40th Year of Publication

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April – June 1998

THE GHAURI MISSILE LAUNCHING – PAKISTANI ENGINEERS & SCIENTISTS MAKE HISTORY!



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Chief Editor's View Point

The Ghauri Missile – Pakistani Engineers & Scientists Make History!

The spectacular launching of the 'Ghauri' Missile on April 6, 1998, under instructions from Mohammad Nawaz Sharif, Prime Minister of Pakistan has indeed added an impregnable sheet anchor to defence capability of the country. The military muscles of the nation have been fortified to new levels. Although, the spade work behind this achievement is years long effort of engineers and scientists commencing believably from mid eighties, yet the bold decision of accomplishment and test firing itself merits high applause, admiration and speaks of patriotic political will.

It has definitely told the world at large the HI TECH capabilities of Pakistani engineers and scientists. At the same time it has proven that, given resources, trust and a good professional leadership, engineers and scientists of this country can achieve anything for the nation. Unfortunately, the scientists and engineers of this country ever since independence have been subjugated to colonially inherited bureaucratic setup. This jargon well knew how to 'suppress' masses, keep them illiterate but was hardly trained and motivated to achieve speedy and scientific development of the country.

Consequently, the scientists and engineers of the country hardly got opportunities, trust and environment to revolutionize the national economic development efforts. They remained a depressed class of intellectuals. The powers remained concentrated in the hands of

generalist bureaucracy ignorant of challenges of the changing time and a fast developing economy based on self-reliance. Nations which got independence along with us like China progressed by leaps and bounds but we could hardly make major breakthrough in development. Wrong planning and misdirected efforts led the nation to huge debt liabilities without achieving significant impact on the economic and technological horizons.

As a matter of fact, drastic Services Reforms were needed to cut red-tapism on the one hand and to promote professionalism, scientific endeavor, R&D and education at large. Nonetheless, its is never too late to mend. Let us correct past blunders. Let's be a nation who loves and promotes knowledge. Give trust, confidence and opportunities to the scientists, engineers & professionals of the country to reach excellence in the future. This is possible only through a revolutionary Services Reforms package to be evolved and implemented with the effective participation of scientists, engineers & professionals of the country only.



The light of stars that were extinguished ages ago still reaches us. So is it with great men who died centuries ago, but still reach us with the radiations of their personality.



Prosperity comes through two things: exploitation of the earth and distribution of the produce.

Kahlil Gibran



SPECIAL REPORT

TECHNOLOGY OPTIONS AND TRENDS IN DIGITAL CELLULAR COMMUNICATIONS.

WHAT ONCE WAS ONLY A SPECULATION OF THE FUTURE TECHNOLOGY IS NOW BECOMING A REALITY

Engr. Mohammad Saleem Akhtar

Global demand for telecommunications services continues to grow at a tremendous rate. With million of people on waiting lists and an increasing number of people who can afford basic telephone service, operators and governments around the world face a significant challenge to meet the need for telecommunication service. There is now wide spread acceptance of the importance of communications to economic development, and the next ten years will see many billions of dollars spent on telecommunications infrastructure throughout the developing world. Although traditional technologies such as copper and fibre optic cables will dominate the scene, a significant role will be played by wireless communications, particularly in access networks.

Wireless communications has many advantages in terms of providing telecommunications. Wireless systems can be rapidly deployed and do not require major civil engineering works - wireless systems are flexible, they can be dimensioned for initial subscriber demand and then expanded in line with growth. The cost per subscriber of deploying a wireless access network is now equal to the cost of a fixed line network but life time costs are significantly lower as maintenance and operational over heads are much reduced. The most significant trend in telecommunications this century has been the shift towards mobility. The explosion in mobile communications has revealed the high value that people - professionals and consumers alike - place on anytime, anywhere contactability. For many users the mobile phone is becoming their preferred phone, leading them to question the necessity of having different phones and numbers -for communicating in the office, the home and the street.

Operators are also developing new market strategies, shifting their focus from penetration to usage. In the early phases of network growth, the main aim is to achieve the maximum share of new subscribers coming into the mobile market. As the market grows, and competition increases, the high revenue earning business sector becomes saturated and operators are increasingly acquiring their new customers from the lower revenue providing consumer sector. As this trend continues, operators are turning away from simply increasing their subscriber bases towards maximizing the usage of their high value customers. This can be best achieved by moving away from simply providing service in wide area towards provision of service in the areas where users spend most of their time in their offices and homes. As well as providing indoor coverage operators will need to generate tailored service offerings which will attract and retain their high value customers and encourage them to in-

* ***Director Telephones-I Lahore with PTCL, having years long experience in the Telecommunication field with updated insight & knowhow.***

crease their spending levels. This paradigm shift in the attitude of users towards their mobile phones and the changes in the market focus are combining to provide new market opportunities for mobile operators in areas traditionally served by fixed line networks.

If the mobile operator is to take advantage of these new market opportunities and succeed in wining minutes of use from the wireline operator he must provide tailored, personalized service packages which meet the requirement of main target market - the corporate customer. The implementation of tailored service packages has significant benefits for the operator in terms of increased customer retention and reduced churn. The financial and operational benefits that the customer gains from having a service package which fulfills all his wireless and wireline telecommunication needs ensures his long term loyalty.

Cellular phones now number several percent of population of many countries and falling costs are attracting a customer mass market on the one hand and fixed access applications on the other. The use of a simple pocket terminal to access not only the public cellular system but also private domestic and business systems, is often suggested. Message and data transmission may become an important adjunct to voice service. By any measure, the growth of a cellular mobile industry world-wide is expected to reach 549 million by the year 2002, is a spectacular development in the telecommunication industry. To enable the continued growth of this industry, digital cellular technology has been developed to provide increased capacity as well as lay the platform for an increased diversity of non-voice digital services as has occurred in the fixed networks. In addition to the large cellular industry growth, there has been an increased range of mobile technology. Options opened up complementing the "core" cellular technology. These options are described in relation to cellular as well as the importance of related "glue" technologies to complement service delivery options.

To satisfy this demand for "Communications on the move" it is necessary to make sufficient spectrum available and develop technology standards supported by multiple suppliers, to sustain falling costs and increased functionality. The key phase in the industry will be transition to digital technology which will shape future personal communications Networks (PCNs) which are not a technology but a new service concept to the customer.

Today's systems cannot provide such services. Cellular systems have good outdoor coverage of suburban areas, but became over loaded in city centers. Cordless phones and telepoint cannot provide good coverage away from densely populated service areas. Micro-cell systems present problems of a cell and cluster design and heavy mobility management loads.

New access and transmission technologies are required. Desirable attributes are:-

- High spectral efficiency to reduce the need for micro cells.
- Low power and long range, to provide wide coverage.
- Transmission robustness, to simplify cell design.
- A range of digital rates with circuit and pocket access for a variety of services.

Cellular systems with wide band modulation technologies generally have higher inter cell interference resistance than narrow band systems. This allows channel re-use at shorter distances, which reduces the number of cells in the cluster and off sets the extra band width of each cell. It also reduces the distances over which cells must be "hidden" from each other to control inter-cell interference, thus simplifying cell design. These advantages of wide band systems are more valuable in micro cell and indoor environments, where erratic cell shapes and multi-story clusters being more cells into close proxim-

ity. However, one TDMA system allows the same channels to be used in adjacent cells.

Code Division Multiple Access (CDMA) cellular has such high mutual interference resistance that it uses the same continuous RF carrier for several traffic channels in the one sector or cell. It is then possible to re-use that carrier in the adjacent sectors and cells, and throughout the system. Thus cluster frequency patterning is no longer required, base station sites are no longer restrained by elaborate inter-cell interference considerations, and 3-dimensionable clusters in high rise buildings are more practicable.

SPREAD SPECTRUM

Spread spectrum is a class of modulation techniques whereby a pseudo random code which is independent of the data to be transmitted is used to modulate and spread in bandwidth a data bearing signal. The spreading may be accomplished by radio frequency hopping (Fast Frequency Hopping or Slow Frequency Hopping) or by high speed scrambling of the data prior to RF modulations (Direct Sequence Spread Spectrum).

The received signed is de-spread with a synchronised duplicate of the transmitter's pseudo random code, prior to data detection for cellular, the multiple access capacity must be increased by orders of magnitude over previous spread spectrum systems. This requires techniques for distribution of large code families, and techniques for precise power control cellular CDMA systems therefore differ significantly from other spread spectrum systems.

CDMA CELLULAR

Data is scrambled by a pseudo random binary code with much wider bandwidth. The scrambled signal modulates the RF carrier and is transmitted. The receiver input consists of several such signals from different transmitters, which use different scrambling codes. Typically each received signal has a lower power spectral density than the input noise. After down conversion, each transmission is separately de-spread with a synchronised replica of its particulars scrambling code. The other transmissions and the input noise are merely rescrambled, and remain spread or become even further spread, because the scrambling codes are uncorrelated with each other and with the noise. Filtering at the data bandwidth then reduces the interference power at the detector to a relatively low level, allowing reliable detection of the original data. Powerful forward error corrections (FEC) can be used in CDMA Systems, with no bandwidth expansion penalty, because the transmitted signal is subsequently scrambled and spread independently of the data or the FEC algorithm. The data detector can then tolerate more mutual interference noise, and the systems traffic capacity can be increased.

The CDMA multipath receiver, called a rake receiver, is an effective channel equalizer. It consists of a battery of de-spreading circuits for each transmissions, each circuit being synchronised with the delay of one of the paths. Each de-spreader may also off-set the doppler shift of the multipaths component. Combining the de-spread components increases the signal into the detector. Any paths not used remain spread and cause only small amounts of inter symbol interference. Thus a rake receiver can operate over highly dispersive channels. The capacity and efficiency of the CDMA are functions of received power and the multipath efficiency. CDMA is seen to have 2 to 5 times the capacity of the 3 cells GSM system, under conditions ranging from highly dispersive to slightly dispersive, while requiring 10 dB less power per channel.

CODES

The scrambling codes may be periodic pseudo random sequences with periods equal to or greater than the data bit interval. A CDMA system requires a large number of scrambling codes, which must not be reused until several tiers of cells have been passed. Classical

code families with very good correlation properties, such as Gold and kasami Codes, do not have enough codes available for the traffic channels. Alternatively, random codes(as assumed in the analysis above) could be assigned to each call, and transmitted to the mobiles over the system's signalling channels during call setup. The signalling channels are less numerous than the traffic channels and their codes could be detailed in the system definition and assigned to each base station at commissioning time. Terminals could search all the defined signaling codes to acquire the system in a few seconds.

POWER CONTROL

CDMA requires precise control of the received power of each traffic channel. Transmissions from a base to a terminal all come through the same channel and all fade together. However terminals receive more interference from neighboring cells when they approach the cell boundaries. This can be offset by increasing the power of transmission to terminals near cell boundaries, and reducing the power of transmission to terminals well inside the cells.

Terminal transmitter powers must be individually controlled. The averaging time is the integration time of the data detector, which can be extended by interleaving. Thus rapid fading is averaged, and slow fading must be offset. The terminal can estimate the channel loss by measuring the signal from the base station, bet the return channel loss will usually differ due to un- correlated fast fading. Feedback from measurements of the despread signal power at the base station can improve the power control accuracy.

VARIABLE DATA RATE

Various data rates can be transmitted in a CDMA system, while maintaining the system's efficiency, by transmitting the same energy per data bit in all multiplexed data streams, while ensuring that the period of each traffic channel code is at least one data bit period on that channel. The limitations are that at low data speeds, power measurements for feedback power control may be slow or noisy, and at high speeds the mutual interference noise may be non Gaussian.

This analysis shows that when loaded to half capacity, CDMA cellular systems have 2 to 5 times the capacity of TDMA cellular, while using 10 db less power, under multipaths conditions ranging from highly dispersive to mildly dispersive. These advantages occur because the very high interference resistance of CDMA allows the same RF carrier to be used for multichannel access in every sector of every cell, because powerful FEC coding imposes no bandwidth penalty in CDMA, and because accurate dynamic power contact is necessary feature. Thus less infrastructure is required, coverage is improved, and the design and installation of cells of all sizes is simplified. These advantages will be even more important in the multi-storied office wireless communications, situation, where more cells are in close proximity. Various data rates supporting a range of services can be transmitted because the multiplex structure is relatively unstructured. Thus CDMA is a viable attractive technology for future cellular and personal communications systems.

FAST GROWTH PREDICTED.

CDMA is emerging as the preferred digital technology around the world. CDMA was developed by U.S. based Qualcomm, but Korea gets credit for proving its commercial viability. CDMA developed in Korea surprised the whole world in 1996, within 12 months, the Koreans took the system from a start up trial to a mature system of two million subscribers. By October 1997, SK and Shinsegi had a combined total of more than 3.3 million CDMA subscribers. It has predicted that there will be 11 million CDMA cellular and P.C.S. subscribers in Korea by 2001. Increasing market acceptance and adoption of CDMA in the Globe has taken place during the past two years. For example that of the 2,958 P.C.S. licenses awarded in the United States in 1996, 51% chose CDMA, 28%

chose GSM and 20% went with TDMA. Japan's regulatory authorities have given a formal go-ahead for CDMA service deployment. China plans to launch CDMA service in as many as 20 more cities during 1998.

World wide, the number of cellular phone subscribers is expected to drastically increase, 1995 there were 85.3 million wireless subscribers. By the end of 2002, this figure is expected to rise to 549.3, million. CDMA competes primarily against analogue and GSM - an existing, widely expected digital standard that has captured a giant share of the world market. CDMA would experience the fastest growth of all wireless technologies in the near term, jumping from 2% of market share by the end of 1997 to 18% by the end of 2002. During the same period, analog is predicted to drop from 48% to 15% and GSM to grow from 32% to 45%. It is clear that CDMA, as a new technology, faces the challenge of playing catch up, many in the industry are convinced that CDMA will become the digital standard of choice of the next generation of wireless communications.

EN ROUTE TO IMT 2000

Currently digital systems are basically voice-oriented. Increasingly, however, customers are demanding more sophisticated and advanced services, including multimedia, video telephony, Internet access, fax services and other non-voice capabilities. A mobile handset is no longer a merely a product for voice communications it is an enabling device - a technology being used to enable and combine other products. " This is the real concept of the next generations of wireless communications, so called IMT (International Mobile Telecommunication 2000)". However, the view that first generation denotes analog, second is voice-oriented digital, and third is wideband, global, multi purpose and multi media. At these components for third generation featured large in the calculations of the World Administrative Radio Conference (WARC-92) as it started to draft the blueprint of the future public land mobile telecommunications system (FPLMTS), now renamed IMT-2000.

To date, each nation or geographic region has gone its own way in adopting mobile system IMT-2000 aims to unify all the different systems, creating a single standard that will enable a person to use a single handset anytime, anywhere. The basic goal is 'wireless freedom with wireline quality, the requirements for IMT-2000 include:-

- High-capacity, high speed data transfer with transmission speeds up to 2Mb/s.
- Easy-to-use global roaming.
- Personalized, intelligent services.
- High-quality security.

SK Telecomm and NTT DOCOMO plan to jointly develop commercial IMT-2000 systems by the year 2000 and start a test service between Korea and Japan in 2001. Their goal is to offer CDMA based regular IMT-2000 services in both countries in 2002 in time for the world cup, which will be held in Seoul. 'Dream for the Future," in which W-CDMA will be the only standard used worldwide. The system will be truly global, easily expanded and grown, able to achieve an optimum efficiency and it will make everyone happy.

Wireless communications has many advantages in terms of providing telecommunications. Wireless systems can be rapidly deployed and do not require major civil engineering works - wireless systems are flexible, they can be dimensioned for initial subscriber demand and then expanded in line with growth.

WELCOME TO NEW PEC MEMBERS

The Executive Council of the Pakistan Engineering Congress approved membership of the following new members in their fold. The Engineering News congratulates them and welcomes to PEC.

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Every man's [illegible] is written upon his forehead, but in a language none but he who [illegible] revelations can read.

(Kahlil Gibran)

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NATIONAL PRESS HIGHLIGHTS PEC VIEWS

The Nation
MONDAY, DECEMBER 29, 1997

PEC calls for comprehensive technology policy

By Our Commerce Reporter

LAHORE: Pakistan Engineering Congress (PEC) has called upon the government to frame a comprehensive national technology policy which could play a decisive role in country's progress.

PEC has urged those at the helm of affairs to earmark atleast one per cent of Gross National Product (GNP) towards research and training for the transfer of technology to the skilled manpower in the country.

Engineer Khalid Latif president PEC pointed out that in developed countries 2.5 per cent of GNP was allocated on research and development while in Pakistan hardly 0.2 per cent was earmarked which was very discouraging.

DAWN
Lahore, Monday, December 29, 1997

PEC calls for comprehensive technology policy

LAHORE, Dec 28: The Pakistan Engineering Congress has urged the government to frame a comprehensive national technology policy.

The Congress also emphasized that while formulating the technology policy a minimum of one per cent of the GNP should be earmarked towards research and training for the transfer of technology to the skilled manpower.

These views were expressed by PEC President Engineer Khalid Latif at the conclusion of a study visit of a 60-member PEC delegation to the Research and Training Institute of the Pakistan Railways, Walton, on Saturday.

Mr Latif lauded the efforts of railway engineers and researchers for their efforts in carrying out research and training the engineers and railway personnel of Pakistan and 44 Afro-Asian countries on most modern techniques of railway operations, engineering and management.

The PEC president appealed to the government to provide more funds for further promoting its research and training activities.

In industrialized countries, he said, the private sector had played a vital role in the development of technology in Pakistan too, the private sector should come forward to promote technological advance ment to enable the country to enter the 21st century with technological independence, he said.

The Congress chief said the technology sector in Pakistan had remained weak due to years of neglect. He said in developed countries, 2.5 per cent of the GNP was allocated for research and development, while in Pakistan hardly 0.2 per cent was allocated which was very discouraging.

Speaking on the occasion, PR Research and Training Institute director Muhammad Rafiq Mian said 1,628 senior railway personnel from 44 Afro-Asian countries had so far been provided specialized training at the institute since its upgradation in 1982 as the Pakistan Inter-Regional Railway Training College.

This training related to different disciplines of engineering and railway operations, including transportation; motive power and rolling stock, signalling, telecommunication, management and computer.

He said the institute was initially set up as Railway Training School in 1929 to impart training to new entrants in the railway service. With the passage of time it developed into an institute and later as a Directorate of Research and Training to provide higher training facilities to railway personnel representing various countries in Asia and Africa, he said.

Chief signalling engineer Ali Asghar, who also addressed the Congress delegates, said "speed, service and safety" had been the motto of the Pakistan Railways and his lecture related mostly to the train operations and prevention of rail accidents.

Later, the delegates went round various departments and shops of the institute.—APP

INTERNATIONAL
THE NEWS

PEC seeks comprehensive national technology policy

PAKISTAN Engineering Congress (PEC) has urged the government to frame a comprehensive national technology policy for development in the country.

These views were expressed by PEC President Khalid Latif Khawaja at the conclusion of study visit by a 60-member PEC delegation to the Research and Training Institute of Pakistan Railways at Walton Saturday. He demanded that a minimum of one per cent of GNP be earmarked for research and training and transfer of technology to the skilled manpower in the country.

The PEC chief lauded the efforts of the Pakistan Railways' engineers and researchers for carrying out research, and training the engineers and railway personnel of Pakistan and 44 Afro-Asian countries in most modern techniques of railway operations, engineering and management. He said the Institute had been maintaining its standard despite insufficient resources and appealed to the government to provide more funds for further promoting its research and training activities.

In industrialised countries, Khalid said, the private sector had played a vital role in the development of technology, and in Pakistan too the private sector should come forward to achieve this end and enable the country to enter the 21st century with technological independence. He pointed out that in developed countries 2.5 per cent of GNP was allocated for research and development while in Pakistan hardly 0.2 per cent was earmarked which, he added, was discouraging.

Explaining salient features of Railways Research and Training Institute to the PEC delegates, the Institute's Director Rafiq Mian said that 1,628 senior railway personnel from 44 Afro-Asian countries had so far been provided specialised training at the institute since its upgradation in 1982 as Pakistan Inter-Regional Railway Training College.

This training related to different disciplines of engineering and railway operations, including transportation, motive power and rolling stock, signalling, telecommunication, management and computer.

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جنگ
29 دسمبر 1997ء

INTERNATIONAL
THE NEWS
Monday
January 26, 1998

PEC for promoting professionalism

By Our Correspondent

COUNTRY'S external debts would have been reduced by $ 30 billion had professionalism and reliance on local talent been promoted during the last 50 years, said President of the Pakistan Engineering Congress (PEC).

Addressing the members of the executive council of PEC at an iftar meeting, he stressed the need for urgently introducing service reforms and service structure for the engineers enabling them to occupy key positions, and appointing the senior most of them as heads of technical ministries, departments and autonomous bodies.

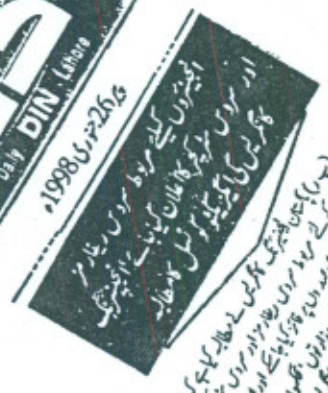
Other members of the Pakistan Engineering Congress called upon the federal and provincial governments to employ unemployed young engineers, whose number is increasing with each passing year, on Annual Development Programme (ADP) projects. They demanded of the government to promote professionalism because the non-professionals, when put to manage the technical ministries and departments, have often made unrealistic decisions.

The Pakistan Engineering Congress members pointed out the engineers, both in public and private sectors, have always played a significant role in the development of the country, but non-professionals have never allowed them to rise to key positions even in the technical departments.

"Our macro-economic planners concentrate mainly on the statistical figures ignoring professionals who are the agents of growth and production", they added.

The executive council of the Pakistan Engineering Congress paid a glowing tribute to the Prime Minister Muhammad Nawaz Sharif on the completion of the first phase of Pakistan Motorway Project, and said the project will go a long way in reviving the economy of the country.





The Nation

MONDAY, JANUARY 26, 1998

PEC stresses need for introducing service reforms

LAHORE (PPI) - Pakistan Engineering Congress (PEC) has stressed the need for urgently introducing effective service reforms and service structure for the engineers enabling them to occupy key positions and senior most of them be appointed as heads of technical Ministries, departments and autonomous bodies.

The Congress also urged upon the Federal and Provincial Governments to employ on annual development programme projects those thousands of unemployed young engineers whose number is increasing with each passing year.

These views were expressed by the members of the Executive Council of Pakistan Engineering Congress at an Iftar meeting held here the other day.

They demanded of the government for an effective growth of professionalism and added that the non-professionals have often made unrealistic decisions when put to manage the technical ministries and departments.

The engineering congress members pointed out that the engineers, both in the public and private sectors have always played a significant role in the development of the country but the non-professionals have never allowed them to occupy key positions even in the technical departments. "Our macro-economic planners concentrate mainly on the overall figures ignoring the engineers and other professionals who are the agents of change of growth and production", they added.

NATIONAL PRESS HIGHLIGHTS PEC VIEWS

THE MUSLIM
ISLAMABAD: SHAWAAL-UL-MUKARRAM 10, 1418 A.H. — SUNDAY, FEBRUARY 8, 1998

PEC stresses for more water storages

BUREAU REPORT

LAHORE, Feb 7 (PPI): Pakistan Engineering Congress has stressed the need for urgently harnessing the rivers by constructing multi-purpose storage dams in order to utilise 40 Million Acre Feet (MAF) of flood water which has been flowing waste into the sea after causing colossal damages on the way.

This was stated in a memorandum presented to the President Muhammad Rafiq Tarar by a 7-meber delegation of the Engineering Congress headed by its President, Engr Khalid Latif Khawaja, which called on him at the presidency in Islamabad today.

The delegation informed the President that due to rapid increase in our population, the country's needs for food and other agricultural products have greatly increased and we have become heavy importer of wheat, edible oil and sugar etc. We have clamped down development of our river water resources and within the next ten years, shortage of irrigation supplies would become grave.

The delegation apprised the President that due to constant neglect, lakhs of acres of land is lying barren and famine conditions are staring us in the face. They emphasised for urgently restructuring the technical services and service reforms for the engineers in government service to bring them at par with other professionals like doctors and lecturers.

They explained that in the absence of a service structure, the engineers are feeling demoralised and frustrated as they are being denied promotions from the grade to another even after putting in 16 years of service while the non-engineers are appointed heads of technical ministries and departments. They said that a 5-tier service structure plan is already under consideration of the Federal Government and requested for an urgent decision.

The delegation informed the President that thousands of graduate engineers are without jobs and their number is increasing every year. They appealed President Rafiq Tarar to urge upon the Federal and Provincial Governments to create jobs for such unemployed engineers in ADP projects against contingencies of these works.

THE PAKISTAN TIMES
Sunday, February 8, 1998

Multi-purpose dams can utilise flood waters

LAHORE: Pakistan Engineering Congress has stressed the need for urgently harnessing the country's rivers by constructing multi-purpose storage dams in order to utilize 40 million acre feet (MAF) of flood water which has been flowing waste into the sea after causing colossal damages on the way.

This was stated in a memorandum presented to the president of Pakistan, Muhammad Rafiq Tarar, by a 7-member delegation of the Engineering Congress headed by its President, Engr Khalid Latif Khawaja, which called on him at the presidency in Islamabad Saturday, says a PEC press release here.

The delegation informed the President that due to rapid increase in population, the country's needs for food and other agricultural products have greatly increased and we have become heavy importer of wheat, edible oil and sugar etc. We have clamped down development of our river water resources and within the next ten years, shortage of irrigation supplies would become grave. The delegation apprised the President that due to constant neglect, million of acres of land is lying barren and famine conditions are staring us in the face. The delegation also emphasised for urgently restructuring the Technical Services and Service Reforms for the engineers in Government service to bring them at par with other professionals like doctors and lecturers.

9 فروری 1998ء
DIN

THE NATIONAL PRESS HIGHLIGHTS PEC NEWS

The Nation

FRIDAY, APRIL 3, 1998

PEC demands release of WASA engineers

LAHORE (PR)–The Pakistan Engineering Congress has expressed resentment on the arrest of Director, Engineering Cell, Communication and Works Department, Lahore and three WASA Engineers in a manhole tragedy, as a scapegoat for those who are really responsible. Arrest of three WASA Engineers without any preliminary enquiry is not only against the natural justice but is also causing harassment among the administration, detrimental to its efficiency.

These views were expressed at a meeting of the Executive Council of Pakistan Engineering Congress held here with Engr Khalid Latif Khawaja in the chair.

The Council members passed a resolution demanding immediate release of Naeem Chughtai, Director, Engineering Cell, C&W Department saying that he has been implicated falsely in theft of trees on the instance of an MNA who wanted an undue favour from him.

Through another resolution, the Council members expressed grief over the recent manhole tragedy in Lahore, causing death of a minor.

The resolution demanded that WASA Engineers and Workers should immediately be released as they have been made scapegoats for those actually responsible.

The Council Members appreciated the directions of the Chief Minister, Punjab, for provision of funds for manhole covers and 100 per cent replacement of missing lids.

DAWN

Lahore, Saturday, March 21, 1998

PEC stresses small hydel power stations

By Our Reporter

LAHORE, March 20: The Pakistan Engineering Congress has emphasized the need for building small hydel power stations on waterfalls in the Northern Areas and on canal headworks in the Punjab and other provinces.

These views were expressed by Pakistan Engineering Congress President Khalid Latif Khwaja at the end of a study tour by a 70-member congress delegation which visited the new site of outfall of Balloki-Sulemanki Link Canal on Thursday. The outfall is being reconstructed by the Irrigation Department some 150 kms from Lahore.

The outfall transfers water from the Ravi to the Sutlej, 15 kms upstream of Sulemanki. The headworks structure was damaged in November 1996 as a result of which the canal had to be closed and a large chunk of area was deprived of irrigation supplies.

The project is expected to be completed by the end of next month and the irrigation supplies will be restored to farmers even up to the tail-end.

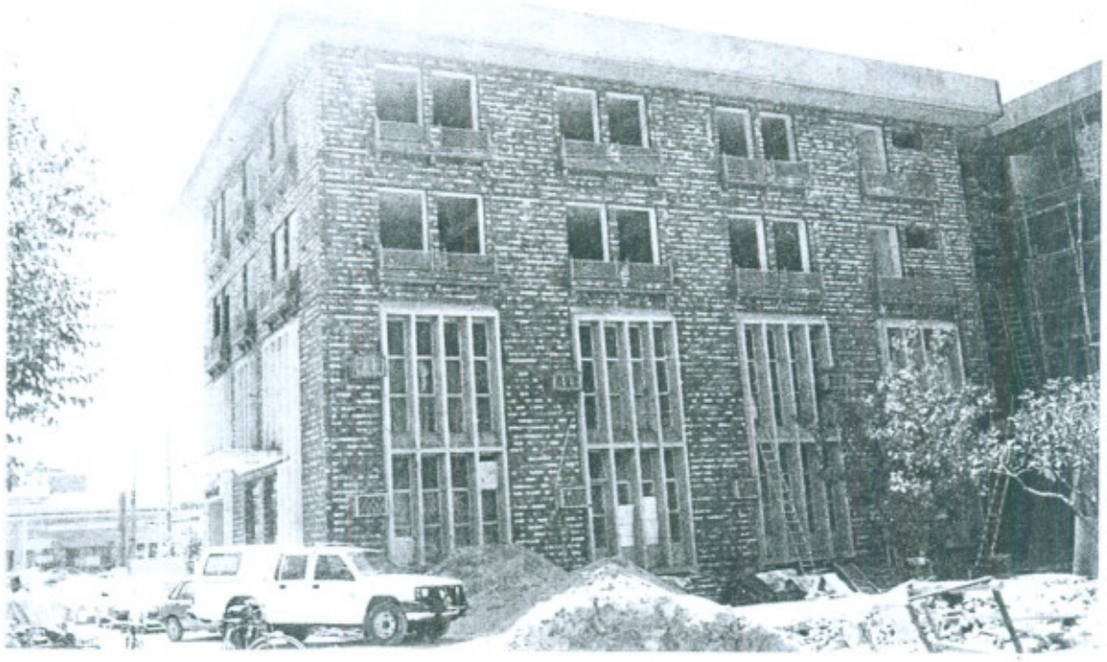
Explaining the salient features of the project to the visiting delegation, superintending engineer Chaudhry Muhammad Akhtar and project engineer Muhammad Azam said the new outfall had been designed for a discharge of 15,000 cusecs with a 19-foot waterhead. The National Development Corporation, a consulting engineers firm, designed the new outfall and ancillary works.

The PEC chief urged the government to make full use of the 19-foot waterfall available at the project site by installing a hydel power unit capable of producing 85 MW of electricity.


نوائے وقت

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حکومت آبشاروں اور نہروں پر پن بجلی گھر بنا کر سستی بجلی پیدا کرے



CONGRESS BUILDING COMPLETED

Here are two pictures of the long-awaited completed building of the Pakistan Engineering Congress. Thanks to the persistent dedicated efforts of the PEC team led by Engr. Khalid Latif Khawaja – the President of the 67th Session of the Congress which made it possible to realise a virtual dream!





EXECUTIVE COUNCIL MEETING OF THE PAKISTAN ENGINEERING CONGRESS HELD ON APRIL 29 , 1998, IN SESSION.





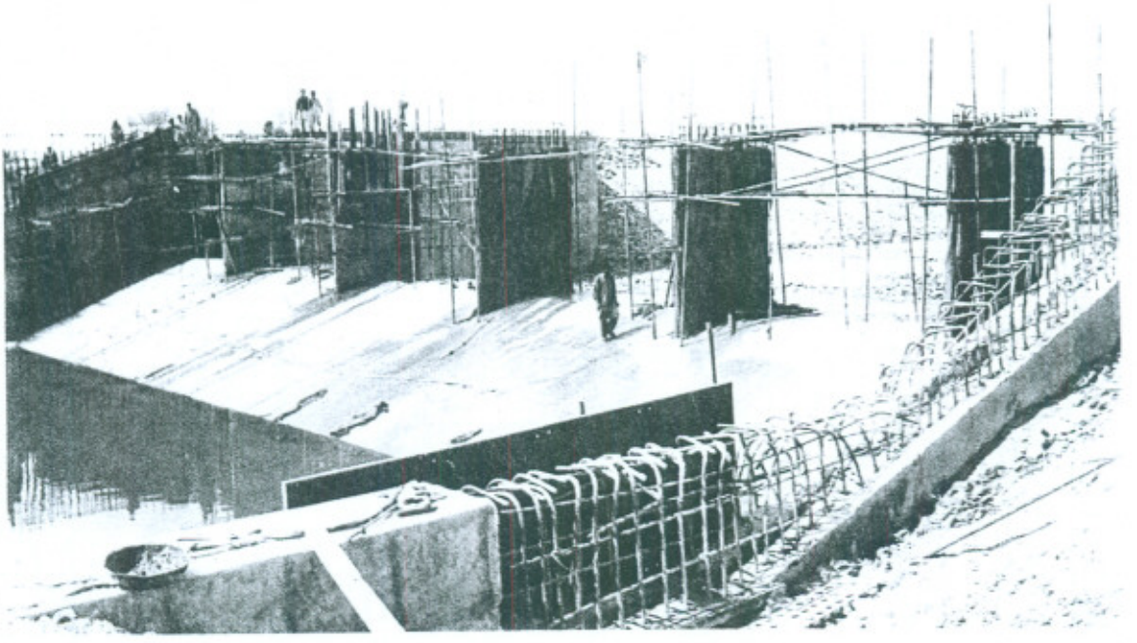
Engr. Ch. Abdus Salam, an expert in structural design, addressing on the subject of "Cracks in Building Structures". On the head table are Engr. Khalid Latif Khawaja, Ashfaq Hassan and Muhammad Rafiq Shad.



PEC Members listening to Engr. Ch. Abdus Salam at the lecture meeting.



Visit to BS Link out-fall – 1 Reconstruction Project by Congress Delegation in March 98. Group Photo taken at the Gulsher Rest House.





PEC COMPUTER CENTRE

PROMOTING COMPUTER LITERACY

By : ***Engr. Husnain Ahmad***

During 57th annual session apart from other heroic deeds on account of CCPEC, ice has been broken, wheels have been set in motion and the centre subjected to ifs & buts previously is no longer the same old storage of computer donated by the President of Islamic Republic of Pakistan.

It is now undoubtedly one among the best reputed computer center in the most competitive computer filled town.

Hats off to the convenor Eng. Iftikhar Ahmad and his team who not made untiring effects but changed the fate of the center. Computer have been upgraded during this session and have started playing a vital role in getting employment to the talented youth of this nation.

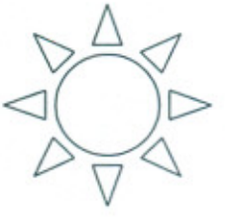
It is offering a lot of technical courses with varying degree of expertise involved for beginners, professionals and even for expert in order to fulfill the needs of a very large segments of populations. Centre has not confined its focus on the engineering community alone but also realising the need of the time is encouraging an offering these courses to people of all age groups from all walls of life. The noblest of all ideas is enlightening the poor offering best services and knowledge free of cost. During the session hundreds of deserving students have been offered free computer education.

The Computer Centre has always been a liability and financial burden on to the Congress but during 67th session it has by the grace of Allah Almighty not only offered maximum courses from which around one thousand students benefited but has also managed to cover its expenditure despite offering a large number of students free of cost education though it would be unfair if the contributions of the President and the Executive Council of the Congress are not appreciated. The Congress not only provided a rent free building but also supported and extended all its cooperation.

On going courses includes M.S. DOS Windows & WinWord, M.S.Excel 97, M.S.Access, Oracle, C++, Visual C++, Visual Basic, Visual Java, Windows 95 Internet Power point, M.S. Project Scheduling and Planning, AutoCAD (Rel. 12 & 13), Web Page Designing HTML, FoxPro, Lotus 1.2.3, and Windows NT, LANE. At present though all available course are offered.

The Convenor and the committee though their shear labour and hardwork putting in heroic efforts and a very well deserved appreciation have been recorded the executive council of P.E.C meetings.

It is however very important that the momentum gained would be maintained the advantage gained should not be wasted and centre which has needs its expansion become of complete success. Now when 67th Session is closing an elections are due, it is very important that the new Council should also take up the issues of Computer Centre religiously and should complete the plan of the present committee and make a dream of having a Computer College with wider degree program and reality.



MODERN BUILDING CONSTRUCTION

EXPERT REVIEWS PRACTICES

The reasons why cracks appear in tall modern buildings and plazas a few months after their construction were spelled out and remedial measures explained here recently at a lecture meeting organised by the congress by an eminent Engineer. Ch. Abdus Salam, former Secretary, Communication and Works Department, Government of the Punjab.

Engineer Abdus Salam, who is an expert in structural design of multi-storeyed buildings and bridges, was addressing a largely attended lecture meeting organized by the Pakistan Engineering Congress with Engr. Ashfaq Hasan, a former President of the Engineering Congress in the chair. With the help of slides, the speaker highlighted the likely causes of cracks and advised on better building practices.

Elaborating his lecture entitled "Cracks in Building Structures", Engr. Abdus Salam said that cracks appear as the buildings are tall, have thin walls with high stresses and are built with rapid pace of construction and inadequate technical supervision.

Engr. Abdus Salam explained that the structural cracks in buildings can be due to faulty design, bad workmanship or over-loading but the non-structural cracks can be attributed to various reasons which include (a) moisture movements, (b) thermal expansion and contraction, (c) elastic shortening, (d) movement due to creep, (e) movement due to chemical reaction, (f) foundation settlement and (g) cracking due to vegetation.

He said the non-structural cracks in buildings generally do not impair stability of buildings, but these are aesthetically unpleasing; cause scare to the residents and with ingress of rain or moisture the internal finishes can be spoiled leading to expensive restoration. With little more attention and care at the design stage and during construction period, their occurrence can be controlled or eliminated, he added.

Engr. Abdus Salam said that it is generally complained that old buildings, constructed during the pre-independence era, performed much better than the buildings being constructed during the present years. He explained that the old buildings, built generally in mud mortar, were low in height, had thick walls made of bricks and the speed of construction was slow to ensure quality work. The modern buildings are, therefore, more crack prone, he stated.

In his presidential remarks, Engr. Ashfaq Hasan, former Secretary C & W, who has life-long experience in building research and design, stressed upon the engineers to invariably monitor foundation soil conditions while designing and constructing high rise buildings. He advised them to always examine personally every item provided in the cost estimates of large construction works to keep the same within reasonable limits. He also narrated his experiences of cracks occurring in the lining of canals; cracks in floors and roof slabs or beams of large buildings and suggested remedial measures.

Speaking on the occasion, the Engineering Congress President, Engr. Khalid Latif Khawaja, pointed out that in D. G. Khan; Rahim Yar Khan and other adjoining Districts, lot of cracks are being developed in large buildings due to shrinkable cohesive soil in these areas. He announced that the Engineering Congress will soon constitute a Technical Committee of experts to investigate and formulate recommendations for the construction of buildings in these Districts to avoid post-construction cracks.

COMPUTER MODELS
FOR
MANAGEMENT OF SEVERE FLOODS IN PAKISTAN

Dr. Shahbaz Khan

ABSTRACT

Recent developments in computer systems and water resources modeling have made it possible to accurately forecast flows in rivers during severe floods. A number of standard modeling software packages are available which can be used to develop reliable flood forecasting and early warning system of Pakistan. The flood forecasting and warning system should include a set of software packages including hydrological data base, rainfall-runoff, reservoir operation, river flow and GIS models of flood plains. Using these models a proper decision support system can be developed to make vital decisions regarding dissemination of flood warning and evacuation of flood prone areas in advance. The flood forecasting and management system can also be used to test in advance different flood mitigation scenarios at reservoirs and to decide upon the optimum releases which will prevent synchronisation of river flows at confluence points and danger to life and property.

1. *INTRODUCTION*

Floods in river Indus and its major tributaries (Fig. 1) occur due to monsoon depressions emerging from Bay of Bengal which travel to Rajisthan in India before moving to the catchments of Pakistani rivers. It is possible to make one day rainfall forecast when the weather system starts moving from Rajisthan in India. However an alert can be given 2 to 3 days earlier when the weather system starts travelling from the Bay of Bengal to Rajisthan. More accurate forecast is issued subsequently after pursuing the weather system track up to Mangla catchment. (Majid, 1996).

The rainfall falling on upper catchments can be measured and transmitted by the remote sensing equipment to flood forecasting centre (Bell et al. 1994). The forecasted/measured rainfall can be used to compute the inflows from upper catchments and nallahs using rainfall-runoff models. The upper catchment and nallah inflows can be used in conjunction with the river flow models to compute flows and water levels at stations along the rivers. For the development of these models tremendous amount of historic data of river basins is required. The required data include river basin maps, catchment characteristics, river roughness, river geometry, hydraulic structures data, and hydrometeorological data. The hydrometeorological data can be complied using a data base and data management package. The data related to flood plain mapping of the river Indus and major tributaries can be used to develop GIS based terrain maps which can be linked with river flow models.

This paper discusses the role of computer models for the development of flood forecasting and early warning system of river Indus and its major tributaries.

** National Engineering Services of Pakistan [NESPAK] (Pvt.) Limited

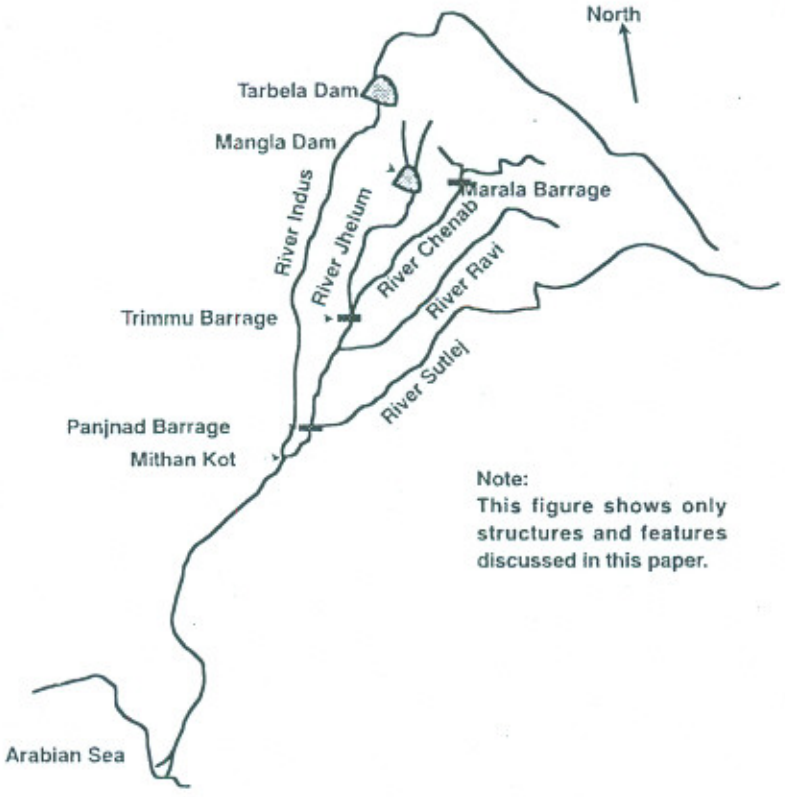


Figure -1 Indus River System

2. *HYDROLOGICAL DATA BASE SYSTEM*

The hydrological data base and data management package can be used to develop and maintain hydrometeorological data base of River Indus and its major tributaries. Following types of data are to be stored and maintained in the data base system.

- rainfall data
- climatological data
- evaporation data
- water levels
- stream flow and canal flow data
- stage-discharge data

The above data is collected by various organizations in Pakistan and can be computerized in the hydrological data base. For the processing of hydrometeorological data the data base system should have following capabilities:

- screening of data to check its reliability
- statistical analysis
- time-series analysis
- relation curve and double mass analysis
- processing of flow measurement data
- fitting and validation of rating curves
- rainfall-runoff simulation

During the real time flood forecasting environment the hydrological data base would be continuously updated to incorporate the latest hydrometeorological information.

The hydrological data base system should be user friendly, PC based and should be capable of storing different types and durations

f data series. The proposed ydrological data base sys-em can be selected from YDAP (DHI, 1994), YDATA (Institute of Hydrol-gy, 1995) and HYMOS Delft, 1992).

RAINFALL-RUNOFF MODELS

In order to forecast the flows from upper catch-ents and nallahs to rivers onceptual rainfall-runoff odels are used. The con-eptual models are based on hysical description of the ydrological cycle, one such odel "Sacramento model" as been developed by Cali-rnia Department of Water esources. It simulates runoff rocess by dividing it into a and phase and a channel hase. During the land phase e hydrological processes of terception, storage, perco-ation, interflow are consid-red in the upper land zone nd deep percolation and roundwater flow are consid-red in the lower land zone to ompute runoff from precipi-ation. The computed runoff is outed through the stream luring the channel phase by imulating the propagation nd attenuation of flood aves by using unit hydrog-aph or the other techniques. he rainfall-runoff model pa-ameters are adjusted/ cali-rated to simulate results as lose to the recorded data as ossible in case of gauged treams/nallahs. The cali-rated model parameters for catchment would be vali-dated for the other recorded ainfall and discharge data. Bedient and Huber (1988) have given details of other hydrological simulation models.

The calibrated model parameters for the gauged streams can be used to estimate parameters for the ungauged streams by establishing relationships between the catchment characteristics and the model parameters.

The stream/nallah outflow hydrographs simulated by rainfall-runoff models are incorporated in the river flow models.

4. RESERVOIR ROUTING MODELS

A reservoir routing program based on Pul's method (Bedient and Huber, 1988) or reservoir operation model based on system analysis and optimisation techniques such as MNGFOP (Bhatti and Ahmed 1997) or MDDDP (Ahmed et al, 1997) can be used to route inflow flood hydrographs from upper catchments computed using rainfall-runoff model through Mangla or Tarbela reservoirs. Different reservoir release scenarios can be formulated using any of these modules and routed through the river flow model. Khan (1997b) has given a detailed procedure for flood mitigation using reservoir routing and river flow models.

5. RIVER FLOW MODELS

For the river flow Modeling one dimensional hydrodynamic river flow simulation models based on the numerical solution of full Saint-Venant equations of unsteady flow are used. The one dimensional hydrodynamic river flow model code to be used to develop flood routing model of river Indus and its major tributaries can be selected from FLDWAV (Fread and Lewis, 1988), MIKE-11 (DHI, 1992), DWOPER (Fread, 1978), or SOBEK (Delft, 1995).

The river flow models are developed using the physical description of the geometry of rivers, continuity equation and a balance of forces governing the flow of water in open channels. The hydrodynamic models can represent the influence of bridges, barrages and dams on the propagation and attenuation of flood waves. The different roughness values and storage characteristics of a river can be considered. The model for river Indus and its major tributaries would be calibrated below the rim stations using the river cross-sections, river roughness, rating curves, discharge and elevation series for a given year. During the calibration process discharge series at the u/s end of a river reach and water elevation series at its d/s end are used as boundary conditions. The model computes water elevations and discharges along a river reach which are checked against the observed data and the river characteristics are revised to closely match the computed and observed data. The calibrated model is

then validated for the other years. Khan (1997a) has described the data requirements and development process of hydrodynamic river flow models of river Indus and its major tributaries.

During the real time forecasting river flow models will be used to predict water levels, discharges and extent of flooding along a river reach. The predicted water levels would be later on compared with the measured water levels and the model parameters would be updated by a Filtering Technique (Goodwin and Sin, 1984) to obtain a close match between the computed and observed water levels.

6. GIS MODEL OF FLOOD PLAINS

A digital terrain map of flood plains of river Indus and major tributaries should be developed after conducting detailed flood plain mapping surveys and using GIS software. In a number of river systems such type of digital terrain maps have been successfully linked with the river flow models (Binnie and Partners, 1991; Bush, 1990). The water levels computed by the river flow model are superimposed on the digital terrain map to instantaneously determine the depth and areal extent of flooding during real time floods.

7. OVERALL OPERATION OF FLOOD FORECASTING SYSTEM

Fig. 2 shows the overall operation of the computerised flood forecasting system. The steps involved are listed below:

a) The forecasted/measured rainfall will be used to compute the inflows from upper catchments and nallahs using rainfall-runoff models. The upper catchment and nallah inflows will be used in conjunction with the river flow models to compute flows and water levels at stations along the rivers.

b) The reservoir routing models will perform the routing of flows through Mangla and Tarbela reservoirs considering inflow hydrographs, from upper catchments, computed from the rainfall-runoff models. The outflow hydrograph from the reservoirs are used as input to the river Jhelum and river Indus models. The releases d/s Mangla and Tarbela reservoirs can be modified if the resulting hydrograph at Trimmu barrage or Guddu Barrage are not acceptable. Khan (1997b) has described detailed procedure for reservoir operation using computer models.

c) The hydrographs at rim stations of rivers and nallah inflows are used as input to the river flow models. The river flow models compute water levels and discharges at stations along the rivers. The water levels and discharges from the field are compared with the computed water levels and discharges and Filtering Techniques are used to update the model state before forecasting the water levels and discharge for future period.

d) The water levels obtained from the river flow models are superimposed on a digital terrain GIS model to determine depth and areal extent of flooding. The flood prone areas are assessed and warning can be issued to such areas for evacuation and for adopting protective measures.



I never speak without error, for my thoughts come from the world of abstraction and my statements from the world of reference.

Kahlil Gibran

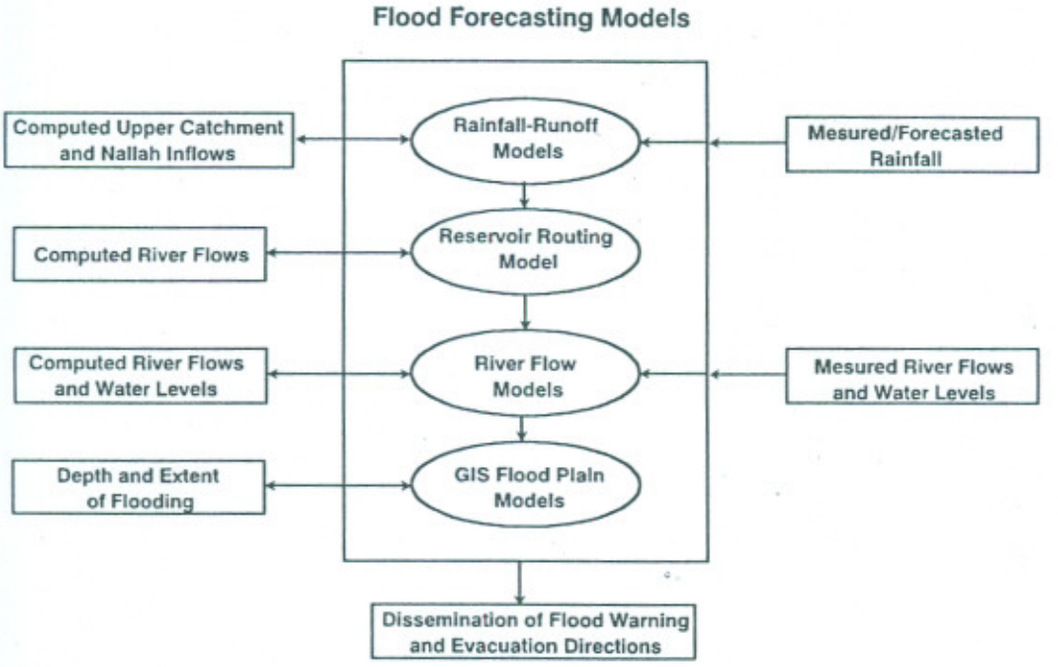


Figure - 2
Flow Chart of Computer Models System for Management of Severe Floods

CONCLUSIONS

A number of standard ware packages, related to hydrological data base lopment, rainfall-runoff, rvoir routing, river flow GIS models, are avail- These packages can be emented on PC based ems and can be used to elop a flood forecasting warning system of river Indus and its major tributaries. During real time operation the flood forecasting system developed using these packages will enable proper reservoir operation, estimation of flows, water levels and lateral extent of flooding along the rivers. The forecasts of flows at important stations will enable concerned agencies in proper operation of structures and breach sections. The advance flood warnings and directions of evacuation of flood prone areas can be issued in advance in order to avoid damage to life and property. The operation of computerised flood forecasting system for a few of years will build confidence of people and will result in proper management of floods.

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LEARNING ABOUT ENVIRONMENT

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1. INTRODUCTION

The term environment may be defined in many ways. In the simplest words, environment is everything that surrounds man. This definition is used with reference to air, water, soil, plant and animal life. Nevertheless, it also includes factors which deteriorate environment like poverty, underdevelopment, urbanization, deforestation, population explosion etc. (Dhyani, 1994). Another definition of environment is made as people, relationship among people and between people and all surroundings i.e. air, water, soil, plants, animals etc. Some environmentalists define environment to be the aggregate of all external conditions and influences affecting the existence and development of an organism, human behaviour or society. Another simple and interesting definition of environment is what stimulates a variety of responses in the five human senses of sight, audition, taste, smell and touch.

In the context of environment certain terms are frequently used while discussing the human impacts on the planet earth. One such term is `Pollution'. It is defined as any condition or substance resulting from human or natural activity that adversely affects the quality of the environment. It may also be defined as anything added to air, water, soil or food that threatens the health, survival, capability or activities of humans or other living organisms (Miller, 1994). The term "Resource" refers to anything humans obtain from living (biotic) or non-living (abiotic) environment to meet their needs and wants. Solar energy, air, water, plants, crops, petroleum, minerals etc., are all resources.

An `Ecosystem' may be defined as a community of plants and animals interacting with each other and with their environment (Kemp, 1994). `Habitat' refers to natural environment or place where an organism or species lives. `Carrying Capacity' refers to the maximum number of individuals of a given species that a particular habitat can support sustainably.

`Development' implies to the application of various resources to satisfy human needs and improve the quality of human life (IUCN, 1980). Development is thus about improving the well being of people. `Sustainable Development' is the development which lasts (World Bank, 1992). In other words, it is the development that meets the needs of the present without compromising the ability of the future generations to meet their own needs. The term `Conservation' is defined as the management of human use of the natural resources in a manner that such use can continue.

Development without conservation has given rise to over exploitation of natural resources and resulted in many environmental hazards and disasters. This situation underlines the need for conservation of natural resources. In fact development and conservation are equally necessary for a better human life on earth.

2. PHYSICAL AND HUMAN ENVIRONMENT

Physical environment is made up of living and non-living things and conditions that characterise the world. The physical environment can be classified into four major environmental spheres: the lithosphere (crust of the earth, deep upto 30 Km); the atmosphere (gaseous layer surrounding earth); the biosphere (made up of flora and

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fauna) and the hydrosphere (ice, fresh and saline water and vapours). The four environmental spheres interact in a variety of ways to form different ecosystems.

Physical environment contains three types of natural resources. (i) `Continuous resources' - which for all intents and purposes will never run out; e.g. solar energy, wind and tidal energy. (ii) `Non renewable resources' - which exist in fixed quantities in the earth crust; e.g. fossil fuels, minerals and some groundwater. (iii) `Renewable resources' - which can naturally regenerate unless these are irreversibly damaged; e.g. plants, animals, clean water, soil and biodiversity (Middleton, 1995). Renewable resources have thus a chance to be depleted. If their natural replacement rate is exceeded, the available supply begins to shrink. This process is known as environmental degradation (Miller, 1994).

The term `human environment' is used to refer to all extrinsic (accessory) resources through which humans are able to benefit from physical environment. Human environment thus includes all aspects of the human species all of which are renewable, e.g. people, their skills, abilities and institutions (Middleton, 1995).

All environmental problems are the result of a mismatch between extrinsic resources and natural resources. These stem from people deliberately or inadvertently misusing or abusing the natural environment.

3. *IMPACT OF HUMANS ON ENVIRONMENT*

A very large increase in human population, alongwith widespread urbanization associated with advances in technology and related developments of economics, political and social structures have all combined to make significant interactions between human kind and physical environment. The human population issue is the underlying issue of the environment as most environmental damages result from very large number of people on the earth. At present, the population of the world is estimated to be 5.8 billions. Population growth rates of the sort being faced today have no historical precedent. It is anticipated that the world population would reach 8 billions by 2025 to further the cause of environmental degradation.

Around 48% of the global population lives in cities and consumes more resources as compared to the rural population. On the global scale there are clear imbalances between richer nations and the poor ones. The 23% people of the world who live in the developed countries command about 85% of the world wealth and income, use 88% of the natural resources and 73% of its energy and generate most of the pollution and wastes (Miller, 1994). Economic power is thus seen as a vital determinant towards resource use and environmental pollution. The difference in economic power is also manifested in political power as developed countries have more influence over decisions that affect interaction with the environment. On the other hand the poor may degrade the environment because they have no other option than to overuse or misuse the immediate available resource. Poverty thus emerges to be a major polluter of the environment (World Bank, 1992). Poor people, at present constitute more than one fifth of the world's population, with over a billion living on less than $1 per day. Half of them are malnutritioned. Ironically nearly 75% of poor and malnutritioned people live in the rural areas where food is grown (Ayres and McCalla, 1996). UNICEF estimates indicate that about 13 million babies die every year due to diseases related to starvation (Raven et al., 1993). Today, over 1.7 billion people in the world lack sanitation facilities and health services. In 1993, tuberculosis took 2.7 million lives and malaria, 2 million. Around 3 million people, mainly children, die every year due to diarrheal diseases (Brown et al., 1996). More than 100 million people in the world are overtly unemployed while about a billion adults are illiterate (Desai, 1995). Only 6% of the world's scientists and engineers live in developing countries. As a result many

nations face difficulties in managing their precious natural resources. Over the next three decades, about 3 billion more people will be added to the world population - the greater majority of them in the cities of the third world and living a life of poverty and illiteracy.

Over-exploitation of the earth natural resources and carrying capacities of ecosystems have drastically changed the face of the planet. Each year more forests, grass lands and wet lands disappear and some deserts grow larger. Every year around 200,000 Km2 area is being lost to economically productive agriculture due to desertification primarily caused by overgrazing and overcultivation. As a result many African nations face starvation and famine. A third to a half of forests have been cut and the remaining may vanish within the next 30 to 50 years due to commercial logging, subsistence agriculture and fuelwood collection. Each year soil erosion takes away 24 billion tonnes of soil. As a result around 20 percent of the top soil which makes it possible to grow the crops has been washed or blown away from farmlands. It is estimated that 30 percent of the world's cropland has lost productivity from soil erosion. In addition, more than 10 percent of the world irrigated area appears to suffer from salt buildup serious enough to lower crop yields. The cleared forests and eroded soils clog streams, lakes and reservoirs with sediments.

Water is extremely precious source for the existence and development of life on the planet earth. Out of approximately 14 x 108 cubic kilometers of the water on the planet only 2.53 percent is fresh and out of that only 0.27 percent water available in lakes and rivers is subject to human use. Uneven distribution of 0.76% fresh water lying underground, makes many arid and semiarid parts of the world without a reliable source (UNEP, 1994). On the other hand, in most parts of the world the finite supply of fresh water is being put to heavy use. At places, underground water is being abstracted faster than it can be replenished. The water table, therefore, is falling in many areas of the world. Globally, having enough clean water to drink and bathe is a life or death issue for one out of every five people. It is feared that within next 30 years, humankind will run out of its water supplies. Industrial wastes, sewage and agricultural run offs are polluting oceans and other water bodies with chemicals, wastes, pathogens and nutrients. The situation has resulted in an accelerating loss of fresh water fish species and contamination of drinking water supplies. In developing countries eighty percent of all diseases are caused by consuming contaminated water and result in killing 25 million people every year (Brown, et al., 1996).

For centuries biodiversity has provided stability to the earth's ecosystem. Estimates of species on the earth range from 4 to 40 millions. The earth's 1.5 million identified species and their genetic materials provide humans with industrial, agricultural and medicinal products. However, present habitat destruction to provide farmland and settlements for the ever-increasing population is resulting in the extinction of thousands of plants and animal species for every passing year. The situation is being worsened through hunting and poaching of wild animals and birds for commercial purposes. Such a great loss of biodiversity would result in lost opportunities and lost solutions to the future problems. The preservation of biodiversity has thus become an important environmental issue of the present time.

Burning fossil fuels and cutting down forests for fuel releases every year 8 to 10 billion tonnes of carbon in the atmosphere causing global warming. As a result the earth temperature is expected to rise between 2 to 5 øC by 2050 to affect climate changes which may ultimately disrupt agricultural productivity and drive countless species to extinction. Changes in global and local temperatures and rainfall could expand the geographical distribution of parasites and vectors, increasing the risk of infectious diseases. Annually 0.9 million tonnes of CFCs are being released in the atmosphere.

This has changed the characteristics of atmosphere drastically with thin spots in the stratospheric ozone, subjecting humans to damaging ultraviolet radiation. Consequently cases of cataract and skin cancer are soaring in Argentina, Chile, Australia, New Zealand and South Africa (Miller, 1994).

On the other hand industrial activities are causing acid rains in many regions of the world with deleterious impacts on forests, crops, buildings, and human and animal life and making several thousands of lakes lifeless. Atmospheric pollution due to mobile and immobile sources has emerged as a significant health hazard in the present days. Consequently, acute respiratory infections claim 4.1 million deaths every year. Toxic wastes from factories and homes poison the air, water and soil. Agricultural pesticides and fertilizers contaminate some of our drinking waters and food. The annual global consumption of pesticides is now estimated to be 2.5 million tonnes. According to WHO, the world faces 20,000 annual pesticide related deaths (Brown et al., 1996). On the other hand, the annual world's fertilizer use of 122 million tonnes, as of 1995, has raised nitrate levels in groundwater supplies of many regions putting the health of many infants at risk. Another important problem that the world faces today is the generation of several hundred million tonnes of solid and hazardous wastes which increase every year. Insanitary disposal of solid wastes and illegal dumping of hazardous wastes in oceans and their acceptance by some African and other countries such as North Korea for dumping on their lands poses a real or potential threat to the environment and human health. In fact in many industrialized nations management of hazardous wastes has become the most serious environmental problem.

All the above issues and facts clearly emphasize the urgent need for the conservation of the environment. As a policy lesson, it is often cheaper to prevent environmental degradation than to attempt to cure it later.

4. THE PAKISTAN CONTEXT

In the third world countries, Pakistan presents a peculiar example of environmental degradation. With 135 million people, it is the 7th most populous country of the world. It's population is growing at an alarming rate of 3.1% per annum. It is estimated that the country's population would exceed 380 million by the year 2030 to render it the third most populous country in the world. A very large population, limited resources, unequal distribution of national wealth and unsustainable pattern of resource use are the major causes of environmental degradation in Pakistan.

Water supply and sanitation coverage in the country is estimated to be 53% and 23% respectively. More than half the population lacks basic health facilities. Infant mortality rate is around 95 per 1000 births and 3.7 million children of less than 5 years age suffer from malnutrition. Around 1.6 million people suffer from tuberculosis. In Pakistan 30% of all reported illnesses and 40% of deaths are attributed to water borne diseases. Annual per capita income is only $ 430 and more than one third of the population lives below the line of absolute poverty. Literacy rate is less than 25%.

Pakistan faces a number of serious environmental problems. Of high concern is the water pollution. Huge quantities of untreated industrial and municipal wastes discharged into the receiving water bodies have caused serious damage to human health, vegetation, animals and aquatic life. Air in the major urban centres is heavily polluted due to natural dust, industrial emissions, automobile exhausts and burning of the solid wastes. Consequently, a large number of people suffers from respiratory and other related illnesses. In cities, the mismanagement of solid and hazardous wastes poses a serious threat to the human health. In agriculture sector, the use of pesticides has exceeded 43,000 tonnes per year (CEHA, 1996) and is considered a potential health