Engineering News

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CODE OF ETHICS

PAKISTAN ENGINEERING CONGRESS

بِسْمِ اللّٰهِ الرَّحْمٰنِ الرَّحِيْمِ

In the name of God, the Beneficent, the Merciful

WHEREAS Allah enjoineth upon his men to faithfully observe their trusts and their covenants ;

that the practice and profession of engineering is a sacred trust entrusted to those whom Nature in its magnificent bounty has endowed with this skill and knowledge ;

that every member of the profession shall appreciate and shall have knowledge as to what constitutes this trust and covenant, and

that a set of dynamic principles derived from the Holy Quran shall guide his conduct in applying his knowledge for the benefit of society.

Now, therefore, the following Code of Ethics is promulgated. It shall be incumbent upon the members of the West Pakistan Engineering Congress to subscribe to it individually and collectively to uphold the honour and dignity of the engineering profession :

۱۔ اِنَّ اللّٰهَ يَاْمُرُكُمْ اَنْ تُؤَدُّوا الْاَمٰنٰتِ اِلٰٓى اَهْلِهَا ۙ وَاِذَا حَكَمْتُمْ بَيْنَ النَّاسِ اَنْ تَحْكُمُوْا بِالْعَدْلِ ۭ اِنَّ اللّٰهَ نِعِمَّا يَعِظُكُمْ بِهٖ ۭ

"Allah commands you to render back your trusts to those to whom they are due, and that when you judge between people, you judge with justice. Allah admonishes you with what is excellent". iv : 58

1. You shall be honest, faithful and just, and shall not act in any manner derogatory to the honour, integrity or dignity of the engineering profession.

۲۔ اَوْفُوا الْكَيْلَ وَالْمِيْزَانَ بِالْقِسْطِ وَلَا تَبْخَسُوا النَّاسَ اَشْيَاۗءَهُمْ وَلَا تَعْثَوْا فِي الْاَرْضِ مُفْسِدِيْنَ ○

"Give full measure and weight justly and defraud not men of their things, and act not corruptly in the land making mischief". xi : 85

2. You shall use your knowledge and skill of engineering for human welfare, and render professional service and advice which reflects your best professional judgment.

۳۔ وَلَا يَجْرِمَنَّكُمْ شَنَاٰنُ قَوْمٍ عَلٰٓى اَلَّا تَعْدِلُوْا ۭ اِعْدِلُوْا ۣ هُوَ اَقْرَبُ لِلتَّقْوٰى ۡ

"And let not hatred of a people incite you not to act equitably. Be just ; that is nearer to observance of duty". v : 8

3. You shall not injure maliciously, directly or indirectly, the reputation or employment of another Engineer, nor shall you fail to act equitably while performing professional duty.

۴۔ اَوْفُوْا بِالْعُقُوْدِ ۭ

"Fulfil the obligations". v : 1

4. You shall faithfully observe and fulfil all your obligations.

THIRTHIETH YEAR OF PUBLICATION

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o Free to members of the Pakistan Engineering Congress Change of address should be intimated promptly giving old as well as new address along with membership number.

o Contributions to this journal in the form of articles, news about engineering works, news about engineers, photographs and technical data etc. are cordially invited.

o Reprints from this journal be made on condition that reference is given to the Engineering News, its Vol. No. and the author.

o Pakistan Engineering Congress is not responsible for any statement made or opinions expressed in this journal.

o Advertisements rates to be settled with the Editor.

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EDITORIAL

SPEECH TECHNOLOGY

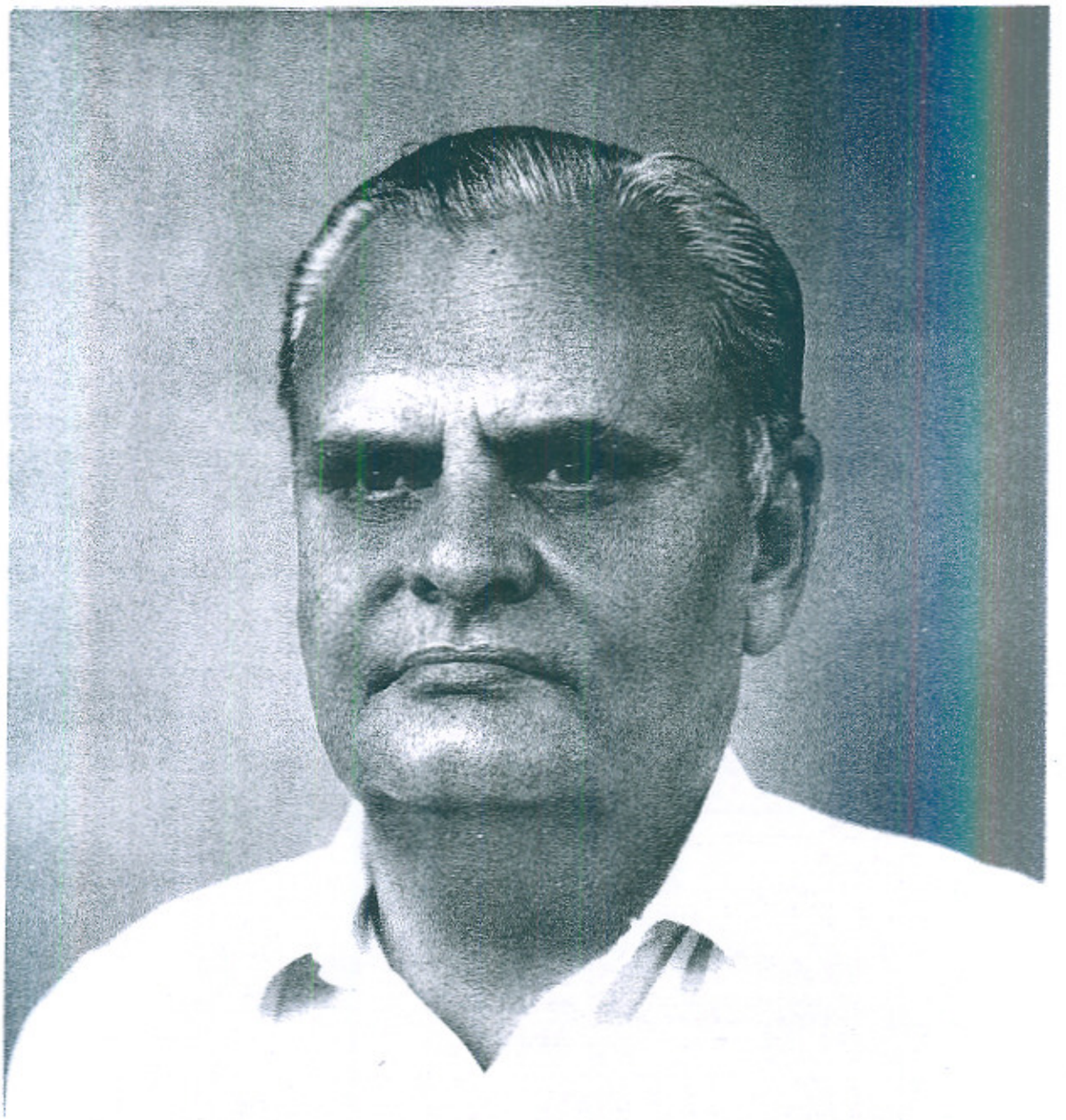
You just say it and it will be done. Thanks to the advancement of "speech technology" the time has already come when machines can be expected to operate on just verbal command. Among domestic appliances today, some can turn off lights while other robots can use vacuum cleaners on being told to do so. Two kinds of telephones, which are already in the market in the United States, offer to place calls upon spoken commands like ''dall the office". Such products are reaching beyond the consumer sector. Speech chips are being used by the military, by doctors and by industries. At Chicago's international airport, luggage these days is routed to appropriate destinations by handlers calling out the name of the place to computer that just sends the bag to the correct container. The biggest advance in cars comes in a small size – a microprocessor. Hidden in on-board computers in the latest cars, they regulate car operations and warn of malfunctions. Why, cars even talk today – and may be one day they'll even argue. Synthesized commands instruct or rebuke the driver. "Please fasten your seat belts," "A door is ajar," "Your fuel is low,' And you can talk to the cars too. The Ford Motor Company has developed a system by which voice commands turn on car lights, raise the antenna, start the windshield wiper, or activate other electrical systems.

Speech technology includes speech synthesis – or the science of teaching computer chips how to talk – and speech recognition – the science of teaching them to listen. Synthesisting a voice is an easier task. Getting robots to listen has also progressed substantially, though speech chips today are generally dependent on particular speakers. In other words, they can be used by one person only. Research is going on to create a system that would respond to anyone's voice. If all this sounds like faddish gimmickry, it would be useful to listen to the voice of Speech Technology magazine. It estimates the industry's current size at $ 450 million, which may grow to $ 1 billion by 1990 in the United States. Meanwhile, the Japanese too are hard at work teaching their machines how to talk and listen.

The Holy Quran states when the Almighty Allah intends to do anything, He only utters "Kun" and it is done. The advances in speech technology are proving the wonderful truth of this statement. How mighty are the computers of Allah and how fast they can convert His voice command into action, are beyond human imagination. However, the Holy Book contains innumerable absolute truths which have sound and scientific work mechanisms. Engineers and Scientists have a wide open field of research. The custodians of these truths are sleeping and those who deny are working out ways and means to achieve them.

TITLE

Mr. Mohammad Khan Junejo Prime Minister, of Pakistan, delivering an inaugural adress at 60th Annual Session of Pakistan Engineering Congress, at Hotel Hilton, Lahore.



Mian Masud Akhtar, the new
President of Pakistan Engineering Congress

LIFE SKETCH OF THE 61ST PRESIDENT OF PAKISTAN ENGINEERING CONGRESS.

Mian Masud Akhtar was born in 1926 graduated with double course in Mathematics and later got his Civil Engineering Degree from Aligarh, India.

He joined the Punjab, Irrigation Department as sub Divisional Officer in Jan. 1947, just before partition of the sub-Continent, where after serving about 39 years in various capacities on different assignments, he had a multifarious experience of Planning, Design, Field construction and Operation of Projects in Pakistan. Due to his rich experience and experience in Management in the Punjab Irrigation and Power Department, he was tipped for the post of Secretary to Irrigation and Power Department Government of the Punjab on 19.4.1984,

Rich with the life long professional experience he had been instrumental in executing major projects :—

Planning field surveys Investigations and Final Project reports in various water sector were to his credit. He showed his Innovation to Design and Research work of Irrigation System of Pakistan. He was responsible for Construction of Surface drains in Rechna Doab in Punjab and Construction of Irrigation Channels in Thal Project, Punjab. He proved himslef quite welversed with operation and Maintenance of Irrigation Canal System and allied Revenue Works.

He rose to the occasion, when he was specially called for execution and completion of Indus River diversion Works at Ghazi Ghat. He was specially deputed the Task to complete certain specific items before the coming Flood season. This Task was completed intime and was highly appreciated by the Government. Similarly on D.I.Khan Darya Khan Bridge on river Indus diversion was completed intime, saving heavy cost of stone-boom etc,due to his personal guidance.

He has to his credit contribution of various technical papers such as "Effective use of Irrigation Water at Farms Level" for FAO Seminar held at Damascus in Dec. 1971 and in the same Forum he presented another paper on "Land and Water use in the Near East". In the Seminar on "Water Management and control for Agriculture" held in Tokyo, Japan in Oct. 1972, he presented the following papers.

i. Rice Production and Water Management.
ii. Water Management for Diversified Agriculture.
iii. Institutional Support to Irrigated Agriculture.
iv. Economics of Irrigation and Drainage Scheme.
v. Application of Modern Technology to Irrigation and Drainage Development.

Because of his meritorious services he was nominated to attend seminars/ study tours not only at home but also abroad. In 1971 he attended a seminoar on "Water Management and Control of Agriculture" in Japan.

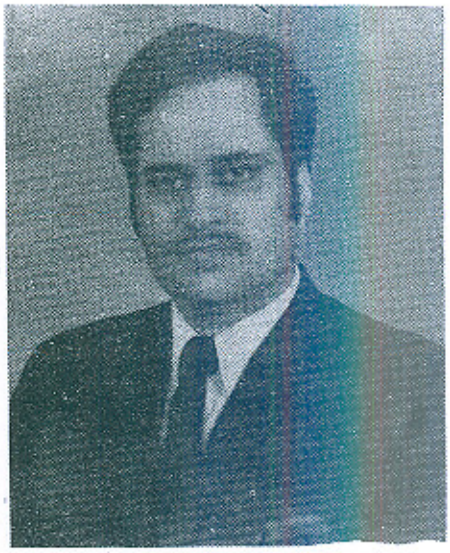
He made a study tour as a part of Technical Training programme arranged by united states Bureau of Reclamation, to discuss design parameters construction techniques, operation and maintenance problems of sub soil Drainage with the experts in 1984 in Egypt, England, Canada, U.S.A. Japan, Hong Kong and Thailand,

His services to the Engineering Community bore fruits of his toil and he was elected as president of Pakistan Engineering Congress for the 61st session.

Let us hope, he will serve the cause of the profession and fellow Engineers to the core of his heart. The "Engineering News" Management Welcomes most cordially Mian Masud Akhter as the new President.

RING IN THE NEW

THE NEW CHIEF EDITOR EINGINEERING NEWS.



R.K. ANVER, born in Jullundar (India) in July, 1932 has a brilliant educational record. A Civil Engineering Graduate, got his master's qualification in Hydraulic Engineering in his mid career. He did a post graduate course in Irrigation Engineering and practices under the auspices of SEATO Graduate School of Engineering Bangkok. He also completed post graduate studies in Financial Management and Project Management by Net Work Planning and Gross Root Finance (PERT/CPM). He got training in the study of Water Resources and Tile Drainage Projects in Netherland and France.

He is a Member of American Society of Civil Engineers, Fellow Institute of Engineers Pakistan and Member of Pakistan Engineering Congress.

He joined the Irrigation and Power Department, Punjab as Assistant Executive Engineer in 1954. He served the Department in different capacities and in 1968, he was elevated as Director Review Cell, Irrigation and Power Department Government of West Pakistan, from there he was sent to Netherlands under UNESCO Felowship. Thereafter he worked as Superintending Engineer, Director Indus Water Treaty and Regulation Government of Punjab. In 1974, he was sent on deputation to National Engineering Services Pakistan (NESPAK), as Chief Engineer Water and Agriculture Division. He was appointed as General Manager NESPAK in 1976, which post he held upto May 1984, when he was called back in the parent Department as Chief Engineer. He is presently looking after Development Zone and his primary functions interalia include planning and construction of Small Dams. He is also supervising the construction of Four Command Water Management Projects being carried out under the aegis of the World Bank and US AID.

He has wide spectrum of Experience in Planning and Design and also in Construction Supervision. As General Manager, Water and Agriculture Division NESPAK (on Secondment from Irrigation and Power Department), he was responsible for Administrative, Financial, Technical/Directional Control and Coordination and synthesis of studies by Multi-disciplinary teams comprising Engineers, Planners, Economists, Environmentalists, and system analysts. Collection, analysis and evaluation of data on ground water, and surface water Hydrology, agronomy, water quality, land use, soils crops, Commanded area development, collection and interpretation of aerial photogrpahs and satellite imagery, preparation of conceptual plans for alternative solutions leading to economic and financial analysis were the main topics of study. He also was responsible for producing feasibility reports for several important projects in water sector in Pakistan.

His meritorious services in the profession brought him to serve in the foreign countries, he worked as Technical Advisor for various important assignments pertaining to the development of water resources projects in Nigeria, Iraq and Saudi Arabia.

He has authored/coauthored more than 40 technical publications and has represented Pakistan on various National and International Forums.

His services as an Engineer and Technical Skill will go a long way in the betterment of Engineering News and rather will give a new life to this journal.

We welcome this stalvart, energetic an appealing personality, an offspring of Jullundhar, which gave to Pakistan so many important serving personnals.

It is hoped that he will handle this magazine with zeal and gusto and will do everything for the betterment of the Engineering Profession.

HIGHLIGHTS OF THE 60TH ANNUAL SESSION OF PAKISTAN ENGINEERING CONGRESS

By

*S.N.H. Mashhadi**

The 60th Annual Session of the premier engineering body of the country, Pakistan Engineering Congress, was held with traditional grandeur at the tastefully decorated spacious Khurshid Mahal of Lahore Hilton from 27th October 1985 to 4th November, 1985.

The session was inaugurated by the Hon'ble Prime Minister of Pakistan Mr. Mohammad Khan Junejo on 27th October, 1985.

After recitation of verses from the Holy Quran, the President Pakistan Engineering Congress, Engr. Masihullah Khan, Chief Engineer, Public Health Engineering Department of the Punjab presented an address of welcome. Welcoming the Hon'ble Prime Minister, the Governor Punjab Lt. General Ghulam Jilani Khan, The Chief Ministers of the Punjab and Baluchistan, Federal Ministers and the elite gathering of the engineers representing various disciplines, the President recounted the services rendered by the Engineering community and the role of the Engineering Congress in voluntarily disseminating engineering knowledge by presenting technical papers on various subjects. He assured the engineering community would continue offering unstined efforts in bringing about viable technological-cum-economical progress of the nation. He drew the attention of the Government, interalia other issues, to the growing unemployment amongst graduates. He also urged the Government to undertake immediate steps to arrest the ever increasing environmental pollution. Full text of the address of welcome is reproduced in this issue.

In his inaugural address the Prime Minister lauded the role of engineering community in its contribution towards the economical growth of the country. He held out that his Government was seized with tackling the problem of providing jobs to the professionals in earnest. He added that the Government believed that maximum benefits must be drawn from the greater educational facility of Pakistanies especially in the field of service and technology and went on to assert that he had issued directions that services of foreign experts be acquired only when absolutely necessary. The text of his speech as reported by the Pakistan Times, Lahore dated October 28, 1985 is reproduced.

On the conclusion of his address, the Prime Minister decorated Engineers M. R. Chaudhry (Wapda), Mian Ghiasuddin (Pakistan Railways), and Dr. N.M. Awan (University of Engineering and Technology Lahore) with gold medals for presenting best technical papers during 59th session.

The inaugural session of this 60th Annual Session had a unique distinction in the history of Congress that in addition to the Prime Minister as the Chief Guest it was attended by Governor Punjab, Chief Ministers of Punjab and

*Out going Secretary PEC.

Baluchistan, several Federal and Provincial Ministers with an unprecedented number of participants of engineers and scientists-over six hundred.

In the afternoon of October 27 and on 28th twelve technical papers were presented in three technical sessions on various topics subjects by distinguished authors. On the conclusion of each of these papers the questions raised by the audience were replied by the authors. The abstracts of these papers have been given in this issue.

On 29th October, 1985 Symposium on Rural Development in Pakistan was held where 11 technical papers were presented. Before taking up the Symposium, the convener Engr. Mian Mazhar-ul-Haq read a key-note which appears at the end.

On October 30, 1985 Engr. S.N.H. Mashhadi presented Secretary's report for the 60th Session to the Annual General Meeting and read the inspiring messages received from the Speaker of the National Assembly, Syed Fakhar-i-Imam, Governor Sind Lt. General Jahan Dad Khan, Governor NWFP Lt. General Fazal-e-Haq and Chief Minister Punjab Mian Nawaz Sharif felicitating the Congress on its novel activities. Minutes of the AGM as recorded by Secretary Engr. S.N.H. Mashhadi alongwith aforesaid messages also appear in this magazine. Thereafter the general elections for the 61st Session were held and the following Executive Council was elected :

President :

Engr. Mian Masud Akhtar

Vice Presidents :

1. Engr Sardar Allah Bakhsh
2. Engr. M.A. Hamid Rehmani
3. Engr. S.N.H. Mashhadi
4. Engr. Akhtar Ali Chohan
5. Engr. Rana Muhammad Saeed Ahmad Khan
6. Engr. Ch. Mohammad Rashid Khan
7. Engr. M.R. Chaudhry

Members :

1. Engr. S.M.A. Zaidi
2. Engr. Haroon Rashid Toosy
3. Engr. Nisar Ahmad Malik
4. Engr. Dr. Izhar-ul Haq
5. Engr. R.K. Anver
6. Engr. Syed M.H. Zaidi
7. Engr. Ch. Abdul Khaliq
8. Engr. Ch. Nazar Mohammad
9. Engr. Safdar Hussain Khan
10. Engr. Abdul Hameed Arif
11. Engr. Sultan Ali Barque
12. Engr. Mian Abdul Majid
13. Engr. Nisar Ahmed Sheikh
14. Engr. Ch. Muhammad Siddique
15. Engr. Javed Ahmed Malik
16. Engr. Nasim Akhtar Sheikh
17. Engr. Muhammad Akbar Khan
18. Engr. Azhar Irshad Chaudhry
19. Engr. Ashfaq Ahmad Koreshy
20. Engr. Zafarullah Khan
21. Engr. Ch. Haider Ali
22. Engr. Rashid Ahmad Baig
23. Engr. (Mrs) Naheed Ghazanfar.

On 31st October, 1985 selected delegates of the Congress left by a special air-conditioned train to Khairpur enroute to Karachi. At Khairpur they visited a gigantic land reclamation Project of Tile Drainage and at Karachi they visited works in progress at the Karachi Shipyard, Pakistan Steels and ACI Ltd. The delegates returned to Lahore on 4th November, 1985.

JUNEJO OPENS ENGG. CONGRESS SESSION

The Prime Minister Mr. Mohammad Khan Junejo, said on Sunday October 27, the Government was giving utmost priority to the task of creating maximum job opportunities for the professionally educated like engineers and doctors.

Inaugurating the nine-day 60th annual session of the Pakistan Engineering Congress in Lahore, the Prime Minister said the Government believed that maximum benefits must be drawn from the greater educational facilities, especially in the field of science and technology, and this was possible only if provided with adequate employment opportunities.

Mr. Junejo said he had already directed that services of foreign experts be acquired only when absolutely essential, and that the expertise of the Pakistani engineers be utilised to the maximum.

The Prime Minister also called for concerted efforts by all concerned to arrest the deteriorating standard in education. He advised the youth to give maximum attention to their education, so that after having qualified their courses they were fully equipped to appear in any interview or stand in any examination.

The Prime Minister said the Government was fully cognisant of the fact that there were hundreds of unemployed engineers and doctors. It could be perhaps for this reason that people did not consider it advisable to get their children taught in these classifications. He reminded his audience that in 1930s engineering and medical education attracted the best.

The Prime Minister stressed that the Government attached great importance to the engineer's profession, because completion of all development projects designed to raise the standard of living of the people depended to a very large extent on the work of engineers. He said Pakistan was a developing country, and the role of engineers in the social and economic advancement was pivotal not only for the present but also for the future.

He said the nation as a whole should have to work very hard to make the country economically self-reliant.

The Prime Minister said he was impressed with the education with which those working in engineering and technological fields were serving the nation. He was also in full agreement, with the code of conduct of the engineers and believed that by pursuing the objectives of this code they would be able to set a shining example of selfless service to the nation.

The Premier said he was happy to know that the Engineering Congress was giving special attention to the multifarious problems of rural uplift. He was sure that recommendations of the Congress in this context would be of great help to the Government, which attached the highest priority to rural development

Mr. Junejo said if Pakistan was to get rid of backwardness and if the country had to achieve its cherished goal of continuous progress, then rural uplift would have to be the main concern of all development activities.

He said the 70 per cent of the population who lived in villages was a national asset. These were the people who produced foodgrains and other crops, used as raw materials in industry. He said it

would not be besides the point to say that rural areas were the fountain heads of the entire national wealth.

Premier Junejo said if the quality of rural life became better, all sectors of the national life would benefit accordingly.

The Prime Minister said whereas the engineers were playing an important role in providing such services as industry, communication, electricity etc, they had also to play a similar role in rural areas The problem created by water-logging and salinity needed their immediate attention, and so was the need to provide guidance to solve rural housing problem in accordance with local conditions. Similarly the engineers had also to play a pivotal role in rural electrification project, in providing better roads between villages and cities and in establishing drinking-water facilities.

He said what was expected of the engineers was that they must devise ways and means to fully utilise local resources.

He said unfortunately developments in Pakistan had been such that backward areas had remained backward. What was lacking was proper planning to provide the people with their basic needs. It was really sad that after so many years there were areas where people lacked clean drinking water and even the minimum of health facilities.

He also made a mention of the use of inferior material in the construction of various development projects and said those indulging in this nefarious practice were the enemies of the country. He said those adulterating the construction material were in fact playing with the lives of their compatriots.

He said he would direct the concerned Ministeries to consider the Congress proposal of creating a quality control authority and to draw a standard's speciafication code. He said that immediate steps should be taken in this connection to avoid colosal national waste. He said the engineers must ponder as to why roads now being constructed break within two years, while those constructed 30 years ago are still intact.

He said it was imperative for the engineers to enforce strict supervision and to ensure that all construction was done in accordance with exact specifications.

He praised the work of the Punjab Engineering Academy, and said it would be in the national interest if engineers from other provinces were also given an opportunity for training here.

Mr. Junejo said his Government was accountable to the people, and as such it must fulfil its obligation to solve the problems of the people and to raise the overall quality of life. He said Government would definitely meet all its obligations in the establishment of a truly Islamic policy, in ridding the society from all evil trends and in rooting out corruption from the society. He reminded the engineers of the importance of honest earnings for a Muslim and said that this in itself was an act of faith.

He said it was important that the engineers should serve the people selflessly and honestly. In developing countries professionals like them were expected to work harder than others, because it were they who were laying the foundations for the future. He said nothing could be more satisfying for the engineers than to know that they were contributing towards the welfare of

others, towards the development of their country, towards raising the standard of living and towards increasing national wealth.

Later, the Prime Minister decorated some eminent engineers with gold medals for their outstanding contribution to the execution of various development projects. The recipients were Mr. M.R. Chaudhry of WAPDA, Mian Ghias-ud-Din of Pakistan Railways and Dr. N.M. Awan of the University of Engineering.

Earlier the President of the Congress, Mr. Masih-Ullah Khan presented an address of welcome and suggested that unemployed graduate engineers should be given a monthly stipend.

He also urged the Government to undertake immediate steps to check the environemntal deterioration.

The inaugural function was also attended by the Punjab Governor, Lt. General Ghulam Jilani Khan, the Chief Ministers of Punjab and Baluchistan, Federal Ministers and a large number of engineers from all over the country.—APP.

ABSTRACTS OF PAPERS PRESENTED AT THE 60TH ANNUAL SESSION

OF THE PAKISTAN ENGINEERING CONGRESS

DIVERTING RIVER INDUS THROUGH GHAZI GHAT ROAD BRIGE.

By (Brig. (Retd.) Ghazanfar Mohammad Khan
and Mohammad Aslam Chohan.

This paper is a detailed technical version of the diversion of River Indus at Ghazi Ghat Road, Bridge. On Feb. 12 1984 Mighty river Indus was tamed to pass through the newly constructed road bridge at Ghazi Ghat to connect Dera Ghazi Khan with the rest of the province by a direct route. On the basis of extensive model studies in the Irrigation Research Institute at Nandipur, the location of this bridge was made to coincide witht the axis of River Khadir by providing symetrical guide banks and the training works.

The diversion plan included construction of temporary regulator for a capacity of 9000 – 15000 cs. in non-modular/ semi-modular working flow conditions respectively, construction of access road, extension of 11K.V. Transmission line from Ghazi Ghat to temporary regulator to dewater the area for construction of the structure below the S.S.W.L; construction of Diversion bund linking shank of Spur R–1 W upto the right edge of the river facing the temporary regulator, excavation of leading cuts to connect the river with the left creek crossing the road bridge in bay 2 & 3, plugging/diversion of River Channels/ creeks of the right side to confine the river in one channel, construction of diversion channel to link the river on upstream and downstream via the temporary regulator, closure of main river channel by diverting the river flow through temporary regulator & lowering the gates, of temporary regulator to stop the water flowing across the structure and then putting a plug Bund at its back and a lot of other ancilliary works.

The detailed history of this project with all technical detailed drawings, design, actual field photograph and related data has been putforth in this paper. Execution of about 200 million cft. earth work, 5 million cft. stone work and construction of an intricate hydraulic structure having foundation 25 ft. to 30 ft. below sub-soil water level including provision of gates gearing arrangements in a short span of 3–4 months is a land mark of human efforts and indigenous resources.

SITE SELECTION KALABAGH DAM PROJECT

By

Dr. Izhar-ul-Haq

Kalabagh dam is multipurpose project which shall generate 2400 MW of low cost hydroelectric power near the load centre and create additional surface storage of 7.6 MAF on river Indus. Search for a dam site near the Kalabagh Town started about 30 years back. Various Consultants e.g. Tipton and Hill, Chas T. Main, Harza and Associated Consulting Engineers identified different sites and carried out geological and soil investigations. Out of the proposed sites A, B and C, Associated Consulting Engineers in the feasibility report recommended site C as it was comparatively less distrubed by tectonics and offered better prospects for layout and construction Materials. In 1980 World Bank group reviewed the feasibility report and confirmed the technical and economic suitability of site 'C'. The UNDP sponsored detailed studies for preparation of Tender drawing and documents. Kalabagh Consultants, a Joint Venture of Binnie and Partners, Harza, Preece Cardew, ACE and NESPAK started work in 1982. They reviewed the existing data and studied some more sites e.g. D, E, F and G. Finally Site P7 AA close to site E and C was selected.

Alignment refinement studies continued alongwith the project layout studies. Various alternative layouts were studied with the same basic criteria. As a result of optimization, the final project would comprise of the following main features : Two independent spillways each having a capacity of about 1 M cfs on the right bank, main dam (earth and rockfill) with crest at 945 SPD, diversion channel on the left bank, 4 low level conducts and 8 power tunnels each equipped with 300 MW turbines.

The bed rock consists of alternating Siwalik beds of claystone, siltstone and sandstone. At places the claystone beds were found sheared and having residual strength. Geotechinical studies indicated that it would be safe to replace the hillock containing the LLC and Power tunnels with rollcrete and then build dam over these conduites.

Theory of Minimum Rate of Energy Dissipation and Its Applications

By

*Child Ted Yang**

The theory of minimum rate of energy dissipation states that when a system is in its dynamic equilbrium condition, its rate of energy dissipation is at its minimum value which is compatible with the constraints applied to the system. When a system is not at its dynamic equilibrium condition, its rate of energy dissipation is not at its minimum value. However, the system will adjust itself in such a manner that its rate of energy dissipation can be reduced to a minimum value and regain equilibrium. For open channel flows under certain special conditions, the minimization of rate of energy dissipation is equivalent to the minimization of stream power or unit stream power. The theory of minimum rate of energy dissipation or its simplified versions of minimum stream power or minimum unit stream power can be applied to explain the variation of velocity distribution, bed form and roughness, channel width, channel geometry, channel pattern, and channel profile. The theory can also be used for stable channel designs. The relationship between minimization of rate of energy dissipation and maximization of sediment transport rate or friction factor is explained. Laboratory and field data are used to support the validity of the theory.

U.S. Department of the Interior, Bureau of Reclamation, Engineering and Research Center Denver, Colorado 80225 U.S.A.

REMEDIAL MEASURES TO RASUL BARRAGE

By

Engr. M.R. Chaudhry

1. The Barrages under the Indus waters Treaty consisted of five numbers at Chashma (Indus), Rasul (Jhelum), Qadirabad and Marala (Chenab), Sidhnai (Ravi) and gated siphon near Mailsi (Sutlej) These were designed to divert the waters of the Indus, Jhelum and Chenab towards the East through the Link Canals off-taking from these Barrages. The Rasul barrage was constructed on the river Jhelum supplies from release of Mangla reservoir into the Rasul Qadirabad Link Canal for ultimate supply to the existing Sulemanki Headworks on the river Sutlej. The barrage also diverts supplies to Lower Jhelum Canal. This barrage has 48 spans each 60 feet wide with a total length of 3209 feet. The barrage is designed for a maximum discharge of 850,000 cusecs. The contract was awarded to M/s. Cogefar Astaldi on 31st March, 1965 and the project was completed on 21st December, 1967 about 3 months ahead of schedule. M/s. Coode and partners were the Consulting Engineers for this Project.

2. The barrage was commissioned on 8th January 1968. Later on in May 1968 an unusual occurrence of excessive uplift pressures and also the bubble phenomenon were the cause of great concern, and operational restrictions had to be introduced to ensure the safety of the barrage.

3. The bubbles were noticed at the surface of the water mainly in the areas of the down stream concrete block and stone approns of the barrage when the tail water was low and still water conditions existed below the barrage. This phenonmenon which had given rise to concern that piping of material from below the aprons due to underseepage might be connected with it had arisen at the same time as higher pressures than design were being recorded in pressure points located under the downstream floor of the undersluice bays of the barrage. The following conclusions were drawn after carrying out the analog study permeability tests below the sheet pile cut offs chemical analysis of bubble samples and inspection by divers of the source and nature of emergence of bubbles :—

(i) The piezometers indicate that pressures under the standard bays are well within acceptable values and the analog studies do not indicate any excess gradients. Therefore the bubbles have no significance either with regard to the safety or the operational performance of the barrage.

(ii) The permeability of the subsoil is normal for the type encountered, and the underseepage velocities are well below velocities which could cause piping of material from below the barrage floor.

(iii) That the bubbles are not orginating from some underground source such as a gas field or strata of decaying organic matter.

4. The proposal of fibreglass relief wells was finally accepted to relieve the higher pressures caused by the clay layer. Accordingly 24 relief wells, 80 feet deep with a spacing of 15 feet 6 inches were installed in the downstream concrete block aprons of the undersluice bays. The pressures observed in the undersluice bays showed marked reduction and were well within acceptable limits after the installation of relief wells.

5. The following recommendations may be followed for the barrages to be constructed in future.

(i) Pressure points may be provided at every 4th bay as at present the spacing is about double this number.

(ii) Daily readings may be taken on all the pressure points during first year of operation of a barrage.

(iii) Piezometric reading should be taken only in stabilized conditions of upstream and downstream water levels.

(iv) Accumulation of silt should not be allowed on the concrete block apron.

(v) Four rows of bore holes may be drilled in every bay, one at the end of upstream concrete floor second at the centre of the barrage, third at the endof downsteam concrete floor and the fourth at the end of concrete block approns. The data from these bore holes will help to locate the soil profile likely to block the underseepage and preventive measures could be taken at the time of detailed design.

If economically feasible removal of clay layers and replacing with similar sandy fill material existing under the barrage will be best alternative to avoid blocking the underseepage otherwise some other suitable measure will have to be adopted.

(vi) The fibreglass pipe/screen can be safely used for the installation of relief/drainage wells.

CONSTRUCTION OF KHAIRWALA DRAINAGE PROJECT

By

Mansoob Ali Zaidi

Lower Rechna Doab was introducted to canal irrigation with the commissioning of L.C.C. system when the sub-soil water table was at about 60' to 80' depth and the rainfall scanty. With the passage of time and development, water table slowly and gradually started rising leading to serious problem of water-logging and salinity. Such events proceeded along the land slope i.e. from North to South and necessitated provision of drainage systems. By 1978 the whole of Upper Rechna Doab had been covered with horizontal and vertical drainage. However, the areas lying west of Rakh Branch and South of Chakbandi Drainage Basin were still without any drainage facility.

At present a major part of Faisalabad Division is badly water logged. A vast area lying between Jhang Branch and Bhowana Branch, Rakh Branch and Nasrana Disty : consitituting base lines and depression is almost completely waterlogged. About 54% of the total area of 3,33,400 Acres (521 sq. miles) has a sub-soil water table depth of less than 5' and some thing like 14% remains submerged for the most part of the year.

To cover this area, the Irrigation and Power Department conducted detailed survey and prepared a project for construction of 124 miles of trunk drains named as Khairwala Drainage Project The P.C-1 for this project included not only the construction of the surface drains but also 98 major masonry structures and other allied minor structures, like water-course crossings and inlets, etc. The Project approved by the Federal Government for Rs. 195 million in May, 1981, is nearing completion and is scheduled for completion by the end of this year.

The Author through this paper presents a resume of the construction process of various components of the Khairwala Drainage Project alongwith related problems, bottlenecks, hazards and the remedies adopted to mitigate them.

The concept, planning and design part of the project was presented by the Author in his earlier paper No. 458 in the 59th Annual Session of the Pakistan Engineering Congress.

GYPSUM AS AN AMENDMENT FOR THE RECLAMATION OF SALINE SODIC LANDS

By

Mohammad Altaf Hussain

Mohammad Asghar

In saline sodic lands there are two components which need elimination to bring the soil to normal productive condition. They are salinity and sodicity. Salts get dissolved in irrigation water, when applied in excess and are leached down but sodicity persists. In calcarious sodic lands a part of exchangeable sodium is replaced by calcium which comes into solution from calcium carbonate. It produces sodium carbonate which invariably raises the pH of the soil solution to a high level. The soil becomes dispered and decreases abnormally the leaching and sodium replacement of processes. Thus the period for reclamation is enhanced. To hasten the reclamation process the application of some suitable soil amendment is made to provide divalent cations to neutralize sodium carbonate and to replace the exchangeable sodium in the soil.

The easily available amendment in Pakistan is Gypsum. It is calcium sulphate in hydrated form ($CaSO4, 2H_2O$) and is found in massive formations. Its solubility in water at 25^oC is 0.26 percent. As it is very low, the chances of its being lost by deep percolation with excessive irrigation applications in saline sodic lands are ceased.

To demonstrate its beneficial effect to reclaim saline sodic lands some work has been carried out at the Laboratory level and the results achieved therefrom are reported in this paper.

METHODOLOGY OF CONSTRUCTION

OF

HOT-MIX ASPHALT PAVING

AND

OUR EXPERIENCES ON THE EXECUTION OF LAHORE–PATTOKI SECTION THIRD HIGHWAY PROJECT

By

Ch. Ghulam Hussain
Raja Karamat Ullah

The paper deals in two parts :

(i) The detailed outline of the methods and procedures generally adopted for the construction of hot-mix asphaltic concrete courses.

The asphaltic concrete consists of a very carefully proportioned mixture of coarse aggregate, fine aggregate and mineral filler coated with bitumen. When properly designed, it will provide a surfacing of exceptional durability capable of carrying the heaviest traffic. It is widely used for the surfacing of heavy duty roads, motorways, and air-field runways under all types of climatic conditions.

The main requirements of a good quality asphaltic concrete are as follows :—

Sufficient stability, that is it must be able to carry the traffic loads which are envisaged without deformation either in the form of rutting or pushing.

The mix must be durable, that is it must not fret or wear away under the action of traffic and weather.

ROAD SAFETY IN DEVELOPING COUNTRIES

Engr. M. Sadiq Swati

1.1 The problem of Road safety in most developing countries has already assumed alarming proportion. The number of fatalities in road accidents is now the second highest cause of death in these countries, trailing behind only Gastro-entritis. In recognition of the seriousness of the problem, the U.N. now considers the road accidents in the developing countries as one of the most serious health hazard and has mandated the World Health Organization to carry out research in the problem of road safety in the developing countries and suggest remedial measures.

1.2 According to the studies carried out by the Transport and Road Research Laboratory—U.K., the total tangible cost of road accidents in most developing countries was of the order of 1% of their Gross National Product. The amount would increase by at least 30% if cost of pain, grief and suffering is also included. This is a very high cost by any standards and much more so for the most developing countries who can ill-afford to lose such a portion of their financial resources.

1.3 The problem of Road Safety in the developing countries has been growing largely due to lack of proper diagnosis of the problem. Hardly any research has been carried out in this vital field in the developing countries in the past. Little progress can be achieved in bringing the problem under control until the causes of the problem have been clearly identified. Since extensive research is a pre-requisite for proper diagnosis, the real causes of problem could not be detected.

1.4 Although research findings from the developing countries can provide some guidance, the road safety problems in the developing countries are markedly different from the developed countries. The proven road safety counter measures in the developed countries, may not be very effective in the developing countries. There is considerable evidence to this effect as far traffic signals, pedestrian crossings and other road signs and markings are concerned.

1.5 In order to get a clearer picture of road safety problems and its possible solutions, a Case Study of Pakistan is presented. In Pakistan, the problem of Road Safety was first investigated on scientific lines in 1974. During the last sixteen years, the problem has been looked into from the point of view of road, vehicle, driver, enforcement, legislation, driver training, and host of other socio-economic factors. The results of the research carried out to-date are briefly described in the paper.

SOME ASPECTS OF PLANNING

By

Masood Hassan

Plans can be made to do something absolutely new, plans can also be made to improve the productivity of existing assets or investments which may mean doing something absolutely new. Whether has been worked out or not, it does not take much imagination to accept that whatever absolutely new plans are made the inventory of existing assets by and far exceeds the planned. Of course the public relationing aspect of doing something absolutely new is heady wine. However, grim reality also backons : us to take care of the existing accretion of assets demanding continuous attention and this is humdrum most uninteresting business. All plans, by and large, are conceptualized physically in the first instance. Giving the physical concept a financial reflection converts it into a budget, such budgets are therefore, secondary to or reflections of the primary thought. Yet, having converted so many cubic yards of earth to be moved, so many miles pipeline to be installed, so many tons of oil equivalent utilized, so many employees on the payroll, so many hours of mean time between failures of equipment or so many telephone instruments to be installed into a rupee or dollar figure it is so easy to forget the relationship between the physical original and consequential reflections. This connection becomes yet weaker when compounded by delays, inflation and changes in technology during the life of a plan. And there are many other upsetting factors which may be totally outside the control of both the planners and executors. This means when planning, it is necessary not only to look into the economic, techical, financial and social aspects.....it is equally important to ensure that implementation can be managed efficiently. Looking at both the transient conditions (putting something new up) and the steady state (routine looking after) requires a "life cycle costs" approach for it, this approach that provides a realistic picture.

TRANSFORMER LOSSES EVALUATION FACTORS FOR THE GENERATOR TRANSFORMER

OF

PROPOSED KALABAGH HYDROPOWER STATION : A CASE STUDY

By

*MUHAMMAD IRFAN AKHTAR**

Initial price may be the only criterion for consideration while purchasing a few 25 KVA distribution transformers, however, when huge transformers of many MVA capacities are to be procured, no-load losses and load losses, being substantial, are always taken into account.

The overall efficiency of commerical transformers is usually about 99% thus the total loss of 1% is comprising of no-load losses and load losses. For calculation purposes the evaluation factors for no-load losses and load losses are always provided by the purchaser and are considerably different for different power systems. By this information the manufacturer can modify his design of the transformer to make his offer more competitive. In this paper a refined method of determining such evaluation factors is described in detail. For clarity, the case of the generator transformer of Kalabagh power station is discussed in detail.

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*Muhammad Irfan Akhtar, B.Sc Engg. (Elect), M.S (Elect. Engg, USA), MPEC, MIEE, is a Senior Engineer in NESPAK.

AN OVERVIEW OF IRRIGATION & DRAINAGE PROJECTS OF PAKISTAN

By

Nazir Ahmad *
And
Sarfraz Ahmad **

i) Out of the usually accepted figure of 142 maf as average annual surface water resource of Pakistan nearly 40 maf was lost to the sea in the years 1977 to 1982. It is suggested to pump a part of this flow when available and divert it for water supply of Karachi. Possibility of groundwater which exists in the river channel below Kotri is also suggested to be withdrawn for use in Karachi.

ii) In the flood plains of the rivers, potential of about 15.00 maf is available which can be exploited and used for agricultural purposes.

iii) During 1977-78, 96 maf was diverted into the canal systems, 46.00 maf out of this seeped underground and about 16.7 maf on the area which includes saline groundwater underneath. Examination of the groundwater quality along depth indicates that nearly 60 percent of this fresh water recharge amounting to 10 maf can be withdrawn by suitable type of tubewells. The remaining about 6.7 maf can be pumped by shallow tubewells or open wells for drainage of the area. The pumped water will have such quality as can be used after mixing with canal or river water. The water withdrawn will collect the present seepage of about one cusec per square mile from the agricultural operations. This amount will increase with future higher diversion and extension of agricultural intensity. The thin depth of fresh water collected in the area will also be pumped out and utilized. These actions will improve the groundwater quality of the shallow aquifer.

iv) These suggestions need careful comparison with respect to the present actions of pumping highly saline groundwater and its disposal into rivers, sea or evaporation tanks.

v) Presently large sums are being spent on construction, operation, maintenance and replacement of tubewells, pumping highly saline useless water which can infiltrate on surface soil. Our suggestions may carefully be reviewed in the light of our present actions which hydraulically and financially are questionable.

vi) This paper also contains a suggestion to experiment on reduction of losses by evaporation particularly from Lakes and Ponds.

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*Ground water Consultant, 61-B/2, Gulberg-3 Lahore-11
**Tubewell Consultant, 4-C/3, Gulberg-3, Lahore-11

DEVELOPMENT OF SYNTHETIC UNIT HYDROGRAPHS IN SMALL UNGAUGED CATCHMENTS OF PAKISTAN

Mohammad Mahboob Alam

Preliminary findings of this paper had been presented in the Quarterly journal of Pakistan Engg Congress "Engineering News" Vol XXVIII No. 1, March 1984, When the Author was engaged in post graduate research on the topic under discussion. This paper presents certain modifications and refinments in the method descriped therein to make the study more usefull and worth while.

ABSTRACT

The study presents an emperical method of deriving coefficients of Snyder's synthetic Unit hydrograph. Basin lag and peak discharge were related to physical charactiristics of thirteen catachments ranging from 56 to 1560 square miles. These are located in Baluchistan Plateau and Potwar Highlangs lands of Himalayan Foothills in the vacinity of Mangla and Tarbela dams.

Equation for the determination of time base and coefficients used by Snyder were not found in line with the hydrological conditions of the catchments that have been studied. The same is the case with equations for the Time Width of Unit hydrograph of 50% and 75% of peak discharge and coefficients used by U.S Army Corps of Engineers. These emperical equations have, therefore, been modified to derive synthetic unit hydrographs for small catchments in Pakistan.

Synthetic Unit hydrographs derived by the modified snyder's method were compared with that of original snyder's method and U.S. Army Corps of Engineers method. Both the available methods have considerable variation in peak discharge time width and time base of unit hydrographs as compared with the modified snyder's method. Both the methods generally underestimate the peak discharge and overstimate the time width and time base of unit hydrographs. However U.S. Army corps of Engineers method have less variation as compared with the original snyder's method.

Validity of the derived coefficients was also tested by comparing the predicted and observed hydrographs. For the purpose of comparison the predicted and observed hydro graphs of the same storm were plotted on the same sheet to see any variation in peak discharge and its time distribution. Comparison of the predicted and observed results was made in all the catchments using modified Snyder's method and original Snyder's method. Results achieved are quite satisfactory and indicate that derived coefficients can effectively be used for hydrologically similar catchments, using modified Synder's method.

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*Deputy Director (Design) Wapda.

SYMPOSIUM ON RURAL DEVELOPMENT

KEY NOTE

By

*Mian Mazhar ul Haq**

Pakistan is basically an agricultural country and in order to make full use of its potentials in this field, it is important that every aspect of Rural Life is tackled on scientific lines. It calls for a comprehensive treatment which should result in rapid growth of agriculture as an industry, with maximum benefit to the worker in the field. Unless serious efforts are made to improve the lot of the peasant, which is the most important resources of our country, their flight to urban areas and even to other countries cannot be stopped. On the other hand agriculture as an industry, cannot be developed on scientific lines without the trained manpower. None of the programmes in the sector of Rural Development such as clean drinking water, sanitation, education, electricity, water management, salinity control, mechanized farming, soil conservation, agriculture loans, Cropping Cycle, Agricultural Research, Plant protection, Transport, Agro based industries, social economic programme and health programme etc. etc., can be effectively managed without well trained and well contented manpower. The so much talked about adaptation of modern teachnology can only be made effective through well trained labour. A lot of work will therefore, have to be done to extricate the rural population from the difficulties presently being faced by them and to bring about transformation in their outlook. There is no doubt that some work has been done in some fields in the recent past, but most of the villages are still as backward as ever, many of them still do not have safe water to drink, what to talk of sanitation or a decent dwelling.

The development of our rural areas, therefore calls for a comprehensive treatment and all pronged attack under a well conceived plan, preferably through a singular monitoring Ministry, which should be able to co-ordinate efforts of various deciplines and avoid overlap and wastage.

The present symposium, arranged by the Pakistan Engineering Congress is a major step in identifying the problems and needs, connected with Rural Development. Efforts were made to make the symposium as comprehensive as possible for which purpose various organisations were approached for contributing their valuable experience. Some responded well and the result is evident for the following pages. Others may like to come forward, at some other appropriate time, but if all organisations, Government, Semi-Government and Private, pool their resources and tackle all problems connected with Rural Development, collectively, dramatic effects could become visible immediately and the dream of green revolution could become reality within a very short span of time.

The authors who have contributed papers for this symposium have tackled various problems with which they have been associated in accordance with their own experience. Many of us may have

*Convenor, Officer on Special Duty Government of Punjab Lahore.

different experiences, which too should be shared with other. There are many topics which are vital for Rural Development but may not have found place is today symposium. The Engineering Congress would welcome more and more material suggestions and proposals etc. not only from different desciplines of Engineering and Technology but also from Agriculturists Economists, Social Welfare Organisations as well as Private individuals, as a follow up of the present symposium.

The current symposium offers food for thought on the following topics :—

1. **Strategies of Rural Development in Pakistan.**

Mr. M. S. Cheema Director General (Water Management), Agricultural Department gives a vivid picture of our Agricultural needs, past experience, policies, programmes, failures and their causes. He has stressed on the need for setting up Projects that will support one another after carrying out realistic assessment of their interdependence as well as their inter-action with Social Economic condition of the people. He strongly recommends :

i) Maximum participation of beneficieries in decision making

ii) Total mobilization of Human Resources

iii) Decentralisation of Decision making ;

iv) Effective delivery system

v) Evolution of self reliant and self supporting institutions

He has also suggested greater reliance on On Farm Management techniques, by curtailing wastage and losses composed to addition of more water in the system. He recommends greater reliance on the water users Associations, who have done commendable work in water conservation in the past.

2. **Private vs Public Tubewells**

Mr. Ramiz Ahmad Malik Chief Engineer (retired) Irrigation Deptt. has carried out a very interesting and educative comparison of the performance of different capacities of Tubewells for fighting water Logging and Salinity problems installed by Wapda, as well as private individuals. In doing so he has taken all aspects into consideration, such as initial cost per unit discharge, operating cost, life of tubewell, utilization and performance etc. etc. In the final analysis he feels that private tubewells will have to play greater role in this field in the Sixth Plan Period.

3. **Impact of Salinity Control and Reclamation Projects on Rural Development**

Dr. N.M. Awan has presented a very educative performance evaluation of various projects launched by the Government in the past to fight the "twin" menace of waterlogging and salinity, which poses is a real threat to rural economy. His diagnosis indicates major flaws in the past as, absence of participation by the Farmer, lack of coordination between Wapda staff and the consumer, cumbersome procedure for electric connection, etc. etc. His analysis shows that in the past the growth of private tubewells went much beyond the expected rate. He is of the considered view that this trend will continue but, unless, some serious studies are carried out in removing the interaction of technical problems as well as social

and economic problems, the private sector may not be able to bring about the desired result and may get begged down as did the scarp projects. Since the problems, ideentified are common, the author is of the considered view that unless an integrated study is carried out to remove the present hurdles, maximum performance efficiency of any such programme can hardly ever be conceived.

4. Maintenance and Operation of Tubewell

Sh. Abdul Hamid Arif Superintending Engineer, Scarp II, Sargodha has made a comprehensive study on the performance of tubewells in scarp areas and has come out with definite areas of weakness which need attention for achieving better performance/out put, from such tubewells. The suggested remedies will go a long way in prolonging the life of tubewells as well as economic on their operation.

5. Enhancing Water Availability to Farmers – A New Approach

Engrs. Nazar Mohammad M. I. Shaheed and M.A. Zaidi in their joint paper have highlighted the losses in our water courses as well as snags in the operation of private tubewells. They recommend greater emphasis on making pucca nakkas straightening, cleaning and compacting the banks of properly designed water courses, followed by regular maintenance. They also suggest lining of channels in water logged areas only, strongly urge installation of shallow private tubewells in useable ground water zones, by liberalising loans for such tubewells.

6. Farm Machinery and its Role in Rural Development

Mr. Sikandar Khan Managing Director, Millat Tractors Ltd., Lahore has analysed the need for different kind of Farm equipment and mahines suited for different crops. In doing so he has made convincing comparison of yields with modern equipment and that with conventional methods. He is of considered opinion that we have almost reached the limits of water and land resources and it is now only the modern agriculture machinery that can help grow more food, for our ever increasing population.

7. Drinking Water Supply Coverage to Rural Areas

Mr. S.M. Ashraf Superintending Engineer, Public Health Engineering Department Gujranwala, states that one of the major hurdles in Rural Development is, water borne diseases such as Dysentry, Diawrhia, Typhoid, Cholera, Hookworm, Small Pox, Measles and even T.B. etc. These diseases are rampant in our rural areas and not only cause large scale death, especially amongst children but also cripples the manpower so badly needed for development programme. He has suggested greater emphasis on eradication of these diseases by adopting preventive measures, compared to curative measures. If only our rural population could have access to germ free drinking water, it would be singular major step, boosting rural development. In his paper he had discussed different methods of purifying the water available in nature, suiting to different parts of the country such as Sweat water zones, Arid zones, Saline zones, Storm water zones, Hilly areas etc. etc.

8. Sanitation and Drainage in Rural Areas

Rana Mohammad Saeed Ahmad Khan, S.E. Public Health Engineering Circle, Lahore, in his paper, informs that hardly 1.78% of our Rural Population is served with adequate sanitation and drainage arrangements which is negligible. He stresses that alongside the provision of safe drinking water, proper arrangements for the proper disposal of used water is as important, if full benefit from the systems is to be achieved. It is only with adequate arrangements for disposal of waste water as well as solid waste, that complete eradication of water borne diseases can be achieved. He has made several low cost suggestion for the disposal of both, liquid as well as solid wastes, which can be safely adopted suiting to local conditions. The fact remains that this aspect calls for higher priority in our development programmes, since it deals with human beings not only because they are the principal development resource but also from humantarian point of view.

Apartment from suggesting technical solution to the problems he also lays great emphasis on community education and participation, for making any Rural Development Programme a real success.

9. Rural Roads

Rana Akntar Ali Chohan Chief Engineer, Highways (South), Lahore, has laid great stress on construction of network and rural roads, for making the farm produce reach the market in minimum time. The age old Kacha Village tracks can no longer meet the present day needs. He is of the considered opinion that revolution in Rural Socio Economic conditions can only be brought about, by giving priority to the construction of adequate all weather roads, in rural areas. In his analysis he has drawn the conclusion, based on past experience, that such a programme can be successfully implemented only through a specialised agency, compared to local agencies. He states that the Punjab Highways Deptt. has built about 3000 miles of village roads during the period 80-81 to 84-85.

10. Rural Electrification

Engineer Abdul Aziz Chaudhary has offered a paper on Electrification of villages. This is another vital area which calls for immediate attention. Rural electrification contributes towards increased agriculture, reclamation, of water logged areas, small industries, not to speak of the standard of living in general. There are 43244 villages in Punjab and hardly 1/3rd are electrified. The paper lays down the strategy for electrifying the remaining villages during the next 10 years.

11. Non Conventional Energy Options

Engr. Mushtaq Ahmad Bhatti, Project Manager, Nespak, Lahore in his paper suggests utilization of non conventional energy resources to meet the energy gap, especially in rural areas. The Hydro-electric power is badly falling short of ever increasing demand. The fossil fuels, on the other hand, are getting out of reach. He strongly urges the use of Biomass as a major alternate for meeting the energy needs of our rural areas. The raw materials such as cow dung, rice husk wood chips, saw dust barks, cotton bolls, nut shells, straws etc., etc., are readily available and can be usefully utilised. In areas where there is lot of wind, through out the year like lower Sind and coastal areas of Baluchistan, the use of wind-Mill could he made with advantage.

He also recommends continuous re-

search work on the utilization of Solar Energy, which should come within the reach in another 5 to 10 years time.

For long term solution he is of the strong opinion that Pakistan has to exploit nuclear energy, as quickly as possible, for effectively closing the gap between the ever increasing demand on energy and the possible increase in production of Hydro electric, Thermal Power and other non conventional methods, in future.

It is hoped that other people from different backgrounds concerned with the countries Rural Development, will whole heartedly come forward and share their knowledge and experience with their country man. While at the same time the Govt. would consider very seriously setting up a high power nuclear capable of making vital policy decision on controvercial matters as well as co-ordinating the preparation and implementation of a comprehensive integrated Rural Development programme for launching an all pronged attack, by the various agencies belonging to the Local Government, Provincial Government and Federal Government.

MINUTES OF THE 60TH BUSINESS SESSION OF THE PAKISTAN ENGINEERING CONGRESS HELD ON 30-10-1985 AT LAHORE HILTON UNDER THE CHAIRMANSHIP OF ENGR. MASIH ULLAH KHAN PRESIDENT, PAKISTAN ENGINEERING CONGRESS.

1. The 60th Business Session commenced with recitation from the Holy Quran. President Pakistan Engineering Congress, Engr. Masih Ullah Khan was in chair. Before taking up the agenda fateha was offered for the departed souls of the following engineers who breathed their last during the period between the 59th and 60th Annual Sessions :

i) Engr. Ch. Bashir Ahmad, Chief Engineer Highways Department.
ii) Engr. S.K. Baloch, Ex-Secretary Irrigation & Power, Government of the West Pakistan.
iii) Engr. Dr. S.M.H. Bokhari, Member (Water) Wapda.
iv) Engr. Ahmad Saeed Malik, Executive Engineer, I & P Department.
v) Engr. Nasir M. Khan, Superintending Engineer, Public Health Engg. Deptt.
vi) Engr. Ch. Altaf Hussain, Executive Engineer, I & P Department.
vii) Engr. Syed Mohammad Naeem Shah, Superintending Engineer, Buildings Deptt.
viii) Engr. Zafar Iqbal Malik, Executive Engineer, WAPDA.
ix) Engr. Abdul Qayyum Malik, Director Highways Department.

2. Seven messages from — Speaker of National Assembly; Governors of Sind, NWFP and Baluchistan; and Chief Ministers of Punjab, Sind and Baluchistan received on the eve of the inauguration and appended with the report were received by the Secretary. The Secretary informed that these were intended to be published in a Souvenir but due to late receipt of some of these messages needful could not be done. The Secretary, however, placed on record the gratitude of the Congress to all these VIPs by reading out their inspiring messages, copies of which are attached as Appendix-I to these Minutes.

3. CONFIRMATION OF THE MINUTES OF THE 59TH BUSINESS SESSION OF THE ANNUAL GENERAL MEETING HELD ON 6.4.1984

The Secretary informed that no verbal or written comments had been received. The minutes were, therefore, unanimously confirmed. The Minutes comprising 9 sheets were attached as Appendix-I to the Secretary's Report.

4. THE ANNUAL REPORT AND ACCOUNTS FOR THE YEAR ENDING 31-12-1985.

The Secretary read the Statement of Accounts and Annual Report highlighting the activities of the Congress during the Session. These were unanimously approved by the House. The salient features of these activities in brief are as under :

a) Office Bearers

The Secretary read the names of the outgoing members of the Executive Council and office Bearers co-opted later. The Secretary thanked all the Office Bearers who worked diligently and whole-heartedly under the Presidentship of Engr. Masih Ullah Khan.

b) Committees

The following Committees worked during the Session :

i) Membership Committee

ii) Building and Fund Raising Committee
iii) Constitution and Bye-Laws Committee
iv) Publication Committee
v) Annual Session and Proceedings Committee
vi) Auditorium Committee
vii) Symposium Committee

The Secretary thanked the Conveners and members of all these Committees who had worked very hard and made the Session a record success.

c) Membership

During the Session 173 new members were admitted to the Congress.

d) Technical Papers

The Executive Council in general and the Public ation and Symposium Committees in particular made great efforts to collect a record number of papers. It was due to their relentless devotion that 12 papers were published in the "Proceedings" and 11 in the "Symposium on Rural Development".

e) Talks/Lectures by Eminent Engineers/Scientists

Despite the limited resources at the disposal of the Executive Council it was able to stage seven very useful lectures on various topics during the Session.

f) Engineering News Journal

The performance of the Engineering News Journal, however, did not keep pace with other activities due to preoccupations of the Chief Editor and Co-Editors. Only three issues could, therefore, be brought out.

g) Renting of the Congress Building

The basement was leased out to the State Cement Corporation of Pakistan at Rs. 2.50 per sq. foot. But during the Session the basement was flooded thrice, once it happended before we leased it to the State Cement Corporation and twice during the period of their occupancy when most of their carpets and records were damaged. They have vacated the basement w.e.f. 30th September, 1985 They wanted to extend the lease for another period of three years and paid an advance of Rs. 2 Lacs. The Executive Council decided to negotiate a raise in the rent and authorized the Secretary, Joint Secretary and one another member to do the needful. Meeting will be held in this respect early.

5. RESOLUTIONS

With the permission of the Chair the following resolutions were passed:

i) Engr. Iftikharul Haq proposed that lateral entry into service as recommended by the Cornilious Committee in 1970-71 and adopted by the Government in 1973-74 but withdrawn later should be reintroduced. Engr. M.S. Khan seconded and the resolution was carried unanimously.

ii) Engrs. Iftikharul Haq and M.S. Khan moved two different resolutions first seconded by Engr. M.S. Khan and the second by Engr. M.M. Khan. These sought that Secretaries, Additional and Joint Secretaries of Technical Ministries should be appointed from amongst the related disciplines of Engineers. These were carried unanimously.

iii) Engr. M.S. Khan moved that Supreme Court injunction regarding fixation of seniority and promotion of I & P Department Punjab Engineers be implemented without delay. It was seconded by Engr. Azhar Irshad Chaudhry and carried unanimously.

iv) Engr. M.S. Khan moved that in keeping with Pakistan Engineering Council Act 1976 and in conformity with Ministry of Fuel Power and Natural Resources Office Memo No. WA/4/25/74 of 16-11-74, Sui Northern Gas Pipelines should desist from promoting other than Graduate Engineers to above their Grade-III which is equivalent to BS-17. They should also not allow more than 20% quota in BS-17 to promotees. Seconded by Engr. Iftikharul Haq the motion was unanimously carried.

v) Engr. Iftikharul Haq moved and Engr. M.S. Khan seconded that move-over from the lower grade to the next higher in all grades be allowed automatically without subjecting to inordinate delays of office routines. The motion was carried unanimously.

vi) Engr. M.S. Khan moved and Engr Iftikhbrul Haq seconded a resolution that the professional examination by Punjab Service Commission be dispensed with and only viva-voce interviews should be conducted for selection of candidates as done earlier. The resolution was carried unanimously.

vii) As provided in Articles 10, 11,12 and 13 of the Memorandum of Association, Articles and Bye-Laws of the Pakistan Engineering Congress the following members of the Executive Council for 61st Session (1985-86) were elected :

President : Mian Masud Akhtar,
Secretary, Irrigation and
Power Punjab.

Vice-Presidents:

1. Rana Mohammad Seeed Akhtar Khan, S.E. Public Health Lahore.
2. Ch. Muhammad Rashid Khan, S.E. WAPDA.
3. Akhtar Ali Chohan, Chief Engineer, Punjab Highways Deptt.
4. M.R. Chaudhry, Chief Engineer (Civil) WAPDA.
5. S.N.H. Mashhadi, Consultant.
6. Ashfaq Ahmed Koreshi, S.E. Buildings Deptt. Rawalpindi.
7. M.A. Hameed Rehmani, Chief Engineer, Irrigation, Multan.
8. Sardar Allah Bakhsh.

EXECUTIVE COUNCIL MEMBERS

6. Western Zone :	1.	Abdul Razik Khan
Southern Zone :	2.	Ch. Haider Ali
Northern Zone:	3.	Syed Mansoob Ali
-do-	4.	Javaid Ahmed Malik

-do-	5.	Abdul Hameed Arif
Central Zone :	6.	Ch. Muhammad Siddique
-do-	7.	Mrs. Naheed Ghazanfar
-do-	8.	Ch. Nazar Mohammad
-do-	9.	Zafar Ullah Khan
-do-	10.	Azhar Irshad Chaudhry
-do-	11.	Sultan Ali Barq
-do-	12.	Haroon Rashid Toosi
	13.	Dr. Izharul Haq
	14.	Ch. Abdul Khaliq
	15.	Ch. Mohammad Khurshid
	16.	Rashid Ahmed Baig
	17.	Safdar Hussain Khan
	18.	Rana Khurshid Anwar
	19.	Malik Nisar Ahmed
	20.	Nisar Ahmed Sheikh
	21.	Mohammad Akbar Khan.
	22.	Mian Abdul Majid
	23.	Nasim Akhtar Sheikh
	24.	Syed M.H.Zaidi

7. The retiring President was presented the Shield of Congress on behalf of the Executive Council.. A vote of thanks was passed for the retiring President, Office Bearers and Council Members for the commendable work done by them during the Session.

8. The meeting thereafter adjourned with a vote of thanks to the Chair and the participants.

MESSAGE OF FELICITATION
FROM SPEAKER NATIONAL ASSEMBLY OF PAKISTAN

It is matter of great pleasure that the Pakistan Engineering Congress is holding its 60th Annual Session on October 27, 1985 in which, besides matters of technical importance, Rural Development in Pakistan will be discussed in a symposium at great length.

You would be aware that we are going through an age in which technological advancement is taking place in the industrialized world at a phenomenal pace. Unless we keep abreast of the latest developments in technical knowledge and expertiese, we are likely to be left far behind in the race for progress. I am sure that the Engineering Profession in Pakistan has the eagerness, the urge and the capability to acquire the most upto date skills and technical know how and the Congress will, no doubt, suggest ways and means by which this process can be expedited.

It is a matter of great pride and satisfaction that the engineering profession in the country is making its mark and that more and more sophisticated and complicated projects are being handled by our own engineers, without foreign help. I am confident that they will have still greater achievements to their credit in course of time.

It is needless to mention that Engineers are playing a vital role in the rural development of Pakistan and I have no doubt that, in the days to come, they will give off to the nation the best possible results of their dedication and knowledge.

I wish all sucess to the Pakistan Engineering Congress.

Yours sincerely,

Sd/-

(SYED FAKHAR IMAM)

MESSAGE FROM LT. GEN JAHAN DAD KHAN HI(M)
SBT GOVERNOR OF SIND

I am pleased to learn that the Pakistan Enginering Congress is holding its annual session in the first week of October 1985 and intends to bring out a Souvenir on this occasion.

Scientists and Engineers of our country have to play a pivotal role in the national development. It is, therefore, imperative that they get together at regular intervals to discuss the latest trends and developments in the field of engineering. Such mutual exchanges of knowledge and ideas can prove to be very educative for the participants so that the freshly acquired knowledge can be applied for constructive purposes.

The pace of scientific research and progress is indeed very fast and unless we keep ourselves abreast of the latest developments, we shall be left behind. I hope that the informative and thought provoking papers read at the session will add to our knowledge and lead to quality development in the field of science and technology.

I pray for the success of the proposed session of your congress.

Sd/-
Lt. Gen. Jahan Dad Khan

MESSAGE BY LT GEN FAZLE HAQ, GOVERNOR NWFP

It gives me great pleasure to know that the Pakistan Engineering Congress is holding its annual session on October 27, 1985, the historic city of Lahore.

Engineers play an important role in the development of any society. The present day society is heavily dependent on engineering skills in almost all walks of life. It is therefore essential that the professional knowledge of this vital class be updated through annual meets, symposia and other media.

I am sure that the annual session of the Pakistan Engineering Congress will provide an opportunity to our engineers to assemble and ponder over the problems faced by the Nation and the challenges posed to the engineer community.

I wish the organisers every success in its deliberations at Lahore.

MESSAGE FROM THE GOVERNOR OF BALUCHISTAN LT, GENERAL K.K. AFRIDI ON THE OCCASION OF 60TH ANNUAL SESSION OF PAK ENGINEERING CONGRESS.

It gives me great pleasure to learn that the Pakistan Engineering Congress is holding its 60th annual session in Lahore.

I am happy to know that this organisation is voluntarily engaged in promoting engineering skills and updating the professional knowledge of the engineering community for almost about the three quarters of a century; specially in this part of the world which is rather backward in the field of engineering and technology. I appreciate the valuable services of the Pakistan Engineering Congress and hope that it will continue to work for the welfare of the engineers of the country, afresh their knowledge and improve their efficiency by holding regular Conferences, Seminars and Symposia. I also hope that our engineers will carryout their responsibilities sincerely and zealously and play their effective role in the development of the country.

I wish Pakistan Engineering Congress all the success.

MESSAGE FROM CHIEF MINISTER PUNJAB, LAHORE

It gives me great pleasure to know that the Pakistan Engineering Congress is holding its 60th Annual Session in Lahore which will be formally inaugurated by the Prime Minister of Pakistan, Mr. Muhammad Khan Junejo on October 27.

As premier body of the engineers of Pakistan, the Engineering Congress has over the years been instrumental in promoting scientific studies and engineering skills and practices to boost production. The annual session provides a forum for presentation of technical papers on matters of vital importance and the recommendations made in these papers are of great value. These activities of the Congress provide opportunities to the Pakistani engineers to update their professional knowledge and to benefit from the latest results of research.

I am sure our engineers will suggest remedial measures to combat the growing menace of water-logging and salinity which is an open challenge to their skill and prowess. Our engineers have won laurels for their motherland both at home and abroad by designing modern roads and bridges and by implementing projects of repute.

I wish all success to the Pakistan Engineering Congress in its efforts to stimulate research and to promote scientific studies.

Sd/-
(NAWAZ SHARIF)

MESSAGE FROM CHIEF MINISTER, SIND

I am glad that the Pakistan Engineering Congress is bringing out a Souvenir on the occasion of their annual conference. I am sure that this Souvenir will not only effectively highlight the achievements of the congress, but will contain articles on engineering subjects, which will serve as source of knowledge and inspiration to the readers. It will, I hope, at the same time try to infuse in the Engineers a will to serve their country with the best of their knowledge and life. Pakistan Engineering Congress is working for the past many years and during these years has successfully attained high degree of professsional efficiency and competence. It has also been working for the welfare of Engineers. Both these objectives are very commendable.

I am sanguine that the present congressional session will try to inspire the engineers to march forward at a space and acquire uptodate knowledge and the latest technology. In our world and times there is a place only for the best and every engineer will strive to excell himself in his vocation.

I wish the Engineering Congress all the best.

Sd/-

JUSTICE (Retd) SYED GHOUS ALI SHAH

وزیر اعلیٰ بلوچستان

پاکستان انجینئرنگ کانگرس کے سالانہ اجلاس کے موقع پر
کوئٹہ ——— وزیر اعلیٰ کا پیغام

میں پاکستان انجینئرنگ کانگرس کی ان کاوشوں کو جو وہ ملک میں سائنس انجینئرنگ، کے فروغ اور ترقی کی خاطر کر رہی ہے۔ قدر کی نگاہ سے دیکھتا ہوں۔

درحقیقت دیگر ترقی پذیر ممالک کی طرح پاکستان کو بھی سائنس ٹیکنالوجی میں ترقی کی شدید ضرورت ہے۔ تاکہ ملک زندگی کے تمام شعبوں میں خود کفالت کے قریب آسکے ملک کا گرانقدر اور خطیر سرمایہ بیرونی ممالک سے درآمد شدہ مشینری پر صرف ہوتا ہے۔ اگر مُلک کے اندر یہ کوششیں مزید تیز کی جائیں۔ اور ہم اپنی ضروریات ملک کے اندر ہی پوری کرسکیں تو اس سے بہتر اور کیا چیز ہوسکتی ہے۔ لا محالہ اس سے قومی معیشت پر بہتر اور مفید اثرات مرتب ہوں گے۔

مجھے یقین ہے کہ پاکستان کی ہمہ گیر ترقی اور خوش حالی کی خاطر پاکستان انجینئرنگ کانگریس کی کوششیں بار آور ثابت ہوں گی اور موجودہ سالانہ اجلاس ہر اعتبار سے کامیاب اور مفید ثابت ہوگا۔

نیک تمناؤں کے ساتھ

الحاج جام میر غلام قادر خان
وزیر اعلیٰ بلوچستان

USE OF SPRINKLER IRRIGATION IN THE BARANI AREAS OF PAKISTAN

By

*Barkat Ali Luna**
*S.N.H. Mashhadi***

1.0 INTRODUCTION

Sprinkler irrigation is a versatile means of applying water to the surface of any crop or soil. A sprinkler system can apply water to soils at rates equal to, greater than, or less than the infiltration rates, it can be completely automatic or can be manually operated. In general, a sprinkler system can be employed for most soil and topographic conditions and for those areas where surface irrigation may be inefficient and expensive. In the Sprinkler method of irrigation water is applied above the ground surface as a spray thus resembling the ordinary rainfall to a great extent. In this method water is drawn from Rivers, Canals, Storages or wells by pumps and carried by pipes to the fields and then spray is developed by the flow of water under pressure through small orifices or nozzles of the sprinklers. The pressure may also be obtained by gravity if water source is high enough above the area to be irrigated. Thus the essential components of a sprinkling plant are Motor and Pumps with Suction Lines, Main Pressure Conduit, Laternal Piping and Sprinklers. Sprinkler irrigation is most suitable for efficient water application in as-much-as water can be applied at optimum times for crop needs and in quantities that can be retained by the soil without wastage in the form of deep percolation below the root-zone and surface run-off. By careful selection and installation of the equipment the water is applied uniformly at rates based on the intake rate of the soil thereby preventing deep percolation that will avoid waterlogging in the long run and also preventing run-off that can damage the lands and the crops.

The sprinkler is the most important part of a sprinkler system. Most sprinklers consist of one or more nozzles or orifices that spray water under pressure through the air to irrigate the desired area. The wide range in sprinkler and nozzle sizes and types of sprinklers usually permits the designer to select the proper sprinkler and operating pressure to meet specific soil and crop requirements satisfactorily. The type of sprinklers commonly used are discussed in para 2.0.

2.0 Types of Sprinklers

The following three types of sprinklers are generally in use:

1. Fixed nozzles attached to the pipe: In this type paralled pipes are installed about 50 ft. apart and sup-

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**Managing Partner, National Development Consultants, Lahore.

ported on rows of posts. Water is discharged at right angles from the pipe line. The entire 50 ft. width between pipe lines may be irrigated by turning the pipes through about 135°.

2. Perforated Pipe: Perforated sprinkler lines are used more extensively in orchards and nurseries. They do not cover a very wide strip.
3. Rotating Sprinklers: The advantage of this sprinkler over other types is its ability to apply water at shower rate while using relatively large nozzle openings which are particularly favourable in waters containing silt and debris. With large nozzle openings less stoppage of sprinklers is experienced. The slow rate is also desirable on soil having low infiltration rates and is advantageous to the small farmer doing his irrigation alongwith his field work.

3.0 Systems of Sprinkler Irrigation

The sprinkler system includes the sprinkler, the riser pipe, the lateral distribution pipe, the main pipe line and also the pumping plant. Many systems of sprinkler irrigation have been developed during the recent past due to rapid advance in research and technology. The following are the common methods usually practiced in almost all the countries where sprinkler irrigation has been adopted.

3.1 Permanent and Semi-Permanent System

In this system the main lines are burried and the lateral lines and sprinklers remain fixed during the irrigation season. Labour is reduced to the minimum and quality and yield of crops are generally maximal. One man can irrigate 80-160 acres per day. The most extensive use of this system has been on potatoes which show marked increases in yield and quality with light frequent irrigations. Shallow rooted crops like radishes are also responding well to this system. This is also useful for nurseries for maintaining a misty moist condition over plants.

3.2 Portable and Semi-Portable System

The portable and semi-portable systems are most commonly used in agriculture. A fully portable system consists of either a stationary or a portable pump and portable main lines, laterals, and sprinklers. This can be moved readily from field to field thus extending its utility.

3.3 Gravity Sprinkler System

When the source of water is high enough on an adjacent hill to produce sufficient pressure at the sprinkler nozzles without use of a pump, the system is called a gravity sprinkler system. There is no expense for a pump and motor, fuel or electricity. However the length of main pipe line may increase to convey the water from the source to the field.

4.0 PRESSURES

Sprinkler systems operate under a wide range of pressures from 5 psi to 100 psi. The desirable pressure depends upon area to be covered, type of sprinkler used, sprinkler spacing and crop being irrigated. Low pressures range from 5 to 15 psi; medium from 15 to 30 psi;

intermediate from 30 to 60 psi and high pressures from 60 to 100 psi. Giant sprinklers usually operate at pressures in excess of 80 psi. Sprinklers in the low pressure range have small areas of coverage and relatively high sprinkling rates. Medium pressure sprinklers cover larger areas and have a wide range of precipitation. High pressure sprinklers cover large areas and precipitation rates are high. Appropriate pressures can be developed by using proper sizes of centrifugal pumps and motors. Depending upon the site conditions suitable sprinkler system can be designed for each site.

5.0 The Problem of Silt and Debris

Silt and debris are very detrimental to sprinkler equipment, because the abrassive action of silt causes excessive wear on pump impellers and sprinkler nozzles and bearings. Debris plugs nozzles and thus interferes with uniform application of water to the land. Accordingly removal of silt and debris is essential for efficient use of sprinklers. Silt is heavier than water and settles out if given an opportunity. In the barani areas of Pakistan, water is taken from the reservoirs of small dams, or from tubewells and springs. The problem of silt and debris therefore does not exist for all practical purposes.

6.0 High Initial Cost

No doubt the initial cost of a sprinkler system is high as compared to a gravity system, but the increased benefits in using sprinkler irrigation far out-weigh this cost. These benefits are briefly listed below:

i) increased yield and better quality.
ii) less land out of production.
iii) Reduction in initial cost of land levelling.
iv) Saving in water which is so precious in the barani areas.
v) Avoiding erosion of land resulting from flow irrigation.

In fact, the most suitable method of irrigating barani land is by sprinklers and it should be introduced as early as possible.

7.0 Advantages of the System

i) The high degree of water control is the outstanding advantage of sprinklers over other methods of irrigation. Water application can be controlled to within the water-holding capacity of soil in the crop root-zone and thus no water is lost in deep percolation. Water application rates can be as low as 0.25 cm/hour or 0.10 inches/hour, thus permitting the max. use of irrigation water.

ii) Due to the high degree of water control, no surface flow is possible. This avoids all hazards of soil erosion which is a serious menace in the barani areas.

iii) Due to strict control on use of water, no deep percolation is permitted which avoids water-logging in the long run.

iv) The high cost of land levelling can be avoided and thus steep or undulating lands can be irrigated for agricultural produce no less in quantity and quality as on level lands irrigated by gravity flow.

v) Sprinkler systems generally utilize smaller rates of water flow more effectively than surface irrigation methods and are of distinct advantage on soils of high permeability or low water-holding capacity. Under some conditions they can be advantageous on dense soils of low permeability.

vi) Where labour costs are high for surface irrigation, sprinkler irrigation may be the most economical methods for applying water. Sprinkler systems are especially desirable where the required pressure can be developed by gravity.

vii) Sprinkler systems have uses other than those of meeting the water requirements of crops. Fertilizer application, frost protection and temperature control are becoming prominent accepted uses of sprinkler systems all over the world.

8.0 Conditions Favouring Sprinkler Irrigation

Sprinkler systems are most suitable for irrigation of the following types of land and soil:

i) Areas where soil is too porous for good distribution of surface waters. In such areas tremendous loss of water would occur by deep percolation below the crop root-zone, if flow-irrigation is adopted.

ii) Land having steep slopes and easily erodible soils.

iii) Undulating land is too costly to level sufficiently for good surface irrigation.

iv) Shallow soils the topography of which prevents proper levelling for surface irrigation methods.

v) Irrigation streams are too small to distribute water efficiently by surface irrigation.

vi) Labour available for irrigation is either not experienced in surface methods of irrigation or is unreliable, good surface irrigation requires trained reliable labour.

vii) Land needs to be brought into top production quickly. Sprinkler system can be designed and installed quickly.

9.0 Comparison with Surface Methods

i) Higher water application efficiency and no loss in deep percolation.

ii) No soil erosion due to strict water control.

iii) No water-logging in the long-run.

iv) Less land taken out of production and less interference with farming operations.

v) Water measurement is easier with sprinkler system than with surface methods.

vi) When water is already being pumped to the point of use, the pressure needed for sprinkling can be obtained with minimum additional cost.

vii) When domestic and irrigation water comes from the same source, a common distribution can frequently be used.

viii) For areas requiring infrequent irrigation, sprinkler irrigation is cheaper than surface methods.

ix) Whenever water can be delivered to field under gravity pressure, sprinkler irrigationis attractive.

x) Frequent and small application of water can be applied readily by sprinkler system.

10.0 Conclusions and Recommendations

10.1 Characteristics of Barani Lands

The barani areas of Pakistan are generally characterised by the following conditions of land and water:

i) The land available for irrigation is undulating or steeply sloping. Levelling of such a land for applying flow irrigation is extremely expensive and time taking.

ii) Water is a scarce resource in such areas. Small quantities are stored here and there by building small dams at a considerable cost and some water is secured by digging tubewells or from springs. It is, infact, criminal, to waste such water in wasteful irrigation practices.

iii) Land erosion by gully formation is a common feature in such areas. Any form of irrigation in which water is likely to flow over the surface should not be permitted here, because it would encourage gully erosion particularly on steep slopes or undulating lands.

iv) The land available is very fertile but is limited to chunks separated by eroded strips here and there. Max. use of this land without wastage is highly essential.

10.2 Suitability of Sprinkler Irrigation

Sprinkler irrigation is ideally suited to the above conditions of land and water availability, because

i) Undulating and steeply sloping land need not be levelled for application of sprinkler irrigation and thus huge expenditure on levelling operations can be saved.

ii) No wastage of land is involved in field water courses and max. land can be cultivated.

iii) It ensures optimum use of water because there is no loss in deep percolation below the crop root zone.

iv) There is no possibility of surface flow. Hence no gully erosion is possible.

10.3 Recommendations

i) In view of the favourable circumstances as enumerated above, it is recommended that some pilot projects in the barani areas of the Punjab may be started on experimental basis. The only sophisticated part of the equipment is the Sprinkler which can be imported in the beginning, and later on designed and produced locally. This equip-

ment is manufactured and used in almost all parts of U.S.A. and Europe, perhaps the cheapest being from Italy. It will be better if the help of some World Aiding Agencies is sought for import of the equipment and practical training of personnel who have some theoretical knowledge and back ground of the subject.

ii) It is further recommended that these pilot schemes may be got investigated through some suitable consulting engineers who would prepare feasibility reports and PC-I Proformas of such schemes for approval by the Government. Since this is a new venture in irrigation practices of this-country which is dominated by flow-irrigation from Canals, the preparation of feasibility reports and P.C-1 Proformas through expert consulting engineers is essential to convince Government Officers who have been dealing with flow irrigation all through their lives.

ABSTRACT OF PAPERS PRESENTED AT INTERNATIONAL COLLOQUIUM ON CONCRETE IN DEVELOPING COUNTRIES MATERIAL, DESIGN & CONSTRUCTION

The International colloquium on concrete in Developing Countries was held in Lahore, Pakistan from December 14-20, 1985. These colloquium proceedings have been published in two volumes and were made available at the colloquium to all registrants. These include 44 papers from 8 different contries covering all aspects (materials, design, construction and others) of concrete. This international Forum was jointly sponsored by the Institution of Engineers Pakistan, the Canadian Society for Civil Engineering, the University of Engineering and Technology, Lahore.

Abstract of the 23 papers published in volume I relating to materials are put forth for the General interest of the readers and fellow Engineers. The remaining papers of volume II relating to analysis and design will be printed in the next issue.

ABSTRACT OF PAPERS PRESENTED AT INTERNATIONAL COLLOQUIUM ON CONCRETE IN DEVELOPING COUNTRIES MATERIAL, DESIGN & CONSTRUCTION

1. Development in Materials Technology A State-of-the-art

V.M. Malhotra, Head, Construction Materials Section Canmet, Energy, Mines and Resources Canada Ottawa, Canada.

This paper presents a state-of-the-art review on the developments in materials technology. The physical and pozzolanic properties of fly ash, blast-furnace slag, and condensed silica fume are outlined, and their effect on the properties of fresh and hardened concrete are described. Mention is made of non-ferrous slags and rice-husk ash. The limitations of currently available specifications on supplementary cementing materials are discussed and a case is presented for performance oriented specifications. Separate batching of supplementary cementing materials versus the use of blended cements is discussed, and a reference is made to the current practice in this regard in Canada and the U.S.A.

The advantages and limitations of superplanticized concrete, polymer-, polymer-impregnated-, and latex modified concretes and sulphur- and sulphur-infiltrated concretes are discussed. The properties of fibre reinforced concrete are given and reference is made to the slurry-infiltrated fibre concrete. The developments of roller-compacted concrete is traced and its advantages are discussed. A selected bibliography is also given.

2. Recent Developments and Innovations in Materials Technology

K.W. Nasser, Professor, Civil Engineering Department, University of Saskatchewan, Saskatoon, Canada.

This paper presents two investigations: one deals with the effect of replacement of cement with lignite fly ash on the properties of concrete and the other one deals with the ability of a new tester to monitor the slump and the workability of freshly mixed concrete.

Cement was replaced by increasing amounts of fly ash up to 65% and the resulting properties of the concrete were studied. These included the slump, air content, strength, shrinkage and creep. Preliminary results show that replacement of cement by up to 50% with lignite fly ash can be achieved with tolerable changes in the properties of the concrete. However, the savings in the total cost and in the amount of pollutants in the environment will be substantial.

A new apparatus is described which can be used to control the slump and the workability of fresh concrete. A round robin of tests was conducted and the results confirm that the new K-slump tester is a reliable apparatus that can control the consistency of fresh concrete in 60 seconds.

3. **Natural Fibre-Reinforced Cement Mortar Corrugated Roofing Sheets**
C. Berwancer, Professor, Civil Engineering Department, University of Ottawa, Ottawa, Canada.

The relative brittleness of cement-based materials can be modified using natural fibres to meet the objectives of improving the tensile and flexural strength, the impact strength, control cracking and the mode of failure. A review of the literature is presented with discussion for each of the countries where corrugated roof sheets using natural fibres have been produced. The technical information in these investigations has been summarized for coir, elephant grass, kenaf and sisal fibres used in corrugated roof sheets. A summary of fabrication procedure is made.

Natural fibre reinforced corrugated roof sheets have definite cost advantages over the other roofing materials. Indigenous materials are used that require only local labour in their production. The process is labour intensive and can be implemented on a village industry basis with small capital investment. It can provide work where there was none before. This low-cost technology has also permitted the handicapped to build their own homes, providing both shelter and employment. They acquired skills that were marketable, regained self-respect and a measure of independence.

4. **Investigation of High-strength concrete**
Wu Pei-Gang, Lecturer
Zhujin Quan, Associate Professor
Lu Zhang, Lecturer, Quinhua University, Bejjing, China.

This paper presents a review of the investigation of high-strength concrete at Qinhua University, Bejjing, China.

The following topics are emphasized:

1) Production of high-strength concrete using superlasticers under ordinate conditions is described. The selection of raw materials, mix design and technological process of high-strength concrete is illustrated. Typical mix ratios are given.

2) The physical and mechanical properties of high strength concreted are investigated. The permeability, freeze-thaw durability, shrinkage, and creep of high strength concrete are compared with similar characteristics of normal strength concrete.

5. **Wide Application of Expansive Concretes in China.**
Wu Zhongwei, Consultant, Research Institute of Building Materials and Professor Qinhua University, Bejjing China.

Since 1969, expansive cements have been used in a variety of ways in China in various building and construction projects for shrinkage compensating and selfstressing. In addition, a number of successful uses have been made for different purposes for which ordinary cement would not have been effective.

Some principal features of expansive cement concretes are summarized with illustrations and their application described for shrinkage compensation such as waterproofing structures, underground structure, joint filling as well as mass concrete construction, for selfstres-

sing such as pressure pipes and electric transmission poles, and for special purposes such as winter concreting, rapid hardening and corrosion resistance. The advantage of savings in energy (including saving of clinker), replacing xxxxxxxx and timber and cost savings are evident. The prospects of cement concretes in developing countries are very promised.

6. Expansive Cement and its Application.

Shamim A. Sheikh, Assistant Professor.
Michael W. O'Neill
Professor and Acting Chairman,
Department of Civil Engineering,
University of Houston, Houston, U.S.A.

In the research reported here an expansive cement with large expansive potential has been developed and its application in drilled shafts (bored piles) has been investigated. The utilization of concrete expansion in producing self stress is not of primary concern in this application. However, the expansion appears to produce a stronger bond between concrete in the shaft and the surrounding soil and to improve soil properties at the interface. This effect produces an increased frictional capacity and a reduction in the settlement of the shaft at working load levels. An analytical model based on the stress path method has been developed to predict the frictional capacity of expansive concrete shafts.

Two drilled shafts were made with expansive cement in stiff clay, and normal cement was used in a third shaft to serve as a reference. The shafts were nominally 12 in. (305 mm) in diamete and 10 ft. (3.05 m) long. Two months after casting, the three shafts were tested under concentric compression, and cores were taken from the top of the expansive concrete shafts for the purpose of evaluating concrete properties. A year and a half later the shafts were tested first under compression and then under uplift loads. The shafts were later extracted for visual observation and coring along the length of the shafts from both ends.

From the experimental and analytical work reported here, it was concluded that expansive concrete increased the frictional capacity of the drilled shafts by as much as 50% and reduced the settlement by about 50%. The benficial effects of using expansive concrete were available at early ages as well as one and a half years after casting. The expansive concrete behaved as a sound structural material in all tests.

7. Effect of Plasticizers on Strength and Workability of Concrete in Pakistan.

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Use of plasticizers in concrete in this country has, so far, been very limited. Two plasticizers are known to have been used. One of the two is Porzite 73, which is of Candadian origin and the other is Melment L10 which is of Swiss origin. Porzite 73 has been used in WAPDA's Prestressed Concrete Pole Plants and Melment L10 has been used at Faisal Mosque project at Islamabad. No definite information was available except that given by the manufacturers as to the effect of these plasticizers on strength and workability of concrete. In order to study the effect under local conditions, two series of experiments

were planned and conducted in 1981 and 1983.

In the first series, a concrete mix was selected and at constant water contents, the effect of various quantitfes of each plasticizer on strength and workability of concrete was studied. The strength was measured as 7 days and 28 days cube strength and workability was measured both by compacting factor (C.F.) and Vebe Test. In the second series, the workability was kept constant and the reduction in water content at various quantities of the two plasticizers was studied. The resulting increase in strength was also determined.

The experimental results are presented in the form of tables and graphs. It was concluded that, whereas, Porzite 73 has favourable effect on workability, but strength is reduced at high doses. Melment L10, however, has favourable effect on both workability and strength. Most economical dose of each plasticizer can, therefore, be determined.

8. **Analytical Representation of the Cyclic behaviour of Mortar Constituent of concrete**
Ataullah Maher, Principal Research Officer, Building Research Station Karachi, Pakistan.
David Darwin, Professor, Civil Engineering Department, University of Kansas, Lawrence, U.S.A.

An analytical model is developed to represent the behaviour of mortar constituent of concrete under uniaxial cyclic compressive loading. The key characteristics of the experimental behaviour of mortar under cyclic loading are incorporated in the model. A number of the experimental relationships are modified to simplify the model and to improve the realism of the stress-strain curves that are generated. The observed drop in stress for cycles to a constant maximum strain and the relationship between the residual strain and the unloading strain are generalized for all types of cyclic loading. The analytical and experimental stress-strain response is compared. The shape of the analytical envelope curve compares well with that of the test envelope. The shapes of the analytical and experimental loading and the unloading curves are comparable. The overall stress-strain behaviour of the model is similar to the test data. For cycles to a constant maximum strain and cycles between fixed stresses the analytical model successfully predicts the residual strain accumulation, the shape of the curves and the number of cycles to failure. The model is useful for adoption in finite element representation of concrete after generalization to uraxial and uriaxial status of stress.

9. **Design parameters for proportioning Rice Husk Ash Concrete Mixes**
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W.K.B. Weragama
Deputy Chief Engineer, Sri Lanka Government Railways Colombo, Sri Lanka.

Rice husk ash (RHA) is a pozzolanic material. Earlier studies have indicated that structural grade concrete can be produced by replacing ordinary Portland cement (OPC) with up to 50% of RHA by weight. Because of the differences in strength and water requirement characteristics, mix design procedures for flyash concrete may not be used for RHA concrete. In this paper two design

parameters which relates the properties of RHA cement to those of OPC are identified. They are the strength co-relation factor a and the differential lubrication constant f both of which can be obtained by routine laboratory tests. With the values of e and f in hand, the mix design of RHA concrete can be effected through any published procedure for OPC concrete.

10. Aggregates for Concrete in Pakistan

Izhar-ul-Haq, Director
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Aggregates constitute a major portion of concrete and its stability is the most important requirement. The aggregate should be durable and should not react chemically with cement. The paper describes the characteristics of aggregates with particular reference to their physical, mechanical and chemical properties and their location and extent of availability in Pakistan. Pakistan has more than 120 sources of course aggregates. Some of the major sources were studied in detail for use of the concrete aggregates large for projects.

Aggregates in Pakistan are obtaibed for alluvial deposits of sand and gravel and from quarries in the areas where bedrock outcrops are physically approachable. The bedrock consists of sedimentary and igneous rocks. The limestone is quite suitable as concrete aggregates. Most of the igneous rocks are good for concrete aggregates except those derived from low density igneous rocks.

Economic considerations demand that construction material be procured from sources close to the project. Some typical quarries have been described. The samples collected from the quarries were put to the following tests; specific gravity, water absorption, density, Los Angeles abrasion and sulphate soundness. Petrographic and X-ray diffraction studies were also carried out.

11. Low-cost Substitute Materials for Steel Reinforcement in Cement Matrices

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The use of natural fibres as replacements for steel reinforcement in cement paste, cement-sand mortar and concrete mixes have been included. Those papers describing tests on the physical and mechanical properties of the fibres and tests dealing with the fibre reinforcement of the cement matrix have been included. There have been structural applications of the fibre reinforced cement matrices in the form of corrugated roofing sheets, wall panels, shell roofing, rectangular and T-section beams and square columns. Only investigations with applications that require manual preparation of the members through simple forming or moulding procedures have been included.

The tests of full-sized beams and columns have been made using date-palm mid-ribs, bamboo fibres, bamboo splints and culms. A total of 87 simply supported beams, having various cross sections, dimensions and lengths were tested at their third points. A total of 16 columns were tested in axial and biaxial loading. Bamboo woven meshes used in wall panels with mortar applied to both faces have been tested.

The remaining investigations provide information on the physical and mechanical properties of a particular fibre used as reinforcement. The use of these fibres in cement materices to produce laboratory specimens to determine tensile, compressive, flexural and torsional properties of the fibre reinforced specimen have been made.

12. **Rollcrete used at Tarbela Dam, Project**

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Izhar-ur-Haq
Director
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Tarbela Dam is a 482 feet high earth and rock fill dam on the Indus River in Pakistan. It has two spill ways with a capacity of 1,500,000 cu. ft/sec. located on the left abutment with gated ogee-shaped weir and flip bucket for energy dissipation. After the working of the spillway in 1977, a scour about 70 ft deep occurred at the toe of the flip bucket. With the conventional concreting methods, it was not possible to reconstruct the plung pool even in one year. Rollcrete provided the suitable material in quality and quick construction. Earlier in 1974, during the first filling, about 250 ft of tunnel No. 2 and the adjacent rock slope had fallen or eroded. It was necessary to have self supporting material for reforming the tunnel. Rollcrete was the answer as this repair was to be completed within 45 days.

The structures, completed since 1974 and 1978, have passed floods and have performed extremely well. The rollcrete not only affected considerable cost savings but also, out down the time of construction.

13. **Study of Cracks on Sukkur Barrage Pier Corsets in terms of Alkali — Aggregate Reactivity**

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As a part of the remedial measures to pier cracking at the Sukkur Barrage, reinforced concrete corsets were provided at the upstream noses of each pier in 1956. In 1978 cracks were observed in these corsets. The paper presents the studies carried out to ascertain whether or not the formation of these is a result of alkali-aggregate reaction. Samples of concrete obtained from the cracked portion of corsets were subjected to various geochemical and petrographic analysis tests including etching and staining tests, Brucite detection test and studies of concrete slices and their sections under petrographic microscope.

Both the coarse as well as the fine aggregates used in the concrete were found to have grains regarded as potentially alkali-silica reactive. The coarse aggregate comrises a heterogeneous assemblage of limestone, dolomite and chalcedonic chert. The petrographic examination of the aggregate grains near the affected portions do not show any weakness caused by alkali-aggregate reaction. The minor reaction rims noted around some grains and the presence of hardened gel in some small cavities (size 2-4 mm) do however show some alkali-silica reaction. Although the extent of expansion due to this chemical reaction is not certain but nevertheless it

might be a contributing factor in the initiation of the cracks in the corset concrete.

14. Nondestructive Testing for Concrete Strength

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This paper describes nondestructive test methods for estimating in-situ strangth of concrete. The methods discussed are surface hardness tests, rebound and penetration techniques, pullout and breakoff methods, pulse velocity techniques, combined methods approach and maturity concept.

The hardness, rebound, penetration, pulse velocity and maturity techniques do not directly measure the in–situ strength but attempt to measures some other property of concrete from which an estimate of its compressive or flexural strength may be obtained. The pullout and breakoff methods do, however, directly measure some strength property. The accuracy of estimating compressive strength from in–situ tests will depend on the type of test used and may very from 10 to 25 per cent.

15. The use of NDT in Construction.

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The paper discusses the use of pullot testing to achieve safety and economy in construction.

This test is more suitable as a construction tool than the traditional 28 day cylinder test. Collapses have resulted from unrecognised low in–place strength and this test solves this problem

The procedure as per ASTM C900 is illustrated.

The development of specifications and interpretation are discussed. A model specification is presented and suitable interpretation criteria suggested.

Because of the possibility of excessive deflections in concrete structures loaded at an early age, creap and curing factors are reviewed. The stress-strength ratio is seen to be critical.

The benefits of accelerating construction schedules are reviewed and illustrated by an example showing the financial savings which can be achieved.

16. Development in Concrete Technology in India

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Development in concrete technology to obtain enhanced strength and durability has led to the production of fibre reinforced concrete, ferrocement and polymer concrete and their products. Process technologies for the production of steel fibre reinforced manhole covers for light, medium and heavy duty; cellular concrete units and doubly curved tiles for floors and roofs; thin cement flat sheets for use as walls claddings, partitions; ferrocement water tanks for domestic and commercial purposes

and biogas holders; polymer impregnated ferrocement pipes for chemicals and industrial effluents, polymer impregnated concrete, flooring tiles for chemical and abrasion resistance and structures for service in marine environment have been developed. New materials such as, lightweight bloated clay aggregate from Indian clays and waterworks silts, sintered flyash lightweight aggregate from some Indian flyashes have been successfully produced on pilot plant scale for use in lightweight concrete and concrete products. Indigenous technology for the production of cellular concrete using lime and flyash has also been developed. A state-of-the-art on these developments in concrete technology in India is given in this paper.

17. **Construction of Prestressed Concrete Structures**
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A brief overview of the historial, geographical, and demographical past of Canada is presented to illustrate those early factors influencing the structural materials scenario prior to the 1950's. The introduction of prestressed concrete into Canada is described (notably as posttensioned bridges), followed by longline pretensioning of precast concrete in plante and a plant certification program. The gradual and concurrent development of architectural precast is also related, first as a cladding for buildings and eventually as loadbearing sandwich panels. Plant production procedures are described and illustrated, followed by brief descriptions and slides of a variety of bridges, buildings, and miscellaneous structures in Canda. The illustrations involve both.structural and architectural work (precast or cast-in-place), utilizing pre-tensioned, post-tensioned, or reinforced concrete — or a combination of them. Reference is then made to the particular types of precast prestressed concrete members and structures envisaged for optimum use in developing countries.

18. **Precast/Prestressed Concrete Construction in Developing Countries High-Tech., WHO Needs it**
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The Foundation Company of Canada Limited
Toronto
Canada

The suitability of various forms of precast/prestressed construction for developing countries is examined.

The cost-effectiveness of these forms of construction is discussed in principle. Basic costing concepts are discussed to permit more rational choice of construction type to be made.

Examples of certain types of construction are described and discussed.

It is emphasized that sophistication should, where possible, be avoided.

19. **Concrete Technology for Precast and Prestressed concrete in Pakistan**
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Prescon Consultants
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Pakistan

The object of this paper is to explain the proper use of concrete as a building material in developing countries like Pakistan and to advocate the use of the well-known but less understood medium of construction – percast and prestressed concrete.

The paper describes the experience of a practicing engineer as a development process. The prefabrication process is reviewed briefly and its advantages and disadvantages for a developing country are identified with due attention to the economics of the process. The role of engineers to improve the standard and prestige of the profession is also discussed. The paper also includes recommendations for a developing country.

20. Construction, Handling and Erection of Prestressed Concrete Beams for Jinnah Bridge Across Chinna Creek Karachi

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The Jinnah Bridge, Karachi, was opened to traffic in 1982 as a replacement for the century old Napier Mole Road Bridge, and is a vital element in the traffic network linking the Port of Karachi with the rest of the country. The main bridge across the creek consists of simply supported suspended spans, comprising precast post-tensioned beams acting compositely with the insitu deck slab and supported by means of scarf (or half) joints off intermediate table-top structures, each on four piles/columns. The six lane dual carriageway road bridge is designed for the highest class of highway loading including abnormal heavy lifts handled by the Port. The paper describes the construction, handling and erection of the precast post-tensioned pre-stressed beams, about 100 ft. long & 70 to 110 ton weight, and includes interalia; details of concrete mix, casting yard, special steel formwork, placing of concrete, vibration, curing, stressing and grouting, quality control, handling, transportation, lifting and manoeuvring creek, and placing in final position.

21. Use of Concrete for the Rehabilitation of the Singapore River Banks

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Since the Singapore River bed consists of a 15-metre layer of very soft marine clay, topped with a thin layer of a mixture of silt, sand, graval and sandstone boulders, building any rigid river bank protective structures would be too costly. Therefore, precast reinforced concrete slab systems have been selected as a better and more economical solution. They are more flexible and would adjust themselves to certain settlement and yet perform their function.

Three types of precast concrete slabs with river–pebble topping were chosen to suit the different profile of the river banks. They are : (i) Type 1 slabs of 5 metres x 2 metres x 0.2 metres,

weighing about five tons; (ii) Type 2 slabs similar to Type 1 except with skirt wall at one end and (iii) Type 3 slabs with dimensions of 2 metres square x 0.2 metres, used to link Type 1 slabs at different inclinations.

The precast slabs were casted in the temporary casting yards and transported to the riverside for laying onto the required location and position. The local bakau timber piles were used for controlling the alignment and levels of the slab laid.

22. **Parking Areas and Concrete Driveways**
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The paper presents an over view of the construction of concrete parking areas and driveways in Pakistan. The concept of 'Total Cost' in planning and design of parking areas and driveways is emphasized. Criteria for design of pavement thickness, joints and subgrade are reviewed. The general requirements, mix proportions and properties of plain concrete and its quality assurance are summarized. In addition, the paper presents some sound maintenance practices for concrete pavements.

23. **PBFSC A Downstream of Pakistan Steel Mill**
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This paper deals with the production outlines, chemistry, mineralogy, physical properties and use of blast furnace slag with particular reference to granulated blast furnace slag.

Rate of compressive strength development and specification of PBFSC as produced in Pakistan are discussed.

زیادہ مشکل ہے۔ اِتنا وقت صَرف کرنے کے بعد بھی انجینیروں کی ترقی کے مواقع دوسری سروس کے نسبت کم ہیں صُوبائی محکموں میں حالات اور بھی خراب ہیں جہاں تقریباً ۵۰ برس کی عمر کے بعد بھی انجینیروں کو ترقی نہیں ملتی۔ SERVICE STRUCTURE بھی ایسا ہے کہ تقریباً ۱۵۰ انجینیروں میں ۲۰ گریڈ کا ایک چیف انجینیر ہوتا ہے۔ اور اس طرح بہت سے تجربہ کار انجینیر ۱۸ یا ۱۹ گریڈ میں ہی ملازمت سے ریٹائر ہو جاتے ہیں۔ دوئم یہ کہ ۲۰ گریڈ کے صُوبائی محکموں میں کسی بھی انجینیر کے لیے ۲۱ یا ۲۲ گریڈ کی کوئی اسامی موجود نہیں۔ پاکستان انجینیرنگ کانگریس استدعا کرتی ہے کہ صُوبائی انجینیروں کو بھی ۲۱ اور ۲۲ گریڈ تک پہنچنے کے مواقع فراہم کیے جائیں۔

۲۔ کانگریس حکومتِ پاکستان کی مشکور ہے جس نے ۱۹ گریڈ تک انجینیروں کو MOVE OVER کا حق فراہم کیا۔ اس فیصلہ سے سرکاری ملازمین کی تنخواہ میں بغیر ترقی کے اضافہ ہو جاتا ہے، لیکن گریڈ ۲۰ کے انجینیروں کے لیے یہ راہ محدود کر دی گئی ہے۔ ان میں سے ہر ایک کو MOVE OVER نصیب نہیں ہوتا۔ MOVE OVER ہر سرکاری ملازم کی تنخواہ میں اضافہ کی ضمانت دیتا ہے۔ چنانچہ کانگریس پُرزور اپیل کرتی ہے کہ جس طرح ۱۹ گریڈ تک کے ہر انجینیر کو MOVE OVER مل سکتا ہے اسی طرح اُوپر والے گریڈوں کو بھی وہی سہولت ملنی چاہیئے۔ یہ سہولت بطور AUTOMATIC MOVE OVER ہونی چاہیئے تاکہ انجینیروں کی ذہنی پریشانی دُور ہو سکے۔

جناب والا! جیسا کہ میں پہلے عرض کر چکا ہوں ایک نوجوان سالہا سال کی تعلیم پانے کے بعد انجینیر بنتا ہے لیکن یُونیورسٹی سے فارغ التحصیل ہونے کے بعد سرکاری محکموں اور PRIVATE SECTOR میں جب اسکو خاطر خواہ ملازمت نہیں ملتی تو وہ احساسِ محرومی اور مایُوسی کا شکار ہو جاتا ہے۔ آجکل ملک کی چار انجینیرنگ یُونیورسٹیاں تقریباً ۱۶۰۰ انجینیر ہر سال تیار کرتی ہیں لیکن ان نوجوان انجینیروں کو سرکاری محکموں یا پرائیویٹ اداروں میں کُلی طور پر ملازمت فراہم نہیں ہوتی۔ حکومت ایسے نوجوان انجینیروں کے لیے اندرون یا بیرون مُلک ملازمت کا انتظام کرے۔

جب تک نوجوان انجینیروں کو مُلازمت فراہم نہیں ہوتی اسوقت تک GRADUATE ENGINEERS کو ماہانہ وظیفہ کی منظوری دی جائے جس طرح کہ عام آرٹس یا سائنس گریجویٹ کے لیے حکومت نے وظیفہ کا اعلان کیا ہے۔

جنابِ والا! ماحول کی آلودگی میں روز افزوں اضافہ ہو رہا ہے۔ بعض علاقوں میں صُورتِ حال تشویشناک حد تک پہنچ چکی ہے اگر اس بگڑتی ہوئی حالت کا فوری سدباب نہ کیا گیا تو خطرہ ہے کہ خدانخواستہ ہمیں بھی سانحہ بھوپال جیسے واقعات سے دوچار ہونا پڑے۔ پاکستان انجینیرنگ کانگریس استدعا کرتی ہے کہ حکومت ماحول کی آلودگی کی روک تھام کے لیے فوری مناسب اور ضروری اقدام کرے۔

جناب والا! پاکستان انجینیرنگ کانگریس کو فخر حاصل ہے کہ آپ انتہائی مصروفیت کے باوجود ہمارے سالانہ اجلاس کا افتتاح کرنے کے لیے تشریف لائے جس کے لیے مَیں اور تمام اراکینِ کانگریس آپکا تہ دل سے شکریہ ادا کرتے ہیں۔ مَیں آج کے معزز مہمانوں اور شرکاء کا شکر گزار ہوں جنہوں نے اپنا قیمتی وقت نکال کر کانگریس کے سالانہ اجلاس میں شرکت کی۔

مَیں پاکستان انجینیرنگ کانگریس کی ایگزیکٹو کونسل اور تمام ممبران کا اور خاص کر جناب مشہدی صاحب سیکرٹری پاکستان انجینیرنگ کانگریس کا شکر گزار ہُوں جنہوں نے میرے ساتھ تعاون کیا۔ مَیں کانگریس کے ان ملازمین کا بھی شکریہ ادا کرتا ہوں جنہوں نے پسِ پردہ دن رات محنت کی اور میرے ساتھ تعاون کیا ــــ اَب مَیں وزیرِ اعظم جناب محمد خاں جونیجو صاحب سے درخواست کرونگا کہ وہ پاکستان انجینیرنگ کانگریس کے ساٹھویں سالانہ اجلاس کا افتتاح فرمائیں۔

پاکستان پائندہ باد

کر دی جاتی ہے۔ اس طرح سیمنٹ کے کام کا معیار گر جاتا ہے جس سے تعمیراتی کاموں پر بُرا اثر پڑتا ہے۔ اس مسئلہ پر قابو پانے کے لیے نہایت ضروری ہے کہ کوالٹی کنٹرول اتھارٹی کا قیام عمل میں لایا جائے۔ اسی طرح ابھی تک ہمارے ملک میں تعمیراتی سامان کی سٹینڈرڈ سپیسیفیکیشن مکمل طور پر تیار نہیں ہوتی ہیں۔ حالانکہ یہ ادارہ کئی برسوں سے اس کی کوششوں میں مصروف ہے۔ جب تک پاکستان سٹینڈرڈ سپیسیفیکیشن نہ بنیں گی اور کوالٹی کنٹرول اتھارٹی قائم نہیں کی جائے گی تعمیراتی کاموں کا معیار تسلی بخش نہیں ہو سکے گا۔

یہ افسوس کی بات ہے کہ پاکستان میں ابھی تک غیر ملکی مشاورتی فرموں پر انحصار کیا جا رہا ہے جبکہ ہمارے اپنے ملک میں مناسب تعداد میں قابلِ قدر اور موزوں مشاورتی فرمیں قائم ہو چکی ہیں۔ زرِ مبادلہ بچانے کی خاطر ہمیں چاہیے کہ جس قدر جلد ممکن ہو غیر ملکی کنسلٹنگ فرموں پر کم سے کم انحصار کیا جائے اور پبلک اور پرائیویٹ سیکٹر میں جو بھی کنسلٹنگ فرمیں موجود ہیں ان کی مدد سے منصوبے بنائے جائیں۔ البتہ ایسی ٹیکنالوجی جو ہمارے ملک میں دستیاب نہ ہو اس کے لیے ہماری اپنی فرمیں اعلیٰ اور موزوں غیر ملکی ماہروں کو اپنے ساتھ شامل کریں تاکہ ان سے زیادہ سے زیادہ فائدہ اٹھایا جا سکے اور اس طرح TRANSFER OF TECHNOLOGY ممکن ہو سکے۔ جنابِ والا! آپ مجھ سے اتفاق کرینگے کہ پاکستان کی ترقی کے لیے جو درد ملکی ماہرین کو ہوگا وہ کسی غیر کے لیے ممکن نہیں۔

جنابِ والا! مجھے یہ بتانے میں بڑی خوشی محسوس ہو رہی ہے کہ پاکستانی انجینیروں نے گزشتہ سال میں بڑی اعلیٰ کارکردگی کا ثبوت دیا ہے۔ ایک طرف سیم اور تھور کی روک تھام کے لیے ۲۵۶ ٹیوب ویل نصب کیے گئے تو دوسری طرف خیرپور کے پراجیکٹ میں ۳۰۰ کلومیٹر لمبی ٹائیل ڈرینیں بچھائی گئیں۔ بنجر زمین کو لہلہاتے کھیتوں میں تبدیل کرنے کے لیے CHASMA RIGHT BANK CANAL پر کافی حد تک کام ہو چکا ہے جو انشاء اللہ ۱۹۸۶ء تک مکمل ہو جائیگی۔ اس نہر کی تکمیل کے بعد ڈیرہ اسمٰعیل خاں اور ڈیرہ غازی خاں کے علاقہ میں پونے چھ لاکھ ایکڑ زمین قابلِ کاشت ہو جائے گی۔ LOAD SHEDDING پر قابو پانے کے لیے گدو پراجیکٹ پر زور شور سے کام ہو رہا ہے۔ بلکہ تکمیل کے آخری مراحل میں داخل ہو گیا ہے۔ اس منصوبے کی تکمیل کے بعد بجلی کی پیداوار میں ۶۶۰ میگاواٹ کا اضافہ ہو جائیگا۔ تربیلا میں دو اضافی یونٹ لگانے سے دو سو میگاواٹ بجلی اور پیدا کی گئی ہے۔ حکومت کی خواہش کے مطابق دیہی علاقے کو ترقی دینے کے لیے انجینیروں نے تقریباً ۴۰۰۰ کلومیٹر FARM TO MARKET ROADS بنائی ہیں۔ سینکڑوں دیہی اور شہری منصوبہ جات آب رسانی کی تکمیل کی ہے۔ اسی طرح لاتعداد سکول اور ابتدائی طبی مراکز کی بھی تعمیر کی گئی ہے۔ تقریباً ۱۴۰۰ دیہات کو بجلی فراہم کی گئی ہے۔ لاہور میں زید ہسپتال بمعہ عمارت اور EQUIPMENT کے بالکل تیار ہے۔ ڈیرہ اسمٰعیل خاں کا پُل بھی اسی سال مکمل ہوا ہے جس کی وجہ سے صوبہ سرحد اور پنجاب بہت ہی قریب ہو گئے ہیں۔ ISLAMIC ARCHITECTURE کا ایک نادر نمونہ فیصل مسجد اسلام آباد، اسی سال تیار ہونے والی ہے۔ ۲۱ اگست کو کراچی بین الاقوامی ہوائی اڈے پر آپ نے اپنے دستِ مبارک سے ٹرمینل نمبر تین کا افتتاح کیا تھا، وہ بھی پاکستانی انجینیروں کا ایک مایۂ ناز کارنامہ ہے۔ ایک طرف اگر پاکستان سٹیل مل روز بروز ترقی کر رہی ہے تو دوسری طرف سمندر میں تیل کے ذخائر معلوم کرنے کے لیے آپ نے حال ہی میں OFF-SHORE DRILLING کا افتتاح کیا ہے۔ ان تمام قابلِ تحسین کارناموں کا سہرا یقیناً پاکستانی انجینیروں کے سر ہی ہے۔ جنابِ والا! پاکستان کے انجینیروں نے اپنے ملک میں نہیں بلکہ بیرونِ ملک بھی اپنی قابلیت کا سکہ جمایا ہے۔ پاکستان کے تعلیمیافتہ انجینیر آجکل عالمی بنک اور ایشیائی ترقیاتی بنک میں اعلےٰ عہدوں پر فائز ہیں۔ اسکے علاوہ بے شمار انجینیر افریقی ممالک، سعودی عرب اور خلیجی ریاستوں میں اپنی قابلیت کی وجہ سے دُنیا کے دیگر انجینیروں سے زیادہ مقبول ہیں لیکن افسوس اس بات کا ہے کہ وہی انجینیر اپنے ہی ملک میں عدم توجہی کا شکار ہو کر رہ جاتے ہیں، اس کی چند وجوہات یہ ہیں:

۱۔ ایک نوجوان سالہا سال کی مسلسل محنت اور تعلیم کے بعد انجینیر بنتا ہے۔ علاوہ ازیں انجینیرنگ کی تعلیم غیر فنی شعبوں کے مقابلہ میں

پاکستان انجینیرنگ کانگریس کا سالانہ اجلاس بڑی اہمیت کا حامل ہے۔ اس سالانہ اجلاس میں انجینیرنگ کے مختلف شعبوں سے متعلق تکنیکی مقالے پڑھے جاتے ہیں جس میں ملک بھر کے انجینیر بڑی دلچسپی سے حصہ لیتے ہیں۔ کانگریس کے سالانہ اجلاس میں اب تک ۴۶۷ مقالے پڑھے جا چکے ہیں اور امسال ۱۲ اہم مقالوں کے علاوہ دیہی ترقی کے موضوع پر سمپوزیم کا انعقاد کیا جا رہا ہے۔ جس کو بجا طور پر آپ کی حکومت کی سرفہرست پذیرائی حاصل ہے۔ گزشتہ ۳۷ برس میں پڑھے جانے والے مقالے انجینیرنگ کا قابلِ فخر اثاثہ بن چکے ہیں۔ کوئی اہم تعمیراتی منصوبہ ایسا نہ ہوگا جس پر مقالہ نہ پڑھا گیا ہو۔ ان میں تربیلا ڈیم پراجیکٹ۔ تونسہ بیراج۔ تلجے برج، اسکارپ ٹیوب ویل پر لکھے ہوئے مقالے تاریخی اہمیت رکھتے ہیں۔ کانگریس کے سالانہ اجلاس کی ایک اچھی روایت یہ بھی ہے کہ اس کے اختتام پر انجینیروں کو ملک کے منتخب منصوبوں کے عینی مشاہدے کا موقع فراہم کیا جاتا ہے جس کے لیے پاکستان ریلوے ایک سپیشل ٹرین کا اہتمام کرتی ہے۔ گزشتہ سالوں کی طرح اس سال بھی ایک سپیشل ٹرین لاہور سے کراچی جائے گی اور اراکین کانگریس خیرپور ٹائل ڈرینج پراجیکٹ، پاکستان سٹیل مل، ایسبسٹوس پائپ فیکٹری اور کراچی شپ یارڈ کا براہِ راست معائنہ کر کے موجودہ ٹیکنالوجی سے مستفیض ہونگے۔

جناب والا! کانگریس کی صدارت کا عہدہ سنبھالنے کے بعد میں نے اپنی ایگزیکٹو کونسل کی مدد سے ماہانہ تکنیکی لیکچروں کے انعقاد کا ایک نیا سلسلہ شروع کیا تھا جس کے تحت کانگریس کے زیرِ اہتمام قومی اور بین الاقوامی شہرت کے ملکی اور غیر ملکی نامور انجینیروں نے ان لیکچروں میں حصہ لیا۔ ان لیکچروں کے ذریعہ انجینیرنگ شعبوں میں تازہ ترین ٹیکنالوجی اور معلومات فراہم کی گئیں۔ جس کی وجہ سے انجینیروں کی پیشہ وارانہ کارکردگی میں خاطر خواہ اضافہ ہوا ہے۔

جناب والا! پاکستان کی اقتصادی ترقی انجینیروں کی مرہونِ منت ہے۔ انہوں نے CIVILIZATION TRAVELS BY ROAD کو ثابت کرنے کے لیے قصبہ قصبہ، قریہ قریہ سڑکوں کا جال بچھایا ہے۔ دریاؤں پر بند باندھ کر بنجر زمینوں کو لہلہاتے کھیتوں میں بدل دیا ہے۔ دور دراز علاقوں میں جہاں انسان کا گزر نہیں ہوتا تھا وہاں آب رسانی، طبی امداد، سکول اور بجلی پہنچانے کے بیشمار منصوبے پایہ تکمیل کو پہنچائے ہیں۔

انجینیروں کی دورانِ ملازمت تربیت کا دو سال پہلے تک کوئی انتظام نہیں تھا۔ پاکستان انجینیرنگ کانگریس حکومت پنجاب کی مشکور ہے جس نے اسکے ایماء پر دورانِ ملازمت انجینیروں کو تربیت دینے کے سلسلہ میں ایک انجینیرنگ اکادمی لاہور میں قائم کی۔ اب تک اس اکادمی میں نئے فارغ التحصیل انجینیروں کے لیے تین کورس مکمل ہو چکے ہیں جن میں ۸۵ نوجوان انجینیروں نے تربیت حاصل کی۔ اس کے علاوہ چند روز قبل ایک اور کم وقتی کورس تجربہ کار انجینیروں کے لیے اختتام پذیر ہوا ہے جس میں ۲۵ انجینیروں نے تربیت حاصل کی۔ اس سلسلے کا چوتھا کورس نومبر میں شروع ہونے والا ہے جس میں مزید انجینیر حصہ لیں گے۔ حکومت پنجاب کا یہ تجربہ بہت کامیاب رہا ہے اور پاکستان انجینیرنگ کانگریس کی استدعا ہے کہ ایسے تربیتی مراکز دوسرے صوبوں میں بھی قائم کیے جائیں۔ جب تک دوسرے صوبوں میں ایسے مراکز قائم نہیں ہوتے اسوقت تک حکومت پنجاب کی اکادمی سے یہ سہولت دوسرے صوبوں کے انجینیروں کو بھی فراہم ہونی چاہیئے۔

جناب والا! کسی بھی ترقیاتی منصوبہ کی تکمیل کے لیے انجینیروں کی فنی صلاحیت کے علاوہ تعمیراتی سامان خاص اہمیت کا حامل ہے۔ مشاہدے میں آیا ہے کہ انتہائی کوشش کے باوجود کبھی کبھی منصوبہ جات کی تکمیل خاطر خواہ معیار تک نہیں ہو پاتی۔ ان تعمیراتی کاموں کے گرے ہوئے معیار کی سب سے بڑی وجہ ناقص تعمیراتی سامان ہے جس پر موثر کنٹرول نہیں۔ یہ صورتِ حال سول انجینیرنگ کے منصوبوں تک ہی محدود نہیں بلکہ بجلی، مشینری اور فراہمیٔ آب کے سامان پر بھی اس کا برابر کا اطلاق ہے۔ حالانکہ ملک کی سیمنٹ بنانے کی فیکٹریاں خاطر خواہ معیار کا سیمنٹ بنا رہی ہیں لیکن دیکھا گیا ہے کہ فیکٹری سے لے کر کام میں استعمال ہونے تک سیمنٹ کی بوری سے سیمنٹ نکال کر اس میں آمیزش

بسم اللہ الرحمٰن الرحیم

قابلِ احترام جناب محمد خاں جونیجو صاحب — وزیرِ اعظم پاکستان
لیفٹیننٹ جنرل جناب غلام جیلانی خاں صاحب — گورنر پنجاب
جناب نواز شریف صاحب — چیف منسٹر پنجاب

مرکزی اور صوبائی وزراء کرام و معزز مہمانانِ گرامی
فیلو انجینئرز ——— السلام علیکم!

میرے لیے اور پاکستان انجینئرنگ کانگریس کے لیے یہ بڑے فخر کا مقام ہے کہ میں آج اس پلیٹ فارم سے آپ سب کو پاکستان انجینئرنگ کانگریس کے ساٹھویں سالانہ اجلاس کے موقع پر خیر مقدم کر رہا ہوں۔ پاکستان انجینئرنگ کانگریس ۱۹۱۲ء میں قائم کی گئی۔ یہ برِ صغیر کی پہلی پیشہ ورانہ تنظیم تھی۔ اس کانگریس کے صدر ایسے نامور انجینئر رہ چکے ہیں جن کے ساتھ کام کرنے کا ہم میں سے بہت سے انجینئرز کو فخر حاصل ہے۔ ہمارے اس سالانہ اجلاس کی صدارت قبول کر کے آپ نے انجینئر برادری کو بڑی عزت بخشی ہے۔ یہ امر اس بات کا واضح ثبوت ہے کہ آپ کو ہماری کانگریس، ہمارے پیشے اور انجینئر صاحبان سے کس قدر محبت ہے۔ آپ کی موجودگی ہمارے اس خیال کو مزید استحکام بخشتی ہے کہ آپ نے انجینئرز اور ٹیکنولوجسٹ کی کارکردگی کو سراہا جو کہ اس دور میں ملک کی معاشی ترقی کے لیے اہم ستون کا کام کر رہے ہیں۔

اس کانگریس کے پہلے صدر سر ایچ۔ پی برٹ تھے۔ دوسرے صدر کرنل میگلیگن جن کے نام پر لاہور کے انجینئرنگ کالج کی بنیاد رکھی گئی اور جو اب ترقی کر کے یونیورسٹی کا مرتبہ حاصل کر چکا ہے۔ سر گنگا رام اسی کانگریس کے صدر تھے جن کا نام رفاہی ہسپتالوں اور اداروں سے منسوب ہے۔ یہ بہت کم لوگوں کو علم ہے کہ وہ ایک مشہور انجینئر تھے۔ رینالہ کا ہائیڈرل سٹیشن اور لفٹ اریگیشن سکیم انہی کی مہارت کا کارنامہ ہے۔ آزادی سے پہلے اسی عہدہ پر ایکین۔ منٹگمری۔ والٹن بھی فائز رہے ہیں۔ جن کے نام سے سڑکیں اور دوسرے ادارے منسوب ہیں۔ مسٹر ہاول انجینئرنگ کالج لاہور کے پرنسپل رہ چکے ہیں، جنہوں نے مری کا منصوبہ آب رسانی بنایا اور ڈونگا گلی سے مری تک ۳۰ کلومیٹر لمبی پائپ لائن اور سڑک تیار کی جو کہ ساٹھ سال سے زائد عرصہ سے بخوبی کام کر رہی ہے۔

معزز مہمانانِ گرامی! آزادی کے بعد بھی انجینئرنگ کانگریس کو قومی زندگی میں نمایاں مقام حاصل رہا ہے اور پاکستان کے بہت سے انجینئر اس کانگریس سے منسلک رہے۔ ان میں سے خان محمد اعظم خاں، خواجہ عبدالغفور، خان بہادر عبدالحمید، خان بہادر انعام اللہ خاں، شیخ محبوب الٰہی اور شیخ احمد حسن سرِ فہرست ہیں۔ انہوں نے اس کانگریس کے صدارتی فرائض بھی انجام دیئے۔ میں نہایت انکساری سے ان سب مایہ ناز انجینئروں کو ہدیۂ تہنیت پیش کرتا ہوں۔

جنابِ والا! کانگریس کے اغراض و مقاصد مکمل طور پر تکنیکی ہیں اور اس میں سیاست کا ذرہ برابر بھی دخل نہیں۔ کانگریس کے چیدہ چیدہ مقاصد اس طرح ہیں:

۱۔ انجینئرنگ کے پیشہ اور اس کے عمل کو فروغ دینا۔
۲۔ ممبران کانگریس کو پیشہ ورانہ معاملات پر بحث و تمحیص کے مواقع فراہم کرنا۔
۳۔ ایسا ضابطۂ اخلاق قائم کرنا جو ممبران کانگریس کی کارکردگی میں مددگار ثابت ہو۔

٥- وَلَا تَأْكُلُوٓا أَمْوَالَكُم بَيْنَكُم بِالْبَاطِلِ وَتُدْلُوا بِهَا
إِلَى الْحُكَّامِ لِتَأْكُلُوا فَرِيقًا مِّنْ أَمْوَالِ النَّاسِ
بِالْإِثْمِ وَأَنتُمْ تَعْلَمُونَ ۝

"And swallow not up your property among yourselves by false means, nor seek to gain access thereby to the judges, so that you may swallow up a part of the property of men wrongfully while you know". ii : 188

5. You shall not abuse your position or power, nor accept illegal gratification of any sort.

٦- وَقُولُوا قَوْلًا سَدِيدًا ۝

"And speak straight words." xxxiii : 70

6. You shall express your opinion on engineering or other matters in a frank, open and straightforward manner.

٧- اجْتَنِبُوا كَثِيرًا مِّنَ الظَّنِّ إِنَّ بَعْضَ الظَّنِّ إِثْمٌ
وَلَا تَجَسَّسُوا وَلَا يَغْتَب بَّعْضُكُم بَعْضًا ۚ

"Avoid most of suspicion for surely suspicion in some cases is sin; and spy not nor let some of you backbite others". xlix : 12

7. You shall not criticise another engineer's work without his knowledge, nor malign or injure his professional reputation.

٨- وَلَا تَقْفُ مَا لَيْسَ لَكَ بِهِ عِلْمٌ ۚ إِنَّ السَّمْعَ
وَالْبَصَرَ وَالْفُؤَادَ كُلُّ أُولَٰئِكَ كَانَ عَنْهُ
مَسْئُولًا ۝

"And follow not that of which thou hast no knowledge. Surely the hearing and the sight and the heart, of all these it will be asked." xvii : 36

8. Your professional advice shall be based on full knowledge of the facts and honest conviction, and you shall not write articles or advertise in self-laudatory language or in any manner derogatory to the dignity of the profession.

٩- وَتَعَاوَنُوا عَلَى الْبِرِّ وَالتَّقْوَىٰ ۖ وَلَا تَعَاوَنُوا
عَلَى الْإِثْمِ وَالْعُدْوَانِ ۖ وَاتَّقُوا اللَّهَ ۚ

"And help one another in righteousness and piety, and help not one another in sin and aggression and keep your duty to God." v : 2

9. You shall help one another in upholding and doing what is right, and shall not associate with those who transgress and those who indulge in unethical practices.

١٠- وَأَمْرُهُمْ شُورَىٰ بَيْنَهُمْ ۖ

"And whose affairs are decided by counsel among themselves." xlii : 38

10. You shall decide matters of common professional interest by mutual consultation.

١١- وَاعْتَصِمُوا بِحَبْلِ اللَّهِ جَمِيعًا وَلَا تَفَرَّقُوا ۚ

"And hold fast by the covenant of God all together and be not disunited." iii : 102

11. You shall strive individually and collectively to enhance the prestige of the engineering profession by ordering your conduct in accordance with this Code of Ethics, and shall not be disunited.