Engineering News

A QUARTERLY JOURNAL OF THE PAKISTAN ENGINEERING CONGRESS

Vol. XXXI June 1987 No. 3

COVER STORY

In consideration of the recommendations, made from time to time, by the Pakistan Engineering Congress, the Government of the Punjab established an Engineering Academy over a lush green area of 18.5 acres spread along the banks of Lahore Branch Canal near Niaz Beg in the suburbs of the metropolitan city of Lahore. This Academy provides a very congenial atmosphere for the purpose of planning, organising and undertaking training of Engineering on their first entry into service and also for imparting in-service training to Engineers of the Government Departments, autonomous bodies and private sector.

Run by a Board of Governors with Minister of Irrigation & Power as its Chairman and besides eminent engineers, the Secretaries of various technical departments as members, the Punjab Engineering Academy stands as a monument of learning and inspiration and has proudly passed out about 600 trainees over a short span of three years.

THIRTY FIRST YEAR OF PUBLICATION

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o Free to members of the Pakistan Engineering Congress.

o Change of address should be intimated promptly giving old as well as new address along with membership numbers.

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

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

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CODE OF ETHICS

PAKISTAN ENGINEERING CONGRESS

بِسْمِ اللّٰهِ الرَّحْمٰنِ الرَّحِيْمِ

In the name of God, the Beneficent, the Merciful

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

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

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

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

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

١- إِنَّ اللّٰهَ يَأْمُرُكُمْ أَنْ تُؤَدُّوا الْأَمٰنٰتِ إِلٰى أَهْلِهَا وَإِذَا حَكَمْتُمْ بَيْنَ النَّاسِ أَنْ تَحْكُمُوا بِالْعَدْلِ إِنَّ اللّٰهَ نِعِمَّا يَعِظُكُمْ بِهٖ

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

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

٢- أَوْفُوا الْكَيْلَ وَالْمِيْزَانَ بِالْقِسْطِ وَلَا تَبْخَسُوا النَّاسَ أَشْيَاءَهُمْ وَلَا تَعْثَوْا فِي الْأَرْضِ مُفْسِدِيْنَ ○

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

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

٣- وَلَا يَجْرِمَنَّكُمْ شَنَاٰنُ قَوْمٍ عَلٰى أَلَّا تَعْدِلُوْا اِعْدِلُوْا هُوَ أَقْرَبُ لِلتَّقْوٰى

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

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

٤- أَوْفُوْا بِالْعُقُوْدِ ○

"Fulfil the obligations". v : 1

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

٥- وَلَا تَأْكُلُوْا أَمْوَالَكُمْ بَيْنَكُمْ بِالْبَاطِلِ وَتُدْلُوْا بِهَا إِلَى الْحُكَّامِ لِتَأْكُلُوْا فَرِيْقًا مِّنْ أَمْوَالِ النَّاسِ بِالْإِثْمِ وَأَنْتُمْ تَعْلَمُوْنَ ○

"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- وَقُوْلُوْا قَوْلًا سَدِيْدًا ○

"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- اِجْتَنِبُوْا كَثِيْرًا مِّنَ الظَّنِّ إِنَّ بَعْضَ الظَّنِّ إِثْمٌ وَلَا تَجَسَّسُوْا وَلَا يَغْتَبْ بَّعْضُكُمْ 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 بِهٖ عِلْمٌ إِنَّ السَّمْعَ وَالْبَصَرَ وَالْفُؤَادَ كُلُّ أُولٰئِكَ كَانَ عَنْهُ مَسْئُوْلًا ○

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

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

٩- وَتَعَاوَنُوْا عَلَى الْبِرِّ وَالتَّقْوٰى وَلَا تَعَاوَنُوْا عَلَى الْإِثْمِ وَالْعُدْوَانِ وَاتَّقُوا اللّٰهَ

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

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

١٠- وَأَمْرُهُمْ شُوْرٰى بَيْنَهُمْ

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

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

١١- وَاعْتَصِمُوْا بِحَبْلِ اللّٰهِ جَمِيْعًا وَّلَا تَفَرَّقُوْا

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

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

EDITORIAL

RESEARCH IN ENGINEERING DEPARTMENTS

"Take away all our factories, our trade, our avenues of transportation and our money, but leave me our organisation and our men, and in four years time I will have re-established myself," said once Andrew Carnegie, a great industrialist of the United States. Verily he spoke of his men of scientific knowledge and the scientific institutions engaged in insatiable quest for the infinity through research and hard work.

True to the great industrialist's notions, the pace of the technical and scientific knowledge about engineering works is expanding at a phenomenal rate the world over. According to some authorities, new knowledge is replacing 10 percent of the old knowledge every year. However, in Pakistan, engineering research has been accorded the lowest priority in developmental plans and is not receiving due encouragement or patronage it deserves. The Government is so heavily committed to physical development that research has been pushed to the background and quest for knowledge is vanishing from the Nation as a whole. It is often forgotten that engineering research is always purpose-oriented and is wholly 'applied' in character; and because of the repetitive nature of engineering works, it yields rich dividends to the Nation.

Most of the engineering research is emanating from the developed countries who are making substantial investment in research projects. But the new technologies gained cannot be transferred to our engineers without demonstrating their success through research laboratories under our own conditions. A few engineering research organizations established in the public sector have unfortunately been diverted to testing work, by the force of circumstances, lack of trained manpower and lack of incentives which negate the very purpose of creation of such organizations. It is needless to mention that research is an integral part of development and Pakistan is not only to keep pace with ever-changing times in the domain of technology, but also to catch up with the developed countries of the World. With these objectives in view, it is proposed that in all engineering and technical departments of the Government both at the Federal and the Provincial level as well as in the Public/Private Sectors proper research cells should be created and the existing ones augmented to meet the needs of the present day World. It may be mentioned that in Egypt which is a developing country like ours, there are ten institutions under one research centre, each catering for the requirements of its own region. By developing

research avenues in this way, numerous extra posts for appointment of qualified engineers would be created. To catch up with the advanced countries of the world it is imperative that the staff engaged on research, design, planning and development should be provided with the special incentives and fringe benefits so that they could concentrate on work whole-time without fear of any financial constraints. Such incentives include:

i) Special pay scales at least 50 percent over and above the national pay scales in each grade; ii) free residence with covered area fixed for each grade; iii) free transport; iv) free electricity, gas, telephone and water; v) special increments and accelerated promotion and vi) Acknowledgement of work in the form of special awards.

Any half-hearted efforts to meet the above requirements would not achieve success.

In addition, our research policy should also include the fundamental concepts; such as

i) the research activity must be regarded as developmental and budget allocations for research must be substantially increased and

ii) training facilities for research workers must be given higher priority by the Government.

Research involves investment for a better future and cannot be measured in the form of immediate financial returns. It may be mentioned that the Government of Pakistan have already experienced the outcome of a liberal research policy in the case of the research laboratories of the Pakistan Atomic Energy Commission. As a result of this policy, Pakistan has been placed in the front line countries of the World in the field of atomic energy development. If a similar policy is adopted for other engineering subjects there is no reason that Pakistan would not move to the front line of World nations in all fields of development.

SPECIAL DEVELOPMENT PLAN FOR BALUCHISTAN

BY

*S. R. Poonegar**

KEEPING in view the dire need of the province and to bring it at par with other provinces in the field of economic development the Special Development Plan for Baluchistan was introduced during 1982-83 under the special directives of the President General Muhammad Ziaul Haq.

The funds for the Projects included in the Special Development Plan are provided by the Federal Government and Foreign Agencies/Governments in addition to the funds provided for normal Annual Development Programme. Upto June 1986, Rs. 3132.01 million including a Government of Pakistan contribution of Rs 679.80 million were spent under this Programme. Following four projects have so far been completed:

(MILLION Rs.)

(a) Acquisition of Buldozer and spare parts under Japanese grant. 113.837

(b) Acquisition of graders and accessories under Japanese Grant. 116.500

(c) Water Supply Scheme Saranan under Japanese grant. 16.800

(d) Rural Electrification Project No. 2 (UK Grant). 110.000

The plan for the year 1986-87 was prepared for Rs.529.450 million which included Rs. 176.483 million as local contribution.

The following projects were included in the Special Development Plan 1986-87.

1. **Baluchistan Minor Irrigation & Agricultural Development Project. (World Bank/KFW):**

The project is estimated to cost Rs. 382.30 million. It envisages construction of 28 minor irrigation schemes which on completion will irrigate an area of about 3800 hectares.

2. **Small Irrigation Schemes (Kuwait Fund):**

The total cost of this project is Rs.403.63 million including FEC of Rs 317.66 million. Under this project, 40 small irrigation schemes will be constructed. So far 19 schemes have been completed, 9 are nearing completion, 7 are in advanced stage, while the work on 4 has recently been started. The additional area of 43568 hectares will be brought under cultivation on completion of these schemes.

*Chief Secretary of Baluchistan

BIAD (UNICEF/E.E.C.:

The project is estimated to cost Rs. 740.440 million out of which Rs. 400.000 million is to be provided by UNICEF and other agencies. The objectives of the project includes provision of drinking water, mother and child health care, basic literacy training and construction of multipurpose community centres.

So far under the project 13 rural water supply schemes have been completed while 13 are in progress. 785 sanitary latrines have been constructed. 250 CHWs and 108 TBAS have been selected for training during 1987-88.

4. Quetta water Supply Project (Kuwait Fund):

The approved cost of the project is Rs. 188.847 million including FEC of Rs. 110.749 million. The project aims at providing drinking water to Quetta City by installation of 26 tubewells. All these tubewells have been installed. Main transmission pipe line has been 50% completed. Work on the construction of 4 overhead Tanks of one lac gallons has been started. The project will be completed in 1987-88.

5. Gaddani Water Supply Project (Kuwait Fund):

The project is in advance stage of completion. It will serve a population of 40,000 of Gaddani and surrounding villages. The total cost of project is Rs. 41.71 million.

6. BALAD Project (USAID):

The Project is estimated to cost of Rs. 617.84 million including USAID contribution of Rs. 540.00 million. The main objective of the project is to accelerate integration of Mekran Divison into the socio-economic stream of the Province by improving the standard of living of people through providing drinking water and agriculture infrastructure, improvement of roads and other allied works.

Under this project, a Housing Complex, 22 primary schools, deep drilling in 5 karezes and installation of one siphon have been completed. Work is in progress on 2 water supply schemes, Turbat Town Road, deep drilling in 12 karezes, rehabilitation of 2 karezes and 4 delay action dams is in progress. Construction of Kach Bridge is being started.

7. Rural Electrification Project (Kuwait Fund):

The project is split up into two phases and estimated to cost Rs. 189.82 million. The Kuwait Fund has provided assistance for this Project. 1st phase involved electrification of 300 villages, 852 tubewells and industrial connections and 10,400 domestic connections. So far 299 villages have been electrified, 413 industrial and tubewell connections and 10400 domestic connections have been provided. Phase-II covers electrification of 180 villaes. This phase will be started soon.

8. **Baluchistan Transmission and Tube-well Electrification Project (CIDA):**

The project cost is Rs. 89.729 million. It is being executed with the assistance of CIDA. The following electrification work is to be carried cut:

(1) 33 KV Sorcab – Zehri Line.

(2) 33 KV Khuzdar – Wadh Line.

(3) 33 KV Khuzdar – Nal Line.

(4) 33 KV Loralai – Ruki Line.

The work is in progress and will be completed by June, 1988.

9. **Self-help Community Development Project (West German):**

The project is estimated to cost Rs.35 million including FEC of Rs.30.00 million. The project relates to the community development in rural areas. It envisages implementation of small schemes with community participation in different areas of the Province. This project is also expected to be completed in the first quarter of the next financial year.

10. **Sibi Rakhni Road:**

Total cost of the project is Rs.742.307 million 358 K.M. long road linking Sibi-Talli-Kahan-Kohlu-Rakhni is proposed to be constructed. The work between Rakhni and Barkhan has since been completed. Efforts are being made to obtain financial assistance from some foreign agency for this project.

11. **Liari Urmara Road:**

The construction of 256 miles long road is estimated to cost Rs 750 million. The preliminary planning on this project has been completed. Efforts are being made to secure foreign assistance for this project.

12. **Baluchistan Fisheries Project:**

The cost of this project is Rs.563.109 million including FEC of Rs. 370.50 million. Pasni Fisheries Harbour Authority has been created and land acquired for the construction and operation of fish harbour. Detailed designing has been completed, construction is being started.

13. Agriculture Extension and Adaptive Research Project (World Bank): This project is estimated to cost Rs. 161.290 million with FEC of Rs. 116.29 million. The project aims at increasing agriculture production through reorganisation of existing extension services at Rs.5.00 million and setting up research station. The work is in progress.

14. **Small Irrigation Schemes (ODA/UK):**

The project is estimated to cost Rs. 81.59 million with FEC of Rs. 66.36 million. The proejct includes 15 small perennial irrigation schemes in Kalat, Kachhi, Bela, Pishin, Zhob and Loralai Districts. Work on one scheme is in progress while the feasibility of 6 other irrigation schemes is in progress.

15. **Pat Feeder Canal Project (ADB):** The project is estimated to cost Rs. 3067.00 million. The FEC is Rs.1489.00 million. The work will be started during 1987-88.

16. **Quetta Sewerage Project (Netherlands):** The Netherlands Government has agreed to finance this proejct which is estimated to cost Rs. 140.00 million. The project aims at improving the sewerage system in Quetta Town to cater to the growing requirement of population.

The size of Special Development Plan for the year 1987-88 has been fixed at Rs. 483.00 million. The amount includes foreign assistance of Rs.322.00 million.

RAILWAY ENGINEER HONOURED

Engineer Ghiasuddin, General Manager, Pakistan Railways has gained Fellowship of the Chartered Institute of Transport, London according to a communication of the Institution.

Fellowship is the highest grade of Corporate Membership of the most prestigeous professional body of transporters in the world. Very few persons are enjoying this status in Pakistan.

Engr. Ghiasuddin, FCIT is also the Chairman of Lahore Section of the Chartered Institute of Transport. The Chartered Institute of Transport is patronised and chartered by the Royal Family of U.K.

REGULATING STRUCTURE AT R. D. 75 OF ABBASIA FEEDER (HYDRAULIC MODEL STUDY)

by

*Abdul Shakoor**

INTRODUCTION

A new regulator is being constructed along the left flank of panjnad Headworks for the new Abbasia Panjnad Link Feeder with a capacity of 5000 cusecs. For this purpose, the existing left pocket of Panjnad Headworks will be modified to create proper hydraulic flow conditions for the diversion of increased supplies, to the new Panjnad Link canal.

Along Abbasia Link Canal, a number of regulating structures will be constructed for distribution of water into the off-taking channels. One such regulating structure is located at R.D. 75 of the Link Canal. The design drawings of the same were prepared by Wapda Design office and it was requested by Director Design Scarp–VI to model test, the hydraulic design features of the regulating structure.

THE MODEL

For the study of given objectives, the model was set up at the Hydraulic Research Station, Nandipur on 1/10 geometrical scale. The model incorporated sufficient length of Abbasia Link Canal on the upstream side as well as on the downstream side of the regulating structure alongwith the regulators for Aabehayat Distributary (870 cusecs), Shireen Distributary (372 cusecs) on the left flank, link Feeder (95 cusecs) and Jamal Minor (70 cusecs on the right flank and cross regulator escaping the remaining discharge of 2722 cusecs according to lay out plan (Fig. 1).

THE EXPERIMENTS

The experiments were performed with the proposed design as well as with modified design. The experiements conducted with the proposed design indicated that the design structure needed structural changes, because of t the fact that:–

i) the flow entry and exit conditions of the off-taking regulators were not proper. The swirls and eddies were noted in front of left and right distributary regulators as well as downstream of the regulating structure (Fig. 2).

*Principal Research Officer, (Hydraulics) IRI, Lahore

ii) the velocity distribution through the off-takes was not uniform.

iii) the eddies noted at the intake of each regulator showed the tendency of disproportionate silt entry into each regulator.

iv) the energy dissipation devices at the downstream of some of the regulators were not adequate.

v) the detailed observations revealed that the circular wing walls of 30 ft. radius as provided to the off-takes on the left as well as on the right flank encroached the main line from both flanks. These walls decreased the cross-sectional area of the canal resulting into increase in velocities in front of off-takes of the regulators. At the same time, the wing walls increased the turbulance in front of the regulators thereby increasing the tendency of irregular inflow of sediment into the regulators. Similarly, the circular wing walls as provided at the exit end of each off-takes were not expanding the flow uniformally and properly through-out the sections.

(vi) the upstream glacis of the regulators of left flank were provided 1:1 slope. This slope was inducing spiral flow with heavy concentration of sediment load into the regulators.

vii) the dimensions of the cis terns below were inadequate to dissipate the energy properly. Particularly, it was noted for Aabehayat regulator that the fluming ratio was 20%. Normally, the energy dissipation and expansion of flow downstream with this percentage of fluming ratio was not possible with any of the known devices.

In view of the observations, the dimensions of regulators were modified and improved hydraulically by experiemnts. The modified lay out was proposed and supplied to Wapda vide Technical Report No. 855/Hyd/1986 (Fig. 3). The salient features of the revised lay out were:

i) The regulators of Aabehayat and Shireen were rotated clockwise from 90^{o} to 64^{o} and 90^{o} to 30^{o} respectively. The upstream abutment of Aabehayat distributary was given a parabolic approach. The upstream abutment of Shireen distributary was given a suitable compound curve.

ii) Similarly, the flow entry conditions of regulators on the right flanks were improved by providing suitable approach curves.

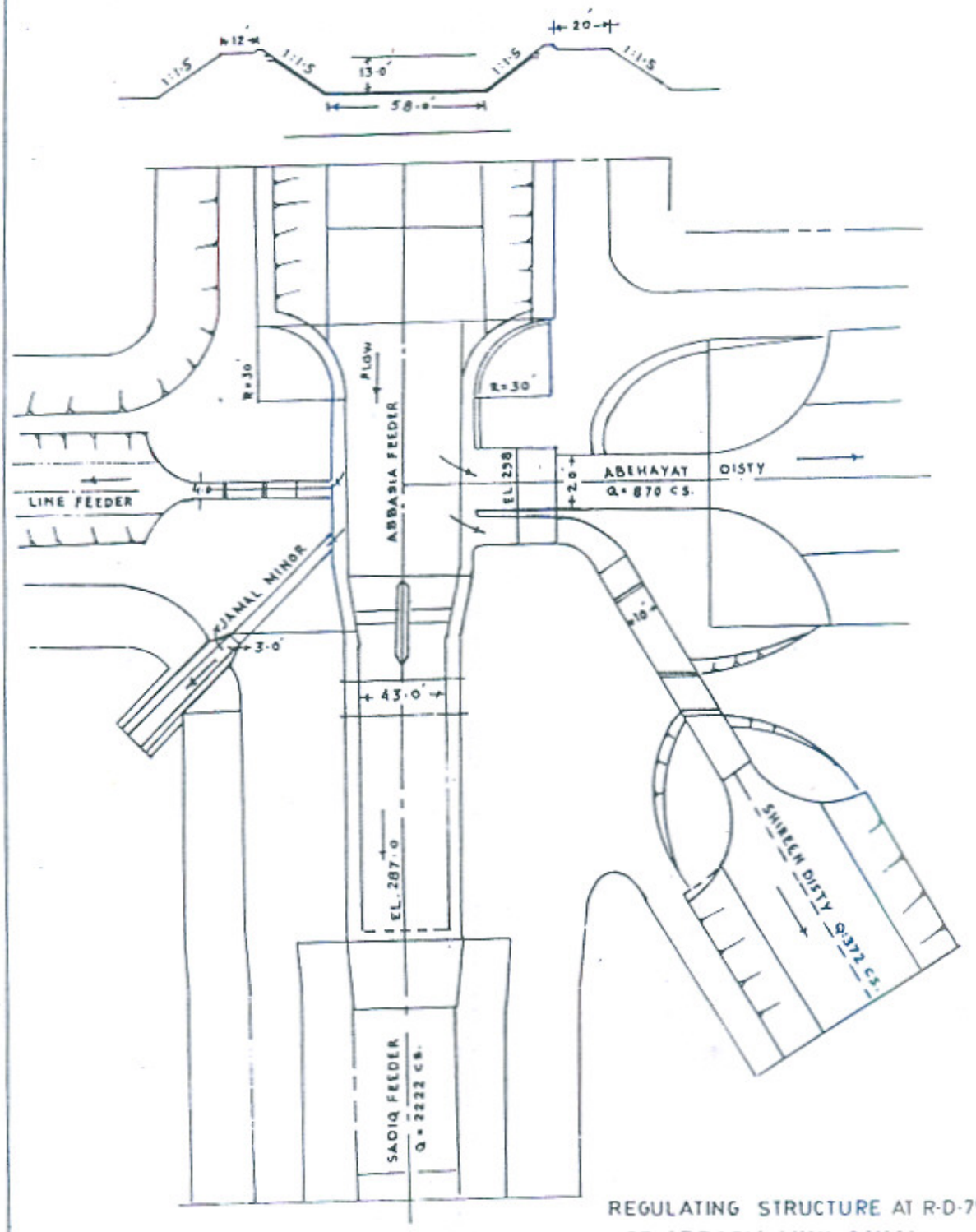
iii) The cistern dimensions were suitably modified.

iv) For Aabehayat regulator the throat width of 20 ft was widened to 33 ft to increase the fluming ratio. Also, the circular baffle walls were provided in the cistern of Aabehayat and Shireen regulators to expand the flow uniformly lower down. Also, the dissipation blocks were provided at the end of floors.

v) For the elimination of vortices at the entry point of the regulators (Shireen & Aabehayat), the upstream glacis slope of regulators 1:1 was provided a vertical cut from the bed in concave alignment (Fig. 3). The vertical cut helped in eliminating the vortices, thus reducing silt entry into the left flank regulators to desired limit by deflecting the heavier bottom sediment towards the main link lower down.

vi) Over and above, these changes in design of regulators, an additional measure was proposed by providing a guide wall of suitable length and location in the canal itself (Figs. 3–4). The position and length of this guide wall was so adjusted that the flow distribution in all the regulators was further improved. Also, the study of dry bed configurations after the test runs showed that the bed ripples containing heavier particle size seemed to move towards the regulators on the left flank without guide wall thereby increasing their due share of sediment charge (Fig. 5). Subsequently, the direction of these ripples was changed by guide wall to straighten out and follow the run of flow (Fig. 6). By so doing, the proportionate silt distribution into the regulators was achieved.

Fig. 1



REGULATING STRUCTURE AT R-D-75
OF ABBASIA LINK CANAL

REF:
1, PROPOSED DESIGN

Fig. 2

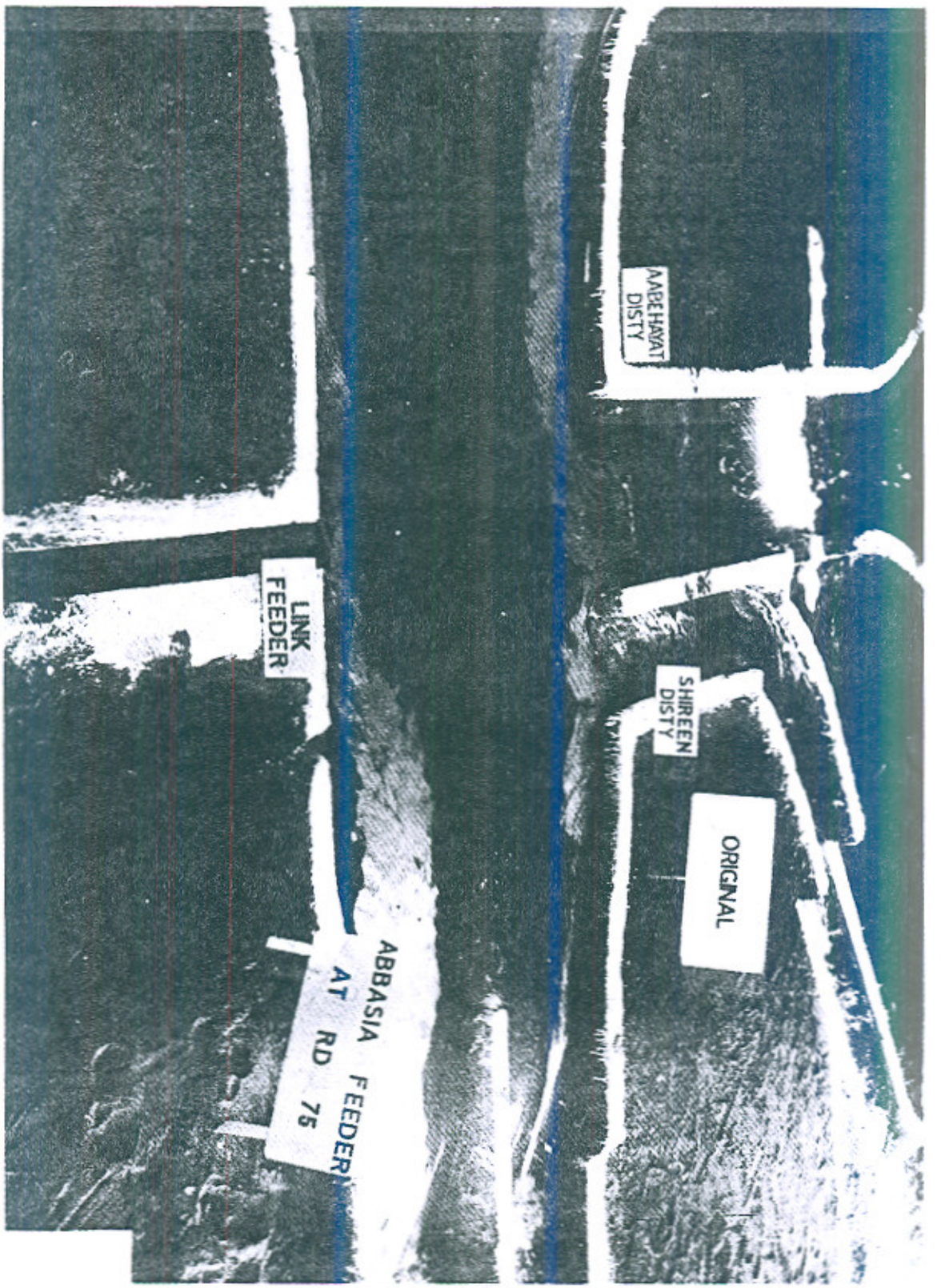
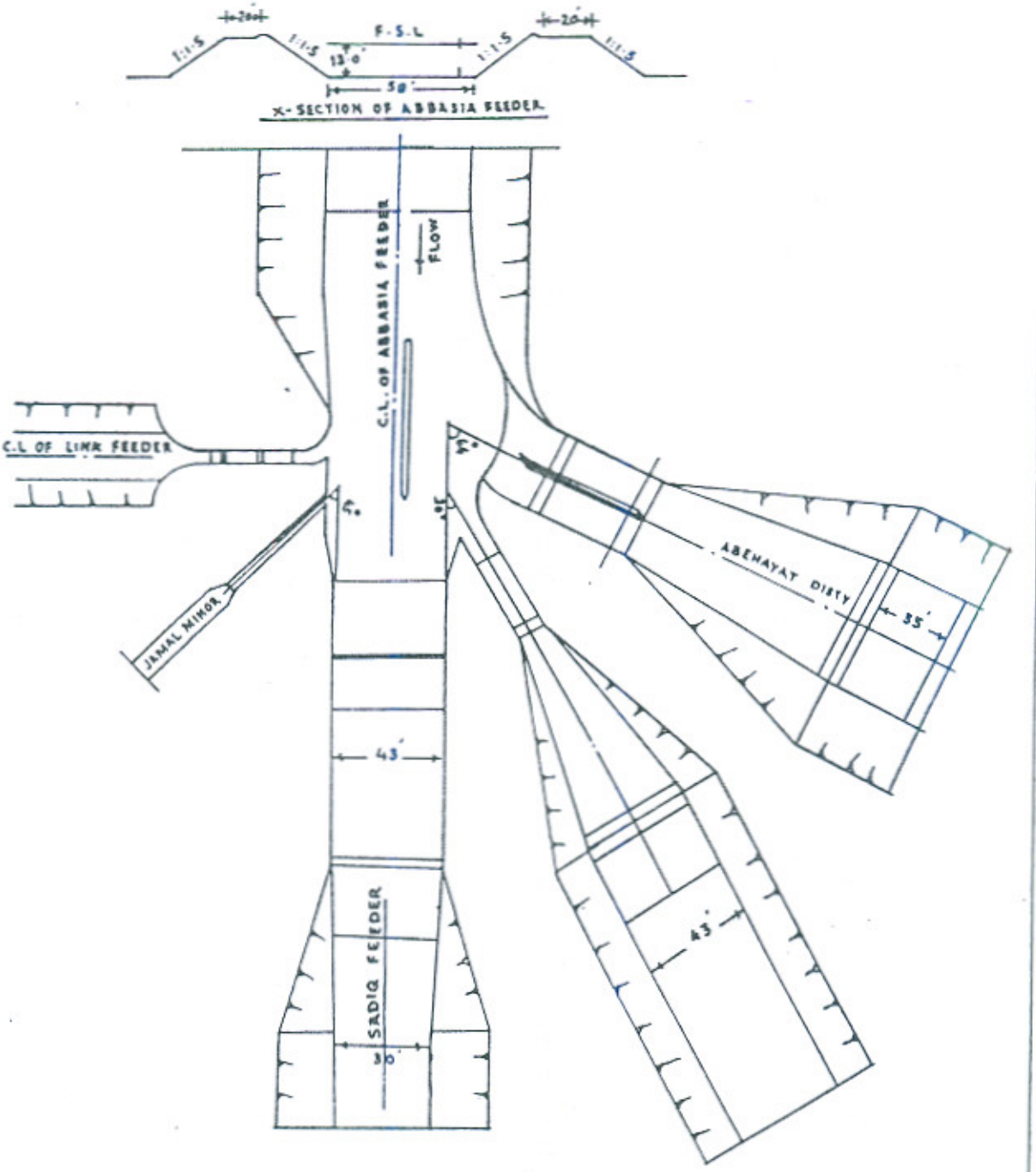

MAREHAYAT DISTY
LINK FEEDER
SHIREEN DISTY
ORIGNAL
ABBASIA FEEDER AT RD 75

Fig. 3



REGULATING STRUCTURE AT R.D. 75 OF ABBASIA LINK CANAL

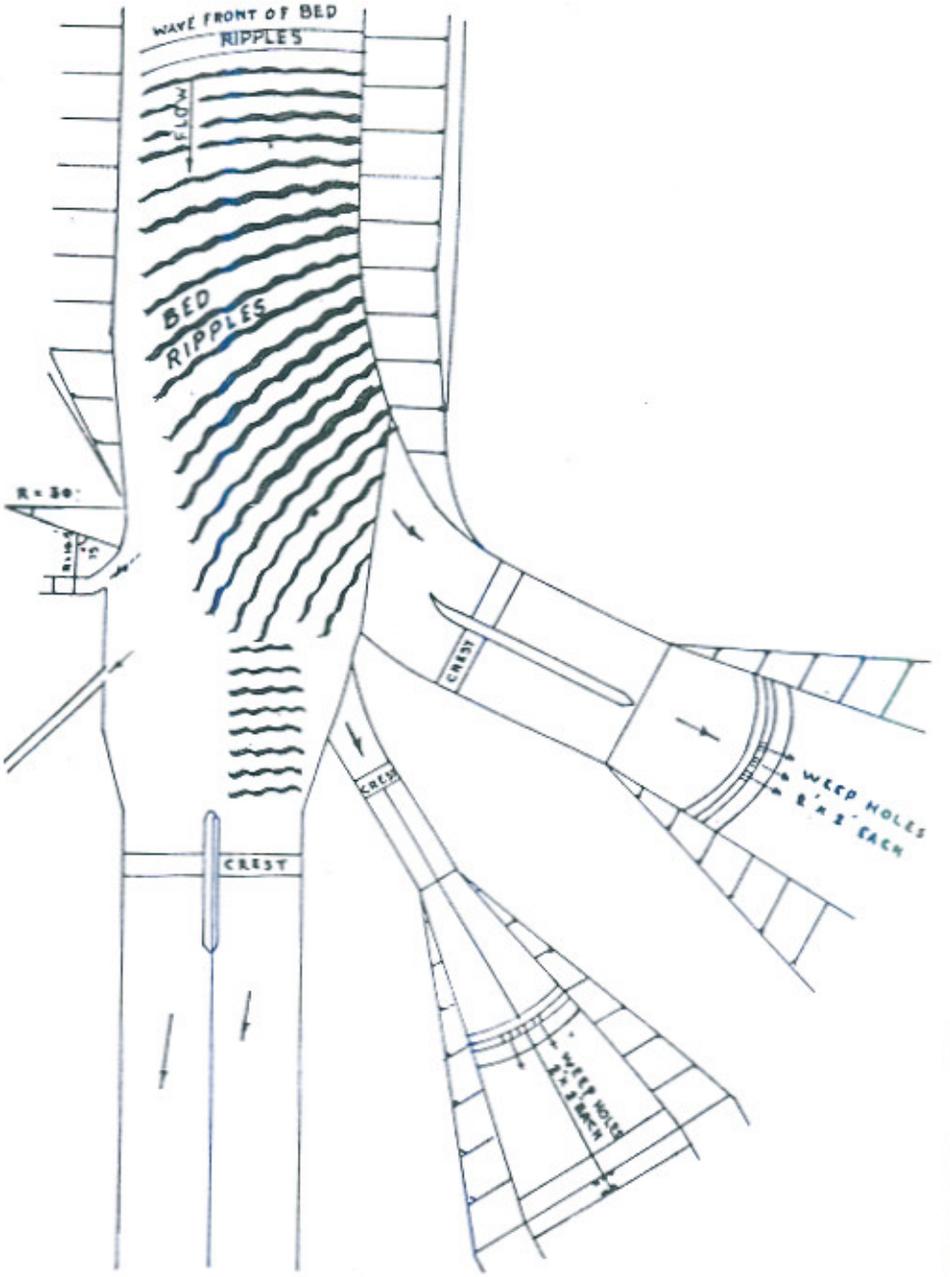
REF.

1, MODIFIED DESIGN WITH GUIDE WALL.

Fig. 4


ABBASIA FEEDER AT RD 75
LINK FEEDER
SHIREEN DISTY
AABEHAYAT DISTY

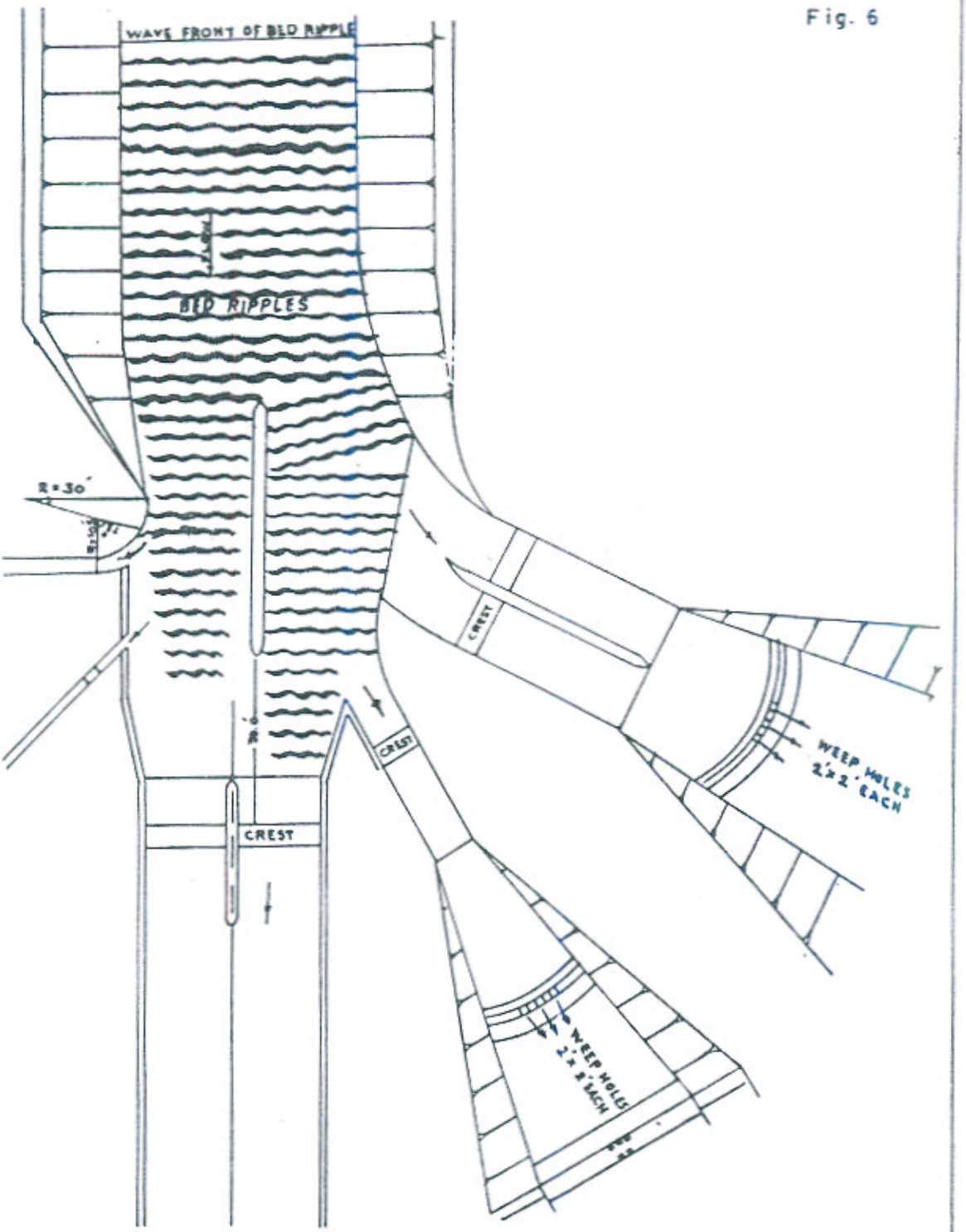
Fig. 5



REGULATING STRUCTURE AT R.D.75
OF ABBASIA LINK CANAL

REFERENCE i, MODIFIED DESIGN WITHOUT GUIDE WALL
ii, RIPPLE WAVE FRONT

Fig. 6



REGULATING STRUCTURE AT R.D 75
OF ABBASIA LINK CANAL

REF I. MODIFIED DESIGN WITH GUIDE WALL.

II. RIPPLE WAVE FRONT

MAINTENANCE OF A RECLAIMED LAND

By

*Muhammad Altaf Hussain**
&
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It is a practice in the N.W.F.P. that the Wheat and Sugarcane crops are sown together in the month of November. The buried Sugarcane sets remain dormant in the winter season, whereas the Wheat crop germinates and takes its normal course to maturity in the month of April/May, when the sugarcane sets germinate and the crop matures in the month of October/November. Thus there is no competition between these two crops. Normally a field under the Wheat crop cannot be utilized to grow the Sugarcane crop but this practice has helped to remove this limitation.

A reclaimed land needs the provision of crop cover throughout the year, to keep it in fit condition for crop production. This practice was considered suitable for this purpose as it provides not only the crop cover but also helps to keep the salt movement trend downward. The Wheat crop gets its normal delta of irrigation whereas the sugarcane crop is a high delta crop and spares some water for leeching. Keeping this in view it was considered worthwhile to adopt this practice in the Canal Irrigated areas of the Punjab. The hypothesis was put into practice at the laboratory level and encourging achievements were made (1983). The same has been tried at the field level and the results obtained therefrom are presented here in this paper.

REVIEW OF LITERATURE

1) Asghar (1945) observed that the Soil surface evaporation causes accumulation of salts within the rootzone of crops.

2) Asghar et al (1962) found out that Sugarcane, Berseem and Rice are the high delta crops, where some irrigation water is spared to be added into the ground water.

3) Hussain & Bashir (1966) submitted that winter fallowing is more harmful than fallowing in summer.

4) Altaf & Sadiq (1982) reported that in arid regions the bare lands are generally saline. Agricultural lands are affected with the cropping pattern followed on them. Fallowing in winter is more harmful than fallowing in summer. The extent of harm done to the soil is also related to the depth of water table from the natural soil

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surface and the amount of salts the ground water contains.

5) Altaf observed (1983) that when wheat and sugarcane crops are sown together, the land is prepared only once. The upward movement of soil moisture and salts is checked up as the wheat crop receives its consumptive use requirements of water and the moisture in the soil remains stationary, whereas sugarcane is a high delta crop. The moisture movement trend during its growth period remains downward which eliminates the chances of soil salinization.

MATERIAL METHODS

The results have been taken from the Project "Use of Hydrochloric acid for the Reclamation of Saline Sodic calcarious Soils". There were ten treatments which are given here under:

1. Control.

2. Application of Hydrochloric acid:

a) To meet the full Gypsum requirement of the first one foot of the soil.

b) To meet ½ Gypsum requirement of the first one foot of soil.

c) To meet ¼ Gypsum requirement of the first one foot of soil.

3. Application of Sulphuric acid.

a) To meet the full Gypsum requirement of the first one foot of the soil.

b) To meet the ½ Gypsum requirement of the first one foot of the soil.

c) To meet the ¼th Gypsum requirement of the first one foot of the soil.

4. Application of Gypsum.

a) To meet the full Gypsum requirement of the first one foot of the soil.

b) To meet ½ Gypsum requirement of the first one foot of the soil.

c) To meet ¼th Gypsum requirement of the first one foot of the soil.

The Project was started in 1982-83 and was completed in 1985-86. The Reclamation process was taken in hand from October/November 1982. The first crop grown was Berseem. It was followed by the Rice crop. During the next year the same rotation was followed. Thus two berseem crops and two rice crops were grown. The second rice crop was followed by the wheat and Sugarcane crops sown together. The analysis results of the soil in different treatments before sowing the crops together and after the removal of the sugarcane crop are given in table 2A and 2B. The crops were sown together in the month of November; the Wheat crop matured in

the first week of May, whereas the Sugarcane crop germinated at that time. It took its normal course of growth period and matured in November.

100 Lbs Nitrogen as Urea, 100 lbs P205 in the form of Superphosphate and 60 lbs K20 as Potassium Sulphate were applied before sowing the crops together. Only 100 lbs Nitrogen in the form of Urea was given to the Sugarcane crop in the month of May.

RESULTS & DISCUSSION

Mechanical analysis results (Table 1) indicate that the soil texture varies from loam to clay loam. The results achieved from the study carried out on them could be applied to any soil in the country.

The chemical analysis results (Table –2A) show that in all the treatments the soil is fit for growing the Sugarcane and wheat crops.

The results in (Table–2B) indicate that there was no material change in the soil after the wheat and sugarcane crops.

The yield results of the two crops (Table–3) show that a good wheat crop was grown in all the treatments. The yield is comparable with the excellent crop that could be grown anywhere. Similar is the case of the Sugarcane crop.

The irrigation delta applied and the rainfall received during the growth period of the two crops (Table–4) indicate that 22.5" water was given to the wheat crop which is quite sufficient to meet the consumptive use water requirements of the crop. The salt in the soil would have remained stationary, whereas in case of the sugarcane crop 7.0" water was applied over and above the consumptive use water requirement of the crop. It should have passed below the rootzone of the crop and would have eliminated the chances of the salt accumulation in the soil profile.

CONCLUSIONS

The wheat and sugarcane crops can be sown together. The wheat crop germinates and takes its normal growth period when the sugarcane sets remain dormant in the soil in the winter season. They sprout in the month of April/May, when the wheat crop matures. Thus there is no competition between the two crops. The normal yield of the crops are obtained. The land under the wheat crop which cannot be, otherwise, put under the Sugarcane crop is effectively utilized to raise this crop. The land is prepared once and only Nitrogen is to be applied to the Sugarcane crop. Thus the cost of cultivation is reduced much. This practice could be specially beneficial for the farmers having small holdings.

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Table 1

Mechanical composition of the soil under experiment

Treatment	Rep:	% Clay	% Silt	% Sand	Textural Name
Control	R_1	20	35	45	C.L.
	R_2	25	30	45	C'L.
	R_3	22	18	60	L.
	R_4	15	30	55	L.
Full HCl	R_1	23	32	45	L/C.L.
	R_2	20	35	45	L.
	R_3	18	22	60	L.
	R_4	15	25	60	L.
½HCl	R_1	30	30	40	C.L.
	R_2	22	28	40	C.L.
	R_3	23	22	55	C.L/L.
	R_4	25	25	50	C.L.
¼HCl	R_1	16	34	50	L.
	R_2	20	35	45	C.L.
	R_3	20	25	55	L.
	R_4	20	20	60	L.

Full H_2SO_4	R_1	20	30	50	L.
	R_2	20	30	50	L.
	R_3	23	22	55	L.
	R_4	18	27	55	L.
½H_2SO_4	R_1	20	35	45	L.
	R_2	18	37	45	L.
	R_3	22	33	45	L/C.L.
	R_4	15	25	60	L.
¼H_2SO_4	R_1	20	45	35	L.
	R_2	25	40	35	C.L.
	R_3	17	28	55	L.
	R_4	15	25	60	L.
Full Gypsum	R_1	20	35	45	C.L.
	R_2	18	47	35	L/C.L.
	R_3	22	23	55	L.
	R_4	20	30	50	L.
½Gypsum	R_1	18	47	35	L.
	R_2	22	33	45	C.L.
	R_3	20	30	50	L/C.L.
	R_4	20	35	45	L.
¼Gypsum	R_1	18	27	55	L.
	R_2	25	35	40	L.
	R_3	23	22	55	L.
	R_4	18	27	55	L.

Table – 2A

Chemical Analysis Results of the Soil Before Sowing the Wheat and Sugarcane Crops together

Treatment	Rep.	Depth	pH	EC**	Ca+Mg	Na	CO_3	HCO_3	Cl	SO_4	SAR
Control	1	0-6"	8.3	2.0	13.5	6.5	–	2.0	4.0	14.0	2.11
		6-12"	8.2	0.7	4.5	2.5	–	2.5	3.0	1.5	1.67
	2	0-6"	8.3	1.0	4.5	5.5	–	3.0	3.0	1.0	3.67
		6"-12"	8.3	0.9	3.5	5.5	–	3.5	3.0	2.5	4.16
	3	0-6"	8.3	0.9	4.5	4.5	–	3.0	3.5	2.5	3.0
		6"-12"	8.3	1.0	3.5	6.5	–	3.5	3.0	3.5	4.92
	4	0-6"	8.1	0.8	4.5	3.5	–	2.5	3.0	2.5	2.33
		6"-12"	8.1	0.8	3.0	5.0	–	3.0	3.0	2.0	4.08
Full Doze HCl	1	0-6"	8.2	0.9	4.5	4.5	–	3.5	2.5	3.0	3.0
		6"-12"	8.1	1.0	6.5	3.5	–	3.0	2.5	4.5	1.94
	2	0-6"	8.2	1.4	8.5	5.5	–	4.5	4.0	5.5	2.70
		6"-12"	8.2	0.9	6.0	3.0	–	2.5	2.5	4.0	1.73
	3	0-6"	8.2	0.8	3.0	5.0	–	3.0	3.0	2.0	4.08
		6"-12"	8.3	0.8	3.5	4.5	–	2.5	2.5	3.0	3.4
	4	0-6"	8.3	0.9	4.0	5.0	–	3.0	3.5	2.5	3.54
		6"-12"	8.3	0.8	3.5	4.5	–	2.5	3.0	2.5	3.4
½Doze of HCl	1	0-6"	8.1	1.0	4.0	6.0	–	2.5	3.5	4.5	2.24
		6"-12"	8.2	0.9	4.0	5.0	–	3.0	3.5	2.5	3.54
	2	0-6"	8.3	1.4	–	7.0	–	2.0	2.5	9.5	3.74
		6"-12"	8.2	0.9	5.0	4.0	–	2.5	3.0	3.5	3.53
	3	0-6"	8.3	0.9	3.0	6.0	–	3.0	2.0	4.0	4.9
		6"-12"	8.2	0.8	3.5	4.5	–	2.5	2.5	3.0	3.4
	4	0-6"	8.2	1.0	4.5	5.5	–	2.5	3.0	4.5	3.67
		6"-12"	8.2	0.8	4.0	4.0	–	2.0	3.0	3.0	2.83

Treatment	Rep.	Depth	pH	EC	Ca+Mg	Na	CO_3	HCO_3	C1	SO_4	SAR
¼th Doze of HCl	1	0-6"	8.2	0.8	3.5	4.5	–	2.5	3.0	2.5	3.4
		6"-12"	8.3	0.9	3.5	3.5	–	2.5	2.0	4.5	2.13
	2	0-6"	8.3	1.1	4.0	7.0	–	3.0	3.5	4.5	4.94
		6"-12"	8.3	1.2	3.0	9.0	–	3.0	3.0	6.0	7.34
	3	0-6"	8.4	1.5	2.5	12.5	–	4.0	7.0	4.0	11.18
		6"-12"	8.3	1.0	4.5	5.5	–	3.0	3.0	4.0	3.67
	4	0-6"	8.2	1.2	5.5	6.5	–	3.5	3.5	5.0	3.96
		6"-12"	8.2	0.8	4.0	4.0	–	2.0	2.5	3.5	2.83
Full Doze of Sulphuric acid	1	0-6"	8.2	0.8	4.0	4.0	–	3.0	2.5	2.5	2.83
		6"-12"	8.2	0.6	3.5	2.5	–	2.5	2.0	1.5	1.89
	2	0-6"	8.2	1.7	7.5	9.5	–	2.5	5.0	9.5	4.9
		6"-12"	8.2	1.4	5.0	9.0	–	2.5	4.5	7.0	5.7
	3	6-6"	8.2	1.1	4.5	6.5	–	2.5	3.0	5.5	4.33
		6"-12"	8.2	0.8	4.5	3.5	–	2.5	3.5	2.0	2.33
	4	0-6"	8.2	1.0	4.5	5.5	–	3.0	3.0	4.0	3.67
		6"-12"	8.2	0.8	4.5	3.5	–	2.5	3.0	2.5	2.33
½ Doze of H_2SO_4	1	0-6"	8.2	1.3	6.0	7.0	–	3.0	3.5	7.5	4.04
		6"-12"	8.2	1.1	5.5	5.5	–	3.5	3.5	4.0	3.35
	2	0-6"	8.1	1.1	4.5	6.5	–	2.5	3.5	5.0	4.35
		6"-12"	8.1	1.0	7.0	3.0	–	2.5	3.0	4.5	1.6
	3	0-6"	8.3	1.0	4.0	6.0	–	2.5	3.5	4.0	4.23
		6"-12"	8.3	0.8	4.0	4.0	–	2.5	3.0	2.5	2.83
	4	0-6"	8.1	1.0	4.5	5.5	–	3.5	3.0	3.5	3.67
		6"-12"	8.30	0.8	3.5	4.5	–	3.0	3.0	1.5	3.40

Treatment	Rep.	Depth	pH	EC	Ca+Mg	Na	CO_3	HCO_3	C1	SO_4	SAR
¼ Doze of H_2SO_4	1	0-6"	8.3	1.0	5.5	4.5	–	2.0	3.0	5.0	2.74
		6"-12"	8.3	0.7	5.0	2.0	–	2.5	2.5	2.0	1.27
	2	0-6"	8.2	1.4	7.0	7.0	–	3.0	4.5	6.5	3.74
		6"-12"	8.2	0.8	4.5	3.5	–	3.0	2.5	2.5	2.33
	3	0-6"	8.3	1.1	4.5	6.5	–	2.5	2.5	6.0	4.33
		6"-12"	8.2	0.8	3.0	5.0	–	2.5	3.5	2.0	4.08
	4	0-6"	8.2	1.0	4.5	5.5	–	2.5	2.5	5.0	3.67
		6"-12"	8.2	0.8	3.5	4.5	–	2.0	3.5	2.5	3.40
Full Doze of Gypsum	1	0-6"	8.2	0.5	3.0	2.0	–	2.5	2.0	0.5	1.63
		6"-12"	8.2	0.7	5.0	2.0	–	2.0	2.5	2.5	1.27
	2	0-6"	8.2	1.1	5.5	5.5	–	2.5	3.5	5.0	3.35
		6"-12"	8.3	1.1	3.5	7.5	–	2.5	4.5	4.0	5.67
	3	0-6"	8.3	0.9	4.5	4.5	–	3.5	3.5	2.0	3.0
		6"-12"	8.3	0.8	4.5	3.5	–	3.0	3.5	0.5	2.33
	4	0-6"	8.3	0.9	4.0	5.0	–	3.0	3.5	2.5	3.54
		6"-12"	8.2	0.8	3.5	4.5	–	2.5	2.5	3.0	3.40
½ Doze of Gypsum	1	0-6"	8.2	1.0	5.0	5.0	–	2.5	3.5	4.0	3.16
		6"-12"	8.3	0.8	4.0	4.0	–	2.5	3.0	2.5	2.83
	2	0-6"	8.3	0.9	4.5	4.5	–	2.5	3.0	3.5	3.00
		6"-12"	8.3	0.8	4.5	3.5	–	3.0	3.0	2.0	2.33
	3	0-6"	8.3	0.8	4.0	4.0	–	2.5	2.5	3.0	2.83
		6"-12"	8.3	0.9	5.0	4.0	–	2.5	2.5	4.0	2.53
	4	0-6"	8.2	0.8	4.5	3.5	–	2.5	2.0	3.5	2.33
		6"-12"	8.2	0.7	3.5	3.5	–	2.5	2.5	2.0	2.65

Treatment	Rep.	Depth	pH	EC	Ca+Mg	Na	CO_3	HCO_3	C1	SO_4	SAR
¼th Doze of Gypsum	1	0-6"	8.2	1.1	6.5	4.5	–	4.0	3.5	3.5	2.50
		6"-12"	8.2	1.4	7.0	7.0	–	2.5	3.0	8.5	3.74
	2	0-6"	8.2	1.0	7.5	2.5	–	2.5	3.0	4.5	1.29
		6"-12"	8.2	0.9	5.0	4.0	–	3.5	3.0	2.5	2.53
	3	0-6"	8.1	1.1	4.0	7.0	–	4.0	3.5	3.5	4.94
		6"-12"	8.3	0.7	3.5	3.5	–	3.0	2.5	1.5	2.65
	4	0-6"	8.2	1.0	4.0	6.0	–	3.0	4.5	2.5	4.24
		6"-12"	8.2	0.9	4.5	4.5	–	2.5	3.5	3.0	3.00

* Replication

** mmohs/cm.

***Ca+Mg, Na, CO_3, HCO_3, C1, and SO_4 are given as milliequivelent per litre.

Table – 2B

Chemical analysis results of the soil after removing the sugarcane crop

Treatment : Full HCl.

Rep.	Depth	S.P.	pH	E.C.	Ca+Mg	Na	CO_3	HCO_3	C1	SO_4	SAR
1	0-6"	34.0	8.3	0.9	7.5	1.5	–	3.5	3.5	2.0	0.80
	6"-12"	34.0	8.3	0.6	5.0	1.0	–	2.5	3.0	0.5	0.70
2	0-6"	32.0	8.0	1.8	15.5	2.5	–	1.5	9.5	7.0	0.90
	6"-12"	31.0	8.1	1.5	9.5	5.5	–	2.0	7.5	5.5	2.50
3	0-6"	34.0	7.9	2.4	22.5	1.5	–	3.0	8.5	12.5	0.40
	6"-12"	31.0	7.9	2.0	17.5	2.5	–	3.5	6.5	10.0	1.0
4	0-6"	28.0	8.3	0.8	4.5	3.5	–	3.0	4.0	1.0	2.3
	6"-12"	26.0	8.3	0.8	4.0	4.0	–	2.5	2.5	3.0	2.8

Treatment : ½ HCl

Rep:	Depth	S.P.	E.C.	pH	Ca+Mg	Na	CO_3	HCO_3	C1	SO_4	SAR
1	0-6"	31.0	1.5	8.3	4.0	11.0	–	5.5	5.0	4.5	7.8
	6"-12"	30.0	2.2	8.3	3.0	19.0	–	8.0	7.5	6.5	15.8
2	0-6"	30.0	1.6	8.4	3.0	13.0	–	3.5	4.5	8.0	10.8
	6"-12"	30.0	1.6	8.3	4.5	11.5	–	5.0	3.5	7.5	7.6
3	0-6"	30.0	2.0	8.6	10.5	9.5	–	2.0	8.5	9.5	4.1
	6"-12"	31.0	1.5	8.0	9.0	6.0	–	2.0	6.0	7.0	2.8
4	0-6"	27.0	0.8	8.3	3.5	4.5	–	2.0	3.5	2.5	3.4
	6"-12"	25.0	1.3	8.3	5.0	8.0	–	2.5	3.5	7.0	5.3
TREATMENT : ¼ HCl											
1	0-6"	30.0	8.0	1.0	5.0	5.0	–	3.5	3.5	3.0	3.3
	6"-12"	30.0	8.3	1.2	3.0	9.0	–	3.5	4.5	4.0	7.5
2	0-6"	31.0	8.2	1.5	4.5	10.5	–	3.0	4.5	7.5	7.0
	6"-12"	31.0	8.2	2.6	6.5	19.5	–	4.5	13.5	8.0	10.8
3	0-6"	25.0	8.2	1.3	4.0	9.0	–	3.0	3.5	6.5	6.4
	6"-12"	25.0	8.3	1.2	2.5	9.5	–	5.0	3.5	3.5	8.6
4	0-6"	31.0	8.3	1.2	7.5	4.5	–	2.0	4.0	6.0	2.4
	6"-12"	30.0	8.0	1.0	5.5	4.5	–	1.5	4.5	4.0	2.8
Treatment : Full H_2SO_4											
1	0-6"	30.0	7.9	2.9	26.5	2.5	–	6.0	3.5	19.5	0.70
	6"-12"	30.0	7.9	2.9	24.5	4.5	–	4.0	5.0	20.0	1.30
2	0-6"	30.0	7.9	3.8	34.5	3.5	–	1.5	11.5	25.0	0.90
	6"-12"	30.0	7.4	4.1	23.5	17.5	–	2.0	4.5	34.5	5.10
3	0-6"	29.0	7.5	5.5	31.5	23.5	–	2.5	4.0	48.5	5.9
	6"-12"	30.0	7.5	6.0	32.5	27.5	–	2.5	4.0	53.5	6.8
4	0-6"	26.0	7.5	2.2	18.5	3.5	–	2.0	2.5	17.5	1.1
	6"-12"	30.0	7.5	1.9	17.0	1.5	–	1.5	2.5	15.0	0.5

Treatment : ½ H_2SO_4

Rep:	Depth	S.P.	pH	E.C.	Ca+Mg	Na	Co_3	HCO_3	C1	SO_4	SAR
1.	0-6"	30.0	7.5	2.8	22.5	5.5	–	2.5	4.0	21.5	1.6
	6"-12"	30.0	8.0	2.0	13.5	6.5	–	3.0	3.0	14.0	2.6
2	0-6"	29.0	8.3	2.6	3.0	23.0	–	4.0	5.0	16.5	19.1
	6"-12"	28.0	8.3	3.2	2.5	29.0	–	5.0	6.5	20.0	26.3
3	0-6"	30.0	7.5	2.7	14.5	12.5	–	2.5	3.0	21.5	4.6
	6"-12"	26.0	7.8	2.2	7.5	14.5	–	3.0	3.5	15.5	7.6
4	0-6"	26.0	7.3	2.1	19.5	1.5	–	2.0	3.0	14.0	0.5
	6"-12"	29.0	7.3	2.0	17.5	2.5	–	2.0	3.5	14.5	0.80
Treatment : ¼ H_2SO_4											
1	0-6"	32.0	8.3	0.8	5.0	2.5	–	3.0	2.5	2.5	1.5
	6"-12"	34.0	8.3	0.7	5.5	1.5	–	4.0	2.0	1.0	0.9
2	0-6"	30.0	8.2	2.5	7.5	17.5	–	3.5	11.5	10.0	9.2
	6"-12"	31.0	8.2	1.5	8.0	7.0	–	4.0	5.0	6.0	3.5
3	0-6"	26.0	8.4	2.0	3.5	16.5	–	3.0	3.5	14.5	12.7
	6"-12"	28.0	8.4	1.7	3.0	14.0	–	4.0	3.5	9.5	11.7
4	0-6"	26.0	7.9	2.4	12.5	11.5	–	2.5	2.5	19.0	4.6
	6"-12"	26.0	7.5	2.8	5.0	23.0	–	3.5	3.0	21.5	14.3
Treatment : Full Gypsum											
1	0-6"	35.0	8.1	2.4	8.0	16.0	–	4.5	3.0	16.5	8.0
	6"-12"	35.0	8.2	1.9	10.5	8.5	–	5.0	4.5	9.5	3.7
2	0-6"	30.0	7.9	3.3	25.5	7.5	–	2.0	9.5	21.5	2.3
	6"-12"	29.0	7.9	3.1	26.5	4.5	–	2.5	5.5	23.0	1.2
3	0-6"	27.0	7.8	7.0	18.5	51.5	–	3.5	4.0	62.5	17.1
	6"-12"	26.0	7.8	7.5	17.5	57.5	–	2.5	4.0	68.5	17.2
4	0-6"	25.0	7.7	1.9	16.5	2.5	–	2.0	2.0	15.0	0.9
	6"-12"	29.0	7.7	2.6	20.5	5.5	–	2.0	2.5	21.5	1.7

Treatment : ½ Gypsum

Rep:	Depth	S.P.	E.C.	pH	Ca+Mg	Na	Co_3	HCO_3	C1	SO_4	SAR
1	0-6"	33.0	2.9	7.5	25.5	3.5	–	3.0	2.5	23.5	1.0
	6"-12"	33.0	1.8	7.5	9.0	9.0	–	3.5	3.0	11.5	4.2
2	0-6"	31.0	4.7	7.3	36.5	10.5	–	5.5	15.5	26.0	2.4
	6"-12"	32.0	3.0	7.8	19.5	10.5	–	3.0	6.5	20.5	3.3
3	0-6"	30.0	2.5	7.8	22.5	2.5	–	2.5	3.0	19.5	0.9
	6"-12"	32.0	2.6	7.8	23.5	2.5	–	2.0	2.5	21.5	0.8
4	0-6"	29.0	2.8	7.8	22.5	5.5	–	2.0	2.0	24.0	1.7
	6"-12"	30.0	3.0	7.8	26.5	3.5	–	1.5	2.5	26.0	1.0
Treatment : ¼ Gypsum											
1	0-6"	30.0	7.7	2.9	27.5	1.5	–	3.0	3.0	23.0	0.4
	6"-12"	31.0	7.5	3.1	29.5	1.5	–	3.5	3.5	24.0	0.4
2	0-6"	32.0	7.7	3.8	21.5	16.5	–	3.0	5.5	29.5	5.1
	6"-12"	31.0	7.7	5.0	22.5	27.5	–	6.5	12.5	21.0	8.2
3	0-6"	27.0	7.7	10.0	20.5	79.5	–	2.0	9.0	89.0	24.8
	6"-12"	26.0	7.7	10.5	20.0	85.0	–	2.5	13.5	89.0	24.8
4	0-6"	31.0	7.5	2.2	19.5	2.5	–	1.5	2.5	18.0	0.8
	6"-12"	31.0	7.5	1.4	7.0	7.0	–	2.5	2.5	9.0	3.9
Treatment : Control											
1	0-6"	34.0	8.3	0.8	4.5	3.5	–	4.0	3.0	1.0	2.3
	6"-12"	34.0	8.2	0.7	6.0	1.0	–	2.5	3.0	1.5	0.60
2	0-6"	30.0	8.0	2.0	5.0	15.0	–	3.0	3.5	13.5	10.0
	6"-12"	32.0	8.0	3.5	12.5	22.5	–	3.0	11.5	20.5	9.0
3	0-6"	25.0	9.3	1.6	2.0	14.0	2.0	6.0	3.5	4.5	14.0
	6"-12"	25.0	9.5	2.1	2.0	19.0	2.5	5.5	4.5	6.5	19.0
4	0-6"	23.0	8.9	1.2	1.5	9.5	2.5	6.0	2.0	1.5	12.5
	6"-12"	24.0	9.0	1.6	2.0	14.0	2.5	6.0	3.5	4.0	14.0

Table – 3

Mean values of the yield Results of Wheat and Sugarcane in Kgs/Acre

Crops	Control	HC1 Full	HC1 ½	HC1 ¼	H_2SO_4 Full	H_2SO_4 ½	H_2SO_4 ¼	$CaSO_4$ Full	$CaSO_4$ ½	$CaSO_4$ ¼
Wheat	1440	1880	1820	2060	1960	1910	2020	2020	2060	1830
Sugarcane	23470	24700	23600	25080	25140	28090	24260	26720	23310	20430

Table – 4

Irrigation delta applied and the Rainfall received during the growth period of Wheat and Sugarcane

Crop	Irrigation in inches	Rainfall in inches	Total in inches
Wheat	22"	0.5"	22.5"
Sugarcane	51"	10.5"	61.5"

One additional irrigation was applied to the Wheat crop in the end of the month of April to avoid drying of the land which could go to the disvantage of the Sugarcane crop. It was included in the irrigation delta applied to the sugarcane crop.

ANOTHER ENGINEER HONOURED

Prof. Dr. Muhammad Ikram Ullah Vice President of the Pakistan Engineering Congress and Deen Faculty of Civil Engineering, University of Engineering & Technology Lahore has been elevated as Vice Chancellor of the said University. This is a pride for the Engineering Community and honour for the Pakistan Engineering Congress.

PLANT EQUIPMENT MAINTENANCE PRACTICES

by

*Engr. Israr Ahmed**

INTRODUCTION

Every component of a machinery put into operation is subject to wear and tear due to friction and this phenomena starts with the very motion of the part. Wear and tear is a natural continuous feature and its aggravation tends to influence the efficiency of the machinery and the resultant decline in the output. The far reaching effects on the dividends for the enterpreneur and decreasing amenities for the workers that ensue cannot be over emphasized. The production units, therefore, need be kep in perfect fettle. To achieve the ideal operational standards, maintenance efforts must, therefore, be rational and strictly adhered to.

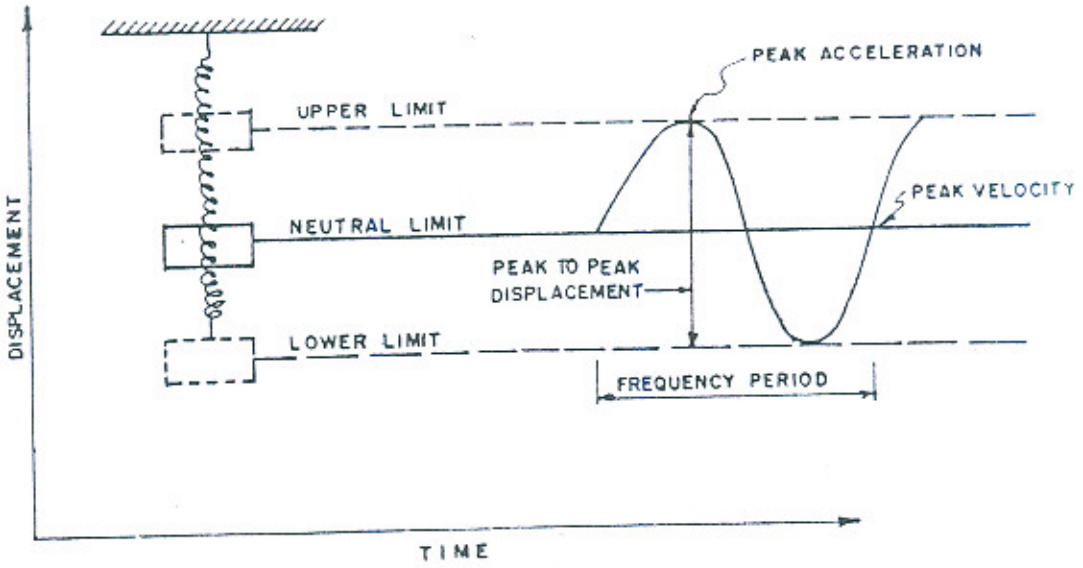
GENERAL MAINTENANCE PRACTICES

There are different means to achieve the desired maintenance levels. One is through periodical shut downs of the plant. Whereas the complete overhauling of all the parts is carried out in this case according to predetermined procedures, the plant remains idle for days on end. The production is stopped altogether much to the deteriment of the enterpreneur. Besides, all parts will have to be attended to even though it may not be necessary. Periodical overhaul could no doubt be greatly appreciated if the shut downs could be for a minimum period and no major replacements of components were involved. The second maintenance procedure is to replace or repair the part only when it has failed. This procedure is most primitive as due to sudden failures, the entire plant grinds to a hault without any alarm. In such an event the broken part has already caused serious damage to other coordinating parts which could otherwise have been averted. Failures in such cases may even last for several days unexpectedly and result in colossal production losses. The third and the best method commonly practised in developed countries, is by constant monitoring of parameters of various components and as soon the vibration of any of these exceeds safe parameters, the part is examined and the defect is remedied. This procedure needs lowering down of that individual part with very little rather negligible shut down period as the defect is detected in very early stages and necessary material and manpower is made available before hand. Regular readings of the vibrations of vital components and their timely maintenance enhances the life of not only the parts concerned but also of the conjunctive parts and the plant as a whole. The production benefits that accrue as a result can well be imagined and hardly need to be over emphasized.

* Associate Engineer Urea Plant Dawood Hercules Chemicals, Ltd., Lahore.

MAINTENANCE THROUGH VIBRATION MONITORING

a) **Vibration:**
It is simply the motion of a machine part, back and forth from its position of rest or neutral or mean one. To illustrate further; consider a body weight W which is attached to a spring and whole system is suspended as illustrated in figure below:



when force is applied to the weight to cause it to move, vibration is caused as weight moves back and forth from its position of rest or neutral position. It may well be remembered that cause of vibration is forceie the force which is changing either in direction or in extent. Different kinds of forces result in different frequencies of vibrations.

b) **Period:**
The amount of time required to complete one complete cycle of vibration is known as period.

c) **Frequency:**
The number of cycles per unit time is known as frequency. The general unit of frequency is C.P.M. (Cycle Per minute).

d) **Vibration Displacement:**
The total distance travelled by the vibrated part from one extreme limit of travel to the other extreme limit of travel is referred as peak to peak displacement (see figure above). It is normally expressed in mil (1 mil= .001 inch) or microns meter which is one millionth of a meter (0.000001 meter).

e) **Vibration Velocity:**
Weight W moves up and down (as shown in figure) with a speed which keeps on changing. At top limit the velocity or speed is zero since weight must come to a stop position before it can go to the opposite position or direction. The velocity is greatest when the weight passes through its neutral position. As velocity keeps on changing so we select the highest velocity. This velocity is normally expressed in in/sec or mm/sec peak.

f) **Vibration Acceleration:**
Vibration acceleration is the rate of change of velocity. We can not change the velocity without applying force. So acceleration is measure of force which causes vibration. In fig. 'A' the acceleration is maximum at the peak and zero at the neutral position. It is expressed in g.s. units where g is acceleration due to gravity.

g) **Conversion of Displacement, Velocity and Acceleration into Each Other:**
These three measures of vibration are related with each other as shown by formulas given below:

$$V_{peak} = 52.3DF\ 10^{-6}$$

V_{peak} = Vibration velocity in Inches per peak

D = Peak to peak displacement in mils

F = Frequency in cycles per minutes (C.P.M.).

$$g_{peak} = 14.1D \left(\frac{F}{1000}\right)^2 \times 10^{-3}$$

g = Acceleration due to gravity

CAUSES OF VIBRATION

Following are the major causes of vibration:

i) Misalignment
ii) Unbalance of rotating parts
iii) Bent Shafts
iv) Worn, eccentric or damaged gears
v) Bad bearings
vi) Electromagnetic forces
vii) Looseness
viii) Resonance
ix) Hydraulic forces
x) Cavitation
xi) Rubbing
xii) Bad drive belts and drive chains.

SIGNIFICANCE OF VIBRATION CHARACTERISTICS

Vibration analysis is used to detect

and describe the unwanted motion of a machine. Each characteristic of vibration indicates something significant about the vibration. A general machinery vibration severity and vibration acceleration charts are placed at Appendices A&B for reference. Vibration identification chart is also placed at Appendix C. Frequency variation indicates which part is at fault and what the problem is. We tune the analyser at different frequencies to determine highest vibration which when observed is noted. The following simple formula is applied for such determination.

$$\frac{\text{Frequency}}{\text{Speed of Machine}} = A$$

If 'A' is 1 the vibration is due to unbalance

A = 2 Vibration cause is looseness

'A' is greather than 15 or higher cause of vibration is antifriction bearings or bad gears. For more detail see Appendix C.

DETERMINATION OF VELOCITY, DISPLACEMENT OR ACCELERATION FOR ANALYSIS OF AFFECTED COMPONENTS.

Velocity:

It is used for checking overall machinery condition as velocity is directly related to frequency and displacement.

Displacement:

It is not used widely to determine condition of machine. However, under dynamic stress displacement may be a better indicator of severity. The components which are rigid or very brittle will cause machinery damage even at small displacement. To illustrate the important relationship between displacement and stress Consider a very large slow rotating machine. Assume this machine is working at vibration 90 mils peak to a frequency of 60 C.P.M. due to unbalance. (As 'A' is 1 in para 'Significance of Vibration Characteristics'). Vibration in terms of velocity is only 0.28 (Apply formula) In/Sec. which is slightly rough region in the graph (Appendix A). However, the displacement is 90 mils which is equal to 0.09 inch so failure may occur due to stresses. Displacement reading should be taken at machine with slow speed which may be subjected to low frequencies vibration. Vibration should be measured at frequency less than 600 C.P.M.

Acceleration:

Measurements are closely related to the vibration forces being applied to the machine, and relatively large forces can occur at high frequencies even though the displacement and velocity of the vibration may be small.

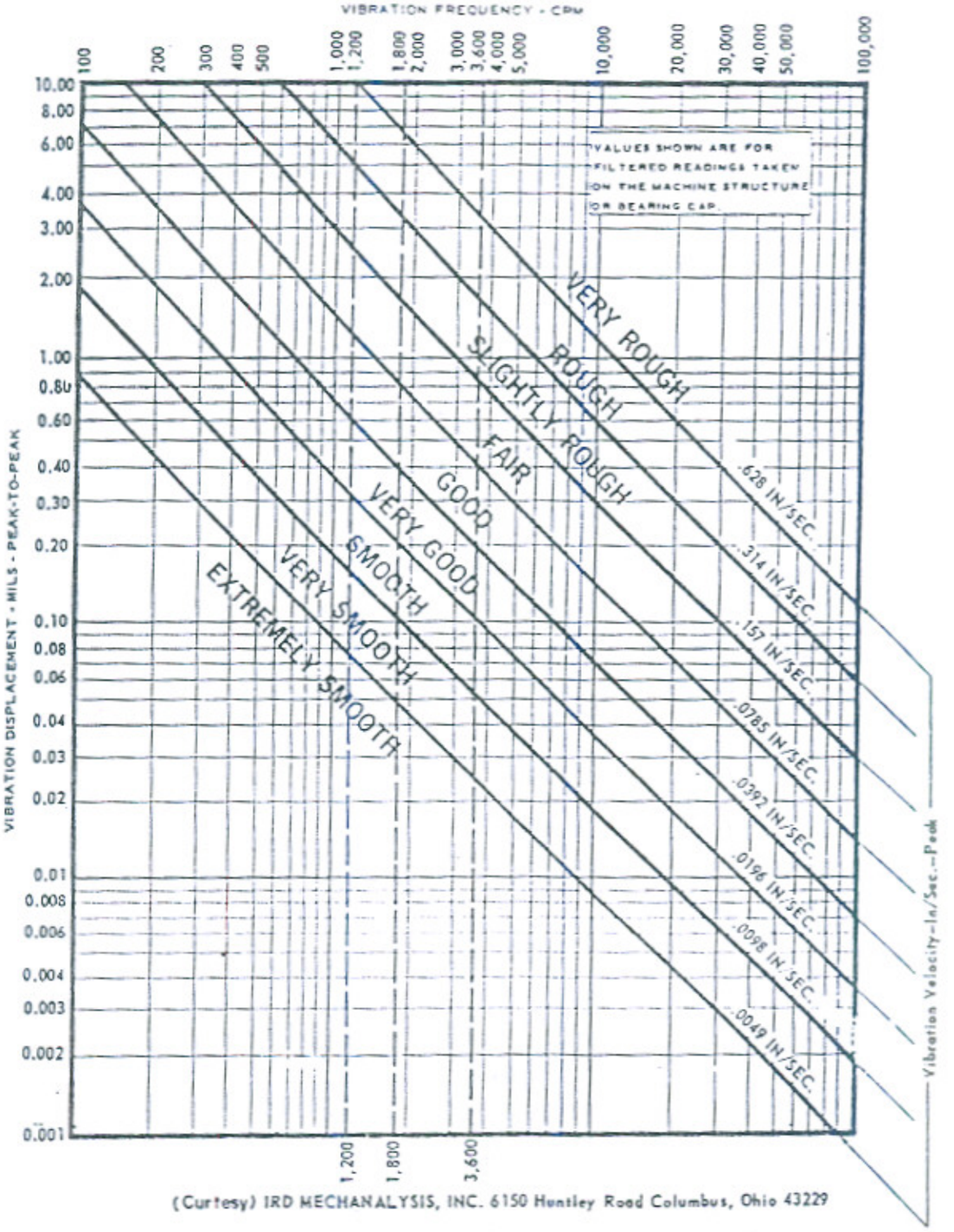
Consider a machine which has vibration. 01 mils peak to meet displacement at a frequency of 620000 C.P.M. Although the frequency represent 0.32 in/sec velocity but acceleration 54 g.s. which is very rough (Refer Appendix B). So at higher frequencies failure may occur due to high forces.

Conclusion

With readings taken as above, it is decided well in time as to when the concerned part needs attention and well before any damage can occur. Thus the plant continues to operate smoothly witout any major set back and its life too is appreciably enhanced..

GENERAL MACHINERY
VIBRATION SEVERITY CHART

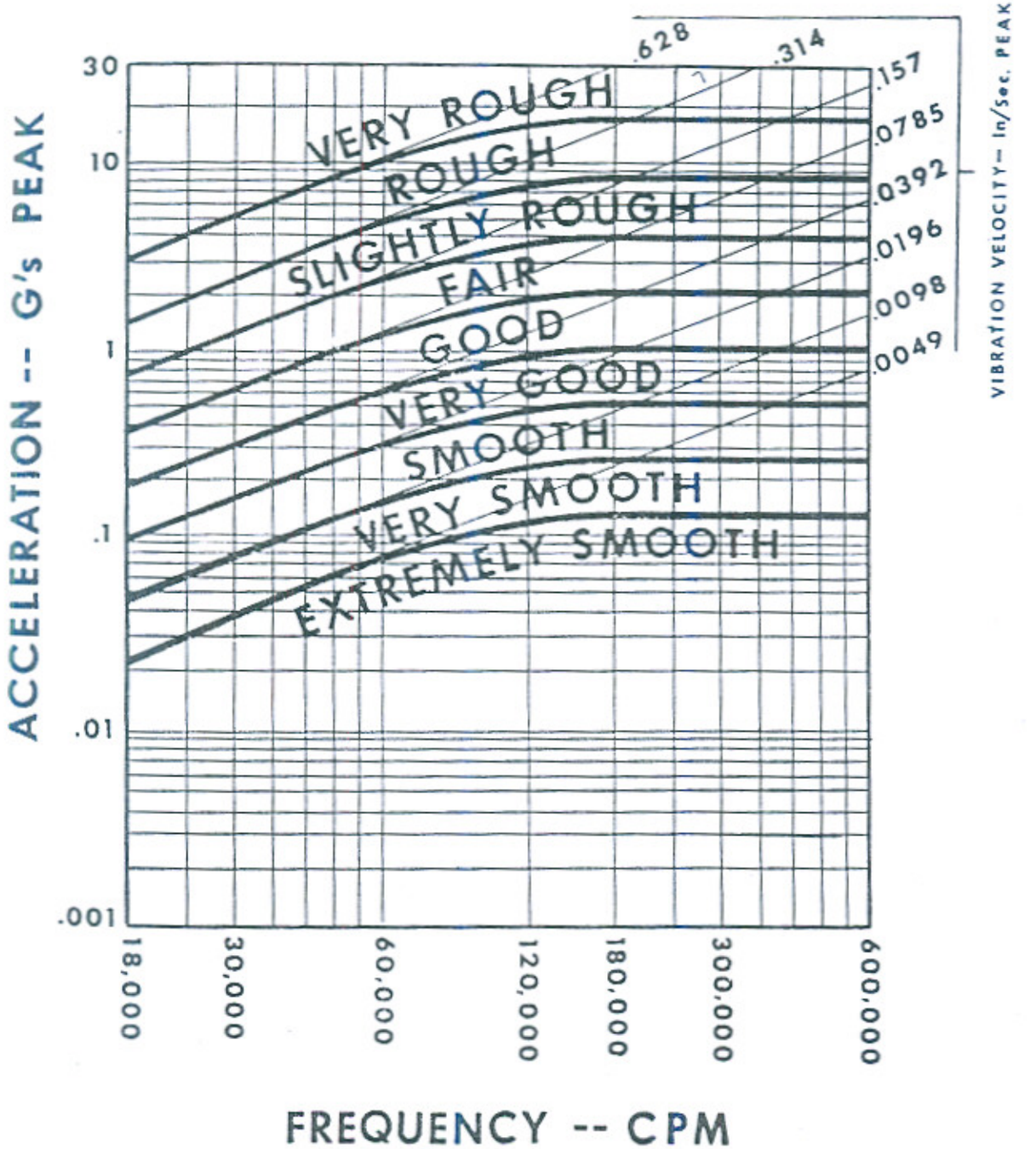
For use as a GUIDE in judging vibration as a warning of impending trouble.



(Curtesy) IRD MECHANALYSIS, INC. 6150 Huntley Road Columbus, Ohio 43229

This chart can be used to cross-reference displacement with frequency to determine vibration severity.

VIBRATION ACCELERATION
GENERAL SEVERITY CHART



This chart can be used to cross-reference acceleration with frequency to find the zone of severity.

VIBRATION IDENTIFICATION

CAUSE	AMPLITUDE	FREQUENCY	REMARKS
Unbalance	Proportional to unbalance. Largest in radial direction.	1 x RPM	Most common cause of vibration.
Misalignment couplings or bearings and bent shaft	Large in axial direction 50% or more of radial vibration	1 x RPM usual 2 & 3 x RPM sometimes	Best found by appearance of large axial vibration. Use dial indicators or other method for positive diagnosis. If sleeve bearing machine and no coupling misalignment balance the rotor.
Bad bearings anti-friction type	Unsteady - use velocity measurement if possible	Very high several times RPM	Bearing responsible most likely the one nearest point of largest high-frequency vibration.
Eccentric journals	Usually not large	1 x RPM	If on gears largest vibration in line with gear centers. If on motor or generator vibration disappears when power is turned off. If on pump or blower attempt to balance.
Bad gears or gear noise	Low - use velocity measure if possible	Very high gear teeth times RPM	
Mechanical looseness		2 x RPM	Usually accompanied by unbalance and/or misalignment.
Bad drive belts	Erratic or pulsing	1, 2, 3 & 4 x RPM of belts	Check Drive Belts
Electrical	Disappears when power is turned off.	1 x RPM or 1 or 2 x synchronous frequency.	If vibration amplitude drops off instantly when power is turned off cause is electrical.
Aerodynamic hydraulic forces		1 x RPM or number of blades on fan or impeller x RPM	Rare as a cause of trouble except in cases of resonance.
Reciprocating forces		1, 2 & higher orders x RPM	Inherent in reciprocating machines can only be reduced by design changes or isolation.

Vibration Identification Chart.

PARTICLE SIZE DISTRIBUTION/ FINENESS OF DRY HYDRATED LIME CEMENT.

By

*Ali Mohammad**
*M. Zafar Iqbal**

SUMMARY

Over the years, there has been a steady increase in the fineness of the cements. The fineness of grinding and particle size distributions exert profound influence on the rate of strength development and its ultimate value. In case of dry hydrated lime as well, the higher surface area is apt to accelerate the chemical reactivity, setting rate, plasticity, putty yield and other generally desired qualities. Since there is always some limiting value of fineness associated with each cementing material, beyond which the strength is only infinitesimally affected, a study was conducted to investigate the influence of particle size distribution on the development of strength of the dry hydrated lime cement. Increasing the particle size distribution per unit area resulted in increased strength at different hardening periods. Generally, the minus 150 micron locally produced dry hydrated lime has been found suitable for producing mortars for masonry and plasters.

INTRODUCTION.

The dry hydrated lime powder manually prepared and used to make various mortars, for evaluating their compressive strengths versus common-in-practice cement mortars; was invariably sieved[1, 2] through 90 micron (British Standard No. 170) sieve to about the fineness of the ordinary Portland cement. Sieving of fluffy material in finer sieves, is very trouble-some and tedious owing to the agglomeration of the particles and the liability of the meshes to become clogged. Some questions, therefore, cropped up later on, as to what should be the most viable, degree of grinding and fineness that could be adopted without jeopardising the strength or the stability of the units to be constructed.

FINENESS OF CEMENTING MATERIALS.

The value of cement when employed as a structural material depends primarily on its mechanical strength[3] in the set and hardened condition. The strength develops due to the cohesion of the particles of the cement and their adhesion to the grains of sand or other aggregate with which they are mixed. When used as a mortar, the adhesion of the material to the surface

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of brick or stone is also of prime importance.

The reduction of the clinker to a very fine state of division by grinding is usually considered[3] to increase its value as a cementing material in two ways. In the first place, a fine powder is able to coat the surface of grains of sand or other inert material more completely than a coarse one, so that a more intimate contact of the components of the mortar is assured. In the second place the reaction between cement and water takes place only at the surface of the solid particles, further action being hindered by the accumulation of the products of the reaction coating the unattacked material. Hence the more finely ground a cement and greater the surface exposed in proportion to its mass, the more rapid is the rate of hydration and the greater is the proportion of the cement which reacts.

The cost[3] of grinding of the cement clinker increases with the fineness to which it is ground, and this in itself would set some limit to fineness, but there are also limits imposed by the type of grinding machinery used and indeed by what is desirable.

There has been a steady increase in the fineness of cements over the years. The results[3,4] recorded by Rodgrave and Spackman in 1879 showed a residue of 10% on a sieve having an aperture of 500 micron (30 mesh per linear inch) and 45% on one with 150 micron aperture (100 mesh). According to Blount.[5] a residue of 10% on a 300 micron sieve (50 mesh) was considered un-reasonable in 1886. By 1910 the residue on 85 micron (180 mesh) for many British and continental cements had dropped well below 10%[3]. Most of the present day ordinary Portland cement[6,7] average around 5% on the 90 micron (170 mesh) sieve. Similar general trends in the USA have been reported [3,5] by Gonnerman and Lerch.

The influence of fineness of the strength of mortar has been investigated[8,9] by Dyckerhoff and Grant in Germany. They used the same cement in all the tests; but in one series the cement used was as manufactured, and which left 10% on 300 micron (50 mesh), unsifted, and in the other after sifting through a fine sieve, all passing through a 85 micron (180 mesh) sieve. The coarsely ground gave greater strength when used neat than when finely ground or sifted, but gave much lower strength when mixed with sand. At two week, with 3 and 5 parts of sand, the gain of strength of sifted cement mortars over unsifted was 41% and 64% respectively.

Elliot Clark[8] in Boston USA divided Portland cement and passed it through 300, 212, 150 and 125 micron (50, 70, 100 and 120 mesh) sieves and made into briquettes, both neat and mixed with different proportions of sand, which were tested from 1 to 52 week. The strength went on increasing with the increase of percent passing through 150 micron (100 mesh). The strength at 66% passing of 1:5 cement-

sand mix was more than double, at 90% four time and at 100%, about five time more than at 45% passing.

The fineness of grinding and particle size distribution also have significant effect on the setting[10,11] properties of the cementitious materials. In general, cements set more rapidly when greater is the specific surface of its hydraulically active components. This is attributable to the fact that amount of hydration products that are formed at the start of the setting process depends, under otherwise idential circumstances, on the magnitude of the surface reacting with the mixing water. As hydration progresses, however, the reaction rate diminishes, because the hydration products form a shell round the cement particles which restricts the access of the water to the as yet unhydrated nucleus. Further, the particles eventually become fully hydrated and cannot then provide any more hydration products and thus cannot contribute further to the strength formation.

There is, however, some limiting values of fineness associated with each cementing material beyond which the strength is only infinitesimally affected. Tests made on neat cements by Kuhi[3,12] and others (UK) showed that beyond a certain point, (between 1 to 10% residue on a 90 micron), the strength often decreased with finer grinding, and this led them to suggest that a definite optimum limit of fineness exists. Later studies supplemented this view point. The effect of increased fineness was found proportionately much greater at early than later age. An increase in specific surface from 1800 to 2500 cm^2/g raised the crushing strength at one day by 50 to 100% at 3 day by 30 to 60% and at 7 day by 15 to 40%. Increases in fineness beyond about 2500 cm^2/g produced only a relatively small increase in strenth.

In case of lime, as well, the higher surface area has been reported[13,14,15] to exert a profound effect on the chemical reactivity, setting rate, putty yield, plasticity, workability and the generally desired qualities of hydrates for most purposes. For a large majority of purposes, therefore, the fine particle size is preferred.

In the putty form, the particles have the smallest size below[14] one micron. While dry hydration produces comparatively coarser lime with a particle size from 10 to 350 micron. Lime in putty form is thus ideal but it is cumbersome to use, as it has to be prepared at the work sites and consumes sufficient time and labour. Hydrated lime from the dry hydration process is generally coarse but still regarded suitable for buildings works where a very fine lime from the structural point of view is not necessarily required. The extreme particle fineness accentuates the storage sensitivity and makes it more susceptible to damage. The both American[16] and British[17] Standard specifications, therefore, permit the use of hydrated lime having coarse grading provided the percentage of particles above a particular size remains within the following limits:[14]

Particle Size.	Maximum permissible%	
	BSS	ASIM
Under 600 micron. (25 mesh BS sieve).	–	99.5
Under 200 micron (170 mesh B.S Sieve)	95	–
Under 90 micron (170 mesh BS Sieve).	90	85

The more finely, thus, a cementing material is ground, the greater is the strength and particularly the early strength, it yields. Whether there should be some limit to this and whether there is some particular type of particle size distribution which is better than others, is a much mooted question. A given specific surface in a cementing material could be produced with a variety of particle size distributions, but no final answer[3,18,19,20], can yet be given as to whether there is some optimum grading. A study was, therefore, necessitated to find out the most desirable degree of grinding of the dry hydrated lime powder.

EXPERIMENTAL

A typical mix, of the ratio of 1:2:9 cement:dry hydrated lime:sand (by volume), was selected to determine the compressive strength at different hardening periods. The freshly slaked dry hydrated lime fractions of minus 2.36 mm (No. 7), 600 um (No. 25), 150 um (No. 100) and 90 um (No. 170 British Standard) mesh sieves, were separately used to cast 50 mm mortar cubes at 105 + 5% flow under standard mixing and preparation condition.[6,7, 17,21,22] Fine Ravi river sand duly washed and dried, of fineness modulus of 0.85, and Portland cement under the brand name of Zeal Pak conforming to BSS[7] and Pakistan Standard[23] were used throughout. The specimens after demoulding were cured under wet gunny bags, till the time of test. The results are given in Table 13.1 and plotted in Fig 13.1

DISCUSSION OF RESULTS.

Results in respect of crushing strength of 1:2:9 cement-lime-sand mix (by vol) prepared, cured and tested under identical conditions at the age of 3,7,14 and 28 day using dry hydrated lime of minus 2.36 mm; 1.18 mm; 600; 300; 150 and 90 micron meshes, are given in Table 13.1. It may be seen that the strength goes on increasing with the fineness of the hydrated lime powder and attains maximum value with minus 90 micron fraction, which resembles the fineness of the ordinary Portland cement. The compressive strengths, at the age of 28 day with minus 2.36 mm; 1.18 mm; 600 um; 300 um; 150 um and 90 micron fractions was respectively 0.91; 1.064; 1.204; 1.40; 1.505 and 1.61 MN/m^2. Assuming strenth of the minus 90 micron fraction as 100 percent, these strengths were lesser in the reverse sieve order, as 6.5; 13; 25; 34 and 43 percent. The strengths of minus 150 and 90 micron fractions, at all the testing periods, were, however, quite close.

As already stated, the sieving of

fine fluffy material particularly through fine meshes is not an easy operation. If some free moisture is also present then it becomes almost impossible as the particles strongly physically adhere to each other, get clustered and clog the meshes, although, may in reality be finer than the meshes through which being sieved. These thus present a pseudo behaviour and apparantly the lime looks to be coarser than the actual. In commercial production, it is always desirable to use coarse grinders as the fine grinding needs special and costly grinding/ pulverizing machinery and more energy. The manually produced dry hydrated powder, was always found in a very fine state of grinding and more than 75 percent of it easily passed through 90 micron mesh. The strength obtained with minus 150 micron fraction was well within the prescribed limits of various standard specifications[24,25] for masonry.

The compressive strengths of 1:2:9 mix determined with lime powder of different sieve fractions has also been plotted (Fig 13.1). The rate of increase of strength with the increase of fineness upto minus 300 micron fraction is pronounced whereafter it decreases and the curve acquires a somewhat parallel to X-ax in shape. The rate of increase of strength beyond minus 150 micron sieve becomes low indicating that there is not much gain in strength by changing fineness from 150 um mesh to 90 micron mesh or even more. Extremely fine particles are not likely to hydrate so promptly during mixing and placing and to confer any thing to the strength. They may tend to be concentrated in any laitance formed or on surfaces against forms where they may cause map cracking or grazing or unsightly weathering. Since they do require undue amounts of water and consequently undue shrinkage and cracking may result. Conversely, the coarse particles of the less finely ground material may hydrate later and cause disruptive expansion.

The fraction passing 150 micron (no. 100 BS) sieve has been used in constructing an experimental masonry wall in the exterior which has been plastered on both sides. The mortar as well as the plaster has behaved perfectly well. No popping or pitting, shrinkage or expansion has been noticed over a span of about two years.

CONCLUSION

The development of strenth of the dry hydrated lime powder is directly related to its degree of fineness. The finer the product, the more would be the strength. The rate is, however, pronounced upto 150 micron mesh fineness whereafter it attains somewhat constant value. The maximum strengths were given by 90 micron passing fractions but the strength with 150 micron passing fraction was quite close and also well within the prescribed limits of various standard specifications and code of practices. Because of the ease of grinding, sievability and economic viability, minus 150 micron dry hydrated lime powder is most suited to produce standard mortar as such or in connection with Portland cement for masonry and plasters.

TABLE – 13.1

CRUSHING STRENGTH OF 1:2:9 (BY VOL) CEMENT-LIME-SAND MORTAR USING DRY HYDRATED LIME OF DIFFERENT PARTICLE SIZE/FINENESS.

Particle size/ fineness of dry bydrated lime (BS Sieve).	Crushing Strenth at the age of (day).			
	3	7	14	28
	MN/m^2	MN/m^2	MN/m^2	MN/m^2
No. 7 (2.36 mm) pass.	0.196	0.462	0.63	0.91
No. 14 (1.18 mm) pass.	0.231	0.483	0.665	1.064
No. 25 (600 um) pass.	0.28	0.49	0.672	1.204
No. 52 (300 um) pass.	0.35	0.609	0.833	1.400
No. 100 (150 um) pass.	0.371	0.693	0.996	1.575
No. 170 (90 um) pass.	0.364	0.819	1.071	1.610

i) Consistency/flow. = 105% ± 2%

ii) Curing condition. = 1 day in the mould, then under wet gunny bags till the time of test.

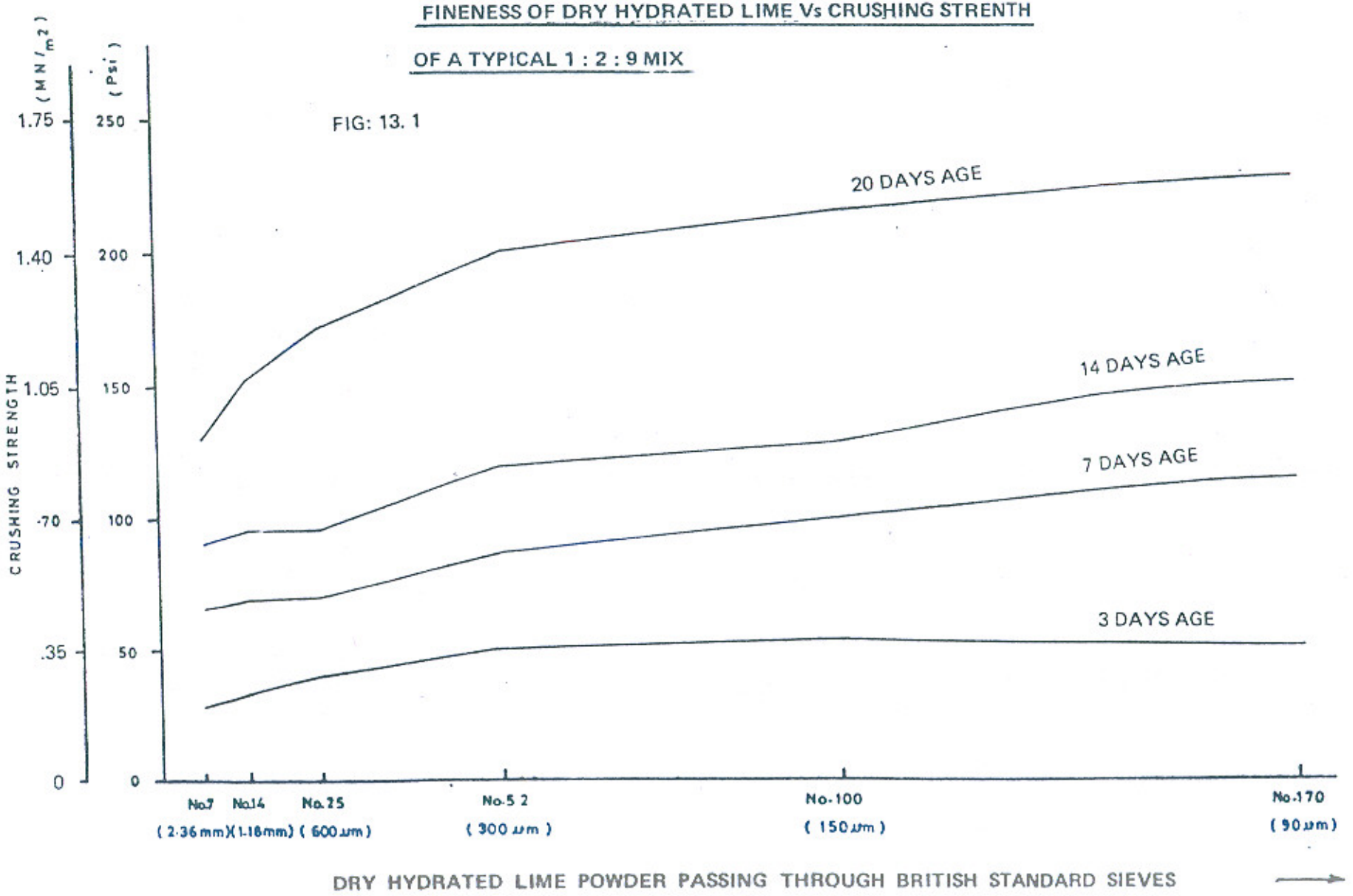
iii) Density; lb/ft^2 (Kg/m^3). = Cement: 80 (1280);
Lime : 35 (560);
Sand : 80 (1280).

iv) Each result is the average of six test specimens.

FINENESS OF DRY HYDRATED LIME Vs CRUSHING STRENTH

OF A TYPICAL 1 : 2 : 9 MIX

FIG: 13. 1



AUTOMOBILE PERFORMANCE ON LIQUIFIED PETROLEUM GAS

BY
MAJOR NASIM AKHTAR KHAN

Abstract

The use of Liquified Petroleum Gas (LPG) has not attained satisfaction in many of the users mind. The present article clarifies doubts if any from the mind of many users. The study is still continued and is expected to reveal true picture on the use of LPG in next few years time.

Introduction

1. LIquified Petroleum Gas is one of alternate substitutes of petrol gasoline. It has been used in cars satisfactorily over number of years. Few doubts have always discouraged volunteers to try going into this field. Their doubts are due to presence of excessive amount of Sulphur in the fuel, due to which the components of engine forming combustion chamber i.e. piston top, cylinder head and cylinder liner wear out resulting in poor engine performance. Here the constituents of LPG have not been analysed or evaluated rather it has been taken as a constant factory and engine deposits and wearing of component is being studied. In this study, Mazda 808 car was used with Lovato Auto Gas Kit of Italy fitted on it. The details of the engine are given in Table-1.

TABLE – 1

Car Model	Mazda 808 Model 1977
Engine	Four Stroke Inline 4 Cycle, O.H.C. 5 main bearing water cooled Petrol Engine No. 0370
LPG Kit	Lovato Auto Gaskit (Italy)
Exhaust Valve Number	488/1
Inlet Valve Number	324/1
Odometer Reading	54465 Km
Bore and Stroke	73 mm x 76 mm (2.87 x 2.99")

Experimental Details

2. The LPG Kit was fitted on the engine when it had run 23,220 kilometers in July 84. Since than the car has run 31,225 km in 30 months, of which 30,000 km have been made on LPG. The LPg is of Fauji Foundation Pakistan, named FONGAS. The engine cylinder head was opened at 54,465 km reading to study the possible effects. The engine has been closed without changing any other components except cylinder head gasket and it is planned to be reopened at 60,000 km.

3. During driving the vehicle following instructions were followed:—

a. The car was single owner driven.

b. The lubricant was changed regularly at interval of 3000 km except for the last change when 10,000 km were run on same Lubricant.

c. LPG Kit tuning was carried out regularly with more or less no mishandling.

4. Components of the engine which were changed during these 2½ years or 30,000 km include.

a. Contact breaker (CB) points were changed four times. This is also usual with well maintained petrol cars.

b. The silencer was changed twice. First at approximately 7000 km run on gas when cars original silencer was changed with locally built silencer. Secondly at 28,500 km of gas run when new galvanized sheet silencer was fitted and in both cases the silencer had been badly rusted.

5. Following other observations were made:—

a. The spark plugs were not changed and they are still working perfectly.

b. Even at normal running condition the engine used to be operating at slightly higher temperatures than normal temperature given by the manufacturers. The same is indicated by a dot on the temperature gauge on this veh.

c. The cylinder head gasket was blown-off badly in cylinder number ONE and partially in cylinders THREE AND FOUR.

Observations

6. To arrive at precise impact of use of LPg, all major components of the engine were studied. It was observed that there were carbon deposits on inlet and exhaust valves as well as top of piston and hemispherical cavity in the cylinder head. When these deposits were carefully removed, to observe actual impact of LPg combustion on the metallic surfaces, it was found that there is no sign of any pitting, scoring or scuffing on these surfaces. This fact clearly indicates that upto 30,000 km, combustion effects on the combustion chamber surfaces are not detrimental to the engine life. Even if pitting starts developing now, it is estimated to take another atleast 60,000 km before any real impact is made on the engine performance. The detailed observations on few selected components is given in the paragraphs below alongwith their photographs.

a. **Cylinder Head.** (Fig 1). There were carbon deposits seen in all four hemispherical cavities (combustion chamber) and on

inlet as well as exhaust valve. These deposits on exhaust valve were found rust in colour and thicker than rest of the portion in combustion chamber which had black carbon deposits. The inlet valve also had black carbon deposits but much less in magnitude. The carbon deposits on all valves are considered normal and any vehicle running on gasoline will also have similar amount of deposits. The amount of carbon deposited on exhaust valves was however not same in all cylinders as can be seen in the figure.

b. **Cylinder Block.** (Fig 2). The figure shows the plan view of cylinder block with cylinder head removed. The pistons in cylinders number 1 & 4 are on top dead centre (TDC) and pistons in cylinders number 2 & 3 on bottom dead centre (BDC). Both pistons on TDC show that there is carbon deposited on them.

c. **Piston No 1.** (Fig 3). This is a close up view of piston at TDC in cylinder number 1. The carbon deposits are in form of scales and strongly welded with each other and to the piston top, mainly in the centre of the piston. The white circumferencial border shows the actual surface of the piston.

d. **Piston No 4.** (Fig 4). The close-up piston in cylinder number 4 is quite different from piston number 1. The deposits are comparatively more and in two prominent layers. The white marks show the actual surface of the piston top and were made to gauge the thickness of the deposits.

e. **Cylinder No. 3 Walls and Ridege.** (Fig 5). This figure shows a close up of cylinder wall and development of ridge at the TDC. The walls are scratch free with no unusual wear & tear, pitting or scoring. The ridge of the cylinder wall has started forming but its size is not abnormal for an engine run 50,000 km.

f **Piston No. 4 Cleaned.** (Fig 6). To study the actual effect on the engine it was necessary to clean the carbon deposits and study the original surface. This was done for piston No. 4 and there was no pitting, scoring or unusual wear & tear seen. The black spots seen are strongly bonded burnt carbon deposits which could not be removed by simple cleaning. The ridge development mentioned in Fig 5 can be seen from different angle in this figure. The wall surface in cylinder number 3 is also clean and without any unusual marks.

g. **Combustion Chamber Cylinder No 2.** (Fig 7). The figure shows close up of hemispherical combustion chamber, in cylinder head over piston number 2. Rusty exhaust valve shows the amount of carbon deposited on it, the spark plug is also rusty in colour. The entire combustion chamber has black thin carbon deposits alongwith inlet valve whose number can be read in the figure. These deposits have been cleaned and shown in Fig 8. The manufacturers numbers can be read and surface is seen clear of any abrassion or undue wear.

h. **Combustion Chamber Cylinder No 3.** (Fig 9). The figure shows the exhaust valve of piston number 3 alongwith the carbon deposits. The deposits on this valve are more than any other cylinder.

j. **Cylinder Number 2 & 3.** (Fig 10). The figure shows pistons in cylinder No 2 & 3 at bottom dead centre. The carbon deposits on each can be seen to be similar to other cylinders shown earlier i.e. cylinder Number 1 & 4.

Conclusion

7. The study on this engine leads to following conclusions:—

a. There is no unusually observable developments/deposits in the combustion chamber for 30,000 km or in 30 months time.

b. No pitting was observed on piston top or cylinder head.

c. The total amount of carbon deposits are considered lesser than or comparable to those observed in gasoline engines for this mileage.

d. No ridge was observed in any of the cylinder which negates the foul impression that LPG causes excessive wear on cylinder liners and scores out cylinder head and piston top by pitting.

e. Even if pitting/scoring starts developing now, it is estaimated to take another atleast 60,000 km before any real impact is made on the engine performance. This means that an engine running on LPG can be assumed to run safely upto 90,000 km. The effects beyond this are still under investigations.

Bibliography. Mazda Owners Manual Model 808.

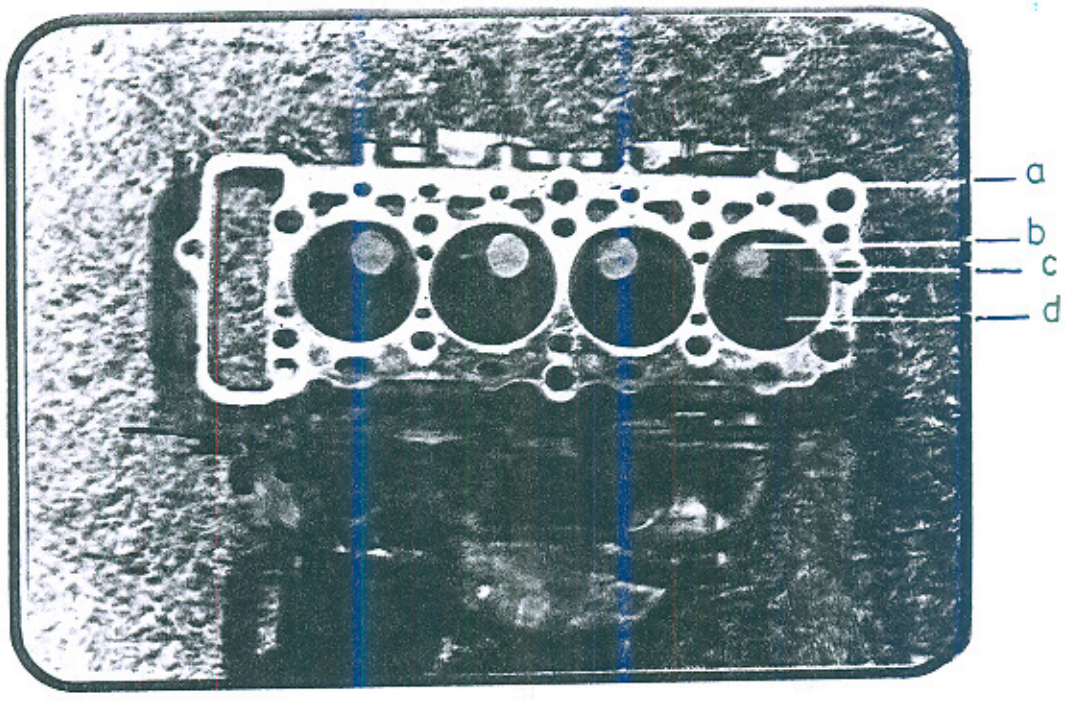


FIG.1 **CYLINDER HEAD**

a. CYLINDER HEAD
b. EXHAUST VALVE
c. HEMISPHERICAL CAVITY
d. INLET VALVE

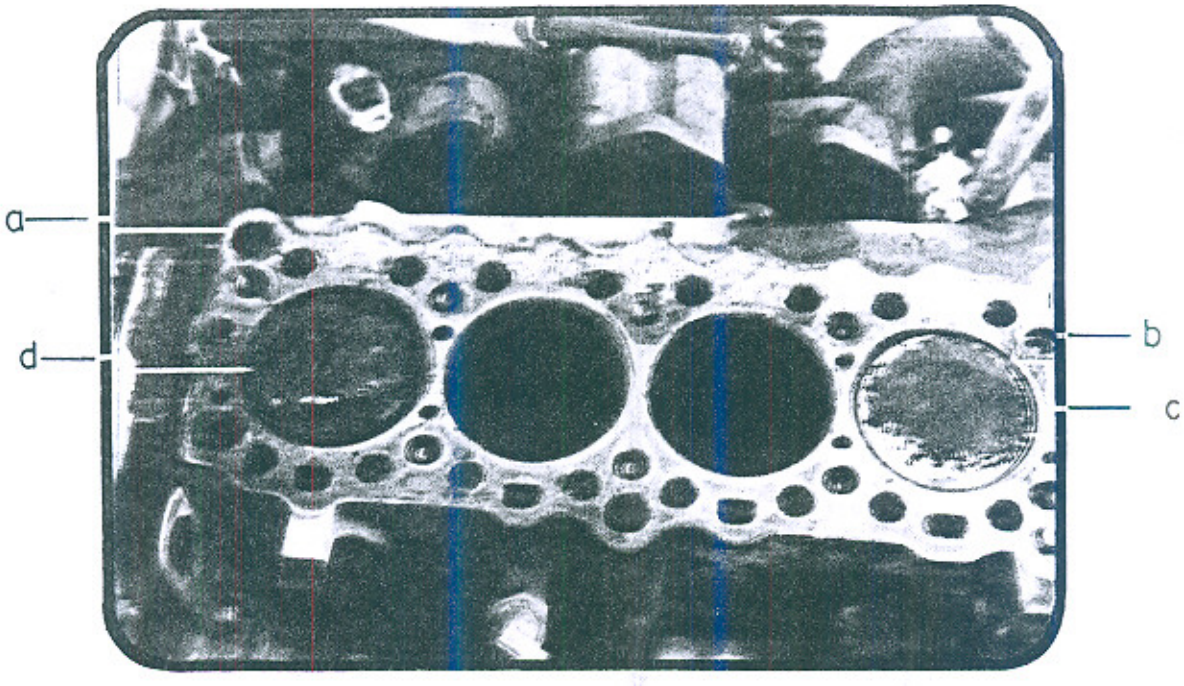


FIG. 2. **CYLINDER BLOCK**

a. CYLINDER BLOCK
b. CYLINDERS
c. PISTON No.1
d. PISTON No.4

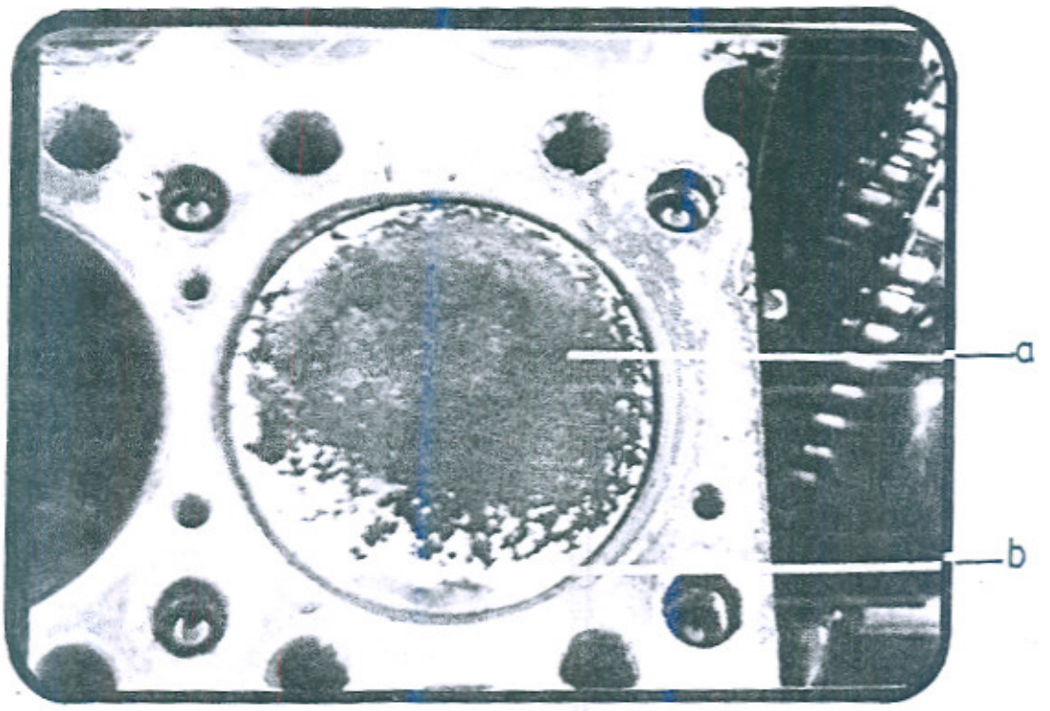


FIG 3 **PISTON NUMBER.1**

a CARBON DEPOSITS b. CLEAN SURFACE

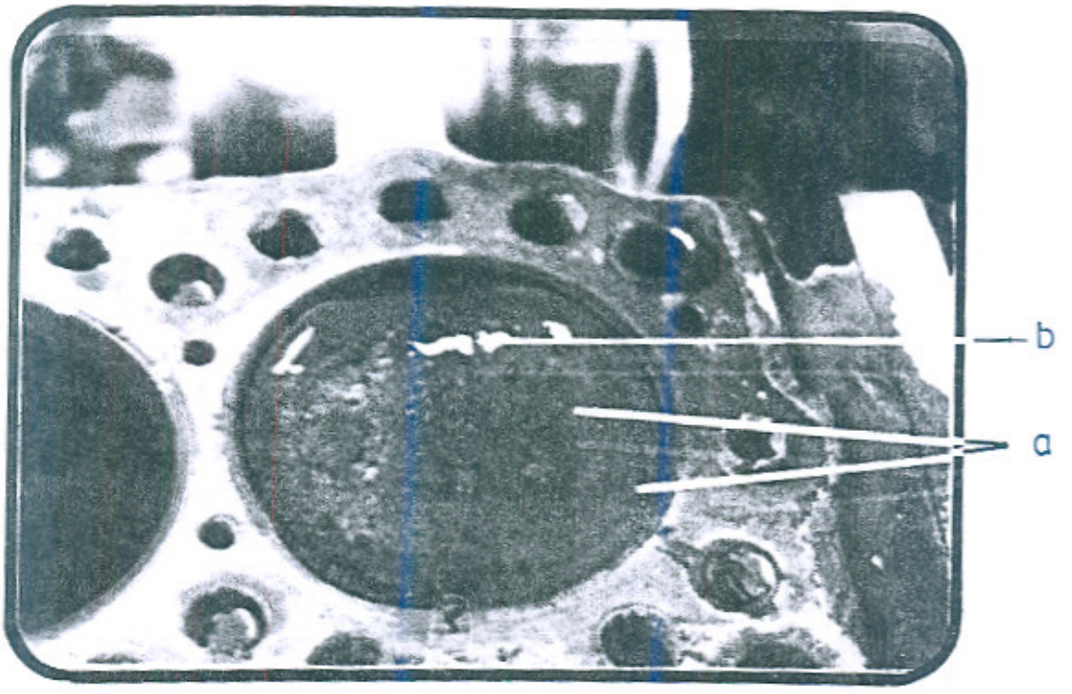


FIG. 4. **PISTON NUMBER .4**

a. TWO LAYERS OF CORBON DEPOSITS

b. MARK SHOWING ACTUAL SURFACE

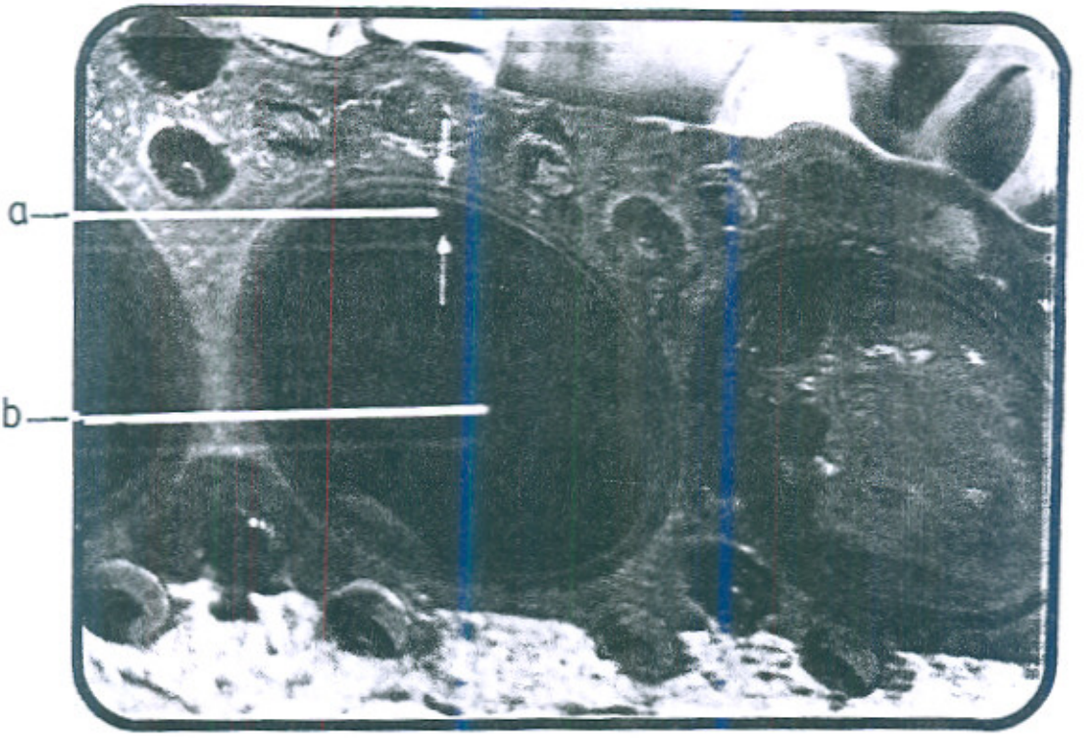


FIG 5 **CYLINDER NUMBER. 3**

a. RIDGE DEVELOPMENT

b. SCRATCH FREE SURFACE

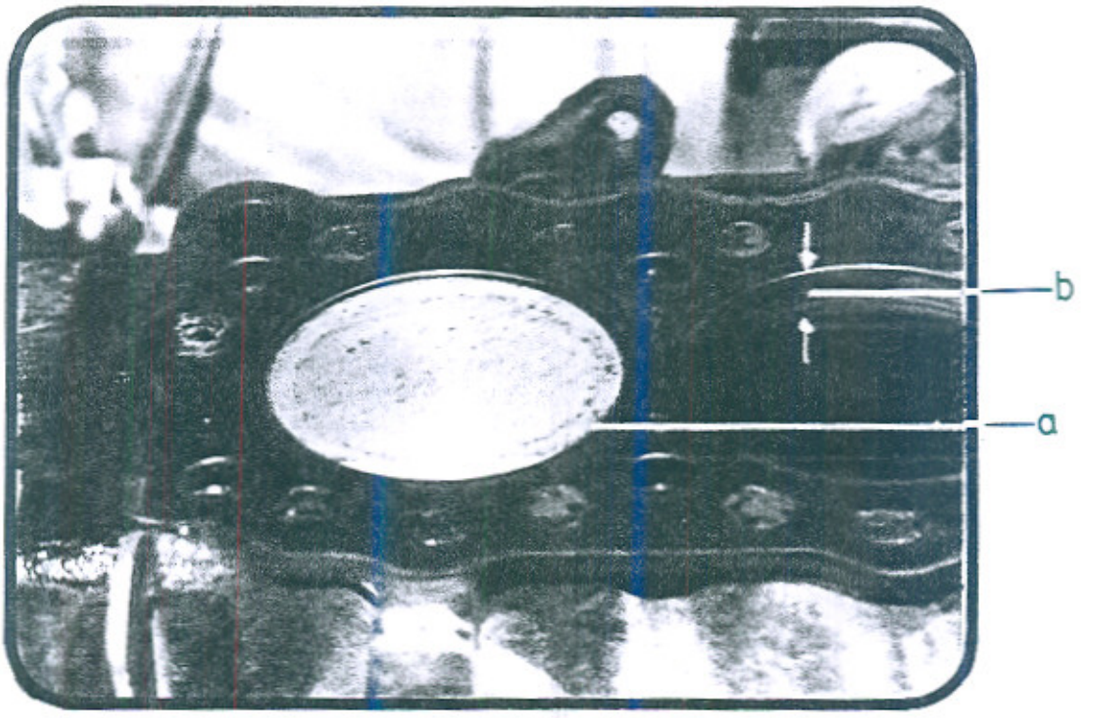


FIG. 6 **PISTON NUMBER 4 CLEANED**

a. IMBEDDED CARBON DEPOSITS.

b RIDGE OF CYLINDER NUMBER 3

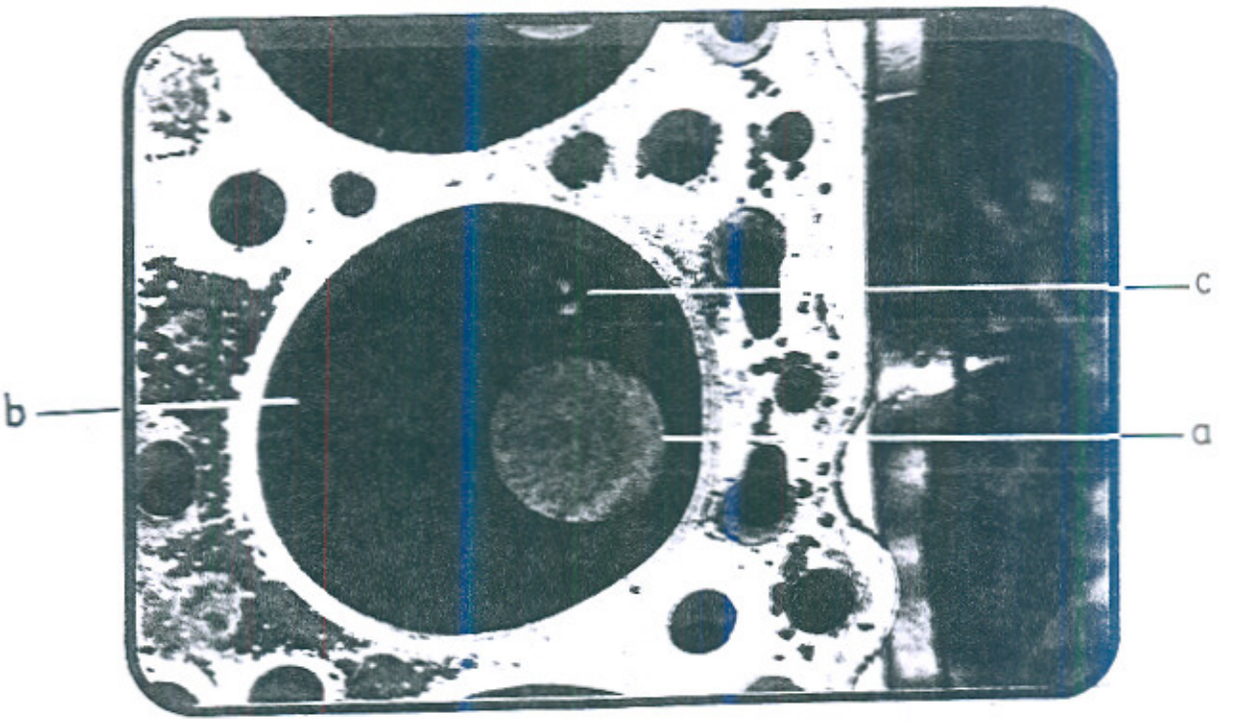


FIG 7 **COMBUSTION CHAMBER CYLINDER No.2**

a. EXHAUST VALVE
b. INLET VALVE
c. SPARK PLUG

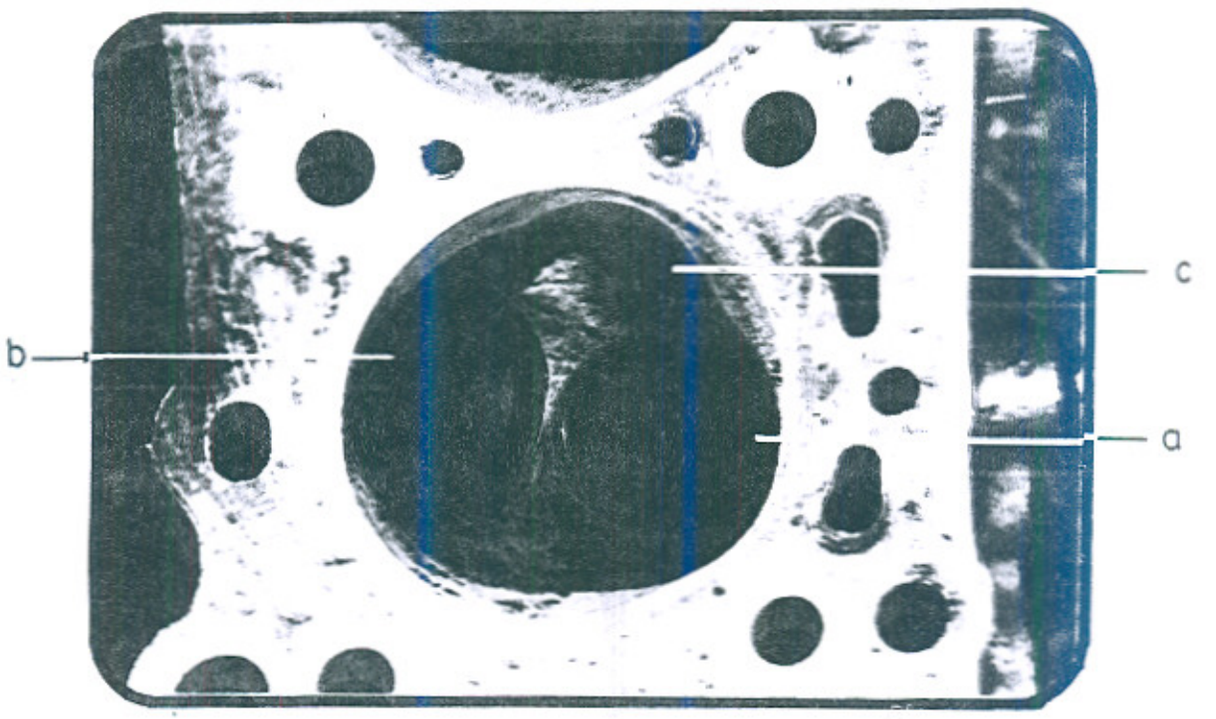


FIG.8 **COMBUSTION CHAMBER CYLINDER No.2 CLEANED**

a. EXHAUST VALVE b. INLET VALVE
c. SPARK PLUGS

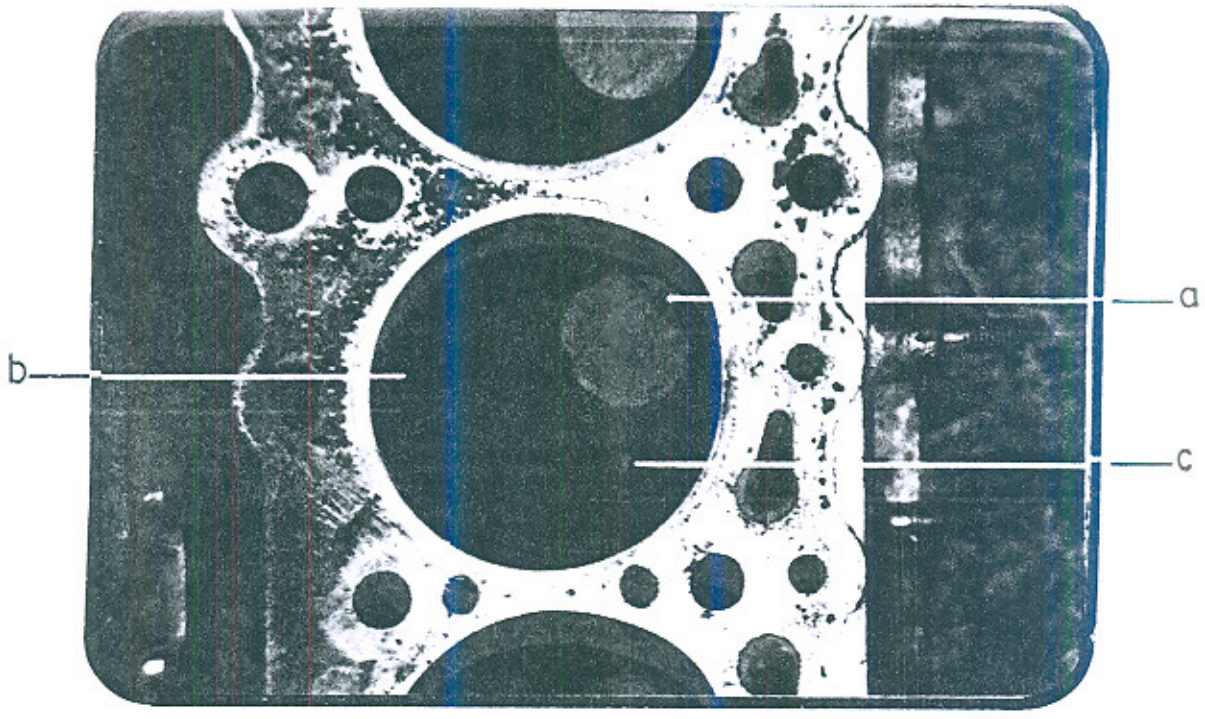


FIG. 9 **COMBUSTION CHAMBER CYLINDER No.3**

a. EXHAUST VALVE
b. INLET VALVE
c. SPARK PLUG

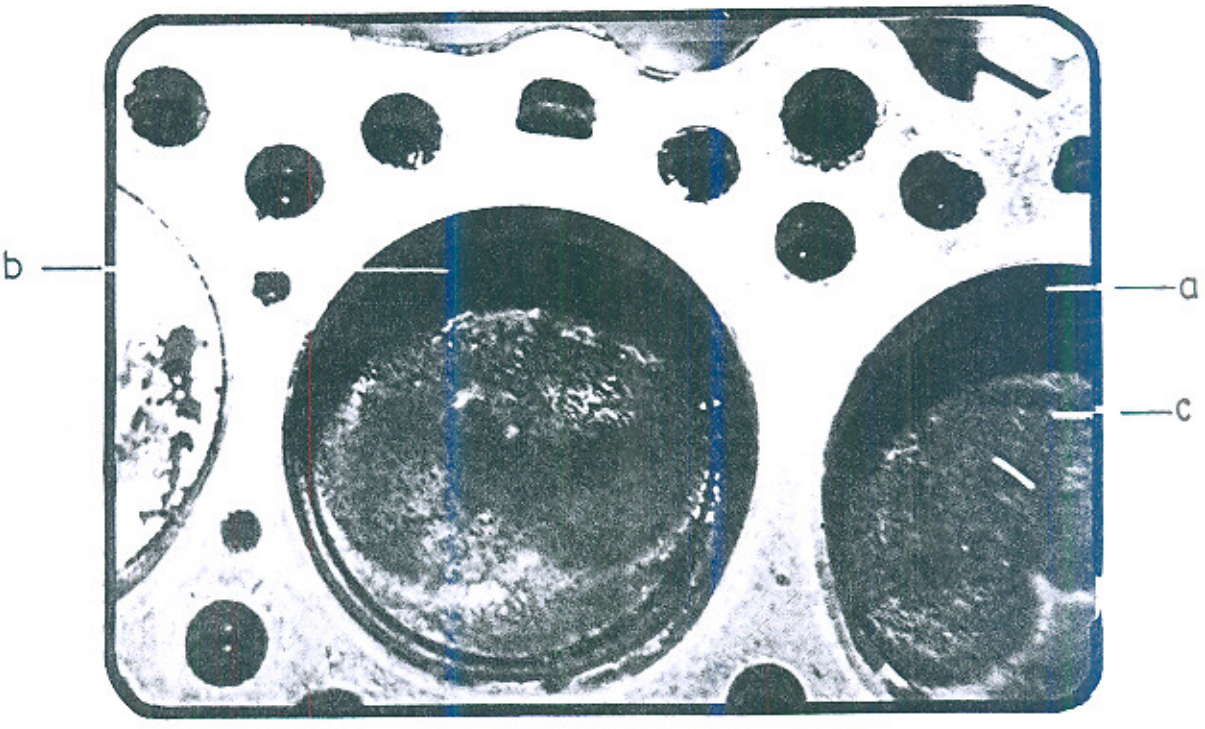


FIG. 10 **CYLINDER No 2 & 3**

a CYLINDER NUMBER 2
b CYLINDER NUMBER 3
c CARBON DEPOSIT CYLINDER No 2

MAKING GOOD DECISIONS IN CONSTRUCTION INDUSTRY

BY

ENGR MAJOR MIAN MUHAMMAD AZAM*

INTRODUCTION

1. Construction business is fundamentally the managemnet of people. The success or failure in profession is largely dependent on leadership, which is vital for good management and inspires people to perform and accept directions willingly. The decision making is the most important and outstanding Role of a leader. The engineers are always called upon to make decisions. As such they should know when a decision has to be made on principles and when on merits of the case. Good decisions do not just happen, they are developed through detailed analysis, in-depth study, clear understanding and correct evaluation.

2. The objective of good decision making is to make the best use of resources and time in order to achieve the optimum end return.

3. Logical Process of Decision Making. The logical process of good decision making includes:-

a. **Identification of Problem.** The problem is recognised/Identified soon it crops up and time must not be wasted on analysing the symptoms.

b. **Detailed Appreciation.** The problem is considered at length, enlisting all factors conducive to its aggravation. The impact of each factor alongwith the logical solution is discussed in detail. All possible logical solutions are considered, thus rejecting any preconceived solution.

c. **Evaluation of Alternatives.** All alternative measures are correctly evaluated to safeguard against implementation of preconceived notions keeping in view time, cost and resource factors at disposal.

d. **Picking Most Suitable Decision** The decision which fits in the best, within the prevailing conditions is picked.

4. Criteria for Decision Making. Decision making is an art and very few are endowed with the gift. Others can however, learn good decision making. The rules of good decision making generally are:-

a. One must always aim at what is "RIGHT" rather than what is "Acceptable".

b. Decision Making being risky, one should either act or may not but must not compromise.

*Project Incharge - Army Residential Flats Abbotabad.

c. One must apply "Courage" and "Boldness" to make decisions.

d. One must make timely decision otherwise the likely benefits that could accrue may languish.

e. One must make decision only after considering all disagreements.

5. **Technique of Decision Making.** A decision is a judgement. It is a choice between the alternatives and rarely a choice between "Right & Wrong". Good decisions require a synthesis of past experience, sound facts and overall refined judgement. Decision making is God gifted quality. Nevertheless, the logical process outlined above would lead to good decisions. Some of the techniques of decision making are discussed below:-

a. **Holding Decisions.** These are usually of an emergency nature, made at the spur of a moment of stress. In fact, these are transient ones as a prelude to better decision which can be taken later after collecting more facts about the problem. For example if the roof of a cement store starts leaking during rain, immediate decision would be to cover the cement bags with waterproof and then afterwards attend to the leak in the roof. Similarly if a hotel manager finds, that water is flooding the basement the employees and even their families can be called to SALVAGE THE property.

b. **Interim Decisions.** These are made to lessen the effect of a problem, or a potential problem. In the case of flooding of the basement of Hotel for example, if Manager learns that nearby drain has given in, there is very little he can do about RAINS or Repair of Drain. He can, however, rent TRUCKS and hire MEN to shift water sensitive Equipment to a safer place.

c. **Correcrive Decisions.** These are made after detailed analysis of the problem and after the root cause is identified. The Hotel Manager in such a case can approach the concerned agencies to repair the drain, and improve the drainage of the area to cater for future rains, so that the problem does not occur again.

7. **In Relation to Decision Maker**

a. **Emergent Pattern.** Keeping in view the urgency of the matter, "HE" alone makes the decision based on whatever information, is available to him.

b. **Controlling Pattern.** Necessary information is collected from various sources including the subordinates. But subordinates provide the relevant information only and not the suggestion of a solution to the problem. Based on this information "HE" alone makes his decision and announces the same.

c. **Comprehending Pattern.** The subordinates are invited to give ideas and facts about the problem in their individual capacity. After listening to the appropriate people "HE" makes his decision which may or may not reflect subordinates ideas and suggestions about the matter.

d. **Entertaining Pattern.** A meeting with the subordinates as a group is arranged to collectively discuss the problem and suggest possible solutions. "HE" allows them to participate, but forcefully dictates his own point of view. "HE" makes a decision and briefs others as to how the decision has been arrived at.

e. **Supporting Pattern.** A meeting of the subordinates is held and "HE" acts as the chairman. The problem is placed before the house for dicussion and solution is invited, without trying to dominate or steer the decision making process. The most suitable decision resulting from the discussion is accepted as the decision of the group.

8. **Conclusion.** Decision Making is a personal judgement and is a choice among the alternatives. Engineer as professional is always called upon to make decisions. As such he must know when to make a decision on principles and when on merits of the case. At time of emergency, the decision is the personal directive, whereas the corrective decisions are group efforts. Decision making is risky and requires courage and boldness to act in time, otherwise the opportunity may vanish.

ACCORD ON JINNAH BARRAGE

LONDON, May 7: Agreement has been reached between the governments of Pakistan and the United Kingdom for a detailed study to be carried out with British aid on the hydroelectric potential of the Jinnah Barrage in Pakistan.

Studies have already been carried out which indicate that the difference in water level between the upstream and downstream sides of existing barrages on the River Indus (and also at falls on certain of the principal canals) can be used to generate hydro-electric power, using the flow of water which is normally passed through the barrage.

It may be recalled that a group of British companies made a technical presentation to the Prime Minister, Mr. Mohammad Khan Junejo in London on April 7 on a proposal to generate hydroelectric power from the River Indus without the need for any significant inundation of agricultural land.

(Courtesy PPI)

PLAN TO MAKE BETTER ASPHALT CARPETED ROADS

Punjab Government is implementing a comprehensive programme for the construction of high quality asphalt carpeted raods due to increase in traffic.

This was stated by the provincial Minister for Communication and Works, Mr. Saeed Ahmed Khan while delivering presidential address in the seminar arranged by Pakistan Engineering Congress on "Promotion of construction industry in developing countries", at Lahore on Friday the 10th April 1987.

The Minister said experts should help the Government in utilizing the latest techniques of construction and guide in planning and organization in the field of construction so as to make maximum use of our limited resources.

The Minister said the Government was seriously considering to finance the private sector. We were making hectic efforts to improve departmental practices, the induction of large engineering firms of major projects for their timely

completion. It was the primary need to mobilise our resources as for as possible for attaining self-reliance in all sectors of development, the Minister added.

Earlier, Dr Karmani, Consultant of World Bank delivered a comprehensive lecture on the promotion of contruction industry.—

(Courtesy APP April 11)

HANDTOOL THAT ENSURES PERFECT POINTING

A handtool which enables a bricklayer to achieve consistantly good traditional joints between face brickwork, has been introduced by a British company.

With its interchangeable accessories, the 'Pointmaster' can save time and money by enabling an unskilled person to achieve perfect pointing by simply rolling the tool along the joints. It also speeds up the process of repointing brickwork.

Light and comfortable to handle, the Pointmaster comprises a pair of nylon wheels fitted to a polypropylene moulded handle, to which is fitted one of four joint-forming irons which are held in place by a knurled thumb screw. A small compartment moulded in the handle, takes spare rakes, shims and screws. These are used to raise the heights of the irons to increase the depth of the pointing from the brick-face.

The hardened and tempered steel joint-forming irons are designed to produce the four traditional craftsman's mortar joints between face brickwork: the ironed recessed (square dressed joint): the bucket handle (curved dressed joint); the weather struck (sloping dressed joint); and the inverted diamond (female arrowhead joint).

The tool requires minimum maintenance—only a wash in clear water after use.

(Courtesy Dawn June 27.

GAS CONDENSATE FOUND AT LASHARI SOUTH

Islamabad, June 7, 1987.

Minister of State for Petroleum and Natural Resources Chaudhry Nisar Ali Khan told a Press conference here on Sunday that the Oil and Gas Development Corporation (OGDC) had made a gas condensate discovery at Lashari

South, 27 kilometres from Hyderabad.

Lashari South Well No. 1, spudded on March 23 last, has a potential of 530 barrels of condensate (oil) and 7.6 million cubic feet of gas per day, the minister disclosed.

The discovery follows the earlier two made during the year 1986-87 by the OGDC at Ghotana and Chak Naurang. It is also the third discovery in Sanghar and Wassi concession areas located in Hyderabad, Sanghar and Mirpurkhas districts, the minister said and added that the earlier two finds at Tando Alam and Ghotana fields were both on production.

The movement of the rig to one o such sites namely Thora had already been started, where drilling of the first explaratory well was expected to commence by June 15, he said. The Government, Chaudhry Nisar added, had given a special grant of Rs. 15 million to drill Thora exploratory well during the current financial year.

To a question regarding off-shore drilling, the minister said that an agreement with Occidental was about to be finalised. Another company has applied for drilling of Makran coast.

The Minister announced that OGDC has been assigned the task of developing the Dhodak oil wells. Within three years the Dhodak production will be connected with the main supply lines.

To accelerate the pace of oil exploration and development of the reservoirs already struck, the Prime Minister has given the ministry a green signal to prepare a policy for rapid development of the natural resources of oil, gas and other minerals.

(Courtesy APP June 8, 1987)

FIBRE OPTICS

A NEW ERA IN COMMUNICATION

BY

Azim Kidwai

On the heels of the sweeping electronic upheaval brought about by transistor and micro-electronics in the last two decades, yet another communication explosion is round the corner.

Beginning with nineties, it is going to be the lightwave era and perhaps radiowaves will bow out. The light pulses instead of electrical signals seem to be work-horse of future information networks.

Two new technologies -- fibre

optics and information encoded in Digital form — have fused together to produce extraordinary possibilities. The marriage of computer with its digital language in these communication links, has generated a potential that looks almost limitless.

The picture in all its consequences is staggering. Most long-established traditions may be swept away. It will be new order in this world, science dictating terms whether the politicians want it or not.

LIGHTWAVE ERA

In such a lightwave era, as soon as one would pick up a telephone or switch on a computer terminal on his telephone line, he would be tapping on a vast global linkup. Images in three dimensions, a blend of laser optics and computers would be flashing in one's home and bringing political debates and sport events from across the globe.

There is little likelihood of any Big Brother surviving in such a climate. Human conditions will change drastically.

A personal experience that has some parallel reminds us how even the tiny transistor set had brought about a metamorphosis in a poor underdeveloped country like Pakistan that has seen only oligarchy for about 30 years in its short life of 40 years.

Doing a research project we travelled radially from Hyderabad for about 150 kilometers in all directions in the late fifties when the transistor had not appeared on the scene in Pakistan. In the process, we could talk to the 'hari' every couple of hours and sip his tea in some wayside 'tea-house' under a straw-roof. It was no less than a shock to find the 'hari' of Sind that poor and ignorant.

But then we had an occasion to travel again by road from Karachi to Khairpur in early seventies. This time the same 'hari' was merrily listening to his transistor radio, tunning in BBC and All India Radio for news and music. He was a changed being arguing on national affairs that looked simply amasing.

So much information in rural folk's hand, the Big Brother (the feudal lord and the Pir) had been cut to size even though the 'hari' was still so poor. He was no longer the slave that he was in the 1950s as the condition of his mind and his thought processes had changed. One felt that he couldn't be kept in chains for long.

Fibre optics as the mode of transmission and digital pulses of light as the code of information, the new developments are bigger by many orders of magnitude than the transistor.

The lay person in Pakistan is hardly aware of fibre optics which is only 8 years old, the first live telephone messages on fibre cable were sent only in 1979.

Human hair-like thin strands of pure glass are the physical elements, call them "cables", to carry information at fantastic rates and speeds. A one centimetre thick "cable" comprising such thin strands of glass can carry a quarter million telephone conversations simultaneously.

Glass is fragile. So the strands are encased in sturdy plastic casing.

Because the fibre optics "cable" can carry information hundred times more than an ordinary copper-made telecommunication cable of the same size and glass is a cheaper stuff, the cost is cut down by a similar factor.

A recent article in a technical journal claimed the limit as four billion bits of information that can be transmitted in a second in an operating optical fibre circuit. That is almost the volume of information in a 30-Volume Encyclopaedia Britannica.

The capacity can be increased 5-fold the present arrangements.

Since it is light and not electrical signals transmitting information there is no interference, no noise to ride over the signal.

Information converted into light pulses, these pulses travel inside the fibre glass at the speed of light. The light doesn't go out as it is contained in the fibre by internal reflections. Thus voices, pictures can be transported at a rate of millions of words per minute — thousand million bits of information per second.

Some light does get lost on the way. For that, it is reinforced through repeater stations (amplifying systems) installed at suitable distances.

GLOBAL NETWORK

The range of transmission is global. Though fibre optics cables are at present connecting cities in the USA and Japan fibre cables are now being laid across the Pacific and the Atlantic to have global network soon.

What is digital technology that fits in so well in this glass fibre scheme?

When you tune in a radio today and get the voice or the melody that was being carried on the shoulders of radiowaves, you are receiving things on what scientists call an analogue system. Same is the case with your TV programmes. Varying electronic radiowaves that match the voice or the picture contours is what you are getting. Your loudspeaker or the TV picture tube finally transorms the matching electrical waveform back into soundwaves or picture bits.

Digital is totally different from analogue. It is the language of only two numbers — zero and one. As in a computer, the digital language is a code of zero and one, enacted by "on", "off" switches. Through fast electronic switchs, zero and one (on — off) operation takes place millions of times

in a second.

The words, sounds and pictures are transformed in strings of code made of zero and one.

The strong point of fibre glass is that it is a very suitable means for digital communication, lasers and diodes being the main implements in its receiving and transmitting systems.

Marriage between computer and digital mode of communications is very recent. In the beginning satellites using radiowaves, were the main media for global information system based on digital technology. Such pathways built through space though are not only expensive, there are as well some technical flaws in them.

The satellite in orbit being 36,000 km up, the total path for the radiowaves is over 72,000km. Radiowaves though travelling at the velocity of light take one-fourth of a second for the round trip in such space journey. That is a significant loss of time in systems where millionth of a second is reckoned with. In conversation that loss matters.

The glass fibre cables run straight over the globe, and no such problem arises in a few thousand kilometre journey of light.

The speed records are thus being rewritten with the advent of fibre optics which goes along better with the fast rates now in demand. More so it will be in the nineties and at the dawn of the 21st century when speeds in communication to carry big volumes of information in seconds will be an imperative.

(Courtesy Dawn May 8, 1987)

CONSTRUCTION INDUSTRY

UNEQUAL FOREIGN-LOCAL COMPETITION

BY

Babar Ayaz

PROMPTED by international lending agencies, the top bureaucracy at home is making unequals compete for class one construction contracts.

The trick of the game is to make pre-qualification conditions so difficult that only the leading international firms can compete and local bidders are knocked out at the preliminary stage.

As a result of this policy, which is tied with the project loans arranged by government officials even leading

construction contractors are finding it hard to enter the competition for some of the multi-million projects.

Out of six major projects, which are at one stage or another of allocation, three have already been awarded to international companies.

"Even the remaining three projects are likely to go to foreign companies because the native entrepreneurs cannot compete with the international Goliaths", one contractor observed.

Though tenders for three projects — the Gwadar, Korangi, and Karachi fish harbour — have not been awarded yet, local contractors feel the contract would be scooped up by the foreign companies.

Since these projects involve Asian Development Bank loans the government has called for international tenders.

Official sources said local contractors should not grudge the allocation of tenders to foreign companies because they are given up to 7½ per cent preference over the foreign bids. "They should be able to compete with foreign companies on the basis of this price edge," a foreign-trained official said.

The positive aspect of the new prequalification condition is that it has linked the 7½ per cent preference with the level of local equity in a construction firm.

But the contractors are not satisfied with this advantage. One of them alleged that "the new pre-qualification terms were made strict to keep us out of bidding".

Explaining, he said that in the first place the government projects were too big in value. In the past big project were split into manageable package, but now the tactic is to make the package so big that local contractors were kept out and the money ultimately flowed back to the donor countries' contractors.

"This does not mean we cannot handle big contracts", he hastened to add "but the problem is that the guarantees asked for in this regard are beyond the reach of Pakistani contractors."

CONDITIONS

In most of the contracts, the pre-qualificcation terms now require the successful bidder to provide performance guarantee in the shape of bank guarantee. It is equivalent to 15 per cent of the contract or (at bidder's option) a performance bond equivalent to an amount of 30 per cent of the contract price.

Previously, the peformance guarantee was also acceptable in the form of insurance guarantees, but the demand for a bank guarantee has made it difficult for local entrepreneurs to enter the field.

Taking the National Highways N-5 project as a case study where each section's project was around $40 million

(around Rs 690 million) it is pointed out that the 15 per cent performance guarantee would mean blocking around Rs 103 million in the form of collaterals and 25 per cent in cash.

None of the local companies has the liquidity to undertake such a venture. Even if somebody makes an effort by pooling all the resources, one contractor said, he would not be able to take more than one project at a time.

Another revision in the pre-qualification terms, which is irritating the local contractors is the change in the refund rules of retention money.

Contractors used to get the retention money refunded before the maintenance period expiry by depositing insurance bonds of equal amount. Under the new rules government agencies want to retain the actual amount and the insurance bonds are not acceptable.

Local contractors feel there is a deliberate attempt by the multilateral lending agencies to bar them from bidding, on technical grounds. This problem becomes more acute as the banks and financial institutions are not recognising the construction industry as an industry with the result that they remain deprived of many facilities. Banks are dealing with contractors on case to case basis.

Official circles are of the view that they cannot give these tenders to firms which cannot assure them of their technical and financial health.

The contractors contest this. They say that they have been undertaking huge construction jobs for the government in the past and have sufficiently proved their ability to handle them.

The basic problem, a contractor said, was that nobody was willing to realise that local firms cannot compete with international giants in liquidity.

"What we are asking for is that the packages should be smallers," a contractor explained, "so that more and more local contractors, qualified as class one, could take part in the tenders," and the financial terms should be easy."

INDUSTRY

"Pakistani contractors," they said, "had grown with major projects like Tarbela Dam and Pakistan Steel. Step-by-step, they can make the country self-sufficient in this regard."

The same contractors have been obtaining some foreign contracts also outbidding other countries. Some of the Middle East and Sri Lankan projects are clear example of their ability.

For the officials who draw the pre-qualification terms for projects financed by the World Bank and other institutions the major problem is that they have to listen to the donors.

"It is typical of developing countries which become dependent on these agencies, which promote the interests of international capital in its expansion in

the underdeveloped world," one observer commented.

However, the reponsibility of protecting the country from exploitation is with the bureaucracy which must safeguard the national interest.

Since each project is negotiated separately, they are expected to do the hard bargaining where loans are required and to learn to avoid the temptations of loans as much as possible, which of course, is a tall order.

The woes of local industrialists businessmen, when it comes to ask for a fair competition with the multinational corporation or on the utilisation of tied project loans, thus remain unredressed.

(Courtesy Dawn May 16–22, 19

PAKISTAN'S FIRST SOLAR CAR

Rashid Ali Khan

PAKISTAN is one of the countries that have been blessed with a tremendous amount of sunlight as the sun shines here all the year round.

Apart from several benefits, this provides us with an opportunity to obtain solar energy to meet our ever increasing (energy) requirements.

However, unfortunately, for want of expertise and planned as well as large-scale efforts we have still not been able to fully avail ourselves of this God-given source.

Thanks to some researchers and scientists who have been endeavouring to tap this valuable source which is, at present, almost going unutilised.

An outcome of these efforts is invention of the first solar car in Pa tan which is the work of three talen final year mechanical department dents of the NED University of E neering and Technology, Karachi.

At present, the total cost of vehicle comes to about Rs 80,0 which was mainly financed by department and some other commer organisations.

Launched on June 6, the sn and sleek single-seater car had ear gone through several tests conduc by the team of its inventors' S Attique Shafaat, Syed Mohammad B Tirmizi and Syed Sirajul Matin.

The three-wheeler, weighing 565 pounds, is 130 inches in length and 75 inches in width with a height of 52 inches.

Of the wheels, the rear one is of a motorcycle while the remaining two are the reinforced wheels of children's sports cycle.

The body is made up of fibre glass and the structure is of thin steel pipe.

It is fitted with ten panels of solar energy (British petroleum solar panel) with a storage capacity for three hours at a speed of 24 km per hour.

The solar panels convert light directly into D C current and the energy thus produced is transmitted into the electronic control unit – the brain of the car fitted beside the seat.

When the car is moving, energy is consumed by the motor and when the vehicle is stationary, energy is stored in a battery installed in the rear of the car.

Its mechanism is a bit different from that of the other cars; its gear is applied first, then the clutch is pressed to start the vehicle which is fitted with a single horse power (D.C.) motor.

According to its inventor, Sye Attique Shafaat, after modification and improvements in the time to com the seating as well as the speed of th solar car can be enhanced and the cos lowered.

He said there was an ample scop for introducing such type of cars i the country, which will enable us t manufacture them locally besides savin the precious fuel by turning to the sola energy.

Therefore, the invention of the so lar car can be described as a major breal through. Thanks mainly to Dr Jam Ahmed Khan, the present Vice-Chance lor and the then head of the NED mechanical department, who had assi ned the project to the boys toward the middle of 1985 and guided them a the way.

The project (the solar car) woul soon be submitted at the (university mechanical) department and then would rest with the sponsors to mobilis these talented young men to carry fo ward their work for the greater good c the country and its people.

(Courtesy Dawn June 6, 1987