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which have prevented the export of wheat overseas, it has not been possible to give the elevator a full test. As soon as the export of wheat overseas is allowed it is probable that large quantities of elevator wheat will be put on the English market.

The after effects of the Great War are still being felt in many other directions. It has caused a shortage of funds, and owing to this shortage of funds, and also to the difficulty of framing new Railway "Branch Line" terms (which shall be sufficiently generous to attract capital in the present state of the money market and yet not too generous with respect to the probabilities of the future) the Communications Board has not yet been able to inaugurate any new railway developments in the Province. Much spade work, however, has been done and many railway projects, some of which have been in abeyance for years, have been arranged on a list in order of preference. As soon as the financial position has improved the Communications Board will be ready with considered projects.

The prospects for the development of agricultural tramways in various parts of the Province have been investigated by the Agricultural Tramway Engineer and in some instances detailed projects have been prepared. A system of a total length of about 200 miles in the Lyallpur area costing Rs. 56,00,000 has been projected in detail and its construction has been recommended to the Local Government. Possibly funds will be arranged for this in the Provincial Development Loan.

A comprehensive road programme is being drawn up involving an entire reconsideration of the question of the distribution of the financial burden between the Provincial Government and local bodies. Bound up with this question is the necessity for devising more suitable types of road than are at present known to us in this Province. The hitherto unrealised possibilities of the "Kacha" road are being investigated and trials are being made of other materials.

The Quarry Engineer has completed his investigations and has organised the available sources of stone metal supply, as a result of which all parties concerned are getting a more regular and cheaper supply of stone metal than before. At present the most desirable stones are not popular as owing to their hardness they do not bind properly. Investigations are being made with the object of overcoming this difficulty.

In the Nili Bar area it is intended to provide suitable communications before the colonisation and sale of Government lands. With this purpose in view a scheme of railways, tramways, and roads has been sketched out and funds are being arranged for in the Development Loan.

Other matters being dealt with by the Communications Board are trunk telephone lines, revision of motor vehicle legislation, the improvement of the bullock cart, the management of central depots of plant to be loaned to local bodies. The activities of the Board are thus varied and useful and only await a supply of funds to bear immediate fruit.

The report on the Sutlej River Hydro-Electric Project has been completed during the last year, and it gives an indication of the vast power resources possessed by the Punjab. The scheme has been designed to give 80,000 kw without the aid of any dam, *i.e.*, by directing the minimum flow of the Sutlej River through a 20-foot tunnel on the Nina Devi ridge beyond Rupar. The gross head amounts to 363 feet and the minimum flow is 3,300 cusecs. It may be mentioned that the building of the Bhakra Dam will double the amount of power available, while still further subsidiary storage will bring the figure up to 240,000 kw (continuous). In the 80,000 kw scheme it is proposed to transmit power at 132,000 volts by overhead cables as far as Lyallpur in the west and Delhi on the south, at the same time taking off 44,000 volt branch lines at places where the loads justify doing so. It will probably be possible to supply power to consumers of 20 kw and over at prices ranging from 65 to 1.5 annas a unit according to the size of the plant. While this very large undertaking may not perhaps materialise for two or three years there is every possibility that a smaller scheme (also investigated by Col. Battye) will be proceeded with. This latter—the Nangal Scheme—is a small plant of 8,000 kw which will supply power to the Kalka-Simla Railway, the Nalagarh Quarries, the hill stations and Simla.

The development of Public Electrical Supply Projects has not been so rapid as might have been expected. The main stumbling blocks in the past appear to have been lack of confidence on the part of promoters of such enterprises in the engineering and financial prospects of undertakings and the difficulty of obtaining unbiased expert technical advice in the preliminary stage. Applications for licenses have now been received for Rawalpindi, Jhelum, Sialkot, Gujranwala, Ferozepur, Lyallpur, Multan, Jullundur, Ludhiana, Ambala. Of these, three have been granted, *viz.*, for Rawalpindi, Jullundur and Lyallpur. Enquiries have been received regarding schemes for Hissar, Rohtak, Fazilka, and Abohar, and the Government Electrical Engineer has furnished approximate figures of expenditure and income. The Punjab Hydro-Electric and Industry Development Association has made no progress with its scheme and the Lahore Electric Supply Co. has decided not to take power from it. Concessions have been applied for on certain falls on the Upper Bari Doab Canal, the Sone River (near Rawalpindi) and the Ravi River above

Madhopur. Government has now appointed an Engineer who is carrying out a systematic hydrographic survey of the Province.

On 11th February 1922, His Excellency the Governor of the Punjab, Sir Edward Maclagan, opened at Rawalpindi a refinery for the Attock Oil Co. As far back as 1866 the Punjab Government started boring for oil near Fatehjang but with no success. Some 10 years later another attempt was made in the neighbourhood of Cherat.

Another decade passed and then a syndicate brought over Canadian drillers who put down trial borings in several parts of the country with still no success. It was not till 25 years later, *i.e.*, in 1912, that another enterprising syndicate tried Golra at about the same time as a small syndicate, which subsequently became the Attock Oil Co. was engaged in examining an area near Cherat.

A geologist, Mr. E. S. Pinfold, then came to the rescue and succeeded in finding an area at Khaur, about 42 miles south-west of Rawalpindi, which showed every promise of being structurally favourable for the accumulation of oil. It was a remarkable fact that the area and the seepages at Khaur, if they had not escaped the attention of all previous prospectors, which was unlikely, had apparently been regarded as of no value, and this in itself was a striking testimony to the advancement of geological science as the handmaiden of industry, exemplified in this instance by the skilful interpretation given to the geology of the Punjab by Mr. Pinfold, who could say, "dig here and not there, and you will probably find oil at such and such a depth."

The first well put down at Khaur in January 1915 struck oil in payable quantities at the shallow depth of 217 feet. The capital of the Attock Oil Co., which originally stood at £ 25,000, now stands at £ 1,500,000 paid up and it has built an installation on thoroughly modern up-to-date lines capable of handling 65,000 gallons of crude oil per day, and of producing from this the highest grades of kerosene, petrol, motor and lubricating oils. The Punjab, as we all know, is one of the wealthiest provinces in India, but it lacks one important commodity required for further expansion, and that is adequate supplies of fuel within its own borders. If the supply of fuel can be assured by the development of oil resources an industrial revolution will be brought about in the province so far as expansion of some of the indigenous industries is concerned.

And now I come to the Punjab Portland Cement Works, which will probably be the largest industrial factory in the Punjab. They will certainly be the most up-to-date cement works in India. This industry is to be supported by Government purchasing a large share of its requirements of cement from the company and

it is hoped that a considerable impetus will be given to industry generally in the province by cheaper cement being available than hitherto. It has been said that the measure of a country's prosperity may be gauged in these days of industrial progress by the extent of its cement interests. It is certainly a fact that without cheap and plentiful supplies of Portland Cement the progress of industrial development is greatly hindered.

The site for the Punjab Portland Cement Works, which was selected by the promoters, Messrs. Killick Nixon and Co. of Bombay, after an exhaustive examination of the possibilities of many other areas, possesses the essentials of an inexhaustible supply of limestone and clay of admirable quality for the manufacture of 1st class Portland Cement. It is conveniently situated near the main line of railway to Peshawar and a new station called Wah has recently been opened. The quarries of the Wah Stone Quarry and Lime Co., Ltd., adjoin the cement company's site. An abundant supply of clear cold water is available from the Chablat river which is fed by copious springs. On this site have sprung up in the last 12 months a medley of brickwork, cauldrons, steel plates, and girders, which will eventually develop into a succession of buildings wherein machines will be installed and the various processes will be performed. Huge blocks of limestone will be broken by giant jaw-crushers into ballast, which will be fed together with clay from the Clay Wash Mill into revolving drums, in which the mixture is to be ground by means of hardened steel balls and flint pebbles to a pastey slurry, which, after treatment, is pumped into the rotary kilns, which are revolving steel cylinders resembling giant telescopes on massive concrete founds. Through these rotary kilns are blown long flames of coal dust and air, and the slurry is gradually converted into "clinker." It has then to be cooled in other rotating cylinders, and is finally pulverised to "Portland Cement." Cement making, of course, is not a simple matter of grinding, burning and again grinding. These are the mere processes but in practice the amount of testing required from first to last, and the adjustment of the chemical composition of huge masses of material, involve an enormous manipulation by compressed air, an infinity of stirrers, pumps, grinding mills, and complicated machinery, all of which has to run 24 hours a day and practically without stoppage all through the year. This again involves expert engineering and chemical knowledge combined with experience of the idiosyncracies of the various materials until the manufacture, which has appeared so simple to the uninitiated, becomes a series of mystic rites. The question of cement is of great importance to all members of this Congress and I have, therefore, brought these new works to your notice.

Another of the great economic changes, in the inception of which the Great War was a most important factor, was the sudden

demand for the supply of forest produce of all sorts in vast quantities. This demand stimulated production, and forced the enormous possibilities latent in the forest estates upon the public notice generally in a way that nothing else could have accomplished. In every civilised country forests had assumed an importance never before achieved. The Punjab forests constitute one of the finest properties ever held by any Government in the world. This property is now entering upon a new era of enhanced economic production. In view of the extreme importance of developing the resources, and incidentally the revenues of the Forests, it has been considered important that the organisation of the forest Engineering Service should provide means for coping with the ordinary work of communications and buildings as well as for the exploitation of forests by special means requiring expert knowledge of logging operations. It has, therefore, been suggested that a Forest Engineering Service should be developed so as to provide experts in logging operations and engineers for construction and maintenance of roads and buildings. Improvements in communications will bring the remotest forests into closer touch with the rest of the country and the future work of the department will henceforward be more in the limelight and its results will be known to a constantly increasing extent.

The activities of the consulting Architect's branch have increased largely during the past year. Many designs have been prepared for structures under erection in the capital and outside it, covering the field of administration of every department. Among public buildings the most important have been designs for a Currency Office, and a Telegraph Office in Lahore, extensive additions to the High Court, judicial and other buildings at Sheikhpura, the Government College Hostel, extensions to the Agricultural College, Lyallpur, a Medical School and Hostels at Amritsar, a new Chemical Laboratory, and a Law College for the Punjab University. Preliminary plans and rough estimates for the construction of the Charing Cross Scheme consisting of blocks of administrative offices round a legislative council chamber have been prepared but as the scheme is estimated to cost a crore of rupees financial considerations have caused it to be put on one side for the present.

And now, gentlemen, I conclude this review of the various schemes for provincial development with a quotation from an article by Sirdar Jogendra Singh, who referred to the Punjab of old as "a land of brave and valiant men but sun-baked and dry, yielding crops only when the rain god was kind, or droning Persian wheels lifted buckets full of water to keep alive patches of green crops. In the Punjab of the present the waters of our rivers flow from door to door transforming arid lands into fertile fields. The Sandal and the Ganji Bars have been broken, providing ample

fields for the growing population. There are new schemes to irrigate more millions of acres, and new industries awaiting capital. In a few years some of our great falls will be harnessed and electricity sweep our rooms, plough out fields and cook our food. The promise of peace holds the promise of growing prosperity."

Also His Royal Highness the Prince of Wales, in his parting address at Karachi, speaking of the great progress in expansion which had taken place in that city, said, "Your expansion is the outcome of that triumph of engineering and colonising skill which transformed millions of acres of desert into a granary of India, which has added, in no small measure, to the world's stock of food, grain and clothing, and peopled a vast place with a happy and prosperous peasantry. I read in this a symbol of the good which united effort can secure in India..... The rapid growth of your city and population, your ever expanding export trade, and your growing importance as a focus of communications are a direct result of one of the most striking achievements in India."

To keen engineers all these schemes are of fascinating interest. To ensure rapid development hearty co-operation between the various engineering services of Government is required, and I trust that the efforts of all of you will be concentrated in that direction.