design work for the Sukkur Barrage resulted in a saving of Rs. 30 to 40 lakhs with better designs and completion of the work in time. In 1937, a special officer was sent by the former Punjab Government to sudy the design office practice on the Sukkur Barrage as a Central Design Office was considered necessary for the Haveli Project and other construction projects to be taken up by the former Punjab Government. As there was no Central Design Office for Sutlej Valley Project, considerable delays in designs, estimates and completion reports were experienced. After a careful study of the design office practice at Sukkur, the Officer on Special Duty listed the following main advantages in favour of having a Central Design Office for the Punjab Irrigation Department :—

*Director Design and Research, Irrigation, West Pakistan, Lahore.

(1) The Central Design Officers having little field work to do will concentrate the whole energy on the preparation of the designs and the investigation into the most economical design of structure for any given purpose. The Executive Engineer of the ordinary construction division has primarily to spend his time on the supervision of actual construction and to see that it is being done economically. He, therefore, has naturally very little time for study and investigation of various alternative designs with a view to obtaining the most economical type of structure.

(2) The Central Design Office will have the advantage of studying their designs on actual models and be thus able to affect modifications before the plans are finally prepared and sent out for execution of work.

(3) The Central Design Office having settled on any given design can standardise forms and arrange for such forms to be printed in order to eIiminste as far as possible all typing work.

(4) As the drawing staff in the Central Design Office will be all working under very close supervision, their outurn of work will be much higher than it would be if the same staff were scattered on all canal divisions. It is possible and economical to engage more highly trained staff in the Central Design Office on better salaries than those given to ordinary divisional draftsmen and tracers and to insist on a high standard of work.

(5) By concentrating the preparation of plans and estimates in one office the total number of draftsmen, estimators, tracers and calculators required will be less than it would be if each canal division was given the additional staff which would be required if all plans and estimates pertaining to that division were prepared by it, thus resulting in economy.

(6) By employing high class of drawing office staff a very much higher standard in the preparation of plans and estimates can

be obtained and by systematic organisatian of the preparation and check at each stage of the work in the Central Design Office the necessity for the checking of plans and estimates technically and arithematically by sanctioning officers is entirely eliminated. The plans and estimates sent through the Central Design Office direct to the sanctioning officer can be sanctioned by him at once without any further check at all.

(7) The Central Design Office will have the advantage of Chief Engineer's personal touch and guidance in the preparation of dessgns.

(8) The Central Design Office will be able to keep the Chief Engineer in immediate touch with the position as regards the estimated costs of works compared with the provisions in the project estimate and will keep a careful record by graphs to show the progress of various kinds of works for each canal system and for the whole of the administration at a glance.

(9) The Central Design Office will be able to standardise designs of gates and bridges and to consolidate rcquirements for all such works and deal with the tenders which it will be possible to get at very competitive rates.

(10) The Central Design Office will deal with all the correspondence with the P. W. Railway and Buildings & Roads Branch regarding masonry structures in which the approval and concurrence of these departments is required. This would ensure a uniform policy and is bound to save a lot of time in the disposal of such cases.

(11) It was suggested by officers on the Sukkur Barrage that it would be advantageous if the Central Design Office collected materials for writing up the completion report as the construction progressed. They had to appiont an Executive Engineer and one Assistant Engineer on special duty for a couple of years after the construction was completed for writing of the completion report and experienced a lot of botheration in the collection of reliable figures with the result that the comple-

tion of report could not be printed for a considerable time after the construction had been finished. Similar trouble was experienced in the case of the completion report for the Sutlej Valley Project. One section of the Central Design Office will be entrusted with this work as well.

To lighten the burden of the heavy duties of the Central Design Office, over-centralisation in the Irrigation Department was avoided. The designs of headworks, main canals and branches were done in the design office and the smaller channels were left to the field officers so that they could keep in touch with design. There was no bar for field officers to come forward with new ideas and improvements even on the designs of headworks, main canals and branches.

From the above, it can be seen that the Central Designs Office was not only responsible for the design work, but also for project planning, preparation of specifications, quantity surveys and finalising contract documents. With its intimate association with the Research Institute, the design office contributed to the advancement of modern design practices in the Irrigation Department. The design of weirs on permeable foundations which is a speciality of the Irrigation Department has been developed by people associated with the design and research in the Department. Advances in the design of falls, outlets and other hydraulic works were also possible for which the Department is famous for possessing the most interesting and largest contiguous system of irrigation in the world.

The Central Design Office undertook such major projects as Haveli Project, Thal Project, Bhakra Nangal Project, part of Rasul Hydro-electric Project and Drainage Project. After Independence, the design office was depleted of most of its officers who migrated to India. The office had to be developed from a small nucleus of officers left after Independence. In spite of these serious difficulties, major projects were undertaken by the Irrigation Deparement viz, the entire canal system of Thal Main Line Lower, B. R. B. D. Link, Balloki-Sulemanki Link, Marala-Ravi Link, Taunsa Barrage Project, most of the work of Rasul Hydro-electric Project and Chichoki Hydro-electric Project, part of the work of Shadiwal Hydro-

electric Project and some preliminary work on Gujranwala Hydro-electric Project. The Central Design Offices in the former Sind undertook the Kotri Barrage Project and most of the designs of Gudu Barrage Project. In the former N.W.F.P., Dargai Hydro-electric Project, Kurram Garhi, Baran Dam and Warsak High Level Canal Projects were undertaken. It is of interest to note that all these works were completed entirely by Pakistani officers. For the hydro-electric projects, however, some help was obtained from consultants but even for these, designs were prepared by Pakistani design Engineers and were only checked by the consultants.

With the vast programme of development in the country both for the Indus Basin Settlement Plan and the Second Five-year Plan, it is necessary to further expand the organisations dealing with the project planning, design and investigation in the various development departments. Proper organisation of these wings and money spent on them is a sound investment as it is in these fields that lots of advances can be made. It may be of interest to record here that the Bureau of Reclamation U.S.A. is one of the largest design organisation in the world. Field organisations of the Bureau are not so big and all the work in U.S.A. is done by big construction firms, to be supervised by the Bureau's field staff.

It is desirable to thoroughly train our officers in the designs of of some of the major dam and power projects which are to be constructed under the Indus Basin Settlement Plan and five-year plans so that they are in a position to undertake such works independently later on.

An important consideration which should be borne in mind for all design work is that the planning and design work should start considerably ahead of construction. Unfortunately, this has not been followed in the past due to rush of work. In future, all designs should be prepared sufficiently in advance of construction so that there is enough time lag between preparation of designs and construction. This would facilitate quicker preparation of estimates and systematic progress of construction. Thus, the usual malady of excess in estimates could also be considerably checked.

According to the latest recommendation of the Central Government, it was proposed that the subordinate staff, such as overseers and draftsmen,

should be abolished in due course of time and the unnecessary duties which are being done by engineers, namely, accounting, revenue, etc., should be separated and the engineer left entirely with engineering work. With this recommendation, the existing practice of getting drawings through draftsmen would be eliminated and the design engineer would himself do the drawing work which will be conducive to better efficiency and quicker outturn. The standard practice followed in all the advanced countries is that the man who designs also prepares the drawings. In the process of drawing, many new ideas develop and the work evolves as an integrated whole.

As already discussed in the previous pages, a single design office has been performing the various jobs such as planning, specifications, contracts, quantity surveys, etc., in addition to the design work. It would be desirable to have separate sections not only for each one of these but to further separate the design work into various specialised fields, such as designs of hydraulic structures, designs of modern reinforced concrete and pre-stressed concrete, designs of earth dams, designs of hydel and thermal power plants. This would be possible with the vast programme of development works to be undertaken in the next ten years if these officers are suitably organised and given the responsibility and encouragement.

Unlike construction work which can be entirely done by machines, planning and design is a creative activity which requires the highest development of human faculties. This is one of the fields where there is a lot of scope for improvement with advances in new techniques. To quote an example, the design technique namely the trial load method analysis followed for Boulder Dam, the then highest dam in the world, is now outstripped though at the time of the design of Boulder Dam, it was considered a vety satisfactory method.

The traditions developted in the design offices in West Pakistan are valuable and should be nourished wherever the design officers may be working. One of the traditions of the design office has been to give equal importance to technical opinion coming from an officer irrespective of his seniority or status. In this way, a scientific outlook into every aspect was developed without the rigidity of set ideas. The design office has expressed technical opinions without fear or favour in the face of political pressures or administrative influences.

The job of a design engineer is not a sinecure. He neither gets the facilities of the field officer nor the laurels of an administrator. His work demands a fructifying imagination and a broad vision which can synthesise the discordant data and discriminate between relevant and irrelevant facts. This is essentially the work of dedicated men. In short, design engineering is not just a profession but a way of life.