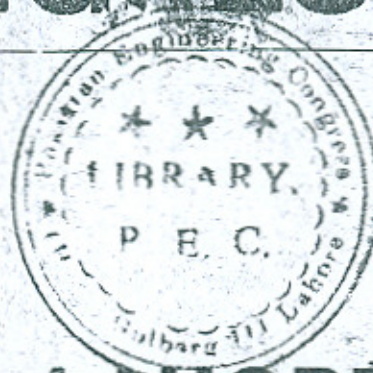


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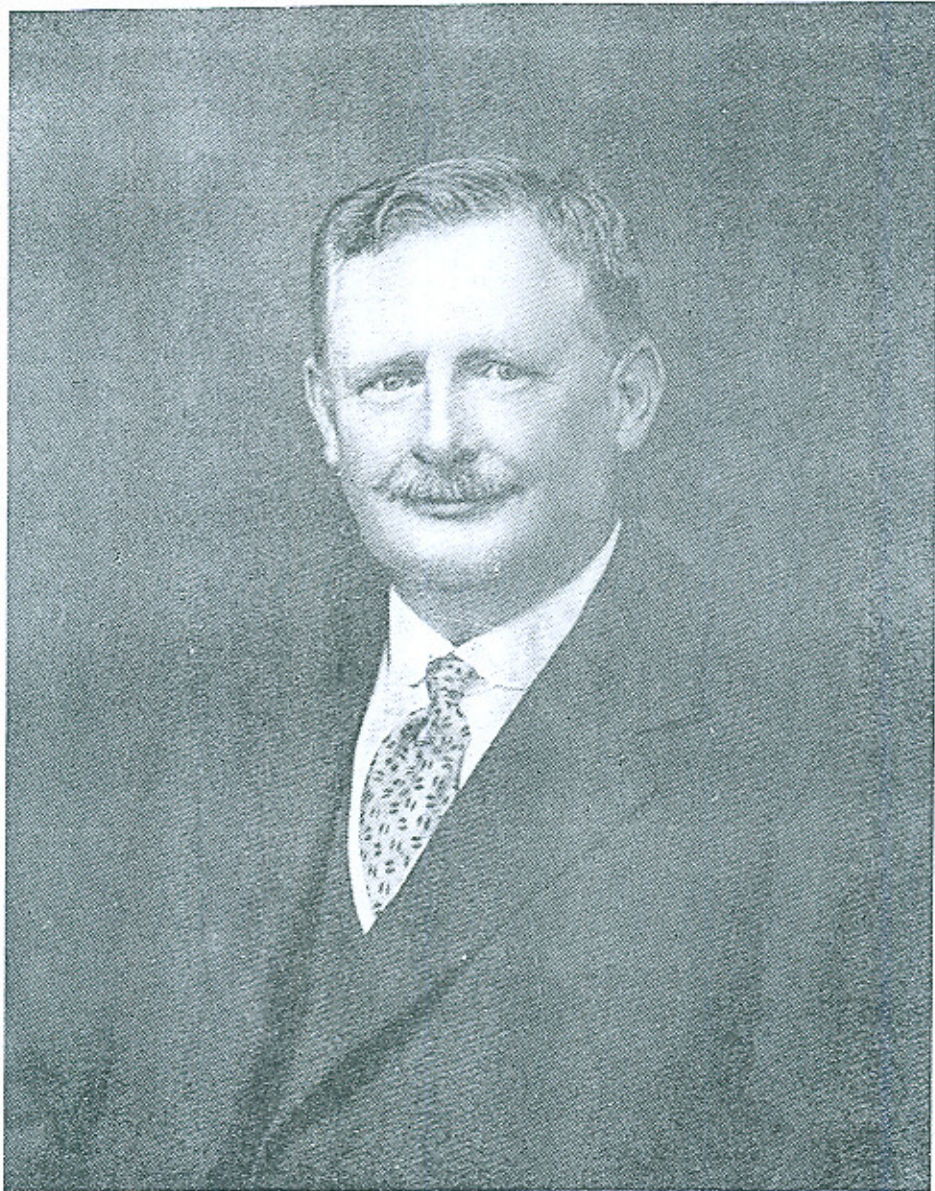
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ADDRESS

OF

Mr. E. R. FOY,
PRESIDENT.

April 1925.

YOUR EXCELLENCY, may I be permitted on behalf of the members of the Punjab Engineering Congress to express the great pleasure they feel at the honour conferred on us by your presence here this morning. The Congress owes much to Your Excellency's predecessors, who, by taking a keen interest in its welfare have raised it to the status of an established Provincial body in the Punjab. Knowing the interest their Excellencies have displayed in all matters relating to the welfare of the Province, and as the Services represented in this Congress exist for the purpose of producing that welfare, we are confident Your Excellency will continue to favour us with your support.

To the distinguished guests also who are good enough to sacrifice their valuable time in attending this morning, the Congress tenders its hearty welcome, and we feel sure that their presence will greatly further what we all have at heart, *viz.*, a close study of the many engineering problems which call for attention and which tend to produce the material, and as a sequence, the moral progress of this great Province.

GENTLEMEN, when I consider the able Presidential addresses given by the eminent engineers who have preceded me, I feel extremely diffident in having to address you this morning. I appreciate very much the honour you did me last year by electing me your President for the year which now closes with the Congress Session of 1925. The preparation of this address has long haunted me and in endeavouring to find something suitable to say to you I have studied the speeches of the past. I then took counsel with my friends explaining how hard I found it to say anything which had not been more ably said by my predecessors. They advised me to speak about the Sutlej Valley Project. This advice has been taken and as I address you on this subject, I beg that you will absolve me from any desire to be egotistical. The address is only meant to be an attempt to give you a brief account of some of the problems of the big work of which I have the privilege to be in charge. Whatever success has so far attended our efforts towards progress on this great scheme has only been rendered possible by the willing co-operation of a large staff of loyal workers whom I have the honour to direct, A further factor towards that progress is the unselfish way in which my colleagues have depleted the staffs in their portions of the administration in order to provide the Sutlej Valley Project with a nucleus of good men both officers and rank and file to carry on the good work. I herewith offer them my apologies for the incessant demands on their good nature and my sincere thanks for their help.

The majority in this room are aware that the Sutlej Valley Project is a scheme based on sharing the waters of the Sutlej between the States of Bahawalpur and Bikaner, and the Punjab Government. The work consists of constructing three weirs in the River Sutlej at Ferozepore, Suleimanke and Islam with new canals from each of these weirs. These canals are meant to bring water, either to deserts not previously favoured with water or to absorb old irrigation from Inundation Canals and give them controlled and better supplies in more efficiently designed channels. A fourth weir is also contemplated on the Pujnad below the confluence of the Chenab and Sutlej Rivers. From this last Weir two canals, one perennial and the other non-perennial will eventually be made, solely for Bahawalpur State.

I did at first contemplate giving you an account of how far we have progressed in this work, but as that would have made this more a glorified Progress Report than a Presidential Address, I have decided to allow you to ascertain those facts for yourselves from the next Administration Report. What I will now try to speak to you about are some special features which have arisen in the course of this Project which may be of general interest as being departures from ordinary methods of design and works construction customary in the past.

We will begin with Weirs. I assume practically every one in this room is sufficiently acquainted with them to know that in general terms the weirs so far built in the Punjab consist of a masonry obstruction built across the bed of the river having on the side where the canal takes out a section at a lower level called the undersluices. These undersluices are fitted with gates for a careful manipulation of the waterlevel above them. The weir itself has generally been fitted with falling iron shutters of such height as would maintain the desired level in times of low supply in the river. At Khanki and Rasul the shutters have been removed subsequently and the Weir Crest raised, but this causes a higher afflux level, allows the weir no elasticity, forces more than a fair share of the river on to the undersluices and induces flow upstream parallel to the face of the weir; that arrangement therefore has considerable objections. An exception to the general arrangement described above is at the Headworks at Balloki, where there is a Barrage fitted with gates from end to end across the river. This work, however, differs from ordinary Headworks in that it is for the greater part of the year a level crossing for passing the water brought down by the Upper Chenab Canal on the right bank, into the Lower Bari Doab Canal on the left bank. In no case in the Punjab, except at Tajewala are there canals taking out on both sides. Tajewala on the Jumna, however, is scarcely a model of design for new canals. It is, however, a specimen of splendid construction and good materials. How it stood up in the unprecedented flood at the end of September 1924 is a tribute to its makers. With the waterways jammed with logs and flood debris, having water pouring over the top instead of passing underneath, outflanked by broken bunds, yet, when the flood subsided these works were standing having lost little

more than portions of their parapets and a few unessentials of that sort. They are lasting monuments to the care and skill of the engineers of some hundred years ago and we of to-day, with our greater experience and knowledge must take off our hats to those men.

In the designs of the Sutlej Valley Project we have been faced with the necessity of having to arrange for canals, taking off on both sides of the weir. The far end of the weir, to that on which the canal takes off has till now been used as the "waste weir" portion, any surplus to the requirements of the canal being passed down the river there, so that the quicker moving and therefore more heavily silt laden water is kept as far from the canal as possible, the portion next the canal in the pocket above the undersluices being almost a still pond. With a canal on the opposite bank the silt stream must be moved to some other place, and this is obviously the middle of the weir. With gates at each end, and for convenience, shutters or some other regulating device in the middle, the next step is an easy transition to gates right across.

Having decided on gates right across, the most economical height of gate had to be investigated. Prices of various sizes were first obtained. Assuming various heights of gate and knowing the maximum discharge of river to be arranged for and pond level, the length of the barrage for each height of gate is a matter of simple computation. It then becomes a question of estimating. Shallow gates need long weirs and high crests, and with cost of gate versus cost of masonry, there comes a point where total cost of gate masonry is a minimum. In this way it was ascertained that the 15 feet or 16 feet gate was the most economical. This has led to very contracted rivers at our weir sites. In the following respects, therefore, it is claimed that the new weirs are somewhat of a departure from old types:—

- (i) Barrage of gates right across.
- (ii) Contracted waterway.
- (iii) A pair of long guide banks to compel straight flow on to the weir. Other weirs have guide banks but they are not as long as those now designed.
- (iv) The crest walls of old weirs were usually founded on a line of wells. Except as pier foundations wells are not now being used, a line of steel interlocking sheet piling replaces them.
- (v) The faces of the regulators are not at right angles to the line of the weir but are set back at a skew of 1 in 4.

By the contraction of the waterway a correspondingly higher velocity in the stream between the guide banks is induced during floods. It is felt, however, that a high velocity if kept straight by the guide banks is less a source of danger than if the river is so wide that the current has room to swing about and strike the guide banks obliquely.

Time does not permit of a detailed consideration of many other questions which have arisen and I can only here mention a few ; the principle of flumes where canals can be contracted without loss of head, thus enabling shorter bridges to be built ; cheaper bridge superstructures than the time honoured brick arch bridges of the past, cheaper falls, baffle walls at the ends of rapids to break the forward velocity ; design of distributary heads which will exclude silt, the use of machinery and labour saving devices, and the substitution of Portland Cement for the older lime mortars. These questions and others raise problems which are well worth the study of keen engineers and have been keenly taken up by all officers.

One of the lessons which the Project emphasizes and once more brings home is the necessity for organizing the supply services almost before doing anything else. Fortunately, the heavy volume of stone supply needed for four weirs and the lining of the Bikaner Canal was so prominent that it could not be overlooked. Later the supply for the Bikaner Canal was not needed ; the State asked that their resources should be utilized but a very large quantity of stone still remained to be handled. In order that there should be no hitch in the supply of materials, simultaneously to all three Headworks, it was necessary to open up and develop the Nalagarh Quarries, which 50 years ago supplied all the stone for Rupar and the Sirhind Canal, and in later years for the heavy training works at Rupar and the torrents crossing the canal. The visit of the Congress this year will be to these quarries. It is unnecessary, therefore, for me to say much and I will leave it to the members to judge for themselves the amount of work that has to be done before actual construction can get its supplies. To reach the quarries we had had to make a railway line from Doraha, 50 miles in length, the last 14 miles being over very difficult country. As the Sirsa Nadi has to be crossed, our operations on the Railway in the way of moving trains are liable to be interrupted during three months in the year by floods. Up-to-date 90 lacs of pitching and building stone have been excavated entailing 250,000 feet of drilling and 80 lacs have been sent out. In addition to the stone figures given above shingle and ballast to the extent of 25 lacs have also been sent out, and to get this material away 520 trains have been run out from Nalagarh and Rupar. Since May 1923, the weekly output now is 10 rakes of 60 trucks which means that nearly 40,000 cubic feet of stone is handled daily. This is a minimum, the figure has been exceeded and the limitations are the trucks available. Such quarries need their own compressor plant for drilling purposes, and an electric installation to give power for crushing ballast, pumping, etc. Tramway plant is needed for internal works, with B. G. trucks and locomotives for outgoing traffic. The station must have its own water supply for the plant, locomotives and drinking water, the last being essential to the health of such a large body of labour collected in one place.

A central lime manufacture depot has been started at Bahawalnagar from which lime is being supplied for all the works on the Project where

cement is not used. It is estimated that 17 lacs maunds of white lime will be outturned from this depot, and to handle it special machinery for feeding the kilns and for loading the wagons to carry away the output is needed and is being installed. To work this machinery an Electric Power House has been put up and is working at present for driving the workshop, lighting and pumping.

At Headworks in the past, the many varied jobs of pumping, breaking stone ballast, grinding surkhi and lime, were carried out by portable steam engines. Mr. Ashford very many years ago pointed out the economy and simplicity of a central power house with electrically driven machinery for each job. His views were considered, and after many careful estimates of various alternatives the central power house fully established its claim for economy and these have, therefore, been installed at each of the Headworks Sites. It may unhesitatingly be said they are all an unqualified success and have fully justified themselves.

Probably the most novel work in this Project is the lining of the Bikaner Canal. This is the first attempt to line a channel of this size and length in the Punjab and probably in India. The Bikaner Government was so anxious that State materials should be used that the Railway Department of the State has laid a metre gauge line about 80 miles long from Khai to Orki along the Bikaner Canal and this connects with the Bikaner Railway System via Sri Karanpore and Hanumangarh. Special trains are running from the Kankar deposits at Darbari to the dump sites along the canal. But this lining work deserves a chapter to itself for which there is no time and except to say that the raw materials are mechanically screened and ground and then the concrete is mechanically mixed and rammed with special pneumatic rammers, we must leave it for the visit of 1926, when a dump should be in operation near Ferozepore.

One thing which the execution of this Project has brought prominently to the front is that no large works of any sort can be carried out without perfect co-operation with other departments. I would refer in the first place to the great demand made on the officers of the North Western Railway, and I would now tender on behalf of the officers of the Sutlej Valley Project and myself our best thanks to Mr. Hadow and Col. Walton, Agents, Cols. Wilkinson and Cowie and Mr. Lines, C.E.'s and other officers for the help they have given us. In connection with this Project an entirely new junction station has been built at Chananwala; Bakhshan Khan and Doraha Stations have been converted into junctions: Hussainiwala near the Kaiser-i-Hind Bridge has been re-opened as a station, with sidings capable of handling full rakes of stone; at Khai, Orki, Bahawalnagar and Rohri, sidings have been put in specially for us. At Orki also a diamond crossing was laid to carry a metre gauge line over the Southern Punjab Railway. Another such crossing was set at Roranwala over the B. B. and C. I. Railway from Fazilka to Kot Kapura. The way the Bikaner Railway has helped us has already been described. In the course of all these activities,

there have been many consultations and discussions and, I can testify to the extraordinary good feeling and co-operation which has existed throughout.* We have further discussed other matters with the Railway such as the designs of steel bridges, and to Mr. Everall the Bridge Engineer, of the North Western Railway, we are indebted for much excellent advice. He has helped by designing for us and by placing at our disposal large quantities of reconstructed railway girders which we are able to utilize in our road bridges, on terms favourable to both parties.

With the Buildings and Roads Branch we have had a considerable amount to do in the way of selection of bridges for arterial communications, etc. The question of running the Trunk Road over the Ferozepore Weir has been decided and a combined Road and Railway Bridge has also been designed and ordered for the Suleimanke Weir.

In the Nili Bar it is the opinion of experienced Revenue Officers that a complete system of good communications will greatly enhance the value of the land to be sold. Here again the Railway, Buildings and Roads, in the Communication Board, and the Irrigation Branch have had to work together. We hope that the need of stone for metalling the roads of the new colony will cause a further demand on the resources of the Nalagarh Quarries and thereby cheapen our output.

In the matter of electricity we have made many demands on the time of the Electrical Engineer to the Punjab Government, and I think much of the success that has attended the installation of Power Houses, already referred to, is due to the advice which we have received from Mr. Milne.

The Posts and Telegraphs too have had their share in the working of the Project. Many miles of telegraph wires have been erected and all important sites down to Islam are linked with Lahore on one side, and with Multan on the other. Telephones have been erected at all three Headworks and at the Quarries. All these facilities tend to the prompt execution of business, and our thanks are due to the Divisional Engineers of the Telegraph Department.

The Forest Department has supplied us with many lacs of sleepers and much timber. In the matter of the valuable *rakhs* in the Nili Bar area, we have had to discuss with Forest Officers the utilization of fuel-wood in existing plantations and no doubt the allotment of lands for new *rakhs* will soon be to the fore.

The Survey Department of the Government of India has done much for us in rectangulation work, the rectangles again being broken up into subrectangles by a staff working under directions from the Financial Commissioner (Development). Precise levelling for a system of Benchmarks or Levelling on subrectangles lines, and the preparation of contour plans for the whole British and Bahawalpur area has been done by

* Although we have not always got all we wanted we must admit we have always been listened to.

the Survey of India and they are now preparing topographical surveys of the whole of the British area. Bikaner has done its own survey work.

In addition to the subrectangulation work done by the Civil Department their staff has also made a complete soil survey by 25 acre rectangles of the whole area to be colonized.

The Medical Department has opened up and supervised many new dispensaries to attend to the medical needs of the staff and labour employed all over a very large area.

We must also not forget the Finance and Audit Departments. The former provides the money, the latter checks the expenditure. I fear many officers regard these Departments as mixed blessings, but all will agree as to the necessity for their existence, and personally I can thank them both for many helpful suggestions. Mr. Davidson is always sympathetic, while I have heard Mr. Carson described as the most human Accountant-General we have had yet. A feeling of co-operation rather than of opposition should be encouraged, and with sympathy in dealing with the inherent difficulties of our work, I do not think Engineers will be found wanting in a desire to meet them half way.

The above shows how widely one must look for help in any big Project.

Gentlemen, Death has once more laid a heavy hand on engineers, some of whom were members of this Congress. I refer to the late Mr. J. H. T. Middleton, at one time our Honorary Secretary, the late Lala Sri Ram Palta, Executive Engineer, the late Mr. H. R. Morris, Assistant Engineer, who was up for membership, and Mr. W. Haines, Mechanical Engineer, at Suleimanke. I ask of you to think of them in silent reverence and to remember that but for their devotion to duty they would probably be here to-day.

Your Excellency, in conclusion we thank you once more for honouring us with your presence, and in closing I would ask you to be so kind as to address the members and declare the Congress open.