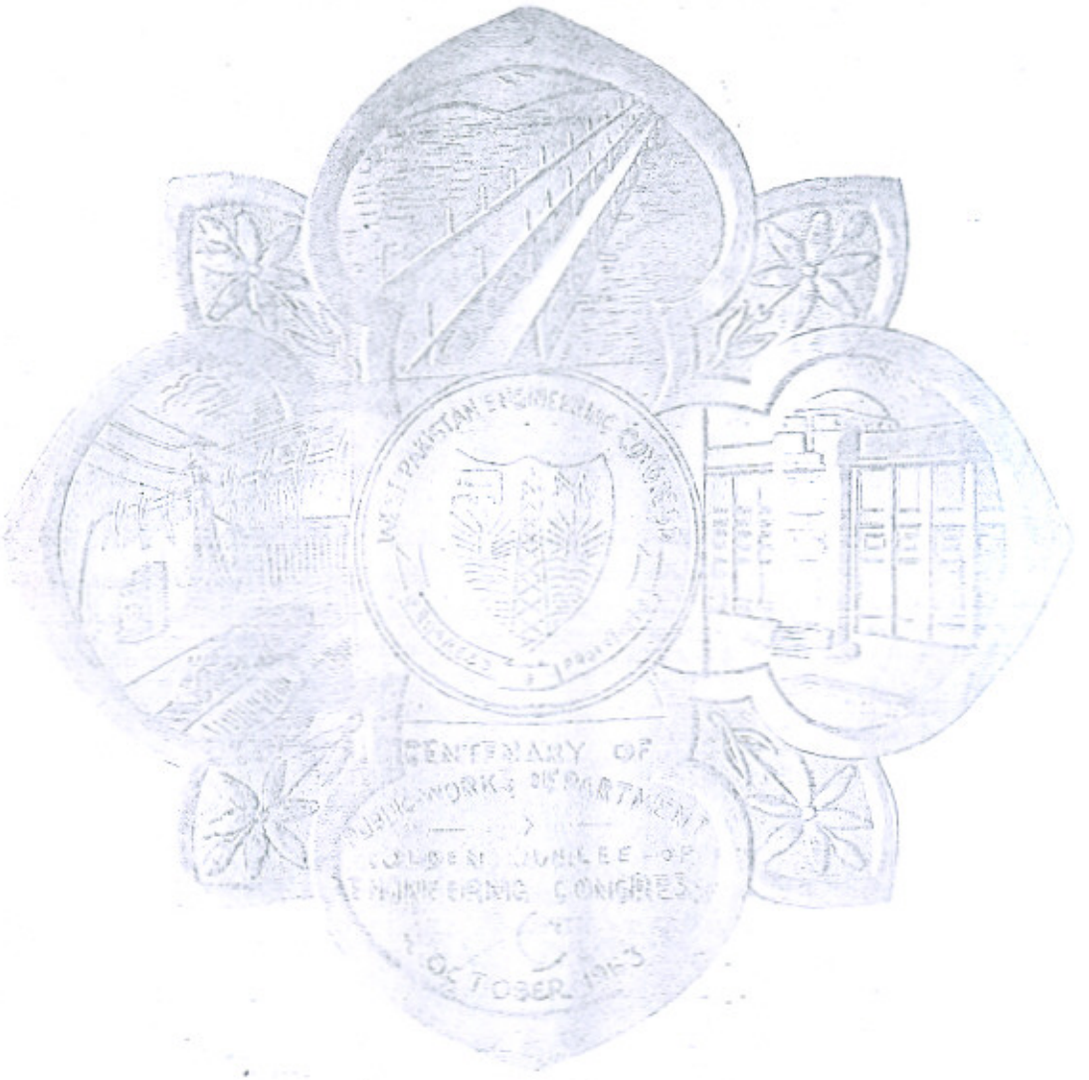
ENGINEERING NEWS

Vol. VIII DECEMBER 1963 No. 4



The Souvenir of the Golden Jubilee of the Engineering Congress and Centenary of the Public Works Department.

QUARTERLY JOURNAL OF
THE WEST PAKISTAN ENGINEERING CONGRESS

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• Reprints from this journal be made on condition that full credit is given to the Engineering News and the author and the date of original publication is stated.

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ENGINEERING NEWS

Quarterly Journal of the West Pakistan Engineering Congress

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CONTRIBUTIONS

TO

The Next Session of the Congress

THE Next Annual Session of the Engineering Congress will be held sometimes in March, 1965. Members of the Congress and the Engineers in general are requested to intimate the Secretary, Engineering Congress, by the end of July, 1964, THE SUBJECT OF THE PAPER WHICH THEY INTEND TO CONTRIBUTE. One page synopsis will be required by the end of August and the paper is requested to be submitted by October, 1964.

Subject for Symposium :

Members are also requested to suggest the subject matter of the symposium for the next session of the Congress. Intimation may be sent to the Secretary of the Congress.



GOLDEN JUBILEE CELEBRATED

In October, 1963, the Engineering Congress celebrated its Golden Jubilee in association with the Public Works Centenary. Never before in the last hundred years, have such a galaxy of engineers met together, to take stock of their past achievements and with such bright future. An international gathering of talented engineers, famous in the world for their creative imagination, old and young, retired and in active service, more than a thousand of them, gathered in the historic Pandal, within the premises of the famous P.W.D. Secretariat, looking back with keen interest to the outcome of their perseverance and with assurance of their future laurels.

The Engineering News Organization proudly presents this Number, having seen the fulfilment of its suggestion and desire. It was in June, 1961, when a suggestion was put forth through the columns of the Engineering News reminding the Engineers to celebrate their 50 years of achievements through the medium of the Engineering Congress. It was a great task, a heavy ordeal and a big responsibility difficult to discharge, yet with the traditional upbringing and training of the engineers, the responsibility was shouldered. The Executive Committee welcomed the idea and started to work to get it through.

Fortunately the council in 1962-63 elected Mr. A. R. Kazi as its president. In company of many selfless, hard workers like H. J. Asar, A. R. Qureshi, Dr. Mubashar, Dr. Mushtaq, Shamim, Latif and others, the work was started with the traditional ability of Engineers to face difficult and arduous tasks and within a year organized a meeting which shall for ever be remembered in the history of the Engineering Profession. In a short period they organized an international meeting of engineers, produced volumes of literature, organized a unique exhibition, the first of its kind in the engineering history of the country, arranged for research papers, a symposium, a study tour and entertainment for the participating engineers. The organizers had to look to

hundreds of other minor details which can be appreciated only by those who have ever had a chance to organize such conferences.

An international meeting of this scale needs funds and it will be surprising for the members to learn that the whole conference was organized from donations without burdening the meagre funds of the Congress.

In this issue we have introduced the main function, have repeated good-will messages, important addresses with brief reviews of progress of the last one hundred years.

The Public Works Centenary combined with the Golden Jubilee not only raised the status of the celebrations but helped to bring together eminent engineers from home and abroad, whose actions, one time or other, have helped to raise the status of the nation.

The two organizations netted together, Engineering Congress celebrating the fifteenth birthday of professional advancement and technical understanding and the Public Works Department celebrating the hundred years of dedicated service to the nation, amplified the importance of the events. The Congress symbolised the mental faculties and Public Works furnished the tool to achieve by physical means the minds' creative imagination. It offered an opportunity to rededicate to the Congress motto of 'Prosperity and Progress' and to look back with pride to the last 100 years of achievements and with a resolve to redouble the efforts and perseverance to undertake still glorious achievements.

This gathering of augustus old associates with recollection of some of their achievements, was a great source of happiness and satisfaction.

It was shared by the President of Pakistan who felicitated the Engineers on the completion of hundred years of dedicated service to the nation.

The future of the Engineering profession is now a growing dimension. They have to persevere to achieve still higher and louder laurels with an expeditious speed in spite of all the meagre resources at their disposal, yet with a vast multitude of manpower.

Let us strive hard and harder, let us soar high and higher, quickly, keep in our mind foremost, all the good words, words of encouragement and felicitation, said about us. Let us be true to bring the Prosperity and Progress through sweat and hard labour.



P.W.D. Holds Centenary and Engineering Congress Golden Jubilee

Seventh October, 1963 will ever be remembered in the history of Public Works of this country as a great day when the Engineers of West Pakistan celebrated their 100 years of dedicated public services. Whereas the engineers served the nation by their sweat and perservance, the Engineering Congress was the brain behind all their actions and achievements.

This celebration was unique in bringing all the engineers of various trades and interests together to exhibit their achievements of the past 100 years. On the eve of the session, Irrigation Power Department and Communication Works Department issued small handy brochure introducing briefly their evolutionary growth to the service of the country. Important dailies published special supplements on engineering achievements of merit. Two voluminous publications introduced hundred years of P.W.D. and West Pakistan Engineering Congress in the form of special articles. Sixteen articles on engineering advancement were printed in the hundred years of P.W.D. and seventeen scientific articles based upon the contributions and papers of the Congress formed the subject-matter of the second publication. Contributions on tube-well, water-logging and salinity, canal lining were abstracted in a special Golden Jubilee Number of the Engineering News.

In the session presentation of the Congress Medal and the unveiling of the commemoration plaque of the centenary celebration was performed by the President and so was the opening of the Engineering Exhibition contributed by Communication Works, Railways, Electricity Wapda and Irrigation Departments. It gave a good review of the last hundred years of achievements. The highlights of the regular session were eight engineering papers and a symposium on Water-logging and Salinity. Another feature of this session was the dinner and luncheon speeches by Guest Speakers, Messrs. G. M. Binnie, E. C. Ichner, G. T. McCarthy and Mohammad Azam Khan. A three days' visit to Engineering Works at Mangla, Sidhnai and Mailsi concluded the session. The Conference organizers had received a large number of good-will messages which included from the President of Pakistan, the Governor of West Pakistan, the Minister for Food and Agriculture. Engineering Societies and Organizations of the world sent their representatives and



President Ayub presenting the Congress Medal to Mr. A. R. Kazi.

delegates besides the despatch of good-will messages.

Many engineering consulting firms and individuals generously contributed to the Golden Jubilee Session. Messrs Binnie and Partners, Tipton and Kalmbach, Tippetts—Abbett—McCarthy—Stratton, Harza Engineering International, Guy F. Alkinson Mangla Dam Contractors, Sir MacDonald and Partners, Coode and Partners, Ghulam Farooq, Dr. Mubashar Hassan and Kh. Azim-ud-Din were some of the notable contributors besides the generous help from Government. Packages Limited, Siemens, Conforce Ltd., Rotary Club and Pakistan Art Council entertained the delegates to lunches, dinners, etc.

We intended to brief the members of the Engineering Congress through the medium of this Quarterly with the activities of the Centenary celebration with brief abstracts of published materials, but the volume is so much that it is impossible to cover it in one issue of the journal.

In this volume and in the next two, we may be including some features of the information for all those who due to unavoidable reasons could not participate in this important session.

FOREIGN DELEGATES

A large number of Delegates from various countries attended the Session. Several consulting and engineering firms sent their representatives.

They included : Mr. A. V. Karpov, an eminent American consultant who has worked for several years on the development of water resources in the Indus Basin; Mr. Geral Lacey, a celebrated engineer and a former Professor in Civil Engineering at Roorkee; Mr. Mcdonald and Mr. Middleton of Sir Mcdonald and Partners of the United Kingdom; Mr. K. K. Framji, Secretary-General of International Commission on Irrigation and Drainage, New Delhi; Mr. Kanwar Sain, a former Chief Engineer of the Irrigation Department and now an Associate of the United Nations Economic Commission for Asia and the Far East, Bangkok; Mr. G. M. Binnie, senior partner of Messrs. Binnie and Partners, London, consultants for the Mangla Dam; Mr. G. D. McCarthy, head of the American consultants for the Tarbela Dam and President of High Dams Association, America and Dr. Olivier and Mr. P. A. L. Patton, the World Bank consultants for the Indus Basin Projects.

Dr. H. L. Uppal, Director Amritsar Irrigation Research Institute, Sir T. A. W. Foy, late Chief Engineer who constructed Ghulam Mohammad Barrage, General Itchner and Mr. Kalmbach were the other well known engineer delegates.

Mangla Dam contractors sent Guy F. Atkinson and Geo. H. Atkinson. Siemens was represented by Dr. Rudolf Harlt and Dr. Karl Schsocder.

Mr. J. R. Carson represented Engineering Institute of Canada and Dean Milton E. Bender Jr., Seato Graduate School of Engineering.

These were some of the well known foreign engineers. The list is not complete. It is not possible to list all the delegates, but the above-mentioned names show the status of the participants.



Engineering Exhibition is Declared Open by President Ayub.

West Pakistan Engineering Congress

Elects New Council, 1963—65

The general body of the Congress elected the new council on 19th October, 1963. The management of the Engineering News takes pleasure to introduce the new councillors.



CHAUDHRY ABDUL HAMID,
President 1963—65

Chaudhry Abdul Hamid is Chief of Electrical Engineers of West Pakistan. For 33 years he has served the Electricity Branch of the Engineering.

During the last four years his department has seen vast expansion of Electrical production and transmission. In a separate article on the Power Production we intend to give some facts and figures of the increase of the power production which has taken place during recent years and particularly since he held the command of the department. The Multan, Hyderabad, Quetta, Sukkur Power Stations came into production recently. Earlier he was responsible for the completion of Rasul Power Station, and the three hydel stations of canal falls at Chichoki Mallian, Shadiwal and Gujranwala came into production when he was controlling the department.

The transmission and distribution of 130 miles of primary grid of 132 kv, 200 miles of 66 kv line, 136 miles of 132 kv, Wah Jhelum transmission line, 220 kv line from Multan to Lyallpur, electrification of tubewells for salinity control and reclamation schemes, village electrification projects and the future planning of the development scheme are a few results of his untiring efforts. He brings with him the vast experience gained at home and abroad for the generation and transmission of electricity.

As an Operative Director of Power, he conducted an extensive tour of Europe and many other countries. As Chief Engineer of

the P.I.D.C., he visited Europe several times during 1954 and 1958. In connection with the settlement of loan from D.L.F. authorities, for high volt transmission lines, he visited Washington in 1958. In 1961 he represented Pakistan in EACFE Power Conference in Bangkok. In 1962 he was a delegate from Pakistan to the CIGRE Conference in Paris. On the invitation of Canadian Government he visited Canada in 1963 as a delegate to the Operation World Market Machinery.

He has been a Vice-President of the Congress. We are certain that with his vast experience of the engieering profession, collected at home and abroad the Congress organization will benefit to a large extent.

Vice-Presidents 1963—65.

The Council elected five Vice-Presidents, three of whom were new-comers and the rest were Vice-Presidents in the last year Council.



Mr. A. G. M. SHEIKH

A new Vice-President of the Council. He has served the Profession for the last 31 years mainly in the Buildings and Roads Department. He was the first Secretary of the Building and Roads Department of the ex-Sind Province in the year 1953. For the last eleven years he is serving as Chief Engineer in different capacities. Since the creation of the West Pakistan Public Health Engineering Department he has worked as its first Chief Engineer and is still continuing in the same capacity. The council will have the benefit of his ripe experience.



SAYYID HAMID

The general body of the Engineering Congress slected Sayyid Hamid as another new Vice-President. A graduate of University College Cardiff of Wales in 1935, joined the Irrigation Department in 1937. His important assignments in the profession included an executive of Bhakra Dam Construction Division, Under-Secretary in Government of ex-Punjab, an Officer on Special Duty for Water-logging and land reclamation investigations. This was the subject to which he ultimately drifted to become chief of all the water-logging and salinity measures and projects in the country. After his study tours first in August 1951 during the construction of Rasul Tubewell Projects and later in Australia for selecting tubewell equipment, he

took over, in 1954 as the first Project Director of Ground Water, Development Organization. In 1958 he became the Chief of the Water-logging and Reclamation Division of West Pakistan, Wapda. During the last 6 years his organization has taken several important actions and decisions which will have far-reaching influences on the vexed problem of the country. His latest study tour included a visit to Russia in 1963 where he went as a member of Pakistan Delegation to study water-logging and salinity control measures adopted in that country.

Mr. A. R. AKHOOND



Mr. A. R. Akhoond, Chief of West Pakistan Railways, is the third Vice-President of the Council of West Pakistan Engineering Congress. He was Vice-President last year also. He brings with him 26 years' experience of working in the Pakistan Railways in different executive categories. He has been a specialist of the Bridges. Since 1944 he made this branch of engineering as a subject of his specialisation. In 1952 he was Deputy Chief Engineer Bridges before taking over as Director Civil Engineering, Railway Board. In February 1961 he was posted as Chief Engineer Railways. His interest in design of bridges took him to U.S.A. to improve his technical information on the subject. His ripe background of railway engineering will be an asset to the Congress.

Dr. MUBASHAR HASSAN

Every young Engineer is well acquainted with Dr. Mubashar Hassan as a Professor of the Civil Engineering Department in the Engineering College and later on the Engineering University of Lahore. For more than a decade he has taught Hydraulics and Fluid Mechanics to graduates of the Engineering College. At least three-quarters of the young engineers in West Pakistan are his students. His experience of educating and training the young engineers is a great asset to the council. He has background of several years of working of the Executive Council of the Congress. He was a Vice-President in the last Council also.



Ch. MOHAMMAD ASHRAF

With the selection of Mr. Mohammad Ashraf as the fifth Vice-President, members of the Congress have introduced a young energetic engineer among the Vice-Presidents.

Besides his sixteen years' experience of the Engineering profession, the council has one of its Vice-Presidents for the first time in history possessing great interest in games and athletics. As a student in the Engineering College, Lahore in 1943 to 1945, he was winner of many athletic challenged cups, a champion of the College Tennis team, a University Hockey player etc. As an Engineer since 1946 when he joined as S.D.O. he had worked on several projects in connection with operation of canals, pumping of tubewells and groundwater investigations.



Mr. I. A. H. BOKHARI,

Secretary, West Pakistan Engineering Congress, Lahore.

In the history of West Pakistan Engineering Congress, it is the first coincidence to have both the Secretary and the President from the same branch of Engineering. Mr. I. A. S. Bokhari, although has joined the Executive Committee for the first time, yet he is a seasoned engineer. Born in Lahore in 1919, he graduated in Electrical Engineering from the Panjab University in 1940. At the college he won the Dunlop Smith Scholarship for his brilliant academic career. He obtained his Master of Electrical Engineering in 1946 from Brooklyn Poly Technical Institute, New York, and received his practical training with the Bureau of Reclamation, Denevor, and Garike Oil and Transformer Company, New York.

He was appointed Projects Engineer in 1949 in which capacity he continued to work until 1958, when his services were requisitioned by the West Pakistan Water and Power Development Authority. Mr. Bokhari has been responsible for the Planning and Designing of Electric Supply Facilities in the Public Sector in West Pakistan and has been actively associated with Irrigation Department on the development of hydro-electric power and carrying out the Salinity Control and Reclamation Schemes. Although Mr. Bokhari is an Electrical Engineer, he is often identified with Irrigation Engineers because of his extreme intimacy with Multi-purpose Projects.

As an electrical expert he has worked as an Adviser to the Federal Capital Commission and a convener of the Committee

on Gas and Power. He also worked for some time as a membe. of the Board of Studies in the Engineering University, Lahore.

Mr. Bokhari has visited many countries of the world which include U.S.A., Germany, Switzerland and Japan in connection with professional duties.

The Congress is lucky to have such a renowned engineer for the office of Secretary for this session.

Election of Office-bearers

The Council in its first meeting held on November, 1963 elected a number of office-bearers to be entrusted with various duties. These include :—

1. Mr. I. A. S. Bokhari, Hon. Secretary.
2. Mr. Mazhar-ul-Haq Saeed Ahmad, Honorary Joint Secretary.
3. Mian Mazhar-ul-Haq, Honorary Auditor.
4. Mr. Mohammad Saleem Akhtar Bhally, Honorary Treasurer.
5. Mr. E. I. Jauhri, Honorary Business Manager.
6. Dr. Nazir Ahmad, Honorary Editor, Engineering News.
7. Mr. Abdul Latif Mirza, Honorary Publicity Secretary.

Members of the Council

The following constitute members of the Council for the years 1963—65.

1. Mr. A. R. Kazi, S.S.E.I., Secretary to Government of West Pakistan, Irrigation and Power Department, Lahore.
2. Mr. H. J. Asar, P.S.E.I., Chief Engineer, Remodelling Organisation, 32-B, Gulberg Road, Lahore.
3. Mr. A. R. Qureshi, P.S.E.I., Chief Enigneer, B & R, Central Region, Lahore.
4. Mian Saeed Ahmad, P.S.E.I., Chief Engineer, B & R, Quetta.

5. Mr. S. S. Kirmani, P.S.E.I., Chief Engineer, I.B.P., Wapda, Sunny View, Lahore.

6. Sardar Allah Bakhsh, P.S.E.I., Superintending Engineer, Nili Bar Canal Circle, Montgomery.

7. Mian Mohammad Khalil, P.S.E.I., S.E., B. & R., Abbottabad.

8. Mr. Akhtar Hassan, S.E., Primary Grid Circle (Electricity), Lahore.

9. Mr. Jamil Asghar Khan, P.S.E.I., Deputy Project Director, Link Construction, Wapda, 4 Davis Road, Lahore.

10. Mr. Atta-ur-Rehman Khan, P.S.E. I. Executive Engineer, Hazara Irrigation Division, Abbottabad.

11. Mr. Mohammad Rashid Vohra, S.E., Public Health Engg. Circle, National Stadium, Lahore.

12. Sh. Tanwir Akhtar, P.S.E. II, Executive Engineer, 330-N, Samanabad, Lahore.

13. Mr. Iqbal Ahmad Shahab, Executive Engineer, Civil Works Division, 5, Court Street, Lahore.

14. Syed Nazir Ahmad Shah, Executive Engineer, 4th Construction Division, 2, Noon Avenue, Lahore.

15. Syed Faiz Omar, Executive Engineer, Stadium Construction Division, National Stadium, Lahore.

16. Mr. Bilal Ahmad, P.S.E.I., Deputy Project Director, Barrages, WAPDA, Satellite Town, Gujranwala.

17. Mian Iftikharuddin, Section Officer, (Publication) C & W. Department, Lahore.

18. Mr. Iqbal Ahmad Beg, Executive Engineer, Public Health Engg. Division, Satellite Town, Rawalpindi.

19. Mr. S. M. Seraj-uz-Zaman, P.S.E. II Section Officer, Operations, I & P Department, Lahore.

20. Mr. A. B. Akhtar, Executive Engineer, Islam Division, Pallah, Distt. Bahawalpur.

Felicitating and Messages of Good-Will

On the eve of a week long celebrations connected with one 100 *years of the existence of Public Works Department and the fifty years service of the Engineering Congress, a large number of Good-will messages were received. The important ones from selected persons are presented in this issue.*

PRESIDENT AYUB

Appreciated Engineers Dynamic and Dedicated Role in the Development of the Country.

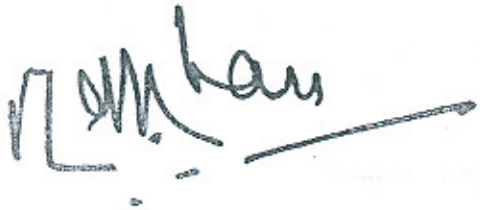
Completing a hundred years of life is a notable landmark in the history of an institution and I take this opportunity of felicitating all ranks of the Public Works Department on the Centenary. The Public Works Department took the field when there was no other agency for carrying out public works and it has played an important role in building up a sound infra structure for the development of the country.

The tasks which lie ahead of our engineers and technicians are much greater in magnitude and significance. For instance, the remodelling of the biggest irrigation system in the world, consequent upon the division of the waters of the Indus Basin, is a challenge to the ingenuity and creative thinking of our engineers, and I am confident that they will prove equal to the occasion. Scientific and technical knowledge is growing at a rapid pace and, if our engineers are to keep abreast of the times, they must devote themselves to research and study while engaged on actual work in the field.

Our resources in building materials are deficient and our research institutions have yet to devise means to exploit the indigenous material to the maximum extent. This aspect of their work needs much greater attention than has been given to it hitherto.

The engineering services are responsible for spending a large portion of the national budget every year and this imposes on them the responsibility to achieve the maximum results with minimum outlay. It also requires hard work, patriotic fervour and a spirit of self-sacrifice in the larger national interest, for on them depends to a great extent the development of our country within our limited resources.

I am confident that all ranks of the engineering profession will continue to play a dynamic and dedicated role in the development of the country.



Mohd. Ayub Khan
President, Pakistan.

MALIK AMIR MOHAMMAD KHAN

Praises the Engineers for the Remarkable Achievement of the Public Works Department.

I am delighted to felicitate the engineers of my Province on the auspicious occasion of the celebration of the P.W.D. Centenary and the Golden Jubilee of the West Pakistan Engineering Congress. The achievements of the P.W.D. over the past hundred years in all its fields of activities are indeed remarkable. The gigantic network of irrigation canals they have built for the Province is a standing tribute to their industry and skill. It is unique in the world and has the distinction of being the largest single irrigated area on the globe. To them also belongs the credit of rapidly expanding road communications and fastly increasing the generation of power to cope with the heavy demands of agricultural and industrial development.

On this occasion, the engineers will naturally look back to a century of their performance. In doing so, they will have ample reason to be proud of what they have done. They must at the same time resort to stock-taking and make the occasion a starting point for preparing to take up bigger challenges that confront them. In the years to come the Nation expects more of them, and to measure up to the people's expectations they will have to work with redoubled energy and in a missionary spirit. The Province faces the grave problem of water-logging and salinity. The lands eaten away by them have to be reclaimed and made productive again. The ever-increasing population demands more food and fibre. They need more and better shelters, quicker and streamlined means of communication, more power to turn the wheels of industry faster than ever before. In all these fields the engineer has a vital role to play. To the extent they are able to do so they will rise in the people's estimation. In their efforts to serve the people and raise their standard of living they shall receive the consideration they deserve from the Government.

I am happy to know that the West Pakistan Engineering Congress on this occasion of Jubilee Session has arranged a symposium on Water-logging and Salinity. This is a measure of the engineers' awareness of the evil and their anxiety to find a solution to the grave problem. The Congress has indeed served in the past as storehouse of engineering ideas. This has to be preserved, improved and put to the best possible use. My advice to the engineers is to do your best in the service of your country and the Nation.



(Malik Amir Mohammad Khan)
Governor, West Pakistan.

MALIK QADIR BAKHSH

Minister for Food, Agriculture, Irrigation and Power, West Pakistan.

A creditable past and extremely reassuring present

It gives me great pleasure to felicitate and greet other ranks of the Public Works Department on this occasion of completing the hundred years of dedicated service to the nation.

The services in the Public Works Department are instrumental in developing the material resources of the country and putting them at the service of the community. The pattern of society undergoes quick changes, sometimes beyond the recognition, as a result of the efforts of the engineering community. The advent of machine age and lately the space age has led us all to develop a high tempo of activities to improve our standards of living and build up a sounder economy to catch up with the rest of the developing nations.

The results of the one hundred years of the professional activities are apparent all around us. The sandy deserts now bloom with lush green fields and wilderness of the sandy 'Bars' is now bustling with a brisk life. A quiet revolution has been brought about by the wonderful system of barrages and canals that provide thousands and thousands cusecs of water to parched lands, feeding the blood arteries in the body-economic of the country.

The faster means of communications, improving each day, help in building up a national unity by establishing easier and frequent contacts all over the Province. At the same time these easier means of communication permit the agricultural produce of the interior of the country to be marketed more conveniently for a better economy for the villager.

The houses in the villages are today lit by incandescent lamps which only few years back were a novelty to many. More and more wheels of the industry are now moving faster than ever and the amenities of life are placed at the doorstep of the common man.

The organisations of the Public Works Department have a creditable past. The Engineers and all the ranks linked with the activities can legitimately look back to their contributions in the growth of the nation. I am delighted to learn that the centennial is being commemorated simultaneously with the Golden Jubilee of the West Pakistan Engineering Congress. This Congress has provided the profession with a forum for the exchange of technical information and pooling of the engineering knowledge. It is gratifying for the two institutions that they are marching forward hand in hand. The Public Works Department is a building arm to shape in physical dimensions, the dreams and findings of its thinking functionary—the Congress.

I have known the engineering community for many decades now and for some time I am directly associated with it in my official capacity. It is extremely reassuring for the nation that this community is today motivated by the highest ideals. Its members are fully conscious of their responsibilities towards the immense task ahead of the nation in all fields of development. The talent available in our country is of a very high order and needs a better recognition and understanding by the nation to encourage them to bring about still better accomplishments.

The functions being held now will go a long way in achieving the good objectives of the Sessions with which the engineers meet in this centennial year. I wish the Engineering Department and the Congress every success.

———

Good-will Messages Received from Engineering Societies and Organizations

PROF. P. DANEL,

President, International Commission on Irrigation and Drainage.

"We are indeed grateful to you for inviting my Commission to send a representative to the West Pakistan Engineering Congress at its Golden Jubilee Session to be held in October 1963. I would have liked very much to attend this session myself, but I am afraid my other preoccupations will not permit me to make this long journey and be present at the occasion. Mr. K. K. Framji, our eminent Secretary-General, whom I understand you know personally, will therefore represent the Commission at the Golden Jubilee Session.

The development of land and water resources is currently receiving, as it should, unprecedented attention all the world over, with a view to increasing production to meet the growing needs and to achieve higher standard of living of a fast increasing population. We hear of the alarming rate of which fertile lands are becoming water-logged and salanized in this part of Pakistan. It is, therefore, in the fitness of things that the West Pakistan Engineering Congress has chosen "Water-logging and Salinity" as the subject of its Symposium and has invited experts in the field from all over to exchange views and to mobilize the existing knowledge and experience on this subject of vital importance to your country. I hope that the deliberations at the Congress will yield very useful contributions to the solution of this problem.

May I take this opportunity of conveying my best wishes for the success of the Golden Jubilee Session of your Congress."

PRESIDENTS

Institution of Civil, Mechanical and Electrical Engineers, London.

"The Institution of Civil, Mechanical and Electrical Engineers convey our greetings and cordial congratulations to the West Pakistan Engineering Congress on the occasion of its Golden Jubilee and to record the sincere wishes of our Institution for the continued success of the Congress."

T. C. HIGGINSON,

President,

Garnet T. Page, General Secretary,
The Engineering Institute of Canada.

"In 1912 the West Pakistan Engineering Congress was founded, to promote science and learning.

Since that time it has made many outstanding contributions to the development of engineering, with particular relation to the solution of important local technical problems.

The Engineering Institute of Canada extends to the West Pakistan Engineering Congress this expression of its sincere greetings, on the occasion of its Golden Jubilee Session."

NIHON KOGAKUKAI

The following is the English Version of Good-will Message received from the Japan Federation of Engineering Societies Sakumocho, Kanda, Japan.

"On behalf of Nihon Kogakukai which is a federation of engineering societies of Japan and now consists of 52 engineering societies, it is my privilege and honour to convey to you sincere and hearty congratulations upon this memorable occasion for continued success of your Congress during 50 years.

I also would like to convey our wishes that your Congress may long continue to play useful role in developing Science and Engineering and will continue to make its contribution to the international understanding of its many technical problems."

祝辞

西パキスタン工学会議の設立五十周年記念式典に際し日本工学会に対し鄭重なご招待をいただき厚く御礼申し上げます。生憎く本会の色々の事情で代表者を送り得ませんことを誠に残念に存じます。

日本工学会は日本における工学関係学術団体の連合でありまして現在五十二の学協会をそのメンバーとしています。私はこれ等学協会を代表して貴会議の五十年間における輝かしい業績に対し、この祝典に際し心からのお祝を申し上げますことを光栄に存じます。

私はまた、貴会議が今後も永く工学ならびに工業発展のために重要な役割を果されると共に今日の各種技術上の問題について国際的合意達成に貢献されますよう希望するものであります。

昭和三十八年九月二十日

社団法人日本工学会々長 丹羽保次郎

Goodwill message received from the Japan Federation of Engineering Societies Sakumocho, Kanda, Japan.

The American Society of Civil Engineers

presents this

Scroll of Honor

with greetings and felicitations to

West Pakistan Engineering Congress

on the occasion of its

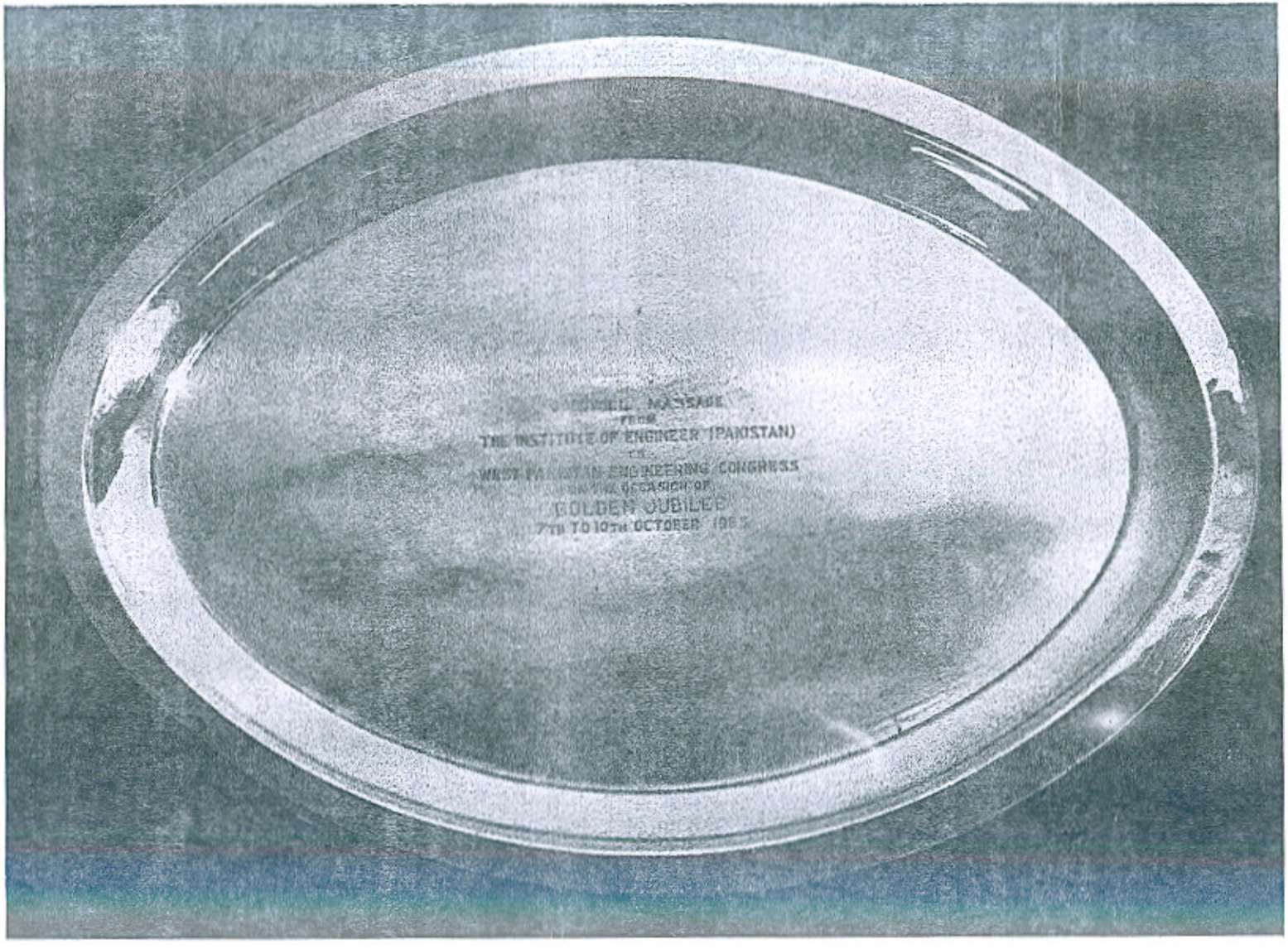
50th Anniversary

The distinguished service that has been rendered mankind and the engineering profession over the years is a lasting monument, universally recognized. May your future be rewarding in even greater accomplishments toward the benefit of humanity.

October 22, 1963

Edmund Friedman
President

W. H. Wisely
Secretary



The Institution of Engineers (Pakistan) sent its cordial Message of Felicitation and good wishes, engraved on a plate as a token of permanent remembrance on this unique occasion of the Golden Jubilee of West Pakistan Engineering Conference.

Presidential Address of Mr. A. R. Kazi, President, West Pakistan Engineering Congress

Mr. A. Rashid Kazi shouldered the heavy responsibility of organizing the centenary celebration of the Public Works Department and the Golden Jubilee Session for the West Pakistan Engineering Congress. In his address of welcome to the President of Pakistan and the audience he traced briefly the history of the achievements of the past hundred years of the Public Works Department. He paid a warm tribute to the pioneers and leaders of the Engineering Profession. The present generation of the Engineers as are the builders of a Welfare state and have thus to surpass the cumulative achievements of the past century, not only in magnitude but also in diversity.

A Galaxy of Eminent Engineers

We are proud of having amongst us today a galaxy of eminent Engineers from abroad, some for a reunion with old asscciations, others travelling from the other side of the globe just to be with us on this happy occasion. On behalf of the Congress I extend to them all our sincere fraternal greetings.

To the eminent Engineer guests from across our close border, who less than two decades ago shared with us the honour of establishing the traditions which constitute our proud heritage, we offer our special felicitations.

I shall be failing in my duty if at this stage I did not thank the members of the West Pakistan Engineering Congress for electing me as their President of this most auspicious year in our history and to the Executive Council and various Sub-Committees for their invaluable assistance.

It is a great honour as well as a great responsibility. I humbly pray to God that I am enabled to discharge my responsibilities properly.

1963—A Great Year for Engineers

The year 1963 is an unusual year for us, in that the Public Works Department has completed one hundred years of engineering progress while the Engineering Congress celebrates the fiftieth birthday of professional advancement and technical understanding. The two organizations are, in fact, part of the same whole, with the Congress symbolising the mental faculties and the Public Works Department furnishing the tools to achieve the physical means of the mind's creative imaginations.

The uniqueness of the occasion encourages me to deviate from the customary practice of dwelling on a selected subject or narrating the progress of professional activities during the year. At this stage in the growth of the organizations, precedents may as well give way to introspection. If this centennial is considered as a year of the Engineer coming of age it becomes incumbent on us to take stock of our inheritance, fix our targets and check our equipment to face the world of tomorrow.

Hundred Years of P.W.D.

Our known heritage in the field of engineering is at least 5,000 years old. The planning and engineering reflected in the relics of Mohenjo Daro, Harappa and Taxila can yet guide the most modern of our town-planners and architects. The monumental buildings, communication system and irrigation works built during the Moghal period still stand out as marvels of engineering. The irrigation practices of today are, comparatively speaking, small improvements over those followed by the early Arab settlers in the plains of the Indus where cultivators paid "abiana" for the facilities provided as is still the practice.

The early engineering was practised purely as an art. It still is in many respects. This art came to be wedded to the knowledge of mathematics and natural sciences not so long ago.

Field Marshal Napier, the First Chief Engineer

In the middle of the 19th century Field-Marshal Napier took over as the first Chief Engineer of all civil works under a new administration at Lahore and about the same time the inundation canals in Sind area started receiving more professional attention. In that area Colonel File, later a General, was developing his ideas of damming the Indus at Sukkur gorge for perennial irrigation.

These many activities gave birth to the Public Works Department which then embraced all branches of engineering. Scientific know-how and technical skill began to be employed with more precision and deeper thought. A new chapter in the history of engineering practices was then ushered in.

The history of the Public Works Department is replete with dedicated services of many stalwarts that served the profession in the following decades. They left such lasting footprints that became the guiding beacons for those who have been in the profession since. These giants of Engineers laboured and progressed under most difficult conditions. Science and technology have since then taken big strides and the younger generation seem to know so much more. However, as I reflect deeper I get more respectful of the Engineers of the earlier generations reminding me of a Norwegian saying :

"If we reached higher than they
We but stood on their shoulders".

With deep humility I pay my tribute to these pioneers and leaders of the Engineering profession in Pakistan.

50 Years of Congress

Individual efforts served the profession for decades but the best could only be achieved through a common platform for exchange of views and interchange of experience. In 1912 there emerged the Public Works Engineering Congress and what now has grown to West Pakistan Engineering Congress. The Congress owes a special debt to a devoted Engineer, Mr. Dorman, who nursed it in its infancy as active Secretary until 1920; and later became its President in 1930. To this

individual the members of the Congress pay their respectful homage on its Jubilee Session today.

The Inheritance, the Loss of Historical Rivers, and the Menace of Waterlogging

Soon after Independence, serious gaps were found in our physical as well as technical resources.

On the physical side the most severe blow was dealt to the irrigation system by the loss of historical river flows. We inherited a growing menace of waterlogging and salinity whose intrusions continuously reduced the crop yields. The loss of hydro-electric power, from across the border, was another big gap in our physical resources. The communication systems both, railways and roads, were exposed to a tremendous strain. The industry was practically non-existent.

The position regarding technical personnel was still worse. The non-Muslims had formed over 60 per cent of the service strength, mostly in the superior posts and almost entirely in the key positions. When they departed not many believed that professional obligations could ever be met. However, the suppressed qualities of the engineers and sub-engineers left to face the suddenly increased responsibility came to the fore. The services not only operated with an invigorated efficiency but tremendous progress has since been made in almost every field of engineering. The industrial development and electric power expansions have been phenomenal. The chronic shortage of food, which plagued Pakistan since independence, has largely been met through the addition of three new Barrages on river Indus and over 3,000 miles of canals, including large inter river links. These and many other engineering works have been completed solely through Pakistanis own efforts.

The Engineers and all the other ranks in the profession who helped Pakistan to meet the emergency and raised it in stature, have good reasons to be proud of their services.

Targets

But, fellow Engineers, let not these flattering reflections lull us into complacency. As our national target, we have chosen to establish a welfare State where no one should be hungry or without shelter and every one enjoy a reasonable standard of living. We need more food as well as more power. We need heavy industries for civil and military needs and steel to support them all. We need better communications and healthier critics and a hundred and one more things.

We are standing at the threshold of an engineering age and this centennial provides us with a wide window through which to see many bright and thriving new frontiers for our country.

The country has already struck pace on the way to progress. Plans are in hand to develop the national resources in a unified and co-ordinated manner. The soil and water resources are being inventoried systematically to plan for optimum results. The foresight with which our worthy President moved every one into activity for the solution of the evils of waterlogging and salinity is providing us with many new ideas for its solution.

The Starting Point

Development of Power and its transmission and distribution has been started in a big way and still bigger plans are on the anvil. Projects for extended irrigation and Power facilities to hitherto neglected areas of West Pakistan are in various stages of planning and implementation. With the help of many devoted foreign experts and contractors,

excellent progress is being made on the gigantic Indus Basin Works. Pakistani Engineers are blending the latest science and tenchiques with the art and practices of our own engineering heritage.

The railways are implementing plans to speed up transportation and adding new services through more thoughtful uses of the existing facilities. The Communication and Works Department are adding over hundred miles of new roads, and improving the existing ones.

There is a growing appreciation of the need for better water supply and sanitation facilities. It is being actively pursued through a specialised Public Health Organization. Industrial development is touching new heights with Pakistani Engineers playing an increasing role in its growth. New structures and satellite towns are providing a changing panorama. Similarly the demands in other engineering fields, such as mining traffic engineering, flood prevention, watershed management and many specialised professions have started making their mark in the growth of our national development. The Inland Navigation too is receiving attention.

Growing Dimensions

This, however, is just the beginning of a steadily increasing tempo in the pace of progress. The demands of next ten years may well surpass the cumulative achievements of the past century, not only in magnitude but also in diversity. Problems new and old constantly demand newer solutions and each problem that we solve creates ten more of equal or bigger complexity. The services involving the science of an Engineer are like an expanding series in mathematics never approaching a limit.

A long way back the Irrigation Engineers moved from the individual systems to inter-river regulation and now to the integrated uses of all available potentials, combining therewith the solution of drainage, salinity and many other problems. The flood control and Inland Navigation are yet to be adequately tried up with the vast irrigation complex.

The problems connected with the integration of surface and ground water supplies, maintaining the salt balance, preparing and operating a scientific water budget are simply overwhelming. To get maximum production, Irrigation Engineers have to provide water at correct times to meet the consumptive needs of crops and to know more about soils, crops, climate and other factors affecting agricultural yields.

The generation, transmission and distribution of power is another expanding field that will command highly technical resources.

In order to put our economy on sounder foundation, we not only need to improve the irrigated agriculture but to embark on a fairly extensive but balanced programme of light and heavy industries. To an appreciable extent the industries shall have to be based on or tailored for our agriculture. The field of industrialisation alone requires the services of almost every known branch of engineering profession, quite a few comparatively new to the country such as chemical and mining engineering, metallurgy, air-conditioning and many more. In turn each creates consequential fields demanding expert knowledge and specialised training. Other nations are exploring the space; the least we can do is to take wiser and longer strides.

My sole aim in raising some of these issues is to highlight the growing dimensions of engineering domain. Development programs are no longer an impressive compilation

of individual projects, nor is the sum of their fiscal provision any true indication of the calls on the engineering profession.

More glamorous fields of nuclear science or more authoritarian role of politics and administration may temporarily steal the show and eclipse the engineer, but the progress and prosperity of the country has by and large to depend on the latter's efforts and achievements alone.

Aids and Equipment

To cope with the growing dimensions of our professional activities, we need more Engineers and a congenial atmosphere for dedicated services. We do not seem to have correctly assessed our technological requirements either quantitatively or qualitatively. A country's pace towards development can often be measured by its capacity to absorb the technicians in various fields. In our Province, however, less than 250 graduates come out of the technical institutions each year to serve a population of 50 million souls and a 310,000 square miles of yet partially investigated area.

For a relief some of the age old laborious ways could be replaced by modern aids to save many professional man-hours. Aerial photography for surveys as well as soil and geological mapping, latest plotting devices, electronic computors and numerous moderately priced instruments could eliminate immense labour in field location and ease many phases of mathematical calculations. The Engineer could also be given aids of semi or non-technical nature wherever feasible to work under his technical guidance instead of the Engineer himself becoming an aid to others.

As we contemplate changing tools and equipment, we may very well obtain a better recognition of the talents of our available personnel.

Although the optimum development of the limited natural resources has lately gained appreciation, utilisation of limited technical talent needs even more careful consideration. Its fragmentation and thin application could bring about ill-effects similar to the thin application of water to cropped fields.

Design and Research

Engineering is an Applied Science but it is sadly significant that the designer and the research worker has not received the recognition of emoluments or position he deserves. The ingenuity of an engineer creates marvels but the applied as well as basic research forms the real backbone of creative thinking for sound and economical projects.

A case in point could be the intensive studies and application of latest developments of soil mechanics for economy in structures and development of better stabilised earthen roads for our villages. New and improved materials from indigenous sources and thoughtful uses of them would provide cheaper buildings and utility articles for local consumption.

In the field of drainage there appears an urgency to collect and analyse more scientifically the data for the evolution of an economic and indigenous system compared to the costly imported equipments presently introduced.

Instrumentation and automation is another field which has received little attention so far. The small Cell of Instrumentation introduced this year in the Irrigation Research Institute may as well be called an apology of an effort compared to what modern world is developing for sensing a frying pan's heat from five miles distance or to register changes in the degree of humidity when a teaspoonful of water is introduced into a hall.

Knowing the very keen interest of our worthy President and the Governor in scientific development of our resources, I feel assured that their presence here today will inspire the right action in this most vital field for progress as well as for economy.

Lack of Post-Graduate Training

The profession has also lacked facilities to impart training at appropriate stages. A lucky few do earn scholarships for a routine Post-Graduate but the majority get little chance of improving their knowledge. It is our desire that as in the case of some other services, a programme of enabling the selected talent to master the latest techniques in the world should be introduced as a regular feature. The oft-repeated request for an Engineering Academy in the country still appears to be a far cry.

To fill some of these serious gaps, the Engineering Congress, on its own and within its very limited resources, this year took a laudable step for arranging no less than 25 lectures, some by eminent international personalities. In addition, a three weeks' course on soil mechanics and foundation engineering and another on consumptive water requirements was conducted by specialists.

The Congress had been handicapped by having no house of its own where it could live and thrive. The valuable heritage has been finding refuge in corners of various offices and borrowed vacant spaces. It is a matter of delight that in this year of its Jubilee celebrations our very considerate Governor has been graciously pleased to allot a plot of land that will equip the Congress members with confidence. We humbly offer our respectful gratitude to Malik Amir Muhammad Khan for his gracious considerations.

The Services

The available talent in the professional fields has up till now been concentrated in Government services. The adverse effect of not having encouraged private enterprise, either in contracting firms or in the consulting fields are now being felt. It is no secret that the best of the talent is now no more attracted towards technical services and this is bound to hit the country's efforts towards extensive development. Apart from an unrealistic low starting salary for a young Engineer, there is an added discouragement against joining the public service due to the diminishing prospects of pay and position. A hard-earned technical experience of over 25 years in the services may at best be rewarded to a lucky few with a maximum pay, and a status not commensurate with their responsible position. It is not what one does not know that is so harmful, as what one knows, but has not enough incentive left to use it consciously.

The engineering fraternity is indeed most grateful to the Government for having restored the position of Provincial Administrative Secretaries in the professional fields. The elevation this year of one Provincial Service to a higher status has been a welcome step. We do hope the engineering services, the real builders of the nation, will also soon be suitably upgraded and given their right position.

Ethics

We who have chosen this creative profession to mould and master the forces of nature have a duty to strive for a better living for our fellowmen. Let not spells of weariness and dejection cloud our vision or impair our capacity to meet the ever mounting obligations. We must stand up to our responsibilities and be counted now,

if we are to lay any claim to the plaudits for the one hundred years of engineered progress.

The very word "profession" has a religious almost reverent connotation and must reflect our faith in whatever we profess. As Engineers, we must display integrity, both technical and otherwise, follow strict codes, and give credit for achievements to the right persons. There has to be the element of dedication and a conscious determination to serve and survive, breaking away from dangerous ruts. The Engineer building the Panama Canal once expressed that the only difference between a rut and a grave is that the grave is shorter and deeper.

To the young friends in the engineering profession, I may avail of this opportunity to express that education does not finish with their graduation. In fact it starts from there. There has to be a relentless pursuit if one is to make his mark not only in his personal career but in the history of our developing nation.

Re-dedicate Prosperity and Progress

The fifty years old motto of the Congress "prosperity and progress" can best be kept aloft by re-dedicating ourselves to the service of our fellowmen and as we build well we shall also be serving God.

To you, Sir, who have laid before us many and true inspiring examples of the highest ideals and of relentless dedicated service to the cause of the nation, I may be permitted to express an abiding loyalty of this engineering fraternity to the nation and to you. Your dynamic personality will, we feel sure, continue to inspire us towards higher goals for many long years. Sir, we shall feel greatly honoured if you accept from us a very humble souvenir, in commemoration of this special day in the history of our organization.

President Ayub

ADDRESSES THE ENGINEERS

President Ayub in replying to Mr. Kazi's address of welcome at the time of centenary celebrations, felicitated the engineers, for the important role they have to play in the creation of a welfare state and then take pride in their performance.

He advised them to work hard to quicken the implementation of development schemes and to compete with other more advanced nations of the world. He stressed the Engineers to achieve the utmost with the minimum possible use of the foreign goods and the supplies and to use the manual labour in preference to machinery to keep the poverty stricken millions of Pakistan which need work to keep themselves alive.

Hundred Years of Service to the Nation

I thank the West Pakistan PWD and the Engineering Congress for inviting me to attend this function. I can imagine the feeling of happiness and satisfaction which the West Pakistan engineers feel on the completion of a hundred years of dedicated service to the nation and the country, and I share that feeling with you. I am, therefore, particularly happy to be present on this occasion.

The completion of a hundred years is a landmark in the history of any people, more so in the history of a limited band of public servants. But I notice that you have traced your origin to the fabulous age of 5,000 years ago when Mohenjo Daro was built. In fact you could trace it to the hoary past, to the time when Adam or his descendants built the first thing with their hands and not with their feet. You can thus be well proud of an ancient past of continuous progress and growth.

Roll in creation of welfare state

The first engineer was the Creator Himself. And what a wonderful and magnificent Creator He was and still is. The human builders and manufacturers are merely agents for the expression of His unlimited knowledge and skill.

God created this world for the benefit of mankind so that it may lead a happy, prosperous and progressive life. The engineers, as the human agents for the completion and fulfilment of the divine will, must keep this goal in view.

The Holy Quran speaks of there being paradise even on this earth. In seeking to

create a welfare State, we strive to achieve the divine purpose. As correctly pointed out in Mr. Kazi's speech, the engineers have the most important role to play in the creation of a welfare State. He has mentioned the handicaps with which Pakistan started its life. To those mentioned by him I would add that while we have very limited resources, we have a large population to provide for.

Compete with Others

Secondly, we have to compete with other and more advanced nations who naturally take advantage of the lead they have already had over us. We have a lot to do, with very limited means and still more limited time at our disposal. For, if we do not create a welfare State within a reasonable time all sorts of dangers, lurk in the decades ahead of us. Not only our own welfare but that of our sons and grandsons depends on what you do and how you do it.

Use Minimum Foreign Exchange

One of the most difficult impediments in the way of our progress is the shortage of foreign exchange. And it will get worse when we have to repay the loans we are taking just now. It is, therefore, imperative that we utilise these loans most economically, efficiently and expeditiously so that they begin to pave their way through handsome yields and higher income of the people. While the Commerce Ministry should worry about higher exports to earn more foreign exchange for the repayment of these loans in future the engineers have to think in the present of how we can achieve the utmost with the minimum possible use of foreign goods and supplies in order to save foreign exchange.

May I, therefore, suggest that the Engineering Congress set up a special body to consider, not only the problems mentioned by Mr. Kazi in his speech but also the problems of the maximum, utilisation of our limited resources and our limited manpower.

Prefer Cheap Labour to Foreign Machinery

We should work out, if necessary, our own techniques and methods of work. For instance, our labour is cheap, particularly in the rural area. Our poverty-stricken millions need daily work to keep themselves alive. Our agriculture being seasonal, 85 per cent of our population in the rural areas sits idle for several months. This population would welcome the opportunity to supplement its income by manual labour at public works. Should we not therefore make greater use of manual labour rather than machinery which costs so much in foreign exchange?

Provide Livelihood to Starving Millions

I realise the advantage of quicker work through machinery but against this you have to weigh the bigger advantage of providing a livelihood to our starving millions. Similarly, cheap but durable types of living accommodation, for our poor people, have to be thought of. They cannot bear the high cost of modern construction. With the fast migration of rural population to urban areas, the problem of housing is a serious one.

Tide Over Shortage of Technical Manpower

I have been feeling anxious about the slow implementation of our development schemes. I am told that one of the reasons is the limited technical manpower available in the country. While we should aim at augmenting our technical know-how those already working have to carry an extra burden. Unless they work with supreme conscientiousness and

self-sacrifice, we would not be able to tide over the intervening period of shortage of technical manpower, at a time when the clamour for development and progress grows daily.

It is a challenge which I am sure that the patriotic engineers of Pakistan will meet with the same devotion and dedication to the welfare of their country as shown by the workers in other fields of national development.

Hard Lot of Engineer Rewarded by his Pride of Performance

The engineers have an advantage over others who are working for the improvement of the lot of the people. The engineer can see, before his eyes in a solid form the result of his endeavours. He can check up at once whether the end result has been achieved or not, and whether his creation is going to be a shortlived one or one which the coming generations would admire and thank him for. Others working for the welfare of the people do not have this advantage and the result of their labours is not visible.

So while the engineer's lot is a hard one in our country and our conditions, he can sit back and admire what he has created. And he has the satisfaction of playing perhaps the most important part in the service of his nation and the country. Let him feel the pride of performance and achievements, even though he has to work more and harder than others and even though he gets lesser pay which I do hope will be put right in the near future.

Engineers Play a Vital Role in a Country

I should not take any more of your time. Mr. Kazi, in his speech, has covered almost the whole field of engineering and its problems, as we see them to-day. May I say, once again, that the engineers are placed in a position where they have to play a vital and important role in the building up and progress of their country and in the improvement of the lot of their poor people. If they realise the gravity and urgency of their task, I am sure that their patriotism and permanent interest in the future of this country would make them produce results for which the coming generations would admire and bless them.

Let the Next 100 Years be Still Glorious

May I end up by felicitating the engineers of West Pakistan on the completion of a hundred years of public service. Let the next 100 years be even better and more productive of results. I agree with Mr. Kazi that we should re-dedicate ourselves, on this happy occasion, to the service of our people and our country.

Fifty Years of Engineering Congress

By **ABDUL RASHID KAZI**
President, West Pakistan Engineering Congress.

Fifty years ago, in the year 1913, *the personnel serving the various spheres of professional activities, met together for the first time to exchange experiences and discuss technical problems on a common platform for the development of the sciences of engineering. Thus came into existence the Public Works Congress, later named the Punjab Engineering Congress and since then grown to West Pakistan Engineering Congress. Just as the name of Colonel Napier will ever remain associated with the Public Works Department as its first Chief Engineer, the name of Dorman will ever remain active in the minds of Engineers of the area as a dynamic spirit whose untiring efforts resulted in the creation of this Congress.*

It was the first technical body of its kind in the Indo-Pakistan sub-Continent, giving a lead to many other Provinces of old India such as Bombay and Burma, to form similar organisations with the same objectives. Since then the engineers have met each year to hold critical discussions on the technical papers presented by its members. These annual sessions have made immense contribution to the sciences involved, as applicable in particular to our country. Many of the theories and ideas developed on this platform have been acknowledged the world over and followed by them in many cases.

The engineers meet again this year, the fiftieth birthday of the Engineering Congress, to hold its Golden Jubilee Session. Simultaneously, under the patronage of the Government, engineers are commemorating the Centenary of the Public Works Department as well.

The turn of the century in the career of professional services is an apt occasion for the members to pause and look back with a critical appreciation at the points of pride and failing and also to take their fellow-men into confidence about the activities and plans that are to provide the desired benefits for the common man. After all there is hardly a phase of life which is not related to or influenced by the activities of the engineering profession.

Responsibilities of Engineers

Every developing nation has high aspiration for improving the livelihood and the way

of living of its citizens. Many a new and smaller States, by sheer dint of efforts, have achieved or about to achieve economic viability. Pakistan too aims at nothing less. Towards this goal the engineers of our country are conscious of their own social and human responsibilities and wish to carry their fellow citizens with them in the forthcoming era of intensive and vast developmental activities. They have hopes that their sincere efforts will receive the appreciation of the public.

The profession of engineering is as ancient as the first efforts made, unknown centuries ago, by human beings to tame the fire for domestic use or build the crudest hut or a cave for shelter against elements. Through the ages humanity acquired more and more knowledge about the properties of matter, sources of power and physical forces and used them for meeting the human needs. Very much later, the building efforts took the form of some magnificent structures for the glory of a great emperor or for the edification of mighty conqueror. We still look at some of these marvellous constructions of the past with the same delight and inspiration as an art connoisseur derives moving along the galleries of the louvre.

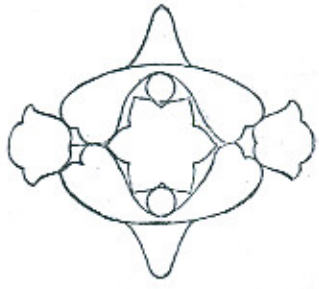
Early in the nineteenth century the industrial revolution in the West and the advent of the machine age started influencing the life all over the world. By the middle of the last century military activities in this part of the sub-continent had been replaced by a civil administration. That provided the concept of "Public Works". The "Keepers of King's Engines", as the army engineers were often termed, started paying greater attention to "Civil Works" for the benefit of community at large and included in their activities extension and improvements to the Communications and Canals. The then newly created "Public Works Department" was headed by Colonel (later Field Marshal) Napier as its first Chief Engineer. In 1863, the assured water supply from the Doab Canal started putting new life into the cultivated fields around Lahore. About the same time another Royal Engineer, Colonel (later General) Fife was building his ideas of damming the Indus at Sukkur gorge to provide perennial supplies to the land in the southern regions. Many new roads were then planned and constructed in what is now the Central region of West Pakistan for the benefit of the public.

The one hundred years of engineering activities through all the ranks serving the profession have provided the nation with the biggest contiguous irrigation system in the world, an expanding network of highways and a fast developing power grid. The activities since Independence through the limited Pakistani technical personnel left to shoulder much bigger responsibilities on the departure of non-Muslims, have belied the doubts and misgivings many had whether the technical services could ever be maintained satisfactorily. The Engineers and all other ranks of the Department have good reason to look back with pride at the tremendous growth in the activities of the profession over the last two decades brought about by their toils and efforts. The public needs have, however, grown far beyond the normal imagination of the people. The population is simply exploding. There has to be an ever increasing emphasis on development projects to feed the growing mouths and improve the standard of living. The current Second Five-year Plan of the country will involve an expenditure of over Rs. 2,300 crores. The Third Five-year Plan may exceed Rs. 4,000

crores. There are more fiscal provision and the sum involves do not correctly reflect the magnitude of the skills and techniques that must be created within the profession. The demands on our technical services during the next decade may far exceed the cumulative achievements of the past whole century. Not only the number but the complexities of the technical problems have now increased tremendously. Every scheme of the engineering profession now demands many times more efforts in a single field than were once needed for all the sectors combined.

Entering New Era of Development

The growing complexities of the problems have to be equally matched by advances in science and technology and in engineering experience. Not every problem can be solved by mathematical formulae or basic science. There are too many variables and too many unknowns which require a correct judgement, sound common-sense, good practical knowledge and above all pooling of the experience. It is in this field that the common platform created fifty years ago in the form of Engineering Congress has helped greatly in stimulating the engineering talent for solving the growing problems. But the country needs much more than has been achieved. We are entering a new era of engineering development. One cannot even touch upon all the fringes of the vast fields of activities requiring the services of the Engineers in every phase of our developing country. The engineering community and all ranks serving the Departments are today motivated by high ideals for service to the nation. They seek the nation's blessings to help them improve the common man's lot.



ENGINEER— The Nation Builder

By **MIAN ABDUL AZIZ**
Secretary, Communication and Works

The first house that was ever built on the face of this earth was the House of God—the Holy Ka'aba. Ever since man has been endeavouring to find shelter for himself. Wood, stone and mud were the natural materials available in abundance and man has been and is utilising them extensively in building construction. With the increase of population, intermingling of people and formation of society, hamlets turned into villages, villages into towns and towns into cities.

Communications started improving out of necessity and paths were widened into bridle paths, cartways and kacha roads. The good old donkey, who has all his life been a faithful slave of the man, and who had been carrying his burden single-handed started getting assistance of the horse, the camel and other animals. The invention of the wheel put the cart behind the animal and was replaced by the vehicles of today.

Man is continuously striving for a better living by exploring the treasures of Nature. The Engineer is the vehicle in the society of man, who transforms the modern inventions into practice to give the society a better home, a better ride and a better food.

Moghal Architecture

Looking back to the past history of the present Province of West Pakistan which was a part of the Indo-Pakistan sub-continent, we find the 'Mehindis' and the 'Memaar' of the great Moghal busy in constructing scalloped arches, massive domes and marble cupolas and decorating them by colourful fresco and geometric relief. The pre-English vandalism razed most of this beautiful work to the ground and instead gave a few forts and the "Baradari" in front of the Shahi Mosque. The early English period saw the 'barrack master' constructing Army lines, strategic roads and essential buildings such as police stations and jails urgently needed to maintain political tranquillity. A Public Works Department was organised and field duties divided among the various Divisions and Circles.

The mid-English period between 1870 and 1910 was the golden era of the English rule when development was ambitiously taken. Railway tracks were laid, the trunk roads were constructed, important bridges were built and utility buildings were erected. We find British architects and national engineers

designing and constructing many buildings in Lahore such as the Government College, Mayo School of Arts, the Mayo Hospital and he High Court. The foreign rule introduced new ideas in construction technique. The tile was replaced by the nine-inch brick and steel was added as a major construction material in the country. Portland cement was a revolutionary invention early this century and gave the engineer a new material to construct and mould the structure with, on scientific lines.

Development of National Talent

In the last forty years of the English rule, the national building activities were subdued due to two reasons ; firstly the two World Wars, in which British was heavily committed and secondly the Independence Movement in the country and the political disturbances. Nevertheless the preoccupation of the foreign rulers gave a chance for the national talent to develop. After Roorkee, came the Engineering School, Rasul, in 1910, and the Moghalpura School in 1931. The latter was raised to a College and the Civil Engineers started getting training in 1938. The Public Works Departments of the various Provinces started expanding when qualified Engineers filled their ranks. At the time of Independence a well knit, well organised and well staffed P.W.D. was working in the Punjab, N.W.F.P. and Sind.

With the dawn of Independence in 1947, the engineer woke to find himself on the horns of a dilemma. A mass of eight million shelterless destitutes crossed the new borders into Pakistan to find a new home here. The pangs of birth had left the communication system paralysed. The Radcliff Award had cut across the finest Irrigation System of the World and beheaded the Punjab Canals of their headworks. The English supremacy along with its pound sterling had vanished. The non-Muslim technical talent had migrated to India leaving behind a disorganised, crippled and depleted P.W.D.

Quaid's Inspiring Guidance

The inspiring guidance of the Quaid-i-Azam and a strong will to survive came to the rescue of the new nation. Bit by bit, the scattered parts of the vast administrative, political, economic machinery were put together and a quick assessment of missing links was carried out. Then onwards was an arduous path for the building engineer, a precipitous activity to a far distant summit. From 1947 to 1955, individual efforts were made by the various administrative units among which the West Wing was divided at that time, to catch up to self-sufficiency, but the gap was too big to be bridged individually. The Units were, therefore, merged into one contiguous whole in 1955 and the First Five-Year Plan came. By then Pakistan had known her problems and their solutions.

Spectacular Results

The Foreign Rule had left the Pakistani ill-equipped in industry, exploitation of local resources and education. The nation was demanding more townships, more factories, more schools, more hospitals and more roads for a quick economic growth in deficient fields of national development. The engineer was put to a great test. With limited local resources, restricted foreign import of building materials and machinery and insufficient technical manpower, he was called to the gigantic task of building the country afresh. There was no escape for him but to accept the herculean task. Head stooped with the burden of responsibility and trust, sleeves rolled up for the will to work, spade in one hand and the trowel in the other, he

started. The overall results were spectacular and the performance more than satisfactory.

In 1960 came the better conceived Second Five-Year Plan, estimated to cost Rs. 19,000/- million. A sizable portion of the estimate pertains to the jobs to be carried out by the B & R. engineers. The current year's budget, which is the mid-plan year, calls upon the B & R Department to undertake works at an expenditure speed of ten lacs of rupees per day. While we have still to achieve the targets of the Second Five-Year Plan in another two years, we may pause here to assess the performance of the engineer since Independence.

Housing and Settlement

West Pakistan at the time of Independence was not only faced with the singular problem of rehabilitating bulk of eight million destitutes but also of finding shelter to the ever-growing population, which alone needed 1.5 lac residential units annually. The city of Karachi presents a typical example of the population blast. Starting with a population of 1,36,000 in 1901, it rose at a steady rate registering 4,36,000 in 1941. In 1951, it shot up to 10,68,000 and in 1961 to 19,16,000. The Korangi, which was the first big effort in providing shelter to the shelterless was reduced to the size of a dwarf before the giant population explosion. North Township has been recently started, but we will need many more townships to meet the ever-increasing demand. Almost every other important town in West Pakistan has by now satellite townships. The Lahore Township designed to accommodate 25,000 families is now taking a start and will be completed in a few years. The construction of Islamabad, the new Federal Capital is a landmark in the history of Pakistan in the post-Independence period.

Allied to the problem of housing was the provision of residential and office accommodation so urgently needed for the reorganised Administrative set-up of the integrated Province. One Unit colonies were built at almost all Divisional Headquarters. Lahore faced the acutest problem of all cities. Although almost two thousand residential units have been built, the problem is yet unsolved. Similarly additional office accommodation was built at various places but an urgent need was felt to construct a befitting Secretariat Building to house all Departments of the Government at one place. The preliminaries of this work, estimated to cost Rs. five crores, are under active finalisation and we may have this important building built in a period of three years behind the Assembly Chambers. The existing Secretariat blocks which are built around the old quarters of General Venture, the Sikh General, will be handed over to the attached Departments.

Community Buildings

There was a great paucity of educational institutions of all types in the Province. The Peshawar University, the Nishtar Medical College, Multan, the Liaquat Medical College, Hyderabad, the Technical University at Lahore, the Agriculture University, Lyallpur, and the Polytechnics at various places were some of the major achievements. Besides, hundreds of schools, colleges, dispensaries, hospitals and other community buildings were constructed in the nook and corner of the vast Province under trying conditions. The projects are by no means over and greater activity will be witnessed in years to come.

An arduous work of great historical importance done by the Engineers in the last decade was the extensive restorations and

renovations of the colossol structure of the Badshahi Mosque. Built in 1673-74 A.D. for Emperor Aurangzeb at a cost of six lac rupias, it went on deteriorating during the last 270 years. The earthquake of 1840 badly mauled its lofty minars the top stages of which had to be pulled down. The tastefully decorated structure was put to a profane use as a military magazine and store-house during the Sikh Civil War and the structure was shaken by the exchange of fire between rival Sikh factions from across the Fort. With the efforts of late Sir Sikandar Hyat Khan the restoration of the Mosque was undertaken in 1939. The engineers toiled up and down the minars, over the massive domes and under the arched roofs for a number of years to bring back the beauty and original lustre of this monumental structure so artistically finished by Fidai Khan Koka. The magnitude of renovations costing over Rs. 49 lacs can be gauged from the materials consumed in this work. Apart from 18,000 cft. of white marble from Swabi and Rajputana and 90,000 cft. of red stone from Agra the engineer for the first time used 60 maunds of copper and 200 tolas of gold in the renovations.

Communications

Although a few roads existed prior to the English rule, the present pattern of communications was developed during the English period of about 100 years. At the time of Independence West Pakistan had a total road mileage of 13,781 miles and 35,000 vehicles plying on them. During the last fifteen years not only those roads have been maintained and improved but another seven thousand miles of roads have also been added for boosting up the economic development of the Province. Compared to the 50 per cent increase in road mileage the volume of vehicles has gone up to 1,18,000 almost 340 per cent above the '47 figures. The Second Five-Year Plan not only envisages the improvement of over one thousand miles of existing roads but also construction of new roads at a rate of six miles a day.

The B & R Department has also embarked on an ambitious programme of constructing new bridges. The modern system of pre-stressed concrete is now in extensive use because of its advantage for longer spans. The Sharaqpur and Wazirabad bridges are typical examples. The bridge on Kabul River at Jehangira now under construction will be unique in having three spans, the two sides one being 225 ft. long and the central one 330 ft. long. The central span will be the longest span in Asia in pre-stressed concrete. Planning of major bridge over the Jhelum has reached an advance stage, while the planning of bridges over the Ravi and the Sutlej was under active investigation.

But this is not enough. There is still a big gulf towards attaining self-sufficiency in economic growth. The Third Five-Year Plan will be much bigger in volume than the present one. The responsibility of the engineers will also proportionately increase. The engineer must make himself fully equipped to discharge in an admirable manner, the trust confided in him by the Nation. He has yet to overcome many ticklish problems. The building materials are deficient. Steel is yet to be produced in the country. Timber wealth is too small to meet the expanded needs of construction. Cement production in West Pakistan in 1947 was only 3.5 lac tons. It has now risen to over 12 lac tons annually but is still far short of the demand.

The engineer has to find and use more building materials without arresting progress if the industrialist does not come to his rescue in time.

Technical Manpower

The same is the case of technical manpower. The tradesman of yesterday is a big contractor and a landlord of today. Skilled technicians have been consumed in more profitable channels of trade. Fresh stock is hesitant. Technical institutes, trades centre and training school are being established with speed but a lot more is still to be done. The production of civil engineers is much short of the demand. Whereas India is now turning out 20,000 civil Engineers annually, we are turning out only about a thousand Architectural classes have only started last year and that too with a nominal admission of twenty. If the professional standard is to be raised to the demand of national aspirations, talent should be attracted to this profession by bettering the prospects in wages and dignity.

Soaring Prices

Since the end of last War, the engineer finds himself entangled in the cobweb of soaring prices of labour and material. The price spiral has upset all his estimates and plans. By the time he is halfway through he finds the remaining money insufficient to carry him to completion. There will probably be no escape from the problem as it always goes hand in hand with a developing economy; and the world has by now shrunk to such small dimensions that a political crisis in a country like Cuba hits the trade in the farthest point of the globe.

The engineer also often finds himself caught up in a whir pool of audit objections. He sometimes in his enthusiasm, to achieve results and sometimes forced by circumstances, acts a little out of step with the dictates of pre-independence account codes. I am happy to see a high powered committee set up by Government to devise a flawless procedure of maintaining the accounts by an organisation independent of the engineer. The engineer when relieved of this non-technical job, will find himself vacant to devote himself fully to the technical job for which he is trained and employed. His capacity will accordingly increase to handle a bigger volume of engineering works.

Road Engineer's Problems

The road engineer has his own complex problems to solve. He finds himself cornered by the two-pronged attack of water-logging and rising vehicular count, one is undermining the sub-base and the other thumping the crust. The old roads are going out of order and becoming inadequate for the volume and load of traffic plying on them. Nature introduced an additional element of regular floods in the post-Independence period to fully test the pluck of the engineer. He found the monster every summer nibbling at the edge or road formation and running away with portions of the black ribbon of the road. The engineer is alive to his responsibility and is feverishly planning to remodel his roads and to make them floodworthy. An ambitious plan to convert the Karachi-Hyderabad and Lahore-Multan links of G.T. Road into an express-way is already on the anvil. The Third Plan will find the engineer rebuilding many of the old roads to revised standards, besides filling missing links in and extending the network of existing communications.

These are only a few of the problems facing the engineers today. By reassuring

(*Continued on page* 53)

Progress on the Indus Basin Project

By **GHULAM ISHAQ KHAN**
Chairman, West Pakistan WAPDA.

West Pakistan Water and Power Development authority as agents to the Government of Pakistan are executing one of the world's biggest construction programmes costing about 1.8 *billion dollars. Some idea of the dimensions of the work involved may be had from the fact that the Link Canals alone represent work equal in magnitude to the construction of four new Suez Canals. The two dams will be amongst the largest structures in the world each about* 2 *miles long and over* 400 *feet high and both of them combined involving* 250 *million cubic yards of fill,* 160 *million cubic yards of excavation and* 5.7 *million cubic yards of concrete. The four barrages and the syphon will have a total length of nearly* 3 *miles which is about* 40% *of the length of all the weirs and barrages built in Pakistan during the last* 80 *years.*

Progress on the Indus Basin Project has to be measured in terms of the physical targets achieved and the consumption of time and money. The project is being implemented under the Indus Basin Development Agreement signed in Karachi on 19th September, 1960, simultaneously with the signing of the Indus Waters Treaty between Pakistan and India.

This Treaty negotiated under the auspices of the World Bank brought to an end the 13-year old dispute on the distribution of the waters of the Indus river system. Under the treaty, Pakistan gave up its claims to the three eastern rivers, the Ravi, the Beas and the Sutlej, and India agreed that the Indus, the Jhelum and the Chenab, except for some uses in the upper reaches, be reserved for the exclusive use of Pakistan. The treaty provides for a transition period of 10 years during which Pakistan has to complete a system of works to replace from the western rivers the supplies so far received from the eastern rivers. Although the primary object of the Indus Basin Project or the Settlement Plan, as it is sometimes called, is replacement, its secondary object is to provide, for an element of development, as distinct from replacement, and to lay the foundation for more effective utilisation by Pakistan of the waters assigned to it by the Treaty.

1.8 Billion Dollar Project

The Project which before the signing of the Treaty was anticipated, on the basis of

some 'horse back' estimates, to cost 836 million dollars is, on detailed investigations and after full engineering, now estimated to cost 1.8 billion dollars. It is financed out of a special Indus Basin Development Fund set up, with the International Bank as its Administrator, with contributions by USA, UK, West Germany, Canada, Australia and New Zealand, loans to Pakistan by the Bank and the United States AID, and with fixed contributions by India and Pakistan.

The Agreement under which funds for financing the Project were pledged by the contributing governments describes the system of works comprising the Project as consisting of two storage dams, one (at Mangla) on the Jhelum and the second (at Tarbela) on the Indus with a total live storage capacity of 8.95 million acre feet, eight feeder canals linking the Western Rivers between themselves and to the Eastern Rivers, four new barrages, at Sidnai on the Ravi, at Qadirabad on the Chenab, at Rasul on the Jhelum and at Chashma on the Indus to serve along with the existing barrages as diversion weirs for the new canal system, and a syphon across the Sutlej at Mailsi.

Two Storage Reservoirs

While each of these works like the parts of a complex machine is essential for the proper and efficient operation of the system as a whole, the two storage reservoirs are by far the most important and also the most expensive component of the Project. Without these reservoirs to conserve the summer flood waters there will be, after the three Eastern Rivers dry up in India, just not enough water to feed the existing canal systems in Pakistan which constitute the backbone of the predominantly agricultural economy of the country. The storage at Tarbela which gives to Pakistan control over the only river left to it with substantial exploitable flows, also provides the key to the development in future of 30 million acre feet of permanent non-silting off-channel storages and 4 million kilowatts of power. It was this long-term potential of Tarbela which Pakistan thought at the time of signing of the Treaty, would offset whatever immediate shortcomings the Settlement Plan might have.

The system of works which is indivisible both in its conception and its object and purpose is perhaps the largest engineering work in the world today. Because of its size and the time limit of 10 years in which it must be constructed, it is also one of the most challenging water development projects ever undertaken. Some idea of the dimensions of the work involved may be had from the fact that the link canals alone represent work equal in magnitude to the construction of four new Suez Canals. The two dams will be amongst the largest structures in the world each about 2 miles long and over 400 feet high and both of them combined involving 250 million cubic yards of fill, 160 million cubic yards of excavation and 5.7 million cubic yards of concrete. The four barrages and the syphon will have a total length of nearly 3 miles which is about 40 per cent of the length of all the weirs and barrages built in Pakistan during the last 80 years.

The Project is being executed by the West Pakistan Water and Power Development Authority (WAPDA) as agents to the Government of Pakistan. The physical construction of works of the size and engineering complexity involved in the Indus Project is difficult anywhere, it is particularly so in a developing country like Pakistan which has its material and manpower resources

already fully committed to the execution of its normal economic development plans. Early in the execution phase, therefore, an attempt was made to identify the stresses and strains which were likely to develop in various sectors of the economy and which unless removed in time could seriously retard the execution of the Project. It was soon apparent that the capacity of the only port at Karachi serving West Pakistan unless suitably expanded, will prove totally inadequate for the task ahead; that the transport system, particularly the railways still struggling to recover from the neglects of the war years, unless extensively renovated may break under the additional strain to which it would be subjected; that the shortage of technical manpower, unless training programmes were intensified will cause a serious bottleneck; and finally that serious inflationary trends will arise in the country unless the production of goods and services in particular demand by the Project is sufficiently stepped up. By attending to these administrative and logistic problems on a priority basis simultaneously with the detailed engineering of the individual components of the Project, it has been possible however to take the Project to a promising start.

Within 18 months of the signing of the Treaty in September 1960, contracts were awarded on the basis of international bidding for the construction of the Mangla Dam, the Sidhnai Barrage and the Trimmu-Sidhnai-Mailsi-Bhalwal link complex including the syphon at Mailsi. Apart from these prime construction contracts, contracts were also awarded for the numerous items of machinery and equipment other than construction machinery required for these works and now a representative international community of Pakistanis, Americans, British, French, Italians, Germans, Japanese, Danish, Swiss and Austrian engineers and construction and manufacturing firms are feverishly busy under incentives of penalty and bonus to ensure that these first phase works, with the exception of the Mangla Dam, are completed by the contract date of March, 1965. The Mangla Dam is scheduled for completion by July, 1968, and up to date progress on each of these works is generally ahead of schedule.

Phase II Works Postponed

According to the original construction programme of WAPDA, Pakistan should have gone to tenders last year on the Phase II works which cover the Rasul-Qadirabad-Balloki-Sulemanki barrages and links complex. However, with over 700 million dollars out of the total availability of 838 million dollars in the Fund committed for the firm phase works, the Bank, pending the conclusion of its negotiations with the contributing Governments regarding additional finances, could not as Administrator of the Fund see its way to authorise additional commitments being undertaken. The Phase II works had therefore to be postponed. Tenders for the Qadirabad-Balloki link have since been issued and negotiations have now reached a stage when Pakistan can hope that it will be enabled to commit the remaining Phase II works also before the end of the current year. Assuming that there is no further delay, it would still be possible, though by a bare margin to complete Phase II by the time the Mangla storage is ready for operation in 1968, with which the completion of Phase II must coincide.

Phase III Works

The remaining Phase III works, which include the Tarbela Dam, the barrage at Chashma and the two canals linking up the

Indus to the Jhelum and the Chenab, must be constructed with the exception of Tarbela, by the Treaty date of 1970 and are scheduled to be committed for construction during 1964-65. Tarbela is programmed for completion by 1972. Judging by the pace of the progress already achieved and taking into account the international interest and the sense of competition that the Project has generated in the civil construction industry there is every reason to believe that, given the finances, the Phase III works will also be built to the original time schedule, and it is on completion of this phase of the work that the Indus Project can be deemed to be fully ready to serve the purpose and object for which it was conceived.

At present the additional finance required to complete the remaining phases of the project is presenting difficulties which unless resolved soon enough may affect future progress. It is particularly important that the Tarbela Dam be built as provided for in the Settlement Plan. This dam is the key-stone to the arch on which the entire Settlement Plan rests. Any change in this plan which may result in the exclusion of Tarbela will lead to the collapse of the arch, and the whole basis of the 1960 settlement may be lost. The World Bank is continuing to negotiate with the friendly countries for the provision of additional finance for the Settlement Plan. A settlement of the Indus Waters Dispute was possible because of the enlightened interest that the friendly countries took in the promotion of peace and stability in the subcontinent and in the economic development of the Indus Basin. It is to be hoped that keeping these very considerations in mind the friendly countries will be prepared to find over the next 8 to 10 years the additional finance required to complete the Indus Basin Project as originally conceived.

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M/s. CONFORCE Ltd.

Salinity and Waterlogging in the Indus Basin

by **Sh. AHMAD HASSAN**
Irrigation Adviser, A.D.C., Lahore

Sheikh Ahmad Hassan is Irrigation Adviser to Agricultural Development Corporation. Prior to his undertaking this assignment he was additional Chief Engineer of the Irrigation Department. He has an intimate knowledge of the working of Irrigation system of West Pakistan and its problems of Waterlogging and Salinity.

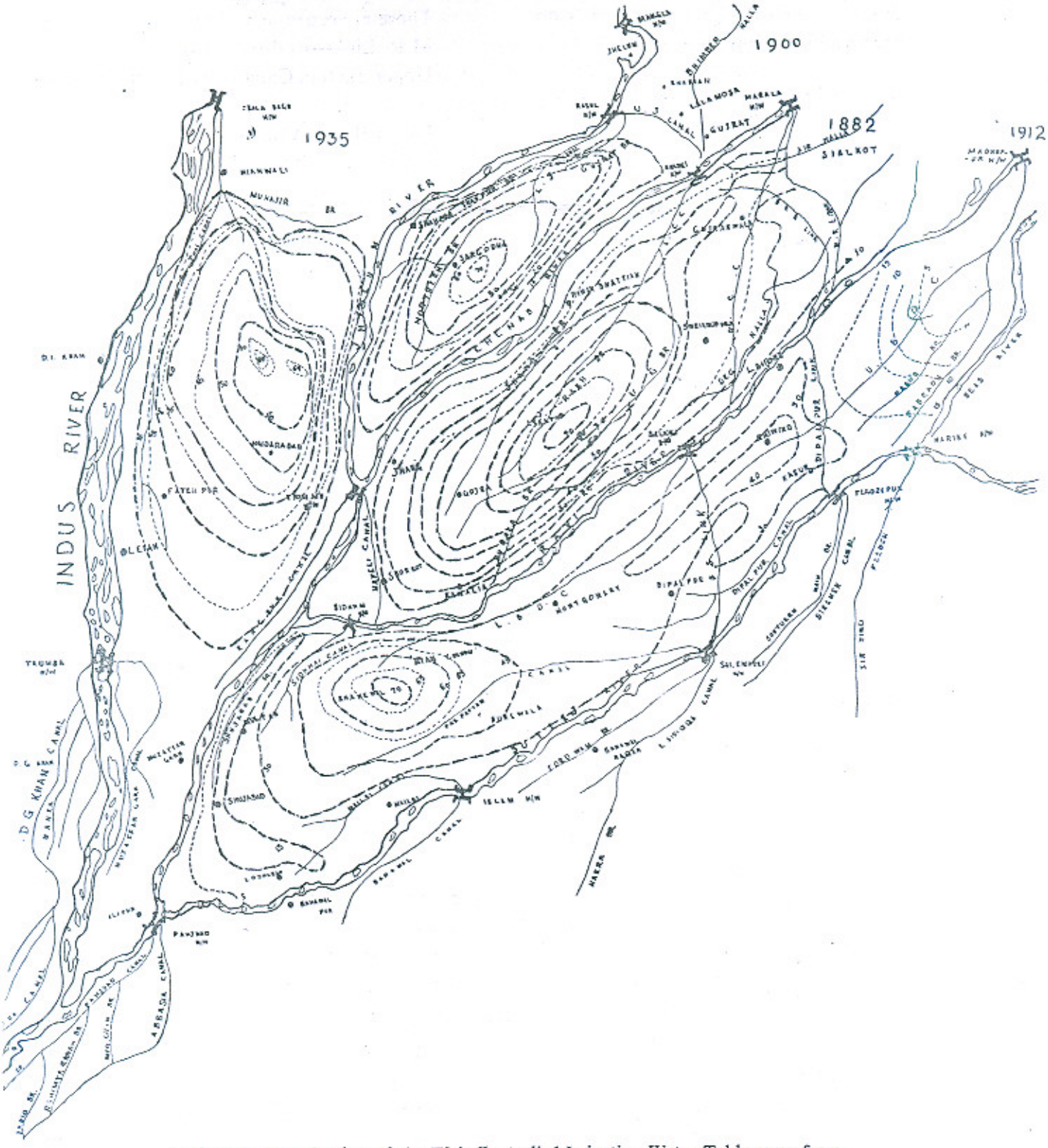
In this paper, the first of its kind from such an experienced engineer, a programme has been put forth and workable suggestions are given acting upon which we can successfully solve the problems of the country by our own resources and within our own means.

The Irrigation System in the Indus Basin has been steadily extending during the last 100 years. The total area now within the command of Irrigation Works in West Pakistan is about 34 million acres out of which about 24 million acres are cropped annually. While more and more areas have been included in the command with the construction of new barrages, hundreds of thousands of acres have gone out of production and still larger areas though still under cultivation have been affected adversely by salinity because of the rising water tables. Nearly one lac acres of irrigated lands are severely affected or going out of cultivation each year because of waterlogging and salinity.

Irrigation caused rise of ground water

Before the introduction of the weir controlled irrigation the ground water was generally very deep but started to rise wherever irrigation was introduced whether perennial or non-perennial. The rate of rise varied in different areas. It is generally faster in the early periods and gradually slowing down as it approached the ground surface.

When the ground water rises to within a few feet of the surface and comes above the surface in depressions and low areas, the evaporation losses from the free surface of waterlogged areas and due to capillary action from areas where the ground water is within a few feet of the surface, balance the seepage from the canals and check further rise of water-table. The ground water thus stabilizes usually 4 to 5′ below the ground surface appearing above it only in depressions and



Before the Introduction of the Weir Controlled Irrigation Water Table away from rivers was 60 to 100 ft. deep in the Doabs. (Year of observation is also shown.)

low areas making them completely water-logged and marshy. The evaporation losses are maximum when the ground water is on the surface and reduce with its depth.

Capillary brings the salts and evaporation makes the soil highly saline

All ground waters contain dissolved salts in varying quantities.

By the nearness of the ground water to the surface, continuous deterioration of the lands takes place due to the rise of moisture through the capillary pull to the surface which on evaporation leaves behind the salts brought by it. This process continuing over a period of some years, makes the top soil highly saline and the land loses its fertility and capacity to produce crops. The permanent remedy lies in depressing the ground water to such a depth as would reduce the rise of moisture through capillary action to the very minimum.

If the ground water is more than 10' deep in an average soil, there is very little rise of salts to the surface by capillary action and the salinity hazard is under control. In an irrigated area it is, therefore, essential that drainage should be introduced when the ground water rises to within 10' of the surface.

The type of drainage suitable for any area depends upon its surface as well as ground water hydrology. On the basis of these features, the irrigated areas of West Pakistan can be divided into four categories.

I. Non-perennial areas having usable ground water.

II. Non-perennial areas with brackish ground water.

III. Perennial areas having usable ground water.

IV Perennial areas with brackish ground water.

I. Non-perennial areas having usable ground water

These areas are served by :—

M.R. Link—its direct distributaries.

Upper Jhelum Canal—its Phalia distributaries system.

Lower Jhelum Canal—its Shahpur Branch.

Upper Chenab Canal—its Rayya Branch, Nokhar Branch and a few direct distributaries.

Lower Chenab Canal—its direct distributaries in the head reach.

Dipalpur Canal

Pakpattan Canal—its Khadir Branch.

Mailsi Canal

Qaim Canal

Bahawal Canal—its Ahmadpur Branch.

Abbasia Canal—its head reach distributaries.

Panjnad Canal—its non-perennial system.

Rangpur Canal

Haveli Canal—its distributaries in the head reach.

Sidhnai Canal—its Shujabad Branch.

Muzaffargarh Canal System except areas in the middle of the Doab which are brackish.

D. G. Khan Canal System except the uplands.

The left bank Guddu canals except some areas close to and south of the Railway Line.

The right bank Guddu Canals—a narrow strip only along the river.

II. Non-Perennial area with Brackish ground water

The upland areas of D. G. Khan Canal.

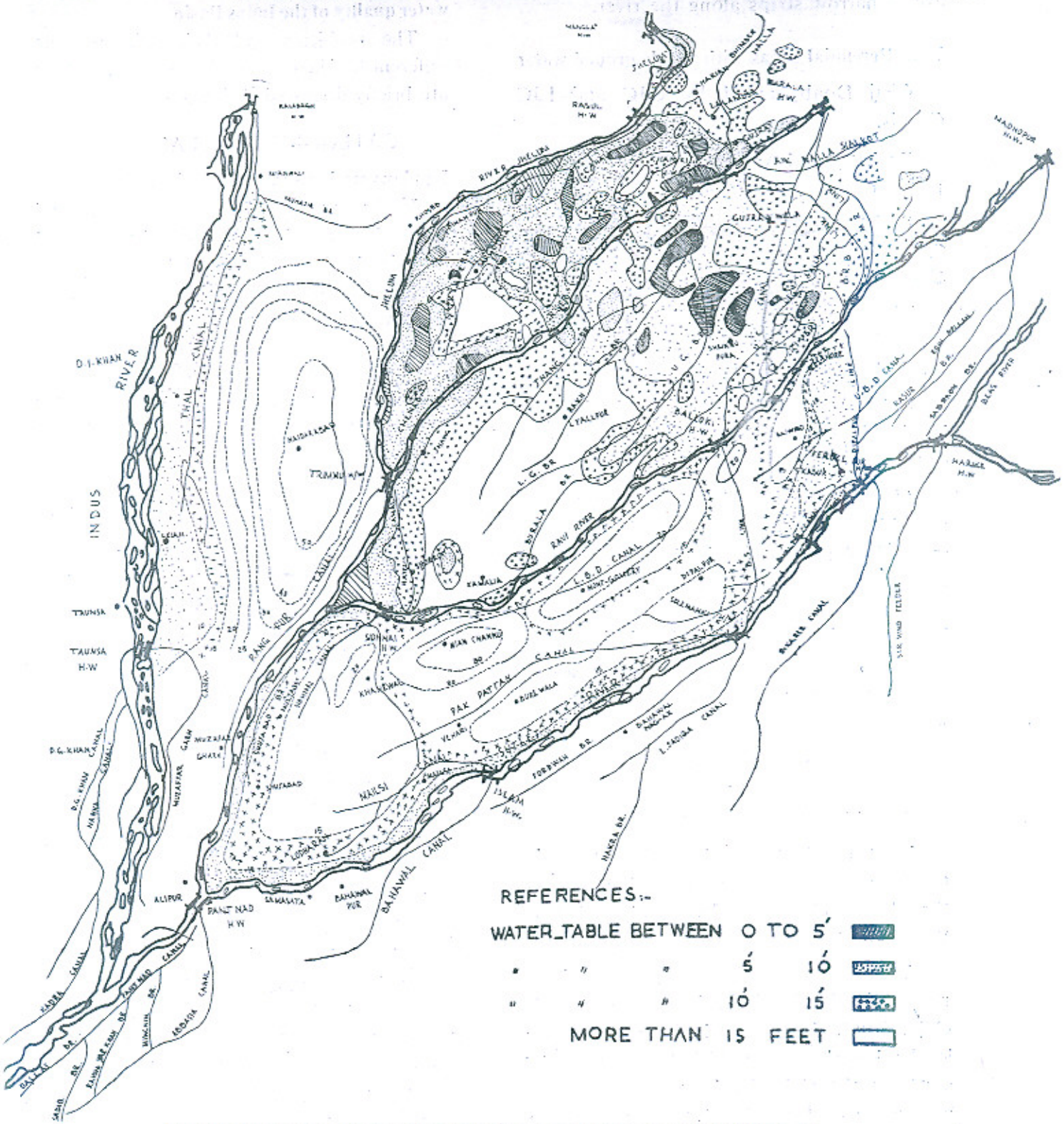
The areas of Muzaffargarh Canal situated in the middle of the Doab away from the rivers.

The right bank areas of Guddu Barrage except a narrow strip along the river.

Most of the Rice Canal System of Sukkur Barrage.

The Non-perennial part of Nara Canal.

EXISTING POSITION OF GROUND WATER LEVEL



Ground Water started to rise when Irrigation was Introduced and Stabilized at 4 to 5 ft. below Surface.

The Non-perennial areas of G. M. Barrage except narrow strips along the river.

III. Perennial areas with usable ground water

Chaj Doab served by UJC and LJC. Canals.

Rechna Doab served by UCC, LCC and Haveli Canals.

Bari Doab served by CBDC, LBDC and Sidhnai Canals from river Ravi and Pakpattan Canal from river Sutlej.

Thal Doab served by the Thal Canal except its Khushab Branch system which has brackish ground water.

But in the middle of all the Doabs there are big blocks of areas having brackish ground water.

Also come under this category some areas of Sukkur Barrage lying along the river and served by Khairpur Feeder West, Rohri and Dadu Canals.

IV. Perennial areas with brackish ground water

The big blocks of areas situated in the middle of each Doab.

All the perennial areas of Sutlej Valley Canals on the left bank of River Sutlej from Suleimanki to the Sind Border.

Most of the areas in Sukkur Barrage Command except some areas lying along the river and served by Khairpur Feeder West, Rohri and Dadu canals.

All the areas receiving or proposed for perennial irrigation in G. M. Barrage namely Gaja, Tando Bago and Badin areas on the left bank of the river and Thatta and Oderolal areas on the right bank except possibly a narrow strip along the river in case of the last named.

The accompanying map illustrates the ground water quality of the Indus Basin

The problems and their solutions are different for these categories of areas. These are briefly discussed below:—

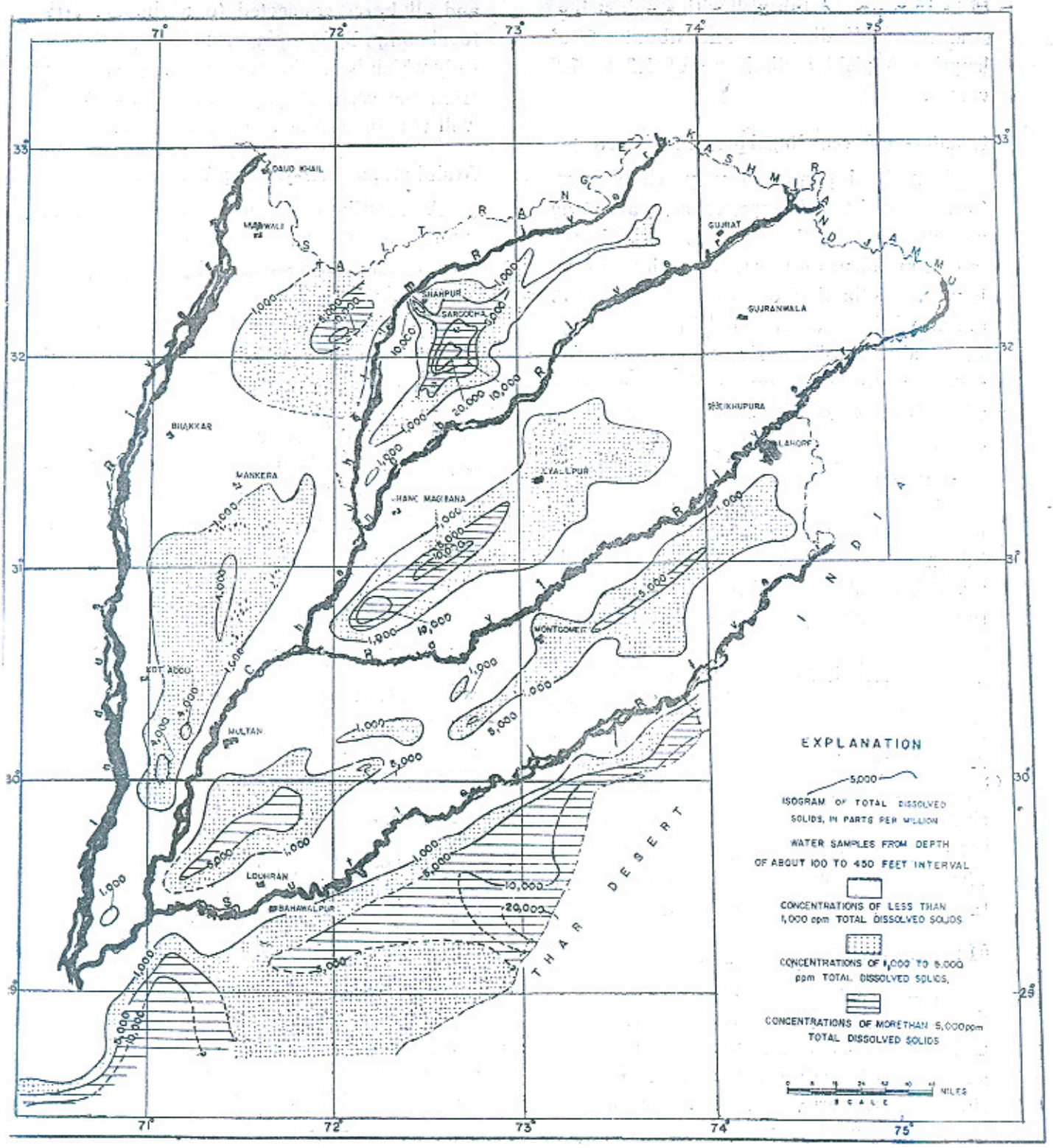
CATEGORY (I) AREAS

Landowners keen to instal Tubewells

In the non-perennial areas having ground water fit for irrigation, the tubewells will provide the best solution. In addition to lowering the ground water to control salinity these would make available a very valuable resource of water for increasing intensities of cultivation and raising agricultural production now restricted by inadequacy of canal supplies. The economics of tubewells for such areas is, therefore, very attractive and landowners all over are very keen for these. Those with enough financial resources are already going ahead with their installations. Hundreds of tubewells are being put in every year by the farmers and their number is rapidly increasing. The salinity and water-logging problems in these areas can very well be tackled by the farmers themselves and they need not wait for the Government sponsored tubewell projects.

Coir String Strainer Tubewells, good yield and durable

Most of the tubewells installed by the zamindars during the last few years have stainers (filters) made from the indigenous materials. These are made of coir string wound round a cylindrical iron frame of the required diameter. Having stood the test of time for the last many years, these have become very popular in the country and are ideal for use by the zamindars in their medium sized tubewells. The life of this strainer under normal conditions is quite long and numerous such strainers are in use for the last



Map Showing Quality of Ground Water in the Indus Basin.

10 to 15 years. A tubewell with a coir string strainer of 6'' diameter and about 100' length can yield a discharge of 1.2 to 1.5 cusecs.

Country-made centrifugal pumps satisfactory

Centrifugal pumps of very reliable performance of 1 to 1.5 cusecs capacity are being manufactured in the country. This is the most convenient discharge for an irrigator to handle. Reliable motors of 10 to 20 H.P. are also being manufactured in the country. In the absence of electric power, these tubewells have to depend on diesel engine power which is more expensive and cumbersome to operate in the out of the way places generally through semi-skilled operators, though reliable slow speed diesel engines are also being manufactured in the country. In spite of this more and more diesel driven tubewells are being installed by the zamindars. As soon as electricity becomes available, the diesel engines can be replaced by electric motors. The Government can help a lot the areas under this category by providing electric transmission lines as early as possible. A discharge of 3 cusecs per 1000 acres or about 2 cusecs per square mile may be considered the average quantity of water which the tubewells will be required to provide. The capacity of the transmission lines should, therefore, be planned on this basis.

Multibore for shallow pumping

In many areas water is saline as we go down. The seepage from the canals by mixing with the ground water in the upper strata helps to reduce the salinity. In such situations the water should be drawn only from shallow depths. The total length required of a strainer can be obtained by having small strainer lengths in a multibore tubewell consisting of two more shallow bores, and all bores connected to a single centrifugal pump. By pumping from the upper strata only which is continuously getting re-charged from the canal seepage, the tubewell water will continue to be a reliable source.

Multibore, an ever-yielding Tubewell

A multibore shallow tubewell offers another advantage. The yield of every tubewell gradually goes down over a number of years. After it has gone down below the economic level, the strainer is replaced. But a long period of declining of yields must elapse before a strainer is replaced, thus effecting the agriculture dependent on it. In case of a multibore tubewell, its discharging capacity can be kept fairly uniform by alternate renewal of each bore after a few years. Thus there always will be one newly put in strainer with the older ones.

Pumping High Ground water saves Evaporation losses

In the areas where the ground water is within 4' to 5' below the ground, the evaporation losses through the capillary action are very high. By depressing the watertable to below 10' this valuable water which is lost to the atmosphere, transporting in the process the salts to the surface, would be available for tubewell irrigation.

Deep depressing of watertable unnecessary

There is a general belief that in the high ground water areas unless tubewells are put in large numbers, the watertable cannot be depressed sufficiently to provide relief. In this connection, it may be stated that in the sweet water zones, even when the ground water is at about 5' depth, individual tubewells provide lot of relief. The aeration of ground water by circulation with the help of a tubewell and the washing down of the salts other-

wise rising with capillary action improve the soil conditions to give good crops. In fact, if the ground water is circulated by pumping, a depth of about 5′ is helpful. It does not harm plant growth; on the other hand it provides part of consumptive use of crop with corresponding reduction in the demand for canal water. The farmers in such areas can, therefore, put in tubewells with confidence.

Replenishment of ground water

As the load on ground water increases, replenishment will become an important aspect. In order to reduce as far as possible the depletion of ground water, it would be advisable to run the non-perennial channels in winter whenever water becomes available due to freshets in the rivers and also by phasing the annual closures of the canals taking off from the various Headworks in such a way that the water released from one Headworks during the closure is picked up at the lower Headworks and fully utilized by running the non-perennial canals in addition to meeting the requirements of the perennial canals. During the running of the non-perennial canals, the tubewells could with advantage be shut down and thus help the ground water storage.

Tubewell drainage useful for rain absorption

With the tubewells providing the drainage, no elaborate surface drainage would be required in the non-perennial areas except in areas of high rainfall and in areas receiving large quantities of seepage from big canals. With the ground water depressed, the rain water can generally be absorbed by the fields as was the case before the ground water had risen so high as to reduce the absorbing capacity of the soil. The non-perennial areas where the ground water is sweet and fit for exploitation by tubewells should have their cropping patterns suited to perennial irrigation. Rice should not be the predominant crop in such areas except in areas of high rainfall.

Encourage farmers to instal Tubewells

The problems of drainage and reclamation as well as of shortage of water in the non-perennial areas having usable ground water can be satisfactorily solved if the Government gives encouragement to the farmers to instal their own tubewells and if electric power is made available as soon as possible. The tax-holiday of 25% in water rates already sanctioned by the Government for canal irrigated areas in which a tubewell is installed by the zamindar is provided very helpful in this connection. The more resourceful farmers are installing their own tubewells. The less resourceful could do so jointly on cooperative basis for which loans from organisation such as Agricultural Development Bank should be encouraged. The Basic Democracies can probably play an important role in persuading the farmers to take up cooperative tubewells. If shareholders of each canal outlet join together to instal a cooperative tubewell near the head of their water-course, the irrigation warabandi will continue to operate whether canal water or tubewell water or the two mixed together are running in the water-course. Sharing of the cost of installation of tubewell and its operation will be according to the share list. The cost of a tubewell will not be more than Rs. 20 per acre if indigenous materials are used and as such within the means of small farmers.

In Category (II) areas instal open surface drains

In non-perennial areas with brackish ground water the most popular cropping