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# CEMENT DEVELOPMENT AND RESEARCH CENTRE

DP/TUR/72/084

TURKEY

Technical report:

PREVENTIVE AND GENERAL MAINTENANCE OF CEMENT MAKING EQUIPMENT

Prepared for the Government of Turkey by the United Nations Industrial Development Organization, executing agency for the United Nations Development Programme

United Nations Industrial Development Organization

id. 77-709

United Nations Development Programme

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Technical report: Preventive and general maintenance of cement making equipment

Prepared for the Government of Turkey
by the United Nations Industrial Development Organisation,
executing agency for the United Nations Development Programme

Based on the work of Alfred Madsen, cement consultant

United Nations Industrial Development Organisation
Vienna, 1977

## Explanatory notes

References to dollars ($) are to United States dollars, unless otherwise stated.

Besides the common abbreviations, symbols and terms, the following have been used in this report:

DIN Deutsche Industrie-norm

TCIC Turkish Cement Industry Corporation

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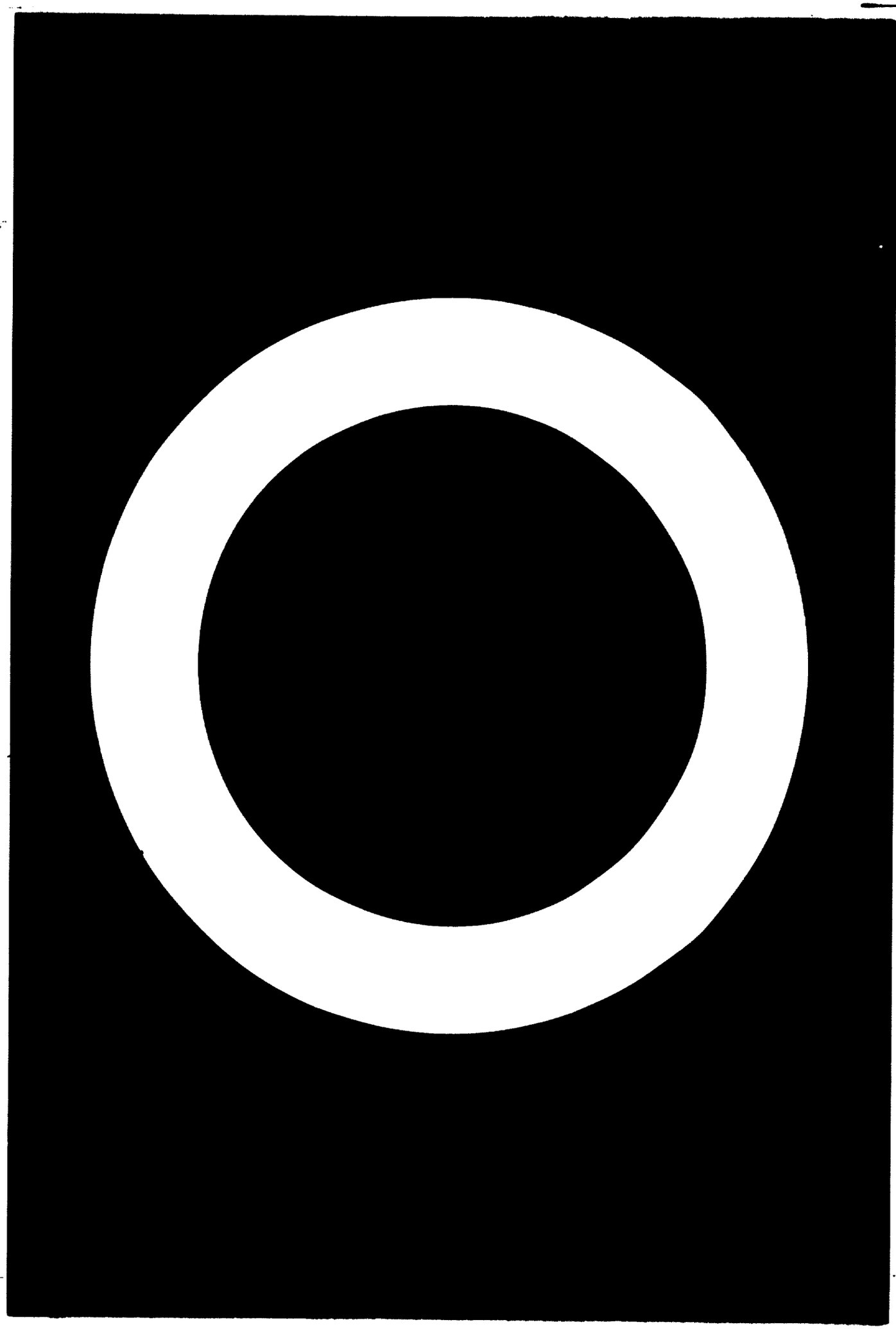
## ABSTRACT

At the request of the Government of Turkey to the United Nations Development Programme (UNDP), an expert in preventive and general maintenance of cement-making equipment was sent on a one-month mission to advise the Cement Development and Research Centre on setting up systems of preventive maintenance. The mission was part of the overall project "Cement Development and Research Centre" (DP/TUR/72/034) that the United Nations Industrial Development Organization (UNIDO) is carrying out as executing agency for UNDP. The mission began on 28 November 1976 and ended on 29 December 1976. The expert was attached to the Centre, the status of which he also evaluated.

During the mission the expert visited two main cement plants, where he discussed problems of maintenance of equipment and also analysed mechanical problems.

On finding that the plants had no facility registers, which are essential to a system of preventive maintenance, he outlined the steps necessary for establishing such a register.



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## INTRODUCTION

The Turkish Cement Industry Corporation (Türkiye Cimento Sanayii - TCS) plays a leading role in the cement industry in Turkey and has various plants throughout the country. The rapid growth of cement production resulting from an ever-increasing demand experienced up to now and projected for the future has led to the introduction of large, modern plants designed and built abroad, most of which are being installed and started-up initially under the supervision of foreign specialists.

This expansion of capacity and technological increase have not been accompanied by equivalent progress in training an adequate number of local technicians in the most advanced methods of use and maintenance of the facilities. As a consequence, production has often been undependable, and the installations have deteriorated when the factories have been taken over by local personnel.

To improve this situation, the Government of Turkey requested the assistance of the United Nations Development Programme (UNDP) for the Turkish cement industry. A comprehensive project was worked out in co-operation with TCS. UNIDO is carrying out this project (DP/TUR/72/034)as executing agency for UNDP. UNIDO is currently assisting Turkish counterparts in establishing a cement development and research centre that will have as its primary objective the training of local engineers in various fields of operation, process control and plant maintenance and the introduction of the most modern systems and equipment. A full-time UNIDO project co-ordinator and UNIDO experts on short-term missions provide supporting services for the project.

The construction of impressive facilities in the outskirts of Ankara, which started in April 1976, is now in its last stages. According to schedule, construction is expected to be finished in 1977, while a full-scale, sophisticated range of process-control equipment is ready to be installed, thanks to bilateral aid.

As part of the overall project, an expert in preventive and general maintenance of cement-making equipment was sent on a one-month mission to advise the Cement Development and Research Centre on how to set up a system of preventive maintenance. The mission began on 28 November and ended on 29 December 1976. The expert was attached to the Centre.

# I. FINDINGS

## Visits to plants

On an earlier mission in 1973 the expert visited two of the four government owned or controlled cement plants (at Adana and Baştaş). On this mission he visited Afyon and the plants at Çorum to familiarize himself with the systems and procedure used for planned maintenance. At both plants he was asked to give advice on mechanical problems.

## Cement plant at Afyon

The expert discussed with plant officials, including the chief engineer of the mechanical section, the organization of the maintenance service of the plant. The expert found that, taking everything into consideration, the planning of the maintenance, week by week, was apparently functioning smoothly, as described below.

The chief engineer makes rounds section by section, so planned that all sections are checked once a week. The chief engineer presents his suggestions for repair work to a committee representing all interested parties throughout the plant, chaired by the works manager, and a repair programme is agreed upon. After the repair has been made, information on what has been done is entered on a report card, one for each machine, and kept for the record. This card represents the history of repairs or changes of every unit in the plant.

The expert suggested how the information could be recorded more conveniently for future planning of preventive and general maintenance.

The filing of drawings, both originals and drawings coming from suppliers of equipment, is in order, although the memory of the staff is depended upon a little too much. The expert was asked to look into the matter of premature wear on the rotors and the housing of Fuller pumps used for the transport of cement.

The rotors are repaired at the workshop, but greater care should be taken to have the surface of the runner blades kept more smooth after the welding. With a rough surface the stream of cement will have a tendency to create even more turbulence and thereby add to the unavoidably heavy wear. The state of the live tires and rollers on the cement kilns, especially the old Fives Lille, was discussed at length. The presence of thousands and thousands of pigeons

under the roof over the kilns is, in the expert's opinion, the main reason for the very bad state of the surface of the live tires and the rollers. The excrement falling from these thousands of pigeons is sticky and acid and contains many sand corns. Together with the moisture from the water cooling or lubrication of the live tires on the kiln shell and between tire and rollers, this excrement forms an abrasive substance, which is poison for a polished surface of tires and rollers; and any correct adjustment of the rollers in relation to the tire to take up the horizontal forces is impossible.

The staff know how to adjust the rollers to utilize the "shear effect" to take up the horizontal forces due to 4% inclination of the kiln, but can do nothing until the damage already done has been repaired and steps taken to avoid future damage. The expert recommended that wooden or sheet-metal roofing be placed immediately over the tires and rollers, protecting them from droppings. After this, all bearings, rollers etc. will have to be thoroughly cleaned.

A complete realignment of the whole kiln will have to be planned, based on all the valuable material and calculations already carried out some years ago by the staff. Some of the rollers have suffered damage beyond repair because they have been damaged from excessive "shearing" owing to surface damage as explained above. They will have to be replaced. Others will have to be machined (resurfaced). A lathe for this kind of work should be available at one or more of the government-owned cement plants.

Finally, the expert pointed out to the staff at Afyon certain minor details regarding routine inspections of the roller bearings to ensure that they are carrying the horizontal forces from the kiln correctly. The supplier of the kiln has been asked to comment on the problems regarding the tires and rollers on the kilns, but has not replied.

A Turkish mechanical engineer should be prepared for the special job of checking existing kilns inside the government owned and controlled cement plants and for adjusting such kilns. A visit to any well-known company making cement machinery (kilns) would be of great value to such an engineer. It would give him the theoretical knowledge of the way of recalculating all the main measurements when, for instance, rollers have been machined or resurfaced. Any change of roller dimensions (diameter) will change all main distances from kiln centre line to roller centre line etc. Also, he should

be given a chance to study the methods of checking kiln performance by the lead thread method and the use of the shell test method (ovality). Responsible kiln manufacturers should be interested in such a training programme, which would guarantee correct handling of their equipment, which they have either supplied or will supply in the future.

As for maintenance staff during the night shift, it is important to have at least one higher-level mechanic on hand to judge the situation correctly, to take the right steps, and also to report and record in the files for future reference.

Cement plant at Çorum

Maintenance

The maintenance programming has been based on a report made by a staff member indicating his findings regarding breakdowns and the malfunctioning of machinery units and equipment. A certain maintenance planning has been carried out based on this report, but no real feedback and filing of information to a facility register is taking place. Maintenance at the Çorum plant may be classified as emergency, or breakdown, maintenance, with no planned maintenance taking place. The principles of preventive maintenance were discussed very thoroughly and all the staff members taking part in the meetings, chaired by the director, fully agreed on the principles laid down. The conclusion was reached that the very first step in planning was to create a facility register, i.e. an inventory of the equipment.

The importance and value of such a facility register was discussed at length; and the expert examined and commented on the existing filing systems for drawings, instructions for running of the equipment and maintenance directions. The expert found, and all involved parties agreed, that too much depended on the memories of the filing and executive staff. Much of the vital information was distributed among some of those dealing with the equipment in question, but not directly accessible to others. This system functions perfectly well as long as there are no abrupt changes in staff.

The expert pointed out the risk involved, in case of fire, in not having a complete set of copies of all drawings in another building or at headquarters in Ankara.

The importance of a certain uniformity in classifications (code numbers) at all the cement plants was discussed. Existing code number systems should, of course, be respected and a modus vivendi among the plants should be aimed at.

Kiln shell

The expert was asked to examine the kiln (4.2 x 60-m Humbolt kiln).

The kiln was started some 5 years ago and has had several "accidents" with "red spots" or "red ring", and the shell has been badly damaged to the point that the kiln motor load varies at one rotation roughly plus or minus 50%. Apparently experience with the smaller Fives Lilles kiln, 2.8 m in diameter, led to the belief that the 4.2-m diameter kiln could, without lasting damage, take the same abuse as the small kiln, that is, the kiln could be run with a burned-out brick lining.

Modern large-diameter kilns have to be watched very carefully. The temperature should never rise above 350° - 400°C for any length of time. If great care is taken now to control the temperature of the shell constantly, revising the raw mix to avoid "eating" the kiln-lining prematurely, improving the burner flame (coal-oil mixed firing) etc. there will be no apparent danger. On the other hand, steps should be taken to replace a section of the kiln soon. For controlling the kiln-shell temperature, a radiation pyrometer, as for instance ARDONOX 7 from Siemens, or a similar one, should immediately be arranged for, either for manual or for automatic use. The process engineer from the Federal Republic of Germany at the plant should be asked to look into the matter of the raw mix and kiln control.

The repairs that have been carried out so far have been done correctly, but the next repair will be a very serious one, which could well be carried out by the local staff but under some kind of expert supervision.

Kiln live tire at outlet end (base I)

Base plate I, for unknown reasons, seems to have been wrongly erected; at least that is the explanation given by the local staff. The whole base frame should have been 100-200 mm closer to base II (out of three). The result is that the live tire (the ring) rests only partly on the roller, which causes damage to both ring and roller. The expert gave instructions on how to deal

with the situation and explained what preoautions would have to be taken if it was decided to repair the kiln shell. When that was done, the kiln should simply be lengthened accordingly.

Kiln rollers Humbolt kiln

The six kiln rollers operate in extremely dirty conditions, and efforts should be taken to improve the situation before the rollers are irreparably damaged. The expert showed how easily it could be done, and the staff saw the importance of changes suggested. (For correct placement of graphite scrapers on all rollers at the side rotating upward, see cover picture on Cement-Kalk-Gips, No. 3, March 1976).

Adjustment of kiln rollers

The expert was asked to look at the Fives Lilles kiln (2.28 x 90 m), live tires and rollers. Some of the tires and rollers are in very bad shape, mostly because of wrong adjustment of the rollers, but also because of droppings from pigeons under the roof of the kiln house.

The expert gave a detailed lecture on the technology of kiln roller alignment and emphasized the importance of constantly controlling the functioning of the rollers.

A booklet written by a İbrahim Onuk, a staff member at the TCIC office, titled "Adjustment of Rotary Kilns"(Döner Firin Ayari) should be studied by the mechanics in charge of the kilns at the plants. The expert had a chance to discuss the book with the author. The expert advised how the live ring (tire) could be machined in place. The rollers will have to be taken down for machining. A lathe for this kind of work is not available at the Çorum Plant.

Combined coal and oil firing of 4.2 x 60-m kiln

The Humbolt kiln has been fired for some time exclusively with coal, but coal of a very low calorific value and with a large amount of impurities. There is thus good reason for using the existing equipment for combined oil and coal firing.

When coal only is used, the burner is kept very far back, in fact, outside the kiln outlet. The result is that the point where the fuel should ignite, just after the burner nozzle, is in a relatively cool atmosphere, and a long "cold" flame sweeps down through the kiln and no "burning zone" is created.

It was decided to make a trial run with the existing small stock of heavy fuel oil, even though it was known that several other factors, such as raw mix, functioning of the cooler, cleaning of the system for preheating the fuel oil, correction and adjustment of instruments and repair of the isolation of the burner pipe would hamper the trial. The expert again called attention to the great risk of damaging the kiln shell under such trials without having the radiation pyrometer for temperature control at hand.

Damage of motor shaft (electric Motor for Fives Lilles raw mill)

The mill motor (740 rev/min, about 800 HP) shaft was sheared off at the coupling side. The expert was asked to inspect the accident and to give his opinion as to whether it would be possible to repair the shaft. After inspection, the expert concluded that a new shaft would have to be obtained.

The damage to the shaft might have occurred a long time ago, owing to malalignment of the motor in relation to the gear box.

Equipment for Shell-test

The expert inspected the equipment for "Shell test" control of the Humbolt kiln and advised TCIC to get in touch with the original supplier, InterCemex, Sweden, to obtain the instructions for the use of this special equipment. Some parts are missing and will have to be purchased if the equipment is to be used. The "Shell test" method is very useful for controlling and correcting the damage.

Overhead running crane for raw material and clinker storage, power collectors

The expert investigated the excessive wear of collector rollers used with the storage cranes and gave advice. A stock of old collector-carbon could be adapted for this use.

Humbolt cement mill

In the two-chamber Humbolt cement mill, an undesirable separation of small and big cylpebs is taking place in the second chamber. The expert inspected the mill and discussed the question with the staff and the foremen. The problem may be solved, but only after a complete analysis of the mill performance and actual mill charge, which will be carried out by the process engineer from the Federal Republic of Germany.

Cement storage (siles) and packing plant

Asked about the possibility of taking advantage of the packing machines under the cement silo, which is to be demolished, the expert gave his advice on how to proceed. If the conus (the lower part of the silo) can be kept intact, cement can be drawn from the next silo, and the bottom of the silo to be demolished can be used as a service hopper for one or two of the existing packing machines.

The expert was later informed by telephone that further trials with oil-coal firing had been successful, giving higher production and better fuel economy, but that further adjustments and corrections would be necessary.

Preventive and general maintenance

The importance of maintenance is obvious, and much has been written on the subject.[1/] To be able to plan any preventive or general maintenance in a cement plant, the first step is always to compile a comprehensive facility register that is, an inventory of all plant equipment and buildings that form part of the installations on which maintenance is to be carried out. After visits to the plants and after talks with the executive staff of TCIC in Ankara, the expert found no such facility registers at any of the government-controlled plants.

Filing of drawings, instructions, lubrication charts, maintenance instructions etc. are substantial parts of the facility register, and consequently the filing of these documents should be correctly organized. In some plants there was a certain order, but too much depended on the memory of staff members or filing clerks.

It is therefore useless to suggest any actual planning of preventive and general maintenance until these registers are well organized and have been functioning for a reasonable time.

At the plants visited, maintenance planning is taking place in one way or another with good results, but at all plants the staff agreed that an effective facility register was badly needed, and the expert consequently concentrated his efforts on this short mission on advising on how to create the register as background for any future attempts to organize preventive and general maintenance.

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1/See in particular Introduction to Maintenance Planning in Manufacturing Establishments, United Nations publication, Sales No. 75.II.B.6.

Establishment of a facility register

The facility register is the very heart of the planned maintenance system. In some plants maintenance control is the sole purpose of the register; in others the cards provide varying degrees of financial information as well, so that the depreciation of the plant and additions to the plant may be recorded and a continuous record made of the standing value of the plant. Any system has to be appropriate, i.e. suitable for the actual situation, but always with an eye on possible improvements. It should be simple and flexible. It often consists of a simple, single-drawer file cabinet that contains the whole system.

It has been the expert's experience again and again that systems are introduced, that even in developed countries have proved too sophisticated to have any practical value.

Use of very complex numbering systems for the equipment (code system) with multidigital numbers, difficult to remember in the everyday work and with a great chance that human errors will be made, should be avoided. These multi-digital code numbers are often needed when a preventive maintenance system is based on the use of computerized data processing, but should be avoided in simple and flexible systems. Making the systems too "rigid"; demanding too much paperwork, control and double control, cards and copies from good foremen, mechanics and maintenance personnel with plenty of work to do, but very often with problems in writing and reading, is dangerous. Planning needs paperwork, but it has to be organized appropriately.

A facility register should first of all have a card for each machine giving all the information needed about the equipment or unit. The type of information placed on these cards will depend on the requirements of the system adopted for the particular plant.

When organizing the facility register, one has to distinguish between organizing a register for a new plant and organizing one for a plant that has been running for several years. When the facility register is organized for a new plant, the information going into the files should be drawn from the information and experience, including experience regarding the need for spare parts, lubrication etc. that the supplier of the equipment should pass on to the customer. The establishment of a new plant in fact provides a rare opportunity to design and introduce an appropriate maintenance system.

When the facility register is organized for a plant already operating, the information needed comes from existing files and very often from the memory of the personnel. Consequently it is much more difficult to set up a register, and the chance of making mistakes and of including misleading information is greater.

A facility register should contain all information pertinent to the unit in question, including:

(a) Name of supplier, serial number and other details of the unit, a written description of the item and details of ancillary equipment, and the names of suppliers for reference purposes;

(b) Spare parts recommended, existing spare parts and where to be found;

(c) Complete history of the unit from construction and erection, with detailed history of repairs carried out, reasons for repairs, date of repairs;

(d) Where to find supplier's instructions and/or pamphlets, drawings etc.;

(e) Existing stock of spare parts, information on minimum stock of spare parts, either according to supplier's experience or/and according to experience during the time the unit or machine has been in operation.

Schedules then have to be prepared, listing the requirements of each item shown in the facility register as far as routine maintenance is concerned.

A facility register should obviously be kept simple. It must be appropriate to the circumstances in the country in which it is organized. Also costs have to be considered.

Suggestions for a filing system

Each machine is assigned a number, independent of any serial or other number given by the supplier. The number should be simple and short to lessen the chance of error. Also when the machines are marked and identified, numbers should be as simple as possible. The first one (or two) digits should indicate the section inside the plant (see annex II) and the following digits should just be numbers in succession, without any special consideration of material flow, location and the like.

In principle, each machine will have one hanging file chart, with the number on it, containing all information regarding the machine. When for physical reasons one chart is insufficient, two or more may be added, all carrying the same machine number with added prefix A.B.C..... or I.II.III..... The

charts should also contain any sketches or other records made by the staff during the lifetime of the machine or unit, thereby giving a complete history of this machine or unit for future reference, when planned (preventive) maintenance is implemented.

All drawings received from suppliers of equipment - construction drawings, infrastructural drawings - should be filed together. They are all folded to DIN A-4 size (21 x 29.5 cm) and given numbers in simple sequence. A drawing from Humbolt showing some element of the kiln has a Humbolt number and now receives a Çorum or Afyon or Adana number, for instance Ç (for Çorum) 4 (kiln section) 632 (if 632 happens to be the next free number). A card size DIN A-6 or similar will have the Çorum number Ç-4-632 in one upper corner and the Humbolt number in the other upper corner, and the rest of the card space will give the title of the drawings and any changes or remarks concerning this drawing, such as dates of receipt and information regarding the whereabouts of the drawing, if it has been taken out for use somewhere (name of person who has taken out the drawing, date etc..).

In a registration book under "Humbolt drawings", the Humbolt numbers are registered with their corresponding Çorum number. The next drawing coming in may be, for example, "Schenck" "raw-mill feeder". This drawing will receive the Çorum number C-3-633 and be filed next to number 632 (the Humbolt); a card for the drawing is established and registered in the registration book under "Schenck" drawings. Irrespective of the kind of drawing, whether machinery, assembly, layout, concrete foundation or building construction, the drawings are filed in this way and given plant numbers in succession.

Original drawings, made in the plant drafting room, receive the next free number in the number succession, and a copy is folded to size A-4 and filed, whereas the original is kept in a flat drawer in another building to diminish the fire hazard and risk of losing the originals. All instructions, spare-part lists, maintenance instructions, directions for using the equipment etc., always have some kind of numbering from the supplier. These numbers are registered on an A-6 card and given a plant number of the same number succession as the drawings. Example: a "Schenck" feeder direction book may have number Ç (Çorum) 3 (raw mill) 634, but will be filed for practical purposes in a separate drawer from the drawings. Consequently, in the drawers containing the drawings some Çorum numbers may be missing. These can be found in the other filing cabinets. (Short instructions may for practical reasons be kept (filed) in the chart for the respective machine or unit.)

Summary

Each machine or unit has a simple number irrespective of its place in the production line or geographic location inside the plant site. Each drawing has a plant number irrespective of its origin. These numbers are consecutive inside the plant irrespective of the production section they belong to. Each drawing has a card giving the history of the drawing (instruction, direction, charts etc.) A registration book serves as a link (key) between number of origin and the given plant number.

Headquarters in Ankara should have a copy of all registration numbers and possibly of all original drawings of importance produced at the plants (spare parts for local production etc.) Headquarters officers can thereby keep track of the state of the equipment and maintenance.

After the facility registers have been functioning according to the accepted methodology for some years, information they contain can be used to plan preventive maintenance. Repairs and replacement of spare parts and general maintenance will have to be planned ahead of any "accidents" to avoid breakdowns, which may cause downtime, not only of one machine but also of all other machines and sections, depending on the machine. When a unit has to be repaired, plans should be made to carry out other maintenance on equipment related to the unit at the same time.

## Evaluation of project "Cement Development and Research Centre" 2/

The project activities have been combined in line with the revised project's long-term and immediate objectives, which are:

Assistance in establishing the Cement Development and Research Centre in Ankara

Assistance in improving the manufacturing process

The whole project will cost $4 million, of which $2.1 million is the counterpart's contribution; the rest is being covered by multilateral and bilateral assistance.

### Premises of the centre

The setting up of the Centre is progressing well, as scheduled. The draft project document from 1973 forecast 5.5 years for this task, and all facts indicate that it will be achieved in 6 or 6.5 years. It means that in the year 1980 the centre should be fully equipped and staffed with well-trained professionals; later no foreign technical assistance should be needed.

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2/ For the reports of other experts, see DP/ID/SER.A/70, DP/ID/SER.A/81, DP/ID/SER.A/88 and UNIDO/IOD.85.

The Centre itself is still accommodated within the facilities of the main office of the State Cement Company (CISAN), but the building of the research centre complex outside Ankara, which the expert visited, is proceeding according to expectations, and apparently it should be possible to start using some of the premises by the end of 1977 or beginning of 1978.

Process control equipment laboratory

Training courses have been arranged in different factories for daily maintenance of the process control equipment. The mobile clinic, suggested in the draft project document in 1973, has been of value for conducting these courses. The Turkish authorities bought sufficient spare parts for repairing instruments. Owing to this assistance the fuel-oil consumption in the cement plants is decreasing.

Raw material laboratory

Bilateral help from the Federal Republic of Germany in the way of laboratory equipment and expert assistance for establishing the raw material laboratory of the centre was promised in 1975. In 1976, an expert from the Federal Republic of Germany visited Ankara and gave his advice regarding details of the equipment to assure correct installations. In January 1977, three Turkish engineers started their training in the University of Aachen for 8 months. In 1978, the same course will start for another four engineers.

According to the project co-ordinator, the first parts of the specified equipment have been ordered. Possibly a second part of the equipment will be ordered in 1978. When the Turkish engineers return from their training in Aachen and the equipment has arrived, two experts will be fielded.

Concrete technology laboratory

Talks are going on between the Turkish authorities and the Governments of Denmark and Japan about setting up the concrete technology laboratory.

Documentation centre

The centre's documentation section will be set up, too. The needed equipment will be purchased by UNIDO, but the Turkish counterpart agency will share nearly 100% of the cost.

Process control laboratory

The process control technology laboratory will be the first unit of the centre to be equipped with sophisticated instruments. Training of its staff is going on successfully.

Summary

These accomplishments are the result of the genuine interest of the Turkish authorities in this unit. Consequently, UNIDO assistance was and is mainly for the creation of the Centre.

This project is a very good example of how UNIDO can stimulate public and private enterprises for a successful project, attracting bilateral funds as well. The project's implementation is highly satisfactory.

## II. RECOMMENDATION

One or more groups of Turkish staff should be formed to assist the cement plants in organizing facility registers. The groups would work at the various cement plants with a central co-ordinator at headquarters in Ankara.

These groups should work completely independently of the staff at the cement plants; that is, they should take no part in the daily work concerned with production maintenance. In carrying out their duties, these groups would depend on all the information they can gather from existing files, archives, records and to a great extent on the information the production staff can give from their notes, their personal technical records and files and from memory.

All necessary filing cabinets, hanging folders (charts) and stationery, such as printed record cards, journals for listing drawings and instructions, must be on hand.

After the first briefings, by the headquarters co-ordinator of the cement plants, the basic code system should be laid down in such a way as to ensure a certain uniformity among all cement plants.

When all the above-mentioned centralized spade work had been carried out, the work groups would collect the needed information and establish the facility registers.

## Annex I

### JOB DESCRIPTION

| | |
|---|---|
| Post title: | Expert in preventive and general maintenance of cement-making equipment |
| Duration: | One month, with possibility of extension |
| Date required: | As soon as possible |
| Duty station: | Ankara, with travel within the country |
| Duties: | The expert will be attached to the Government of Turkey and will in close co-operation with the project manager and local counterparts advise and assist the cement industry in planning and executing preventive and general maintenance of cement-making equipment.<br><br>The expert will also be expected to prepare a final report, setting out the findings of his mission and his recommendations to the Government on further actions that might be taken. |
| Qualifications: | Mechanical engineer with relevant experience in preventive and general maintenance of cement-making equipment |
| Language: | English |
| Background information: | The first cement plant in Turkey was set up at Darica, Istanbul, in 1911, with an annual capacity of 20,000 tons. This plant was expanded in 1923. Other factories and expansions followed in the period 1923 to 1960 where the installed capacity exceeded 2 million tons per year. Participating in the development and playing a role of growing importance since its establishment in 1953, the Turkish Cement Industry Corporation has a dominating position in the cement industry. The accelerated development of this industry is illustrated by the rapid doubling of both production and consumption. From about 2 million tons in 1960, 4 million was reached in 1966 and 8 million in 1972. The rapid growth of the cement industry in the past, and projected growth in the future, combined with the introduction of large and sophisticated plants with modern process control equipment, has not enabled the cement industry to train sufficient personnel to maintain and use the principles of modern production control in the factories. Process and plants are designed abroad and the factories are erected and commissioned under the supervision of foreign experts. When local personnel continue operation after the guaranteed performance has been reached and plants are taken over, a deteriorating performance has been experienced. In particular, production size and economy have suffered because the instrumentation without proper maintenance has failed to record important production parameters. The results have been large, and incidental variations in production increase both fuel consumption and wear on equipment. |

## Annex II

### Suggested code numbers for sections of cement plants[a]

0 : Buildings, roads, railway sidings etc. (infrastructure)

1 : Quarry and precrushing

2 : Secondary crushing and storage

3 : Preparation of raw mix[b]

4 : Kiln section[c]

5 : Clinker storage and handling

6 : Grinding of clinker to cement[d]

7 : Cement storage and handling dispatch

8 : Power plant or substations, electric motors[e]

9 : Workshop

10 : Spare parts and stores

11 : Laboratory

12 : Water supply

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a/ The numbering of sections can be made in accordance with existing code numbers at the plants, but the goal should be to achieve a certain basic uniformity from plant to plant, approved by headquarters in Ankara;

b/ By raw mix is understood the material going to the kiln section for producing clinker, i.e. either raw slurry or raw meal. The section includes homogenization;

c/ Kiln section includes: possible pelletizing, lepol-grates, predrying (heating) systems (cyclones), calcinators etc. and finish with outlet of clinker cooler and crushing;

d/ This section includes clinker transport to storage, transport of clinker to cement mill, storage and handling of gypsum;

e/ Such a section is necessary when the motors do not form an integral part of the machine.

## FOR FURTHER INFORMATION

Hochdal, O. Preventive maintenance - a system for minimising cost of servicing. Zement-Kalk-Gips (Wiesbaden) 10, October 1976.

Waislehner, G. Preventive maintenance at the Dotternhausen cement works. Zement-Kalk-Gips (Wiesbaden) 10 October 1976.

Brochures issued by supplier companies.

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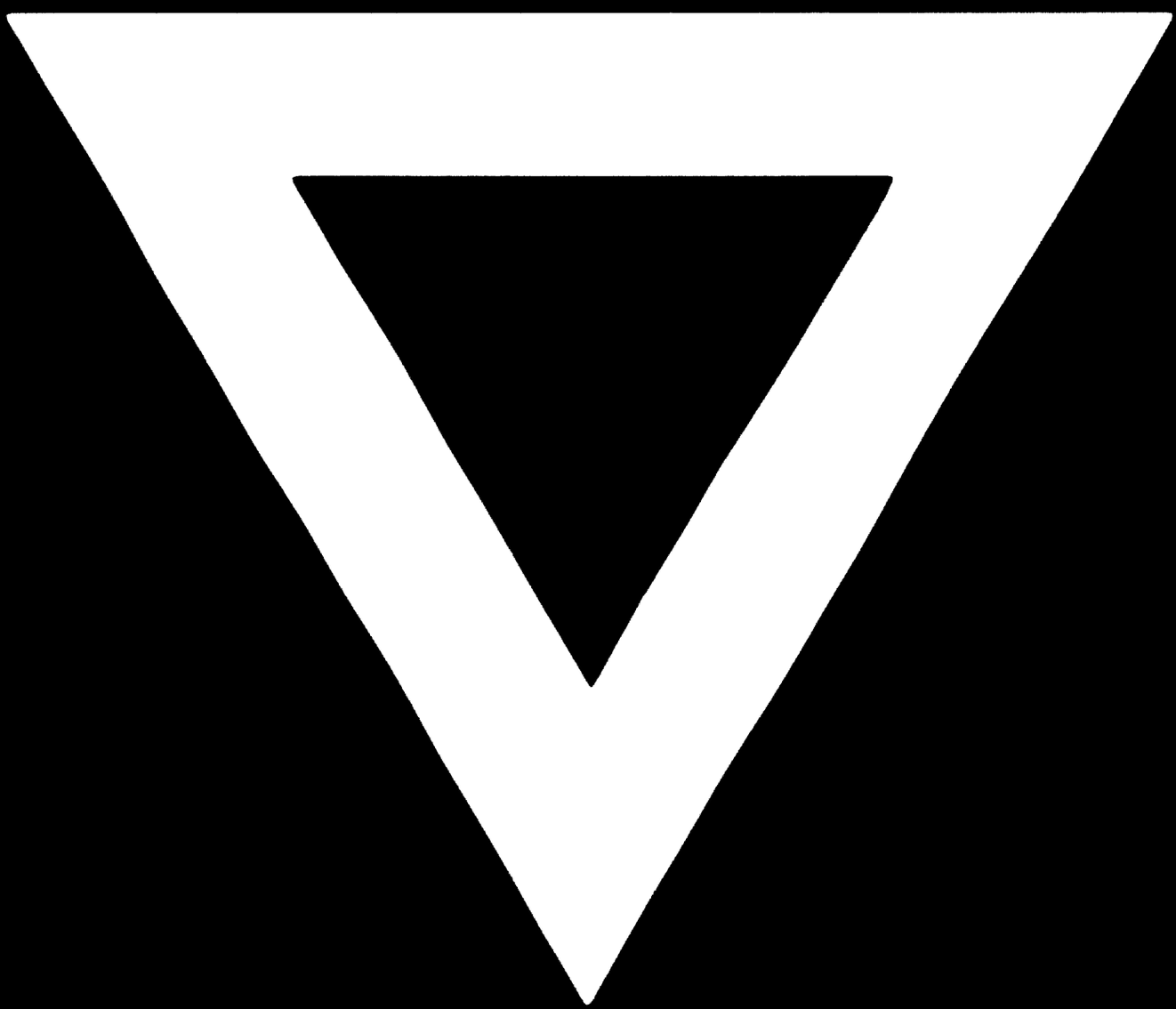

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