ENGINEERING NEWS

Vol. XXVI No. 1 MARCH 1981

A QUARTERLY JOURNAL OF PAKISTAN ENGINEERING CONGRESS

CODE OF ETHICS

PAKISTAN ENGINEERING CONGRESS

بِسۡمِ اللّٰہِ الرَّحۡمٰنِ الرَّحِیۡمِ

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 اللّٰہَ یَاۡمُرُکُمۡ اَنۡ تُؤَدُّوا الۡاَمٰنٰتِ اِلٰۤی اَہۡلِہَا ۙ وَ اِذَا حَکَمۡتُمۡ بَیۡنَ النَّاسِ اَنۡ تَحۡکُمُوۡا بِالۡعَدۡلِ ؕ اِنَّ اللّٰہَ نِعِمَّا یَعِظُکُمۡ بِہٖ ؕ

"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۔ اَوۡفُوا الۡمِکۡیَالَ وَ الۡمِیۡزَانَ بِالۡقِسۡطِ وَ لَا تَبۡخَسُوا النَّاسَ اَشۡیَآءَہُمۡ وَ لَا تَعۡثَوۡا فِی الۡاَرۡضِ مُفۡسِدِیۡنَ ۝

"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۔ وَ لَا یَجۡرِمَنَّکُمۡ شَنَاٰنُ قَوۡمٍ عَلٰۤی اَلَّا تَعۡدِلُوۡا ؕ اِعۡدِلُوۡا ۟ ہُوَ اَقۡرَبُ لِلتَّقۡوٰی ۫

"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۔ اَوۡفُوۡا بِالۡعُقُوۡدِ ۬ؕ

"Fulfil the obligations". v : 1

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

TWENTY SIXTH YEAR OF PUBLICATION

ENGINEERING NEWS

Quarterly Journal of the Pakistan Engineering Congress

o All communications should be addressed to the Chief Editor, Engineering News, P.W.D, Secretariate, Lahore, Pakistan.

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

o When quoting from this journal, please specify volume, number, date and author's name.

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

o Advertisement rates : by arrangement with the Editor.

Vol. XXVI No. 1 MARCH, 1981

Page

In this Issue

Publication for Members only.

TITLE

Guddu Thermal Power Station. Phase II was recently inaugurated by the President of Pakistan.
Photo: Courtesy WAPDA.

MR. S. M. AYOOB
THE NEW PRESIDENT OF
PAKISTAN ENGINEERING CONGRESS

Syed Muhammad Ayoob has been elected as new President of Pakistan Engineering Congress. He was born in District Muzaffar Nagar of United Provinces, India on 8.9.1924. He got his Engineering Diploma of Civil Engineering from Thomson College of Civil Engineering Roorkee, in 1944. He joined Irrigation Branch of P.W.D. of United Provinces on Ist August, 1944 and posted on the construction of Muhammadpur Power Station of about 10,000 K.W. capacity on the Ganges Canal along with all its paraphernalia. Subsequently in July 1946 he was transferred and posted in First Sub Division of Upper Division Eastern Jumma Canal where, apart from regulation, he was incharge of several Cross Drainage and River Training works. He migrated to Pakistan in December, 1947 and was appointed as temporary Engineer in the Irrigation Branch of P.W.D. of Punjab. He worked in various Project Sub-Divisions and contributed in preliminary surveys, investigations, designs and preparation of various Projects. He was appointed Assistant Executive Engineer in Punjab Service, of Engineers Class I, in July 1949. In June 1951 he was posted as Sub-Divisional Officer Marala Head Works. He was promoted as Executive Engineer in October, 1952 and posted Executive Engineer Marala Division, where he continued till October 1954. During his stay at Marala apart from Regulation, Normal maintenance of Headworks and other ancilliary works, Remodelling of the channel section and remodelling of more than 20 bridges and drainage syphons was carried out.

From October 1954 to November 1960 he worked in various Circles, Under Secretary Government of Punjab,

Technical Officer Lahore Region, Assistant Director Design and Research, Assistant Director Construction and Executive Engineer (O.S.D.) Water dispute in the office of Chief Engineer Irrigation, West Pakistan. From November 1960 to June 1961 he was incharge of Kot Adu Division of Taunsa Barrage System. In June 1961, he was promoted as Superintending Engineer and posted to Quetta Irrigation Circle. From Quetta he was transferred to Sukkur Region where he worked as Superintending Engineer Headquarters for a couple of months and then posted to Khairpur Irrigation Circle where he was having administrative control of Sukkur Barrage. During his stay in this circle a 7 ft fall on Rohri Canal were also executed under his administrative control. In August 1965,he was transferred from Sukkur and posted as Superintending Engineer, Lower Bari Doab Canal Circle where he continued upto October 1967. He put in efforts for the exploitation of ground water and got approved four Tubewells Schemes. Remodelling of Lower Bari Doab Canal for a capacity of 8,000 cusecs was also taken-up. In 1967 Government of Pakistan selected him for an International course of Hydraulic Engineering sponsored by UNESCO in Holland. He was awarded diploma in Hydraulic Engineering Delft. His specialised course was Hydraulic structures. During his assignment in Holland, he visited Engineering works and International famed research Organisations. Due to his varied experiences in applied Engineering designs, and administrative fields he was appointed Director Irrigation Research Institute, Lahore in August 1969 where he infused a new life and made it a renowned Institute especially in Hydraulic field. It ranks foremost among advanced Hydraulic Research Stations in the world. He was promoted as Chief Engineer and was appointed at Lyallpur on 27.6.72. Being incharge of Sargodha Irrigation Region, he was incharge of a vast Irrigation System of the Punjab and he took keen interest in Flood Protection Works after the disasterous floods of 1973, Construction of Samundri Drainage System was accelerated and Paharang Drainage Project was planned for drainage of vast areas and protection of Lyallpur from Flood ravages. He was deputed to visit Iran and Turkey for study of the Research Stations in the R.C.D. countries. Due to his brilliant career and administrative ability the Government of Punjab selected and appointed him as

Secretary to the Irrigation and Power Department. Besides Administrative Control of the biggest department of the Punjab, he took keen interest in the running and maintenance of canals, their regulation, Flood Protection Works, proper maintenance of Barrages, control of monetary grants for all the annual works alongwith planning, design and execution of new works. During his period as Secretary most of the Scarps and Barrages completed by WAPDA and transferred to Irrigation and Power Department are being marked independently.

In July, 1978 Mr. S. M. Ayoob was appointed as member Provincial Inspection Team and then Chairman Provincial Inspection Team, Government of Punjab, Lahore, where he served upto December, 1978 when he was assigned with the responsibilities of Member (Water) Wapda, Lahore, which he is holding to-date. The responsibilities include Administrative Control of Water Wing of Wapda, to frame schemes for the provinces of Pakistan as regards:

> Irrigation, Water Supply and Drainage, Flood Control, Prevention of waterlogging and reclamation of waterlogged and salted lands and inland navigation, to process A.D.P. and arrange internal and external loans and cash foreign exchange to prepare perspective and five year plan for the utilization of water resources. He is still handling the gigantic programms of water resources utilization.

The Engineering News welcomes Mr. S.M. Ayoob as new President of the Pakistan Engineering Congress. His dedication to the cause of profession is well known. Under his able guidance, the Pakistan Engineering Congress will not only maintain its cherished traditions but reach new elevation.

MINUTES OF THE 57TH ANNUAL BUSINESS SESSION
OF THE PAKISTAN ENGINEERING CONGRESS
HELD ON FRIDAY THE 5TH DECEMBER, 1980.

-.-.-.-.-.-

Mr.Ashfaq Hasan(President) was in the Chair. About 450 members were present.There were five items on the agenda for consideration.The Business Session was started at 9.00 A.M. in the Ball Room of Hilton International, Lahore. After recitation from the Holy Quran, the following decisions were taken:-

1. Minutes of the last Business Session of the Congress held on 7.5.1978 and 22.9.1978 were read out to the House and confirmed unanimously.

2. The Annual Report and the Accounts of the Congress for the years ending 31.12.1978 and 31.12.1979 were presented to the General Body and were approved as such by the House.

3. Due to continued increase in the cost of printing material as well as that of other elements, it was proposed that the annual subscription may be increased. The proposal was made by the Honorary Secretary of the Congress and was seconded by a number of members present in the Business Session. This proposal was debated for some time. Some members suggested that the increase should be from Rs.30/- to Rs.40/- whereas majority of members suggested that it should be from Rs.30/- to Rs.50/- keeping in view the present rates of commodities. After some deliberations over the issue, it was decided by the House that the Annual Subscription would now be from Rs.30/- to Rs.50/-. This change will take effect from 1.1.1981.

4. As provided by Articles 9, 10 and 11 of the Congress Rules, the following members were elected for the year 1980-1981.

PRESIDENT

1.	Mr. S. M. Ayoob	Member (Water) WAPDA, 705-WAPDA House, Lahore.

VICE PRESIDENTS

1.	Mr. Abdul Rauf Khan	Chief Engineer, Irrigation, Peshawar.
2.	Mr. Sibtul Hasan Shah	Secretary to Govt.of the Punjab Communications & Works Department, Lahore.
3.	Ch.Muhammad Rashid Khan	Superintending Engineer, Ist Electricity Circle, WAPDA, Ravi Road, Lahore.
4.	Mian Mazhar-ul-Haque	Managing Director, WASA, LDA, 4-A, Gulberg-V, Lahore.
5.	Mr.A.W.F. Sheikh	Secretary to Govt. of Pakistan, Ministry of Water and Power, Islamabad.
6.	Dr. N. M. Awan	Director, Centre of Excellence in Water Resources, University of Engineering and Technology, Lahore.

OFFICE BEARERS

1.	Mr. Ashfaq Ahmad Qureshi (Hony. Treasurer)	Director (Works) Punjab Seeds Corporation, 4-Lytton Road, Lahore.
2.	Mr. Nazar Hussain Mashhadi. (Hony. Business Manager)	Managing Director, N.D.C. 70-Baber Block, New Garden Town, Lahore.
3.	Mr. Azhar Irshad Chaudhary (Hony. Auditor)	Executive Engineer, Provincial Buildings Division, Jhelum.

COUNCIL MEMBERS

1.	Northern Zone.	Mr. Faqir Ahmad Paracha, Deputy Secretary, C & W Deptt. Govt. of N.W.F.P. Peshawar.
2.	Western Zone	Mr. Abdul Razik Khan, Secretary, Irrigation and Power, Govt. of Baluchistan, Quetta.
3.	Southern Zone	1. Mr. S. A. Rashid, General Manager (South) WAPDA, Hyderabad.
		2. Mr. Hussain Ali Mirza Project Director/Chief Engineer, Guddu Thermal Power Station, Guddu.
		3. Mr. Badar-uz-Zaman Siddiqi General Manager, M.C.P.Ltd Hyderabad.
4.	Eastern Zone	1. Raja Saadat Mand Khan, Chief Engineer, (Water) WAPDA, Rahimyar Khan.
		2. Sardar Ghulam Jaffar Khan, Superintending Engineer, Provincial Buildings Circle, Multan.
5.	Central Zone	1. Mr. Haroon Rashid Toosi, Executive Engineer, (On leave), 39-Ahmad Park, New Garden Town, Lahore.
		2. Sh. Ahmad Tariq, Chief Engineer, Water Allocation, Punjab, Lahore
		3. Ch. Mazhar Ali, 31-C/II, Gulberg.III, Lahore.

4. Mr. Mansoob Ali Zaidi, Director, Ravi Training Works, Lahore Development Authority, Allama Iqbal Town, Lahore.

5. Mr.Zaffar-ullah Khan, Deputy Secretary(Highways), C&W Department, Govt. of Punjab, Lahore.

6. Mr.M.A.Hamid Rehmani, S.E. Headquarters, Office of the Chief Engineer, Irrigation, Faisalabad.

7. Mr. Javed Ahmad Malik Assistant Director, Office of the Chief Engineer, Public Health Engineering Department,Lahore.

8. Rana Muhammad Aslam Chohan, General Manager (Central) WAPDA, 729-WAPDA House, Lahore.

9. Ch. Haider Ali, Superintending Engineer, WAPDA, 311-WAPDA House, Lahore.

10. Mr.Muhammad Rahid Vehra, Superintending Engineer, Provincial Buildings Circle, Faisalabad.

11. Qazi Muhammad Gulzar Ahmad, Engineering Advisor, PASSCO, 176-A, New Muslim Town Lahore.

12. Mr. Sultan Ali Barque Managing Director, Iftikhar Engineering Corporation, 1-Link Mcleod Road, Lahore.

13. Ch. Muhammad Khurshid, Superintending Engineer, Ist Provincial Buildings Circle, Lahore.

14. Mr. M. M. Khan, Deputy Secretary (Power), Irrigation and Power Department, Govt. of the Punjab, Lahore.

15. Ch. Muhammad Daud, Executive Engineer (Operation), Office of the Chief Engineer, Irrigation, Sargodha.

16. Kh. Zahoor-ul-Hassan, S.E. Headquarters, Office of the Chief Engineer, Irrigation, Sargodha.

This time, all the elections were unanimous and un-opposed, except the elections for the Central Zone. 35 members participated in the election of Central Zone against the 16 seats out of which above mentioned 16 members were elected.

5. This time, it was also decided that in order to make the congress really a Pakistan Engineering Congress, due representation against the seats of Vice Presidents, should be given to the other provinces. This proposal was appreciated by every member present in the Business Session. Accordingly, M/S Abdul Rauf Khan, and Mr. A.W.F. Sheikh, were elected as Vice Presidents from other provinces. This is unique in the history of the Congress.

A resolution was moved by M. Saadat Ali for ammending the constitution, article No. 11 . This resolution was passed and it was left to Executive Council to prepare suitable amendments for consideration of the General Body in the next session.

6. A vote of thanks was passed for the retiring President and the Office-Bearers and Council Members for the work done by them for the Congress during this period.

7. The meeting adjourned with thanks from the Honorary Secretary to the Chair and members for making the 57th Annual Session a great success.

EXECUTIVE COUNCIL OF PAKISTAN ENGINEERING CONGRESS met on 29.1.1981 under the Chairmanship of Mr.S.M. Ayoob and some decisions were taken:

The following office bearers were elected unanimously:

1.	Mr. M.R.Chaudhry Honorary Secretary	C.E. (Civil) WAPDA Sunny View, Lahore.
2.	Dr. Izhar ul Haq Honorary Joint Secretary	Director Design (Water) WAPDA House Lahore.
3.	Mr. H. R. Toosy Honorary Publicity Secretary	XEN; Stores Division, Moghalpura, Lahore.

PUBLICATION OF ENGINEERING NEWS JOURNAL

Mr.M. Afzal Zaffar was nominated by the Council as Honorary Editor for the Engineering News Journal. Mr. Afzal Zaffar will submit proposals for the publication of the engineering news journal in the next Council Meeting.

FORMATION OF COMMITTEES

The following committees were constituted by the Council:-

I - BUILDING COMMITTEE AND FUND RAISING COMMITTEE

a) Rana Allah Dad (Convener)
b) Sardar Allah Bakhsh
c) Ch.Muhammad Rashid Khan
d) Ch. Haider Ali
e) Ch. Mazhar Ali
f) Mr. M. M. Khan
g) Mr. Ashfaq Ahmad Qureshi

II- ACADEMY COMMITTEE

a) Mr. S.M. Ayoob (Convener)

b) Mr. Ashfaq Hassan
c) Dr. N.M. Awan
d) Mr. M. M. Khan
e) Syed Fiaz Omer
f) Mr. Sultan Ali Burque

III-CONSTITUTION COMMITTEE

a) Mr.S.N.H.Mashhadi (Convener)
b) Mr. M. A. Hamid Rehmani
c) Mr. Mansoob Ali Zaidi
d) Sardar Ghulam Jaffar Khan
e) Ch. Haider Ali
f) Mr. M.R.Chaudhry

IV- PUBLICATION COMMITTEE

a) Mr. S.N.H Mashhadi (Convener)
b) Mr. Zafarullah Khan
c) Rana Muhammad Aslam Chohan
d) Ch. Azhar Irshad
e) Mian Saleem Hassan

GENERAL DECISIONS

The following decisions were taken:

(a) The Council decided to form a Committee consisting of:

i) Ch. Azhar Irshad
ii) Mr. Sultan Ali Burque

to prepare proposals for rendering free technical advice to charitable-cum-welfare institutions for construction of Mosques, Hospitals, Schools etc.

(b) It was also decided to open a local centre at Sargodha for the greater participation of the Engineers of that area. Ch.Muhammad Daud Member Executive Council was asked to convene a meeting of the local engineers who are members of the Congress and prepare Bye-Laws for running the local centre. The Bye-Laws may be submitted for approval in the next meeting of Executive

Council. It was also decided that local centres could be opened in other cities if proposals are received from local engineers for opening of such centres.

(c) Mr. Nisar Ahmed Sh. was declared elected as Member of the Executive Council in place of Kh. Zahoor-ul-Hassan because Mr. Ashfaq Hasan Ex-President of the Congress casted his vote in favour of Mr. Nisar Ahmad Sh.

(d) Shifting of Office to Congress Building in Gulberg-III.

It was decided by the Council that M/S M. R. Chaudhry and S.N.H.Mashhadi will work out details and submit report to the Council whether it is feasible to shift the office to the Congress Building in Gulberg-III.

RAPID MIX-RATIO ANALYSIS METHODS OF MORTAR AND CONCRETE

Dr.Irshad Ahmad **

For rapid mix-ratio analysis methods, there are a number of Physical & Chemical methods but these do not give accurate results, so demerits of each methods are pointed out in the Paper. In view of these demerits a new simple, rapid and fairly accurate 'Reduced Volume Method' for determining the cement content in a given mortar or concrete sample, based on measuring the volume of the inert matter associated with the sample under test, has been developed by the author in the Irrigation Research Institue , which is also briefly described here.

Basic properties of cement mortar and concrete such as tensile strength, compressive strength, resistance to weathering agencies, depend upon a very large number of interdependent factors such as cement content, water cement ratio, mode of compaction, the grading of coarse and fine aggregates, etc. The cement content which is the only binding constituent is an important factor.

Need for analysing the mortar/concrete specimens arises to check how far specifications for mortar/concrete have been adhered to by a contractor; ensure uniform distribution of cement in a mix; find out mix proportions in case of unsound structure to assess the causes of its failure.

For rapid determination of cement content in

** *Senior Research Officer, (G.W & H) I.R.I., Lahore.*

mortar and concrete some of physical and chemical methods are briefly given below:

i) Conductivity Method[1]:

This is based on determining the conductivity of the water in which a known quantity of unset cement-sand mixture has been vigorously shaken. Cement, on coming in contact with water, releases free lime, the concentration of which is directly proportional to the percentage of cement present in the mixture. The conductivity of the resulting solution is measured with a calibrated electric device.

ii) Adsorption Method[1]:

This method is based upon the differential adsorption characteristics of cement and sand particles. The percentage adsorption, being directly proportional to the cement content, increases as the concentration of cement increases in the mixture. The mortar(10 g) passing 40 mesh (B.S.) is shaken with 40 ml of 0.2 N $KMnO_4$ solution for half an hour and filtered. The quantity of $KMnO_4$ adsorbed is determined by back titration with a standard oxalic acid solution ($C_2H_2O_4.2H_2O$).The adsorbed $KMnO_4$ determines the cement content of the sample. For easy interpretation of the results,a curve of cement content versus adsorbed $KMnO_4$ is prepared.

iii) Potassium Permanganate Titration Method[2]:

This method resembles the one specified by the ASTM designation C85-54. The mortar(1g) is digested with hydrochloric acid (HCl) and the solution thus obtained, filtered and washed. It is then neutralised with liquid ammonia. The precipitates of mixed oxides are dissolved by glacial acetic acid. A saturated solution of ammonium oxalate is then added to precipitate calcium as calcium oxalate. The precipitate is

washed, filtered and subsquently treated with sulphuric acid, and after titration with standard $KMnO_4$ solution, the calcium content is estimated. A calibration curve of cement content versus calcium content is used.

iv) Potassium Permanganate Capsule Method[3,4]:

This method is similar to that developed by Dewan[2]. The processes of adding hydrochloric acid to 1 g powdered sample, filtering, washing, adding aqueous ammonia, precipitation of mixed oxides as hydroxides and filtering the resulting solution, are carried out in a manner similar to the method described above. The last two operations of adding ammonium oxalate and sulphuric acid are also performed. However, instead of next titration with $KMnO_4$ solution, glass capsule filled with a known quantity of solid $KMnO_4$ are added one by one, until the colour of the solution changes to pink. The number of capsule units added directly determines the percentage of lime present.

v) Selective Solution Method[5]:

The method, introduced by Tabikh and his coworkers, involves washing of a dried and crushed concrete/mortar sample with a mathanolic solution of maleic acid. The hydrated and unhydrated calcium silicates and the hydrated aluminates and ferrites are selectively dissolved by washing, leaving the unattacked aggregates plus the unhydrated aluminates ferrites as residue to be separated by filtration. From the weights of the residue, the water combined in hydrated cement, the free water, and the bulk specific gravity of the concrete sample, the cement content is calculated.

vi) Rebound Hammer Method[6,10]:

Rebound Hammer method is used for measuring surface hardness of hardened mortar and

concrete. It is based upon the height of rebound of a standard steel rod when dropped on a hardened mortar or concrete from a given height. It, thus, gives the strength of cement and indirectly cement content.

vii) Nuclear Techniques[11,14]:

Neutron activation analysis method to assess cement content is based on determining the amount of cement in a radio-active concrete sample and counting the radio activity and determining the cement content, from a cement content versus rate curve.

Other nuclear techniques such as stable tracer analysis, natural radio activity measurement and isotope dilution for determining the cement in concrete are also available.

viii) E D T A Method[15]:

Recently[15] (1978), at the Material testing laboratory in Riyadh, Saudi Arabia it has been found that the use of EDTA solution is useful to verify whether different cements conform to certain specification or not. As EDTA is used to estimate Calcium Oxide of Cement content so this method can also help in determining mix-ratio of mortar/concrete.

Comments on:

i) Conductivity Method:

a. This is mainly meant for freshly prepared mixes.

b. Setting of cement during shaking of the samples affects the results, as consistant readings are difficult to obtain.

c. With the change of cement, new standard graph is required as change in conducti-

vities of cements obtained from different factories has been observed.

d. Washing of sampling bottles is a problem, as the cement of sample sets in the sample bottles during its shaking and taking of conductivity readings.

ii) Adsorption method:

a. The method is applicable only to dry mixes.

b. The adsorption capacity of the clay complex interferes with the results obtained.

iii) Potassium Permanganate Titration Method:

a. The standard graph is required to be changed with the change of cement.

b. Calcium of calcareous aggregates may affect the determination of cement.

iv) Potassium Permanganate Capsule Method:

a. In the capsule method, filling of several capsules with specific quantities of $KMnO_4$ is very time-consuming.

b. It is not as accurate as pottassium permanganate titration method.

v) Selective Solution Methods:

a. It is not as accurate as standard chemical methods.

b. The method is not very economical as it requires large quantity of methanolic solution, etc.

vi) Rebound Hammer Method:

This method is not dependable as it is

very approximate. On concrete this form of test gives very variable results, particularly when larger pieces of aggregate are close to the surface at the point at which the test is done.

vii) Neuclear Techniques:

The nuclear techniques: require costly irridiation and counting equipments. Moreover these are applicable only under ideal conditions. The safety of personnel against potential radiation hazards is required to be ensured while using these techniques and this imposes an extra economic factor during the analysis.

Neutron activation analysis method for determining cement content cannot be used with aggregates containing appreciable amount of calcium.

viii) E D T A Method:

As this method for determining cement content in mortar/concrete is based upon finding calcium present in cement, so in the presence of calcareous aggregates, accurate determination of cement is very difficult. Moreover, the method is not as rapid as other field methods.

In view of the above demerits found in the said rapid methods of analysis of mortar and concrete, efforts should be continued to improve the same or develop some more accurate ones.

To develop rapid and accurate cement estimation methods, the auther of this paper has been conducting research at the Irrigation Research Institute and developed a fairly accurate Reduced Volume method for rapid estimation of cement content in Mortar and Concrete and published[16] the same in a U.K. scientific

and research Journal "Build International". The Principle and the test procedure of the method is briefly given below:

Principle of Reduced Volume Method:

When a sample is intermixed and shaken with an acid (HCl), the reactants are dissolved out, leaving behind the inert matter and soluble silica content of the sample. The residue, when subsequently made to react with an alkali (Na_2CO_3) leaves behind the inert matter that comes mostly from the aggregate. The volume of inert matter is measured in wet state in the volume measuring tube adopted by Puri[17] while performing his size distribution studies in samples of silts and sands. Measurement of this matter can provide a quantitative indication of the cement content in the mortar or concrete.

TEST PROCEDURE:

The pulverised and carefully homogenised mortar test sample (2 g) was placed in a beaker and treated with distilled water (20 ml) and hydrochloric acid (10 ml; specific gravity: 1.16). The contents of the beaker were warmed gently for 5 to 10 min and, after being allowed to settle for about 5 min, were filtered through a Whatman No.41 filter paper. The residue, washed with cold water, was heated below boiling point for about 15 min with sodium carbonate (30 ml of 5%) solution, and then filtered again. The inert matter remaining on the filter paper was washed with a few drops of H_Cl (1:9) and finally with hot water. It was then transferred in the wet state into the volume measuring tube (VMT). The VMT was tapped gently at intervals on rubber paddings for about 10 min to record the volume of the insoluble solid mass. Blank determinations with the same quantities (2 g each) of cement and sand samples, ground to pass completely through the 52 mesh sieve, were also run simultaneously, under similar conditions. The average of two observations was considered sufficient to calculate the cement content in a sample.

RELATIVE ADVANTAGES OF THE METHOD :

(1) The method is based on determining the inert matter of a mortar or concrete sample and thus the question of interference from the limestones, siliceous sand-stones and dolomite types of coarse aggregates, usually encountered in other methods, does not arise.

(2) It does not require the elimination of radicals (for example, the mixed oxides), which otherwise must always be removed by precipitation, etc. before the sample is analysed.

(3) Standard solutions of the reactants are not used, with consequent savings of labour and time.

(4) The standard graphs avoid the need for computation.

(5) A mathematical relation directly interprets the results.

(6) The method can be applied with confidence both in the laboratory and in the field.

(7) Availability of the constituent materials is not likely to pose a serious problem in determining the mix-ratios.

(8) It is a simple method and does not involve the normal weighing and chemical operations. A field engineer with a kit containing the acid, alkali solution, filter papers, beakers/funnels and the VMT would be able to assess the mix ratio being used and thus the uniformity of the mix throughout the construction batch would be effectively maintained.

REFERENCES:

1. *L.R. Chadda, 'The Rapid Determination of Cement in Concrete' Indian Concr. J., 29(8), 419 (1955).*

2. *R.L. Dewan, Indian concr. J., 33 (4), 132 (1958).*

3. G.F. Zafar and Irshad Ahmad, Tech. Rep., I.R.I.Lahore., No.816/S.M. (1966).

4. Irshad Ahmad and others, Pak. J. Sci. Ind. Research 4, 242 (1968).

5. G.G. Clemena, 'Determination of the Cement Content of Hardened Concrete by Selective Solution Method', Virginia Highway Research Council, Rech. Rep., 1972.

6. K.Gaede, Deutscher Aushchuss. fur stahlbeton, Tech.Rep. No.107 (1952).

7. German Standar, Din: 4240.

8. E. Sohmidt, Schweizer Arch. Angew wiss. Tech. Mortar., 169 (A), 176 (1966).

9. E. A whitehurst, Spec. Tech. Pub. Am. Soc. Test Mortar., 169 (A), 176 (1966).

10. C.A.P. Boundy and Handros, J.A.C. 1,61,77 (1964).

11. Iddings, Frank, and others, 'Nuclear Techniques for Cement Determination" U.S. Clearinghouse Fed. Sec.Tech. Inform. PB-178464, 73 (1968).

12. Ya M Butt. Radio-active. Isotopis for studying cements. Toloohkova - T cement, 22 (6), 19 (1956).

13. Boechenin, V.Il, Shirokii, V.K., 'Radio Isotopic X-Ray special Determination of Iron and Calcium in a Cement.' (Keragand politekh Inst. Karagand, U.S.S.R.). Zavod. Lab., 36 (12), 1472 (Russ), 1970.

14. Ximenez Herraiz, Luis 'Rapid Analysis of a Cement by Atomic Absorption.' (Perkin-Eler Hispania. Spain).Mater. Constr. (Madrid)., 138, 83 (Span) (1970).

15. R.M. El-Shahat, H. Hassanein and M. Alfantoukh, Saving Time on Cement Analysis.' Building Research, Paris., 6 (2), 114 (1978).

16. *Irshad Ahmad and others, 'Rapid Estimation of Cement in Hardened Mortar and Concrete by Reduced Volume (RV) Method', Build International, U.K. 8(2), 103 (1975).*

17. *PURI, A.N., A siltometer for studying size distribution of silts and sands, Punjab Irrigation Research institute, Lahore, 1935.*

DISCHARGE RATING FORMULAE AT SHER SHAH RAILWAY BRIDGE ON RIVER CHENAB

By

Mian Hafeezullah

Discharge Division has abundance of collected data. Unfortunately no analysis has been attempted. Essence of data collection lies in its analysis and interpretation since Hydrology is essentially an interprettive science. Without it valu-able data would languish into oblivion.

A stage discharge relationship has been attempted with the available data of observed discharges at Sher Shah Railway Bridge.

1. SELECTION OF SHER SHAH SITE

Sher Shah Railway Bridge is an old site and observed data since 1921 is available. It is a single bridge. (There is no-propin-quity of other seriate bridges). Therefore, any relation derived at this site would be a better representation of River behavioural changes over the past. It could be suggestive of useful conclusions about River Regime.

2. STAGE DISCHARGE RELATION

A graphical representation of Stage Discharge Data was suggestive of an exponential relationship Fig.I. Hence it was drawn on log graph Fig.II and Log-log graph Fig.III. A plot on log paper gave dispersion at low discharges but a good fit straight line was obtained for discharges above 20,000 Cs. The straight line fitted well to data of the last 3 years.

The deduced relationship can be expressed as,

$Q = 1070 \ e. \ 283 \ (h-ha)$

ha = stage at which gauge is zero.

Executive Engineer, Discharge Division.

Where Q is steady stage discharge
h = stage at discharge Q.

This relationship is for the steady state discharge. The accuracy of results from this formula depend on river state at the time of observation.

The same data when plotted on log - log paper gave a fit straight line. The formula deduced can be expressed as

$Q = 2.558\ (h-ha)^{3.7824}$

Where h = gauge reading
ha = zero of gauge
i.e. the stage at which there is no discharge in the river.

This relationship does not hold for discharge above 2 lac Cs. At higher discharges since the river is rising these formula will give major deviations.

The overall average of these relationships has been measured and compared in the proceeding paras.

3. COMPARISON WITH MANNING FORMULA

Manning formula in its usual form.

$Q = \frac{1.486}{n} AR^{2/3} S^{\frac{1}{2}}$ F.P.S. Units for steady state it can be reduced to the form.

$Q = K D^{2.667}$

or $K D^{n}$

Where D = depth of flow.
K is a constant but depends on
n = The roughness constant.
s = Slope of River.
m = side slopes of river X-Section.

B/D ratio of bed width to depth. This shows the derived relationship is analogous to manning formula and the value of K determined here depends upn n, s, m and B/D as given supra.

Thus the accuracy of results reflect directly on the values of n,s,m & B/D of the river X-Section and can give conclusive indications.

Because of so many variables being compressed into a constant and that natural streams and rivers are seldom in steady state; stage discharge relation is essentially in-accurate. We have to determine and define the amount of inaccuracy given by these relationships.

3(i) DIRECT COMPARISON WITH OBSERVED VALUES

The observed values for the years 1976 to 1979 have been compared with the calculated values. No. of values below 15% and above 15% difference have been tabulated below:

Year	No: of Observation	$Q=1070\ e^{.283(h-ha)}$ No: of Observations.		$Q=2.558(h-ha)^{3.7824}$ No: of Observations.	
		Upto 15%	Above 15%	Upto 15%	Above 15%
1976	220	29	191	40	180
1977	268	76	192	104	168
1978	283	138	143	184	99
1979	268	123	145	218	50

This indicate that the relationship is very good fit for 1978 data. Although the observed values are seldom the steady state values even then the results are reasonably acceptable.

Before gauging the accuracy of calculated values it seems appropriate to have an idea of errors in discharge observations.

4. ERRORS IN DISCHARGE OBSERVATION

Errors in discharge observation are broadly of two main categories.

4(i) Random Errors (X'Q)

The total possible errors on the measurement of discharge is the resultant of a number of contributory errors which may themselves be composite errors. These are normally distributed i.e. errors in measurement of velocity in a vertical. These are the errors accounting for the precision of the measurement.

4(ii) Systematic error X"Q

The source of systematic errors is the departure of the instruments from their normal ratings.These errors depend on the magnitude of measured quantities. Current meter is the main source of it.Systematic errors in the instruments used for width and depth measurements can be made negligible if they are correctly callibrated adjusted and checked.

The overall standard error is then XQ

$$XQ = \pm \left(X'Q^{1} \right)^{2} + \left(X''Q \right)^{2^{\frac{1}{2}}}$$

This value should be doubled to give the statistical tolerance on the measurements of discharge.

Thus estimated relative tolerance.

$$= \pm \; 2\,XQ = \pm \; 2 \left(X'Q \right)^{2} + \left(X''Q \right)^{2^{\frac{1}{2}}}$$

Eg. at 95% confidence limits accuracy of discharge measurements may be expected to be within

$$\pm \; 2 \times 5 = 10\%$$

5. CHI SQUARE TEST

The standard X^2 test was used to verify the goodness of fit of these relationships with the observed data. The comparison was made on monthly data and the values of $\frac{(E - O)^2}{E}$ where calculated as under:

Where E = *expected value from formula.*
O = *Observed Value.*

Values of discharge were taken in 1000 Cs.

Table I shows the confidence limits of observed discharges for year 1976 to 1979. Comparison was made of monthly data. The table shows that calculated values have predominantly 99% confidence limit for the year 1976 to 1979. Results for the month of October have relatively low Confidence level of low flows in river. The maximum confidence limits is more than 99% i.e. significance level is 2%. This reflects very favourably on the accuracy of calculated values viz-a-viz observed values. Discharges below 20,000 Cs. were neglected in this test.

With the back grounds of para 4 this shows that $Q = 1070 \ e^{.283 \ (h-ha)}$ can be used to have fairly good estimates of discharges beyond 20,000 Cs.

$$Q = 2.558 \ (h-ha)^{3.7824}$$

Monthly data for year 1976 to 1979 was used (Table II). Here the confidence limits is also dominantly 99%. Confidence level is low for August 1976 i.e. 10%o and January 1976 i.e. 80%. On the whole the relationship gives good estimates for most months of low flows i.e. discharges below 2.0 lac Cs.

6. COMPARISON OF FORMULA

Table III gives the values of observed discharge at various stages along with calculated values of the two relationships. This affords a good comparison and leads to the following recommendations:

1. $Q = 2.558 \ (h-ha)^{3.7824}$ gives better results when Q is less than 20,000 Cs.

2. For Q = 20,000 Cs. to 1.50 lac Cs. both the relationships give comparable results.

3. $Q = 1070 \ e^{.283(h-ha)}$ gives better results for Q above 2.0 lac Cs. It is suitable for estimate of stages at higher discharges and vice-a-versa.

4. Since the relationships are good fit to the last four years data it shows that the overall river regime is stable.

5. With such excellent fit stage - Discharge Relationship it can be a best site for Automatic Stage Recorder. An integrated graph on the recorder will yield a River Hydrograph at the site.

We can safely shift this site elsewhere when the Stage Recorder has been installed.

.....

$Q = 1070 \quad e^{.283\ (H\text{-}ha)}$ for Discharge 20,000 Cs.

Table I

YEAR	1976			1977			1978			1979		
Month	$\frac{(E-O)^2}{E}$	Degress of freedom	Confidence Limit	$\frac{(E-O)^2}{E}$	Degress of freedom	Confidence Limit	$\frac{(E-O)^2}{E}$	Degress of freedom	Confidence Limit	$\frac{(E-O)^2}{E}$	Degress of freedom	Confidence Limit
January	-	-	-	1.635	9	99	-	-	-	-	-	-
February	-	-	-	1.971	3	60	-	-	-	.569	4	97
March	-	-	-	-	-	-	1.335	1	50	4.352*	19	99
April	11.442	22	96	-	-	-	-	-	-	-	-	-
May	3.247*	13	99	-	-	-	1.587	17	99	7.350	17	97
June	3.748*	17	99	-	-	-	11.172	25	99	1.409*	23	99
July	8.209*	24	99	3.721	27	99	4.322*	24	99	7.107*	24	99
August	7.436*	24	99	4.575*	26	99	3.130*	24	99	2.579*	19	99
September	3.609**	22	99	4.845	20	99	4.768	14	98.5	8.425	18	97
October	.242	1	60	-	-	-	.068	1	8	.0567	2	48
November	-	-	-	-	-	-	-	-	-	-	-	-
December	-	-	-	-	-	-	-	-	-	-	-	-

E = Calculated Discharge.

O = Observed Discharge.

Discharge in 1,000 Cs.

* " " 10,000 Cs.

** " " 1,00,000 Cs.

$Q = 1070 \quad e^{.283\ (H\text{-}ha)}$ for Discharge 20,000 Cs.

Table II

YEAR	1976			1977			1978			1979		
Month	$\frac{(E-O)^2}{E}$	Degress of freedom	Confidence Limit	$\frac{(E-O)^2}{E}$	Degress of freedom	Confidence Limit	$\frac{(E-O)^2}{E}$	Degress of freedom	Confidence Limit	$\frac{(E-O)^2}{E}$	Degress of freedeom	Confidence Limit
January	1.702	5	80	3.921	9	93	2.020	16	99	2.034	24	99
February	6.513	20	99	2.339*	18	99	3.589	18	99	1.558	21	99
March	4:535	16	99	3.507*	25	99	6.958	23	99	6.386*	24	99
April	1.438*	22	99	3.081*	25	99	5.147	25	99	.343	26	99
May	1.778*	13	99	3.976*	24	99	2.407	25	99	4.072	22	99
June	3.007*	17	99	2.832*	9	97	7.505	21	99	1.228	22	99
July	12.808*	24	97	2.012*	27	99	29.320*	24	99	3.419*	25	99
August	42.363**	24	10	1.518**	26	99	2.846**	24	99	6.392	19	99
September	6.054**	23	99	8.380	20	98	10.862	21	97	3.278*	21	99
October	2.94	19	99	1.783	26	99	8.576	27	99	1.615*	24	99
November	16.144	27	93	1.333	22	99	.635	13	99	.997	18	99
December	-	-	-	2.706	25	99	.198	26	99	-	-	-

Discharge in 1,000 Cs.
* " " 10,000 Cs.
** " " 1,00,000 Cs.

COMPARISON OF FORMULA

Table III

Gauge	Observed Discharge	Discharge by formula Table No. I	Discharge by formula Table No. II
391.22	534861	433915	266797
389.00	231257	231518	175654
387.00	126806	131453	115332
385.10	69770	76781	73665
383.05	40996	42983	42421
381.00	28790	24063	22226
379.00	12727	13663	10405
377.00	4072	7757	4022

FIG 1

GAUGE AND DISCHARGE CURVE SHER SHAH DISCHARGE SITE ON RIVER CHENAB

BASED ON DATA OBSERVED DURING 1978

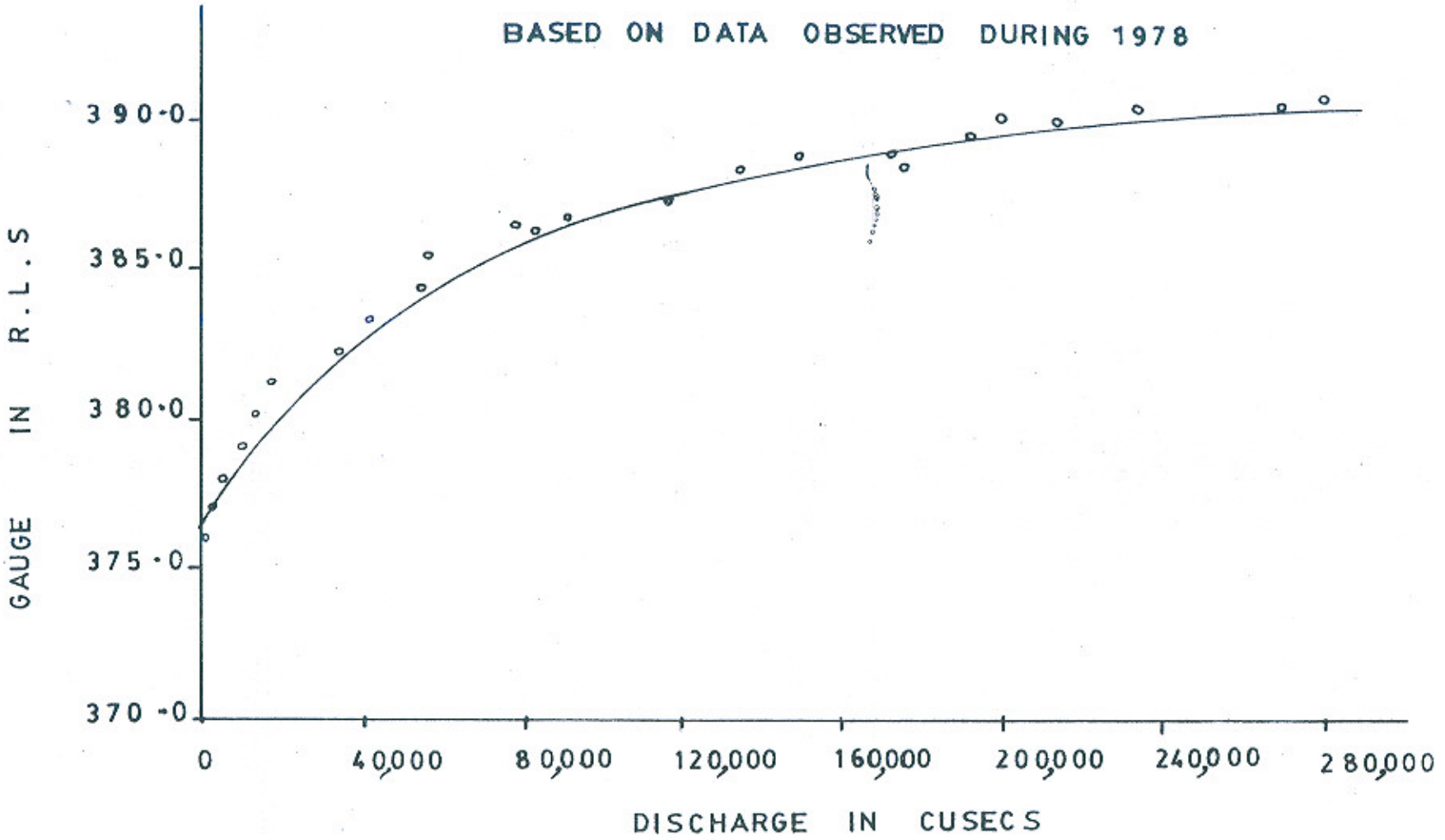
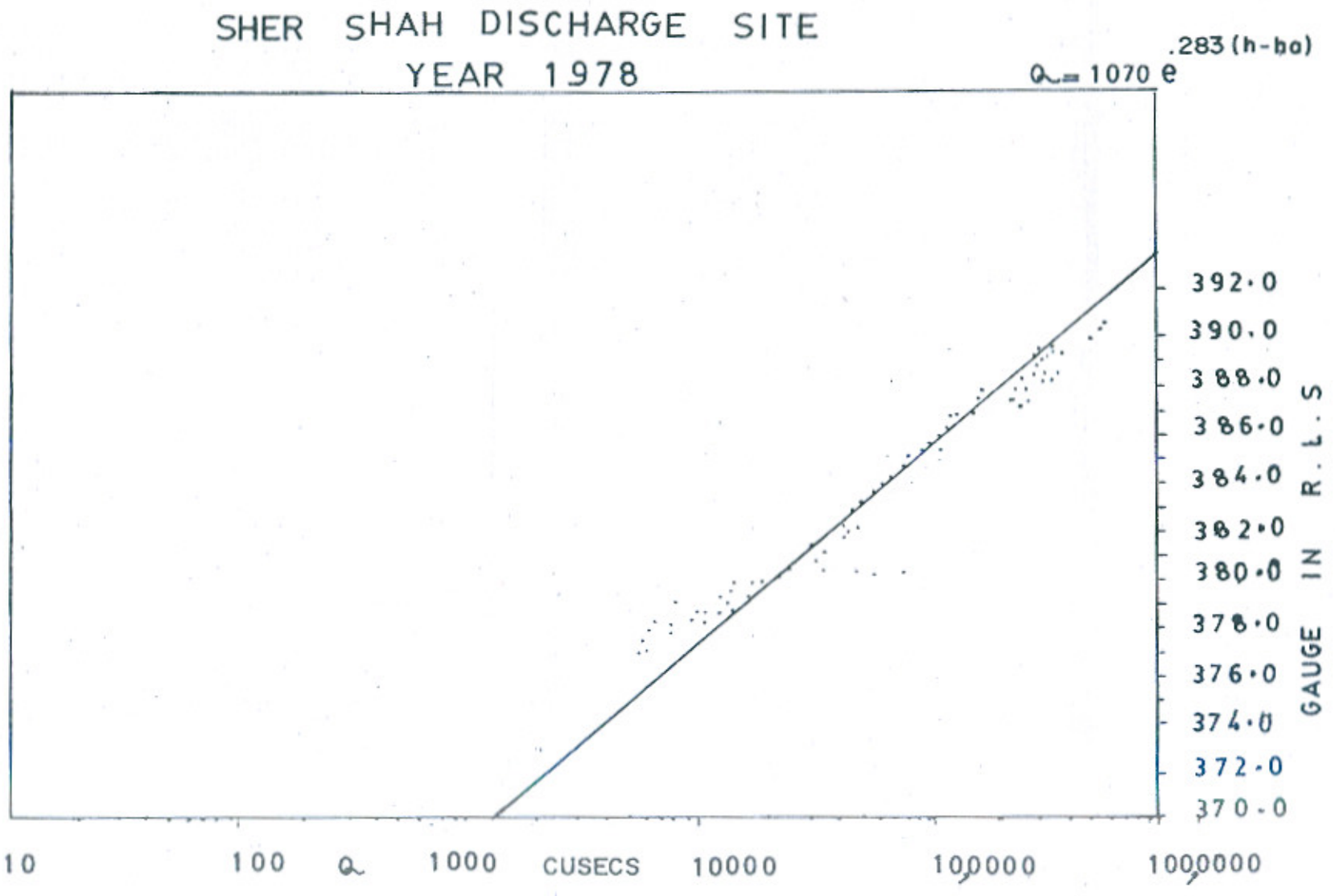


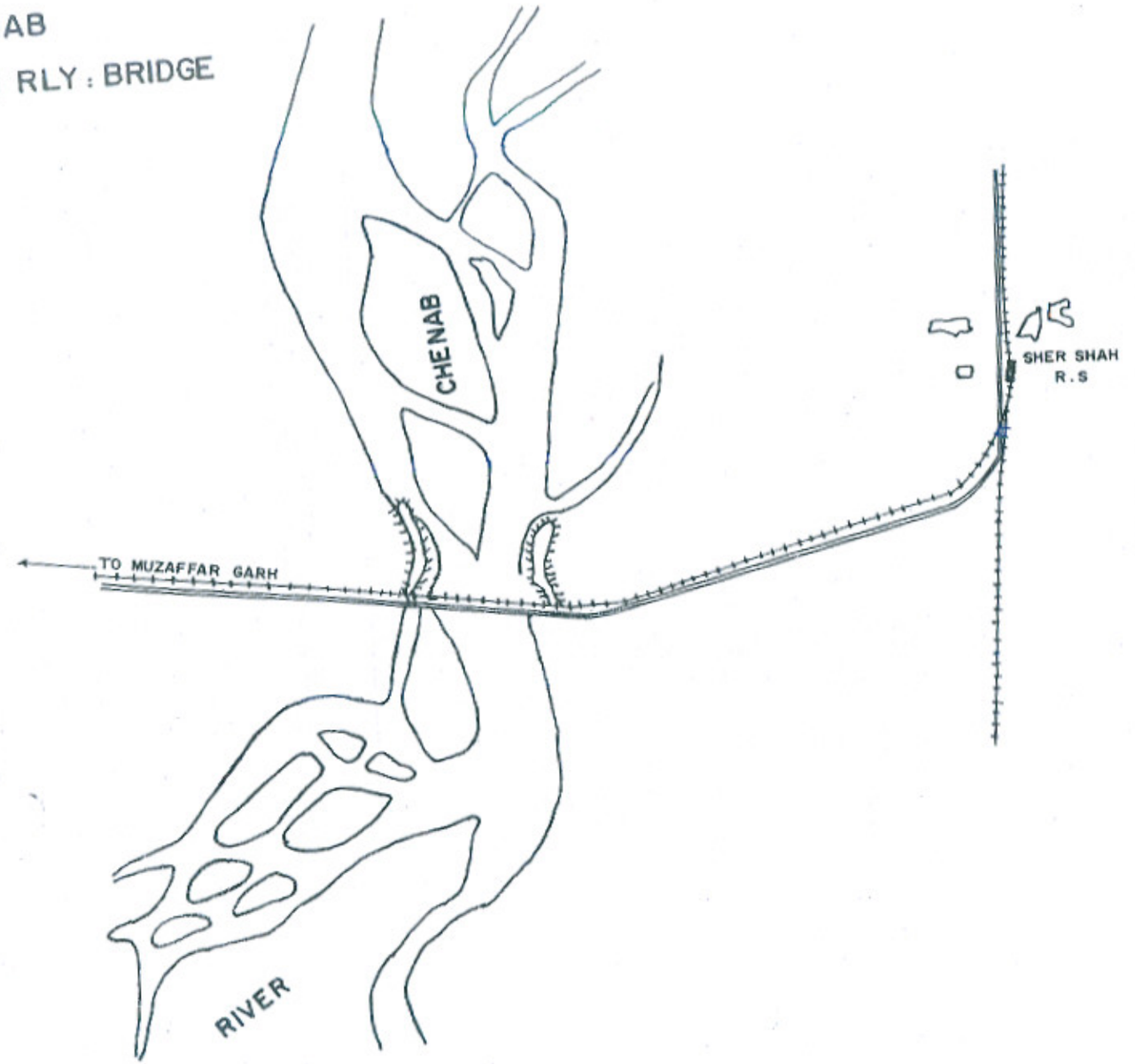
FIG 11


SHER SHAH DISCHARGE SITE
YEAR 1978
Q = 1070 e .283 (h-ho)
392.0
390.0
388.0
386.0
384.0
382.0
380.0
378.0
376.0
374.0
372.0
370.0
GAUGE IN R.L.S
10
100
Q
1000
CUSECS
10000
100000
1000000

PART PLAN OF RIVER CHENAB

SHOWING LOCATION OF SHER SHAH RLY: BRIDGE

SCALE 1" = 1 MILE



BODE'S LAW*

Contributed by Mr.Khalid Faruq Akbar

One of the most puzzling laws of science was published by German astronomer Johann Bode in 1770's. He discovered that the distances of various planets from the sun fall into a curious mathematical sequence described below.

He arbitrarily assigned number 0, 3, 6, 12, 24 etc. to each planet in sequence proceeding away from the sun (each successive number being double of the last one). When 4 was added to each number and the result divided by 10, figures emerged which almost exactly gave the planets distance from the sun in 'astronomical units' (the distance of earth from sun being one 'astronomical unit'). However at that time there was no star at positions 24 & 192. Amazingly the Asteroids and the planet Uranus were discovered later on exactly at those very positions respectively, thus vindicating the truth of Bode's Law. Only the distant most planets Neptune & Pluto fail to obey this law.

The following table illustrates the remarkable results of Bode's Law :-

Planet	*MER*	*VEN*	*Earth*	*Mars*	*Astt.*	*Jup.*	*Saturn*	*Uranus*
Bode's No.	*0*	*3*	*6*	*12*	*24*	*48*	*96*	*192*
Bode's distance	*.4*	*.7*	*1*	*1.6*	*2.8*	*5.2*	*10*	*19.6*
Actual distance	*.39*	*.72*	*1*	*1.52*	*2.52*	*5.2*	*9.5*	*19.2*

(adding 4 to figure in upper row & dividing by 10)

Today, many astronomers dismiss Bode's Law as a mere coincidence. Yet it remains one of the most mysterious statements of natural law formulated by man.

** Also known as Titius Bode Rule(From 'The Earth'-a Life Publication)*

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 will be asked." xvii : 3

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

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

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

9. You shall help one another in uphol ing and doing what is right, and shall n associate with those who transgress and thc who indulge in unethical practices.

١٠۔ وَأَمْرُهُمْ شُورَىٰ بَيْنَهُمْ ۖ

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

10. You shall decide matters of comm professional interest by mutual consultatic

١١۔ وَاعْتَصِمُوا بِحَبْلِ اللَّهِ جَمِيعًا وَلَا تَفَرَّقُوا ۚ

"And hold fast by the covenant of G all together and be not disunited." iii : 1

11. You shall strive individually a collectively to enhance the prestige of t engineering profession by ordering your co duct in accordance with this Code of Ethi and shall not be disunited.