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CEMENT DEVELOPMENT AND RESEARCH CENTRE*

DP/TUR/72/034

TURKEY

Technical report: Study on the optimization of cement kiln and mill production

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

Based on the work of François Le Bel, cement consultant

United Nations Industrial Development Organization
Vienna

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CONTENTS

I. REMINDER OF THE OBJECTIVES TIED TO THE CONCLUSION OF THE EXPERT'S LAST VOYAGE TO TURKEY (19 November-10 December 1976)

In the conclusion of my last report, I suggested to Dr. Farouk Yagiz that he organize a small Symposium every year for factory directors, production and laboratory engineers and higher level and subordinate personnel of the future research laboratory of the Turkish Cement Industry.

Following this suggestion, he organized this Symposium at Ankara this year and asked me to present here a certain number of subjects of importance to the cement industry. Subjects concerned with geological studies and having for critera the selection of raw materials and the choice of production techniques in line with these critera. It is evident that the success of this Symposium will depend upon the choice of these subjects for they are for investments already decided for the cement industry and also a chance to answer the questions of producers having trouble in the functioning of their factories because of problems in the choice of raw materials, production techniques, combustibles, etc.

A second objective was given me at the last minute, that of attending at Istambul in the quality of observor and eventually as a participant to the International Congress organized by "The Scientific and Technical Research Council of Turkey" and the "Building Research Institute". The title of the congress being the "International Conference on Disaster Area Housing".

A third objective was that of advising the Turkish Cement Industry on new problems that could develop. On that subject, at the time of my visit to UNIDO at Vienna, the 1st and the 2nd of September, Mr. Ryding asked me to investigate the possibility of the Turkish Cement Industry using coal and lignites as a low power combustible in the place of fuel oil which to all extents and purposes is not a national product of Turkey.

II. RESUME OF THE MISSION

1 - 2 September 1977 - UNIDO, Vienna :

Conversation with Mr. Ryding

3 - 10 September 1977 - Istambul :

International Conference on Disaster Area Housing

10 - 14 September 1977 - Istambul and Ismir :

Conversation with Mr. Sadik Akalan and Mr. Sommer

Visit to the Cimentas factory - Mr. Bulbul

15 - 16 September 1977 - BAIRAM :

Editing of the Report on the Conference

17 September to
5 October 1977 - Ankara :

Turkiye Cimento Sanayii TAS

Conversation with Mr. Talu, Director General and Mr. Yagiz, Director of the Research Center

Visit to the work site of the Center

Workshops with the directors and engineers

ELBISTAN Project

Editing of the report of the mission

6 October 1977 - Vienna :

Report on the mission to Mr. Ryding

III. ELEMENTS OF FINISHED WORK

A. Stay at Istanbul - International conference on disaster area housing

In compliance with the desire expressed by PNUD, Ankara and by Turkiye Cimento Sanayii T.A.S., I returned to Istanbul the 3rd of September after two days of interviews at UNIDO at Vienna, in particular with Mr. Ryding.

The congress lasted three complete days, two sessions a day with a very high density of communications which one could say that, apart from a few exceptions were at a high or a very high level. Certainly all of the problems posed by the congress were not covered, but a large part of them were. The problems not touched upon will leave a wider field to the workshop organized for November 1977 at Ankara concerning "Low Cost Housing". (Attached in the appendix is a photocopy of that workshop)

The congress opened with a magistral discourse by His Excellence Mr. Faruk Berkol, Undersecretary General of the UN Disaster Relief Organization, that orientated the congress towards the problems concerning relief and aid for the most disinherited populations, those living in the suburbs of large cities and in rural communities, therefore in very vulnerable dwellings.

I won't touch upon all the communications which for the most part are contained in the report given to those attending the congress, but I will cite those which appear to me to be the most striking and which in fact respond to the desires expressed by the United Nations. They are those concerning the problems that are continuously posed in rural communities and are the following :

1.12. Survey of Recent Recommendations for Small Dwellings Before and After Earthquakes by Associate Prof. H. Kardestemcer-USA

1.3. Human Settlements - Framework of Disaster Assessment by A. B. Leman-Canada

1.9. Low Cost Disaster Housing - Planning and Design by Associate Prof. Bhaskar S. Chaudhari-USA

3.5. Temporary Housing for Post Disaster Requirements by O. Ozen-Turkey

4.5. Mobilising Indigeneous Resources for Earthquake Construction by F. Afshar, A. Cain, M. R. Daraie, J. Norton-Iran

Housing System for Low Income People in Human Disaster Areas by Dr. Adel Fareed-Egypt (The text was not distributed).

4.7. Soil Stabilized Housing for Flood Affected Villages in Pakistan by Prof. Dr. S. Nazir Ahmad-Pakistan

5.4. An experiment with Semi-Permanent Disaster Shelters and a Proposal by Suha Ozkan, Architect-Turkey

There were three other current reports. The first two giving recommandations for the construction of rural dwellings following the earthquakes in Iran and Guatemala, they were presented respectively by Mr. R. Rezani (Iran) and Mr. Everett Ressler (USA)

The third report concerned a new technology (glass reinforced concrete) very well adapted to the reinforcing of damaged dwellings and the rapid construction of new dwellings. Simple technology within the reach of all. Presented by Dr. J. W. Smith (UK).

These different reports form a homogenious block with numerous other similar reports from other sources the synthesis of which would give most of the recommandations necessary to humanly, logically and most economically approach the problem of constructing dwellings, either temporary or permanent, adapted to a given locality. Mention is also made of the absolute necessity of having the victims of a disaster participate in the reconstruction operations for two fundamental reasons :

1) To distract them as much as possible from their misfortune
2) To have them express their desires and to collaborate with the

specialist in the conception of their future dwellings and to have the largest number of them participate in the repair and reconstruction operations, naturally in adopting as much as possible local knowhow.

This approach is a bit delicate, but it is essential that those in good health pass from the state of prostration to that of actively taking a hand in the shaping of their own destiny.

Open and sometimes very lively discussions followed these reports. They permitted a classification of the problems and solutions into several categories :

1) What steps should be taken before an earthquake ?

2) After an earthquake what should be done to give the victims of the disaster a new shelter rapidly and in what time limit ? (I will not mention the sanitary problems such as aid for the injured, protection against epidemics, etc. which were only touched upon.)
   a) Immediately
   b) To medium term
      1 Rural zone
      2 Urbane zone

b.2 Urbane zone

Firstly, I will speak of paragraph b.2 which was treated in many reports. The subject is the reloging of the victims and it must take place in several steps :

- temporary emergency dwellings (general classification : immediate aid)
- recuperation of the victim's goods
- recuperation of reusable materials
- reinforcement and/or repair of dwellings or properties not completely destroyed

For that which concerns the truly urbane situation, I will not say that the problem is classic, but it is almost :

Reconstruction adopting modern methods of construction. One is familiar with the numerous models considered as conventional, a certain number of them were presented during the congress. One major question must be asked : How to finance these operations of which the major part will be realized by firms already important and mechanized. No matter what the reponse, the victims must be relodged quickly and not continue to live eternally in temporary dwellings because of financial considerations. It is up to the administration therefore by the fact of the forced generosity of the population to which one will make appeal to regulate this problem. (Example : Solidarity tax)

Before beginning the reconstruction operations, it would be a good idea to investigate the possibility of profiting from the situation to perfect the urbane plan of the city by dividing it into centers and dispersing around these centers the individual lodgings which will thusly be spread out and grouped into ensembles much more humane. In this case, for the individual lodgings the active participation of the victims may be considered the same as in a rural zone.

5.1. Reconstruction Planning on Ground, Learning from Recent Disaster Experiences by Dr. A. Kreimer USA
This document explains what <u>not</u> to do based upon the experiences after the earthquakes at Guatemala and Nicarauga.

b.1 Rural zone

In the rural zone, the problem is very different. Why ? Because it is concerned with small groups of buildings scattered around the country side. Buildings with multiple functions of which the main habitation is often integrated with stables for the livestock, the hen house, the pig pen, grain storage, tool shed, workshop, etc. It is evident that they are extreemly varried in size and construction in line with the families ideas and their vocations. One can find several characteristics or common modules in line with regions, or usage, or climate, etc. but to relodge these populations in prefabricated

(therefore very similar) dwellings is impossible. Past experience proves it. It will be necessary then to regulate an infinity of "special cases" which cannot be resolved without the active and permanent participation of those concerned. They are already motivated by the problems posed in the recuperation of their goods and the gathering of reusable materials from the debris of their old dwellings. Evidence gathered and reported in many documents shows that very rapidly the victims construct sheds with anything at hand (often quite ingeniously) around the temporary emergency shelters put at their disposition (phase a) where all the materials they can recuperate are stored.

These realizations must be considered in general as very uncertain, but it does happen that sometimes these works are well constructed and would no doubt be of quality if the local materials were improved and a minimum of technology put at the disposition of those concerned. If PHASE 1 had been put into effect, these conditions would have been realized. What should be done before an earthquake occurs where one knows summarily the areas where they strike ?

PHASE 1

There is certainly much to do and these actions do not have to all be exceptional for they form a part of the program of development of all countries in the domaine of raising the standard of living, a domaine in which technology plays a very large role. Technology is at the service of urbanization, a discipline which applies to even small localities. On this subject, a very important document was given us during the Congress, "Indigenous Building and the Third World" contents - Exibition by the Development Workshop by F. Afshar, A. Cain, M. Daraie, J. Norton, of which the authors could form with M. Rezzani (Iran), M. Adel Fareed (Egypt), M. Verkerk (UNIDO), M. A. B. Leman (Canada), M. O. Ozen and M. Suha Ozkan (Turkey)

an effective Brain Trust to perfect the conclusions of the Congress in four particular areas which have been a little forgotten. (1)

1) The verification of local materials and a technical estimation of their value and their potential.

2) The study of terrains with recommendations for their drainage, their stabilization, the construction of stable foundations, their uses for other purposes.

3) The substructure for roads and sanitation and the possibility of their extention.

4) Storage depots for indispensible materials -transportable by rudimentary means.

How to lead the local population to an awareness of the advantages of such recommandations if it is not in trying to modify little by little the course of their living conditions.

It has to do with a profound and continuous work. A continuous practical and applied training of which the action must be naturally decentralized being given the very large diversity of situations. How to begin this continuous training ? That merits a serious study that I have not the pretention to undertake, but I imagine that it must be guided locally under the responsibility of the local authorities, the Municipal Council with the active participation of the population by means of a committee of which the members should be recruited from the local population. Educators could serve on the committee if it has to do with education, technology must be represented also. In that manner it will be able to attack and treat very definite problems.

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(1) Attached is a list of the participants and a list of the recommandations proposed at the end of the Congress.

I take the liberty of making a recommandation in the case of Turkey. The country must interest in particular the engineers and technicians of the Roads and Bridges, those of the Building Research Institute and those of the Cement Industry including the members of its' Research Center of which one of the roles is the study of construction materials and the optimal usage of hydraulic binders for the solution of many problems raised by the Congress.

Cement and lime are inexpensive national products of Turkey. They are well distributed geographically and their intelligent usage would give a very large flexibility of construction methods. Because of this fact, the concentrated action of the three organizations I just mentioned could bring to these local committees the technical knowhow that I mentioned coupled with the advantage of giving the engineers/with charged imparting this knowhow the occassion to augment and complete their engineering training, excellent as it already is, on the job. I have remarked that this is an especially fine aid in the theoritic domaines.

My first action would be to bring together my friend Dr. Faruk Yagiz, who is the soul of the research being done in the Turkish Cement Industry and Prof. Dr. O. Ural, Director of the Building Researcn Institute, who directed with the hand of a master this Symposium at Istanbul.

To terminate, several words about PHASE A spoken of in many reports.

PHASE A : Immediate action

Immediate supplying of tents, prefabricated shelters of all types, blankets, etc. All robust and simple to be transported by the most appropriate and diverse methods, for example, placed in containers, or parachutable containers. The assembly of these containers must be simple and appropriate to on the site assembly.

Is there an ideal prototype ? The answer is not simple and no one has solved the problem. The idea of preventative depots was advanced and deserves to be considered, it certainly is important. For the moment, all solutions even though imperfect, are useful. An original idea was advanced in the following work :

3.1. Replacing the Tent, the Challenge of Industry by I. E. MAJZUB (USA)

The author brought to the attention of the Congress that no matter what solution is decided upon, if, for example, in Turkey one is to prepare an emergency aid depot that is to be useful to neighboring countries in case of a disaster, an important financial problem often arises which the countries concerned cannot solve on their own. Considering the international aspect of the aid involved, I imagine that the UN could be the leader in the operation, the financing being assured by the member states following a criteria to be determined, but in which the generosity would play without a doubt an important role.

CONCLUSIONS

Earthquakes have always existed. The only means to save human lives and to lift them from the misery that follows is to plan in advance. One must therefore find answers to question n° 1. What can be done before an earthquake ?

There are two principal responses :

1) Continuous training and education to lead local authorities and populations to revise or modify their conceptions of dwellings and other constructions.

2) Give them the means to carry out any necessary changes :
   - local technical support.
   - simple means to carry out the recommandations that they had a part in forming.

PURPOSE

ORGANIZATION

RCD WORKSHOP ON LOW-COST HOUSING

NOVEMBER 1987 ANKARA-TURKEY

ORGANIZED BY

SPONSORED BY

RCD

PROGRAMME

MONDAY, NOVEMBER

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THURSDAY, NOVEMBER

FRIDAY, NOVEMBER

SATURDAY, NOVEMBER

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DRAFT OF RECOMMANDATIONS OF THE DISASTER AREA HOUSING CONFERENCE

Proposed by the Provisionary Recommendations Committee

The Members of the Committee are:

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1) General definition of disasters effecting the man made physical environment:

Within the term "disaster" natural disasters such as earthquakes, floods, landslides, hurricanes, and man made disasters such as wars, fire and subsidence, that is, every factor that damages the man made physical environment should be included.

2) Recommendations regarding disaster area housing can be considered at different levels:

- International
- National
- Local

Each of these levels have
- Organizational
- Financial
- Technical
- Educational aspects.

3) Stages to be considered are:

3.1) Pre-disaster period:
Long-term planning in disaster prone areas and preventive measures

3.2) Disaster period:
Immediate provisions during disasters

3.3) Post-disaster period:
Coordination of reconstruction and rehabilitation

Each stage should be properly emphasized.
Coordination at international, national and local levels regarding the organizational, financial and technical aspects of the problem should be provided for each of these stages.

4- In those parts of the world where cumulative housing needs exist and where uncontrolled and unsafe squatters and rural housing already create drustic housing needs, disaster housing problem should not be considered saperatly from the general housing problem.

5. Appropriate diffrentation of temporary, semi-permanent and permanent housing must be considered together with the economics of disaster area housing.

6- Data related to the areas prone to disasters (topographical, climatic, economic, social, cultural) must be pre-prepared in order to identfy the users requirments and the potential for coping with disasters.

7- Both on International and national levels a special yearly budget should be allocated for facing disasters.

RECOMMENDATIONS ON INTERNATIONAL LEVEL

1-The U.N. Disaster Relief Organization, in existance, will be extended in cooperation with the U.N. Centre for Housing ,Building and Planning, New York,UNIDO (United Nations Industrial Development Organization), Vienna and the UNDP (United Nations Development Programme), with a sector for Disaster Area Housing to cope with the relief for human disasters, world-wide, such as earthquakes, floods, landslides , wars, etc.

2-The long range objectives of this activity will be centered to provide the needs for all member countries in

2-1. Preventive measurements for disaster area housing in pre-disaster periods;

2-2. Immediate provisions during disasters of human shelter,

2-3. Coordination of reconstruction of housing in post-disaster time.

3- Initially, the above mentioned sector will have the immediate objectives.

3-1. To establish and implement working groups. based on geographical and cultural area-groupings, with the following objectives:

3-1-1. To provide solutions to the problems of temporary shelter after a human disaster has passed.

3-1-2. To provide solutions for disaster shelter, which can be built initially to avoid loss of life and buildings during extreme climatic or ground conditions.

3-1-3. To extend their activities beyond dwellings to other types of buildings, instituti nal, industrial, commercial and public buildings;

3-1-4 To provide solutions which may continue in use, through adaptation by the occupations, of temporary shelter into permenent dwellings.

4- Each working group must have a coordinator and a member, responsible for linking information, exchance of know-how with other working groups.

5- Each working group should be as small as possible, but must consist of:

- A constructor,
- Material manufacturers for building materials:
- A constructiin engineers;
- An architect
- Raw material expert;
- A sociologist

with the following responsibilities.

5-1 To develop structures from local natural materials and construction techniques in accordance with local conditions.

5-2 To develop structures embodying local materials assisted by non-local materials and technologies.

5-3 To develop structures arising from new technologies.

6- FINANCIAL RESOURCES

6-1 The governments of the country of each participating member will fund the member of the working group.

6-2 Other non participants countries can contribute voluntary contributions as a member of the United Nations.

6-3 Building Materials and construction equipment as well as raw materials, in kind, can be made available, through, the responsible UN. Agencies, as bi-laterial or multi lateral aid.

6-4 The United Nations, through, their different agencies and availability of other funds, suchas, for global projects, emergency funds, disaster relief funds, regular programme etc. will contribute for the different activities to be implemented.

6-5 Othar voluntary contributions from International Organizations, such as, red cross, charitas etc. will be channeled through UN. responsible egancies responsible for the implementation of the to be undertaken activities and placed in a therefore established fund.of the United Nations disaster relief organization:

7- An action plan for this purpdse should be an immediate objective for the implementatiton of the above recommandation should be initiated by the U.N. Disaster Relief Organization in cooperation with respective other U.N. Organizations in Geneva. Keeping in mind the time factor for immediate actions,

- Cooperative research activities among countries of common local conditions and exchange of relevant information must be encouraged.

- Organization of similar International Conferences in different countries at proper intervals should be promoted.

RECOMMANDATIONS ON NATIONAL LEVEL

1- Intensive Research programme in Building Research Institutes should be promoted.

2- Building Research Institutes should be consulted before the planning and implementation of the projects related to disaster areas.

3- Building Research Centers, Ministries Planning organizations should cooperate for planning, programming implementation stages for disaster area housing.

4- Aided-guided self help should be encouraged and organized.

- A national financial system for post disaster construction should be established.

TECHNICAL, PLANNING AND CONSTRUCTIONAL ASPECTS

1- Social survey and study of the inhabitants needs and customs is important in planning and designing housing projects.

2-Exchance of technological knowledge between countries should be promoted.

3- Use of indigenous building materials should be encouraged and appropriate structural and construction systems should be developed. Appropriate industrialization of building component production should be considered.

4 Planning of all the physical environment such as farm buildings, industrial buildings, dams , power sources etc. should be considered as well as housing.

5- Flexibility and growth possibilities in the planning o.. housing types should be considered for long term use.

6- Precautions the structural desing of buildings t re ent complete collapse should be emphasized.

B. Stay at Ismir - Conversation with Mr. Somer, Mr. Akalan and Mr. Bulbul

a) Conversation with Mr. Rasih Somer, Chairman of the Board of Directors , CIMENTAS IZMIR CIMENTO FABRICASI TAS.

The objectives, the means and the organization of the Research Laboratory of the Turkish Cement Association must be compatible with the desires of the members of that association no matter what technical ties they might have with outside organizations such as FL Smith for example as is the case for Cimentas.

For the moment the desires expressed by that company concern a quality control by the intermediary of their laboratory standards. It's very little, but it's a start. The day when the Research Center has proved its competence and authority special studies will be called for. For the moment, the technical department of FL Smith makes these studies, but given their corporate purpose (the sale of materials to the cement industry) they are not necessarily completely unbiased.

b) Conversation with Mr. Sadik Akalan, ANADOLU CIMENTOLARI TAS

Mr. Akalan has a very wide competence which makes him quite independent in his ideas and his actions. Guided be his unique conceptions, his factory is the image of a logical approach to given problems.

His advice on the objectives of and his demands on the Research Center are all the more precise because of his extreem efficiency. He calls for competence in many areas :

- Quality control

- Evaluations in the following domains :

1) Geology - raw materials
2) Production techniques
3) Machinery for the cement industry

He demands therefore of the center the competence of a control laboratory, a Research Center and an engineering office. I think that would be the ideal solution but not realizable in the near future. It is at least five or ten years away unless an association would be possible with the engineering office of a large foreign cement company (1). And why not ? This association could be the formation of a small company on a 50/50 basis. The Turkish Cement Association could even have majority control. This company could sell its services to the Turkish Cement Industry.

I think that these conversations are valuable for this association of the State Cement Industry and private Cement Companies seems to me to be essencial if one wishes to receive the maximum return from investments and to avoid a too active competition which leads to over-investment. In this modern world investment planning is indispensible. Over-investment and uncontrolled competition must be rejected.

c) Visit to the CIMENTAS factory - Conversation with Mr. Bulbül, chief engineer of the factory laboratory.

I already had the opportunity to visit this fine factory in December of 1976. In spite of the overall excellence of this facility, there are several operating difficulties in particular the holding ability of the refractories in burning zones for the large Smith kiln of which the diameter is important, a diameter of at least 5m.

I could not make a very precise diagnostic because of the lack of information on the raw materials, but I understood that the acid materials (argiles) originate from a deposit of marly argile which the factory does not own and of which the geological knowledge is elementary. On the other hand, the basic materials are taken

(1) Completely independent from companies producing and selling machinery to the cement industry.

from quarries owned by the factory, they are well identified and of good quality. The problems originate then from the quite dissimilar acid materials. It will be necessary to know their chemical and mineralogical composition and the standard deviations around the average composition of the deposit. The presence of coarse quartz in variable proportion has been noticed. It is probably the reason for the short life of the refractories in burning zones.

A recent experiment seems to prove it. The aptitude to the burning of the raw materials often varies according to the quantity of quartz contained. If the quantity of quartz is augmented it is necessary to increase the temperature. This supplementary increase in calories brings about a suplememtary increase in the ashes, therefore of the active silica which reacts on a part of the lime which then has trouble in entering into combination with the quartz. The clinker produced at that precise moment no longer contains free lime and its silica ratio is augmentated (silica from the ashes from the excess of combustibles). This is exactly what has been verified.

C. Stay at Ankara - Visit to the Research Center

1) Construction site. The construction work is quite advanced. The buildings are well designed and attractive. It is probable that the works of a civil nature will be finished no later than the end of 1977. The finishing touches, the cleaning and the temperature controls must be finished and in operation before the laboratory materials are installed. This installation to be done correctly will take at least three months. The personnel therefore will not be able to begin work seriously before the month of June. It must be understood then that the laboratory will not be able to begin functioning before the end of 1978. (Breaking in of materials, personnel and laboratory methods)

2) Formation of the personnel. Whether it has to do with training received in France or in Germany, it is my impression that it

has been successful if I am to judge by the conversations that I had with those concerned. Their aptitude to understand the problems of the cement industry whether it has to do with the laboratories or the factories has been considerably improved. Nevertheless, there is a problem for those who return from this training. They have acquired a deep educational knowledge, but they cannot put it into practical application until the laboratories are finished and broken in. It will be necessary in the interim to conserve this knowledge and give them a chance to improve it. An office function without a very precise training program could act in the adverse direction. May I then offer the following suggestion subject to its practicality :

- The organization of a training program in a factory (near to Ankara) of at least one month which could be broken up for example into periods of one week, to become aware of :

  a) the practical problems posed in the fabrication of cement,
  b) the assistance provided a factory by its laboratory even with its limited means,
  c) and thusly to better judge the fundemental and complementary role that a central and well equipt laboratory could bring to a laboratory factory.

These programs would have along with other advantages that of creating ties between those being trained and the management of the factories, indispensable ties to create an atmosphere of future collaboration. I must insist strongly on the practical and operational character of these programs.

3) I take the liberty of pointing out that if the laboratory equipment necessary for the selection of raw materials were available at this moment, they would be of great benefit. The raw materials from the quarries of the first seven factories planned in the investment program have already been partially analysed and samples taken from these quarries are waiting at

Ankara for the delivery of this equipment (orders placed in Germany almost a year ago) of which a grand part is useful for the control of clinkers.

Attached is a list of this equipment. The most urgent being those on list A.

LABORATORY EQUIPMENT "A"

A 1	Blaine	Fineness
A 2	Tamis (complete series)	Fract. granul. Separation
A 3	Crusher	Chemical composition analysis
A 4	Pastiller	
A 5	Air compresser	
A 6	FX	
A 7	Atomic absorption	
A 8	Small computor for Data Bank	Data treatment Mathematical models
A 9	Diverse equipment for laboratory (glass-ware, etc.)	Diverse

LABORATORY EQUIPMENT "B"

B 1 Supplementary channels
for analysis

B 2 Idem

B 3 Idem for the Data Bank computor

B 4 RX diffractometer

B 5 A 3 + A 4 Automatic pastille press

B 6 ATD - ATP

B 7 Scanning electron microscope and accessories

B 8 Optical Microscope
- diamond saw
- polisher
- polishing materials

B 9 Laboratory kiln

WORKSHOPS

INTRODUCTION

The purpose of this introduction is to present the subjects of the four workshops the synthesis of which could serve as a pattern to invest :

1) to the best interest of the consumer who is becoming more and more demanding
2) to the best interest of the cement industry very concerned with the returns from its factories whose productivity must be improved and its products which must become more precise and more standardized.

Perhaps the overall title should have been : "How to obtain the optimum production from raw materials from quarries not always homogeneous to the exact cement responding to the demands of norms more and more severe."

Four steps :

1) Geological and mineral studies for a definition of the optimal choice of raw materials. Representivity of the samples. Study of their reactivity.

2) Rational exploitation of quarries. Industrial preparation of the raw material for a kiln operation in continuous, dynamic equilibrium.

3) Choice of production methods in line with
   a) the types of products demanded by the market, and
   b) the quality of the raw materials available.

4) Cement norms. The necessity to establish them. A definition of a quality label. Product control.

WORKSHOP I Animator, Mr. Kalman Havas

Subject : Geological and mineralogic studies to define an optimal choice of raw materials. Representivity of the samples. Study of their reactivity.

The choice of materials for the cement industry lies, outside of critera already imposed, in the definition $\triangle$bc (1) and considerations of a physico-chemical nature.

The most important among these is REACTIVITY and after this is the APTITUDE TO COMBINE.

The reactivity of the raw materials (and in particular argiles) is a fundamental criterion of choice. It is expressed by the willingness of the basic and acid materials to enter into combination at a temperature as low as possible. The following formula permits us to calculate the relative importance of the reactivity of one material to another.

$$\text{Reactivity} = \frac{\text{Amount of } CO_2 \text{ liberated before } 900°}{\text{Total amount of } CO_2 \text{ contained in the sample}} \times 100$$

This value depends upon a considerable number of factors whose intervention makes it difficult to pin point the individual importance of

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(1) $\triangle$ bc = deficiency in CaO expressed in percentage. Term specifically Lafarge, calculated according to the following formula :

$$\triangle bc = \frac{2.6\ SiO_2 + 1.65\ Al_2O_3 + 0.35\ Fe_2O_3 - CaO}{SiO_2 + Al_2O_3 + Fe_2O_3 + CaO} \times 100$$

Aimed at the production of a blended raw material = + 5

each of them. The most important of these factors in the estimated order of their influence are the following :

- the quantity and the fineness of the quartz, contained in the acid phase as well as in the limestone.

- the fineness of the limestone.

- the homogeneity of the mixture (the natural mixtures such as the marls or the limestone schists are always more reactive than the artificial mixtures).

- speed and importance of the diffusion in the solid phase.

- nature of the clay minerals. The importance of knowing the origin of the clay minerals and from there their mineralogical determination (qualitive and quantitive) is essential for a large number of supplementary factors depend on it :

    - number of elementary layers in the sheets of argil,
    - capacity of exchange and of fixation of ions in the clay structure :
        - in the interfoliaceous position,
        - in the tetraedrique position,
        - in the octaedrique position,
        - nature of the fixed ions,
        - importance of defaults in the structure,
        - fineness of the clay minerals,
        - degree of crystallization,
        - percentage of argiles in the colloidal state, etc.

It is evident that each one of these factors implies a special and profound study of which it is difficult to enter into the details. The investigation techniques are also numerous and varied, such as :

- Chemical analysis (FX Atomic absorption)
- X-Ray diffraction
- Thermal analysis, ponderal and differential

- Optical and Scanning Electron Microscope
- Electro Probe Microscope
- Granulometric analysis

The application of the results must surely and inperatively rest on the information furnished by the Data Bank which is a powerful tool for the determination of mathematical models such as the aptitude to the burning. The relative importance of this last characteristic permits a distinction among the raw materials available therefore a fundemental choice which would allow the realization of considerable gains of energy and the adoption of technical solutions the most judicious.

WORKSHOP II Wednesday 28 September 14h-17h30

Subject : Rational exploitation of quarries. Industrial preparation of raw material for a kiln operation in continuous dynamic equilibrium Partially covered in the report Mission UNIDO, November/December 1976).

Animators 1st part, Mr. Kalman Havas,
2nd part, Mr. François Le Bel.

The previous report showed that by a meticulous study it is possible even in a difficult case to define with a certain precision the average sample of an ensemble of representitive quarries.

a) blended raw material,

b) among the blends of raw materials possible, those which allow the ensemble of the quarries the greatest longevity, that is to say those which will allow the factory to produce cement over the longest period of time. It is estimated that the minimum life of a factory is represented, following its capacity of production, by 30 to 50 million tons of clinker.

The correct blend of raw materials being determined, one must now determine.:

- the critical mass of the deposit, that is to say the minimum quantities of materials from each quarry, extracted by industrial means, that on an overall basis have the same composition of the blended raw material.

- for each quarry the coefficients of variation of its composition compared to its average value.

This being done, the ensemble of the quarries must be exploited as much as possible by sections equal to the critical mass or to one of its multiples. The transport of these materials to the crushing mill will be made following a formula that minimizes the qualitive and quantitive fluctuation of the materials at their exit from the crusher. After crushing a continuous sampling will be made to discover with more certainty the standard deviation of the raw materials from their control point, and thusly to schedule the prehomogeneization which follows this sampling (dimension of the piles, number of lines to reduce if possible to zero the standard diviation from the variations of blended raw materials exiting from prehomogeneization around its control point).

Very lively debate followed, numerous questions concerning the technical problem of the system, its price, the flexibility of its exploitation, etc.

Slide presentation showing a complete chain of explcitation just to the exit from the prehomogereization (usine de La Nouvelle, near to Perpignan, France).

WORKSHOP III Thursday 29 September 14h-17h30

Subject : Choice of fabrication methods in function with :

1) the type of product demanded by the market, and
2) the quality of the raw materials available.

Animator, Mr. François Le Bel

1° Revue of the principal processes for the fabrication of clinkers :

- Shaft furnace,
- Kiln with Lepol grate,
- Long dry kiln with chanis,
- Long dry kiln with internal heat exchangers - feeded with pellets.
- Long dry kiln with one stage suspension preheater,
- Short dry kiln with several stages suspension preheater,
- Short dry kiln with flash furnace.

2° Study of the comportement of the fabrication processes in line with the chemical and mineral composition of the blended raw material. The determinant role of quartz and the mineral impurities in the choice of the processes. Alkalis (K_2O Na_2O), of the alkali sulfates (SO_4Ca, SO_4K_2, SO_4Na_2). Circulation and recirculation of these elements in a kiln. Consequences on the function of the latter. Choices of processes.

Several examples :

- Alkali reaction - Choice of a process to produce a cement with a weak akali content -($K_2O + Na_2O$) < 0.6 %
- Raw material rich in quartz
- Raw material rich in $Na_2O + K_2O$
- Raw material rich in sulphur
- and combinations of these three alternatives.

The discussion that followed was also very animated and created a large interest; principally among the engineers charged with the function of kilns equipt with cyclone exchangers.

WORKSHOP IV Friday 30 September

Subject : Cement norms. Necessity for their modification. Definition of a quality label. Product control.

Animator, Mr. François Le Bel

The object of this session was to point out before the finish of the workshops that sooner of later the standards for determining the types of cement in Turkey would be insufficient. The productivity in the domain of building construction and prefabrication have made such strides that the utilizators demand more and more from the performance of the cements, strongly resistant after two days for the rapid breakdown of the frames, regularity of color, minimum shrinkage, etc.

The cement industry cannot always respond to these demands, but to approach them as much as possible, the industry must very closely control the fabrication of the clinkers (this was in part the objective of these workshops) give them a high C_3S content for a normal C_3A, to obtain good initial resistance from corresponding cements in crushing them coarsely, granulometric curves of cements in harmony with the granulometric spreads of the aggregates and sands. These precautions will permit the production of very high quality cements, to weak $\frac{E}{C}$ (0.4 to 0.45), which is easy to pour, and the water and heat shrinkage are minimal.

But how is one to assure the quality of these cements ? By putting a 28 day ceiling on the resistances (attached is a project of the new French norms).

General conclusions and recommandations of the workshops

1° The necessity to create a Data Bank at the Central Laboratory that will eventually concern the entire Turkish Cement Industry. This will permit on one hand to point out by concrete results the choice of fabrication processes and corresponding materials in the case of a new investment and on the other hand to suggest other choices of raw materials or new arrangements in existing factories to resolve the difficulties of exploitation. Example : Partially replace a substandard argile (quartz) by coal ashes (regular coal with high content in ashes of which the silica is reactive).

2° The necessity to assure the concordance of controls in the factory laboratory and the Central Laboratory by conducting parallel experiments.

3° In the framework of the current investment program (7 factories equipt with cyclone exchangers) decided upon without studies touching on the quarries, a minimum of precautions must be taken to reduce the risks taken :

a) The necessity to furnish these factories with a continuous sampling and a prehomogeneization assuring a perfect consistancy in the composition and the reactivity of the raw materials.

b) Condemn all argile quarries containing too much quartz.

c) Eventually council a movement in the direction of a coal charged with ashes, but with the reservation that it be very regular.

d) If the raw material is too charged with alkalis, attempt to extract them by the clinker in adding an appropiate quantity of SO_4Ca in the raw material, it forms SO_4K_2 which will be able to exit with the clinker if one can lower the burning temperature (without coarse quartz in the raw material).

e) Undertake long term geological studies in line with the development plan of the Cement Industry and accumulate quarries.(Quarry Bank).

4° Necessity of improving the contacts between the cement producers and the consumers. Visits to the factories. Access to the data of the factory laboratories. Creation of a climate of confidence and exchanges of information (for example the conversation between Dr. Farouk Yagiz and Dr. Oktay Ural).

5° Definition of a mark of quality, proof that the cements on the market respond to the demands of the norms. Eventual creation of a watch dog Quality Control Committee composed of producers and consumers.

List of participants of the conference held at the Turkiye Cimento Sanayii T.A.S., 27 - 30 September 1977

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ÖZLER H.Müfit	Director of Plant	T.Ç.SANAYİİ T.A.Ş. Fabrika Müdürlüğü ELAZIĞ
ÖZDEMİR Mehmet	Chief of production	T.Ç.SANAYİİ A.Ş. Fabrika Müdürlüğü KONYA
ÖZDENFEDAKAR Cemalettin	Chem. Eng. M.S.	T.Ç.SANAYİİ T.A.Ş. Genel Müdürlük Planlama Müdürlüğü ANKARA
ÖZDEN Nuri	Deputy Director of Op. Dept.	T.Ç.SANAYİİ T.A.Ş. Genel Müdürlük İşletmeler Müdürlüğü ANKARA
ÖZÇELİK Necmi	Chief of production	T.Ç.SANAYİİ A.Ş. BURSA
ÖZDEMİR Burhanettin	Director of plant	Çukurova Çim.San.T.A.Ş. Fabrika Müdürlüğü ADANA
PERÇİN Mahmut	Jeomorfolog	T.Ç.SANAYİİ T.A.Ş. Genel Müdürlük Planlama Müdürlüğü ANKARA

Name	Title	Duty station
SÖNMEZ Yılmaz	Chief of operation	T.Ç.SANAYİİ A.Ş. Fabrika Müdürlüğü SİVAS
SUSU Şükrü	İşletme Müd.Mv.	T.Ç.SANAYİİ T.A.Ş. Genel Müdürlük İşletmeler Müdürlüğü ANKARA
TALU A.Hadi	Chief of production	T.Ç.SANAYİİ T.A.Ş. Fabrika Müdürlüğü ELAZIĞ
VARDAR Bülent	Chem. Eng. M.S.	T.Ç.SANAYİİ T.A.Ş. Genel Müdürlük Proje ve Konst.Müd.gü ANKARA
YALABIK İbrahim	Engineer	Fabrika Müdürü
YENİCE Yusuf	İşletme Müdürü	Başkent Çimento San.A.Ş. Baştaş Çim.Fab. ANKARA
YILDIZ Ali	Engineer	T.Ç.SANAYİİ T.A.Ş. Tesis Müdürlüğü ANKARA
YOLSEVEN Erkan	Chief of operation	T.Ç.SANAYİİ T.A.Ş. Fabrika Müdürlüğü GAZİANTEP
YÜCEER Akın	Chief of operation	T.Ç.SANAYİİ A.Ş. Fabrika Müdürlüğü NİĞDE

D. Specific problems of Elbistan

The Turkish Cement Industry has become interested in a project in the course of realization, the Elbistan Power Station which will consists of four units of 340 MW. In principle, the first group should start up in 1980.

The combustible utilized will be lignite (potential deposit of 3.2 billion tons of which 1.7 billion tons will be exploited. Attached in appendix is a note on the deposit and its exploitation). The ashes of this lignite are calcareous, therefore in principle should contain lime (CaO) and perhaps a certain percentage of C_2S (silicate bicalcique).

These ashes can be used for many purposes if one knows more about their exact composition and their regularity, in fact, more about all of the processes of production intimately tied to the function of the station including the extration operation and the storage of the lignite before utilization.

We propose to obtain this information of which the analysis will permit us to say if these ashes are profitable or not for the cement industry.

This information is tied to a geographical study of the deposit of which we have a vague idea by test boring (see appendix). Mrs. Erkran has undertaken at Ankara to obtain this information from the competent authorities. For my part, I'm going to contact "la Société Sofrelec", engineering office of "Electricité de France" who participated in the study of the Elbistan project. Once the dossier is established, Mrs. Erkran and I will give the Turkish Cement Industry an opinion of the utilization of the ashes. If they are of a quality similar to those of the Bassin de Fuveau (Gardanne, France) they shall be extreemly valuable for the Turkish Cement Industry for the following reasons :

- ground stabilization

- road foundations,

- masonery cement (ashes and slag crushed to a fineness of 4000 cm^2/g Blaine),

- earth cement blocks, blocks, foundations,

- after extinction ($CaO \longrightarrow Ca(OH)^2$) added to ordinary portland cement up to 30 %,

- raw material for a local cement producer of which the clinker will be crushed at the site with 30 % of the ashes.

In the first stage nearly 3 million tons of ashes will be available each year. A quick analysis allows us to envisage their usage in the following manner :

Ashes : 1 MT corrected by limestone or argil would permit the fabrication of :

= 0.3 MT 1 MT of clinker + 30 % ashes added = 1.3 MT of cement

= 0.3 MT 0.3 MT of ashes + 0.3 MT of slag = 0.6 MT cement

= 1.4 MT road foundation and soil stabilization

It must be known of course if this production would be compatible to the needs of the Elbistan region. That is to say within a radius of 300 km. around that locality.

On the map of Turkey, we see in that region 8 cement factories : SIVAS - KAYSERI - GÜRÜM - MARAS - ADIYAMAN - ELAZIG - GAZIANTEP - URFA, functioning or in project of which the capacity of clinker production will be 4 MT. They could use as an additive therefore 1.2 MT of ashes.

These are only ideas, but they merit a deep study. We are going

Nota : 1 MT = 1 Million tons

to do that and will keep you posted on the progress of our studies which will be guided by Dr. Farouk Yagiz in as much as his laboratory can bring us a very effective aid in these studies.

ELBISTAN LIGNITE DEPOSIT

- Lignite deposit that will be exploited for a power station that will consist of 4 groups of 340 MW.

- Start up of first group : 1980.

- Extent of deposit : 3.2 billion tons.

- Tonnage readily exploitable : 1.7 billion tons.

- Qualities :

		Average
Calorific power inferior to	950 to 1600 Kcal	1,050.00
Water content	50 to 60	57.70
Ash content	8 to 23	15.30

- Overburden : 80 m.

- Thickness of deposit : 30 m.

- Annual production : 20 MT.

- Method of extraction : 6 excavators with a capacity of 3000 m^3/h.

- Storage of lignite before usage : Prehomogeneized stockpiles.

IV. GENERAL CONCLUSIONS AND RECOMMENDATIONS

I will add to the general conclusion the common desire expressed by Mr. Talu and Dr. Yagiz to renew these workshops in 1978. I think this is a very positive idea which could finish by establishing on a solid basis the same style meetings, but greatly improved by the larger participation of Turkish engineers and why not also by the participation of different foreign experts put at the disposition of the Turkish Cement Industry. This would be an opportunity for them to become better acquainted and to begin functioning on the same base in a complimentary fashion, that is to say with a maximum efficiency (this is only a wish, of course).

1° One meeting could be devoted to factory incidents in the production of clinker, incidents related in datail with an analysis of their causes and the solutions adopted to resolve them. Such a discussion must be directed of course, but remaining open to controversy.

2° Guest at high levels, for example the engineers of the Building Research Institute could be invited to these debates to :
- gain a better understanding of the problems of the cement industry,
- make known the new tendencies in the construction area which could translate into new demands in the matter of the quality of products,
- create by these meetings the necessary and permanent ties hoped for between the utilizer and the producer of cement.

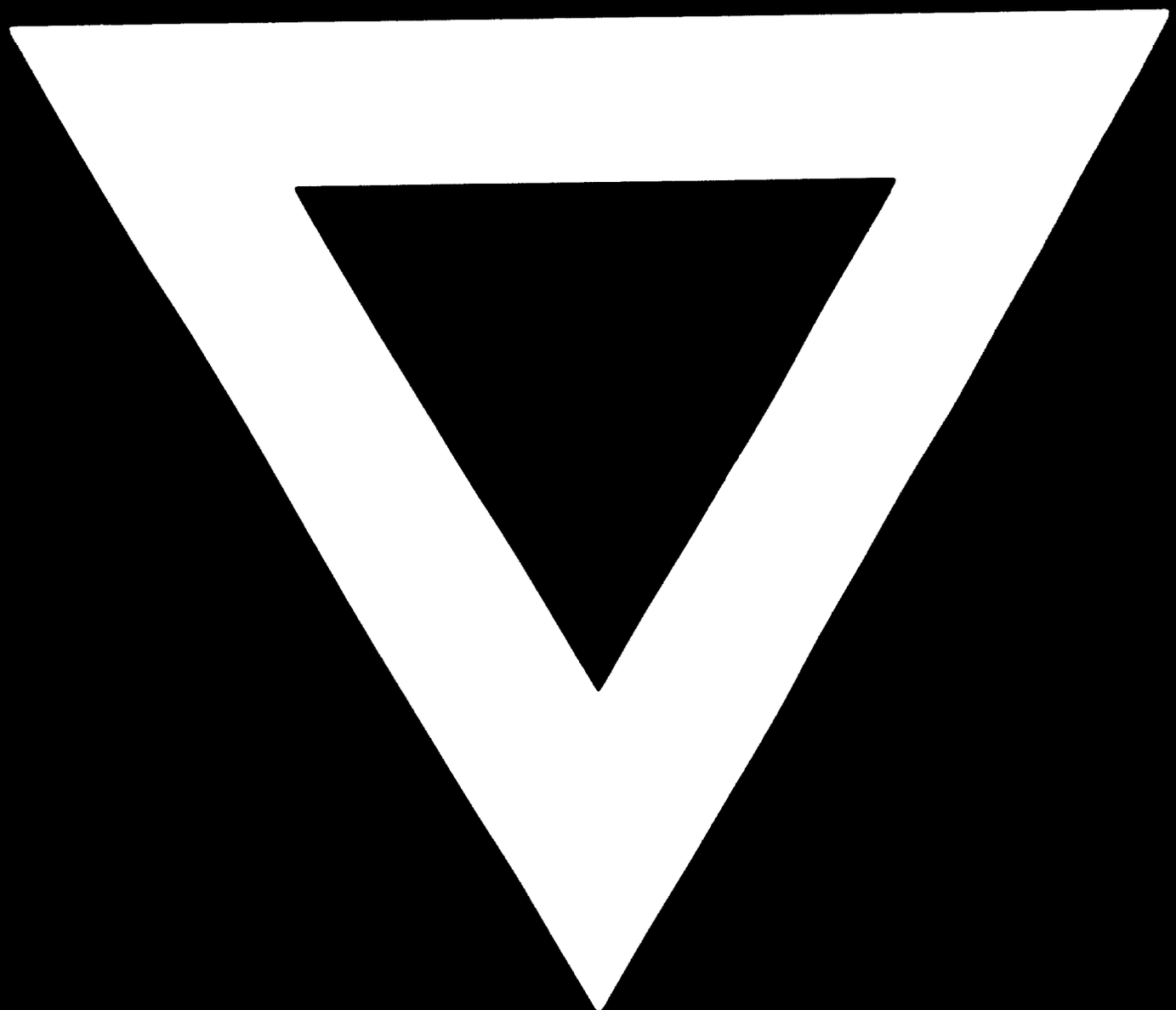
3° This meeting could be held in the Research Laboratory which would thusly become a privileged place for this type of discussion and meeting.

To finish, I must warmly thank Mr. Talu, General Director of TURKIYE CIMENTO SANAYII TAS, Mr. Pay, Technical Director of that company, and Dr. Farouk Yagiz, Director of the Research and Planning Dept., TURKISH CEMENT INDUSTRY CORP for the kindness of their welcome and for the considerable aid they brought me to assure the success of these workshops, and I will not forget Mr. Sigmund Abaffy who's quick intelligence and untiring activity supported me during my interesting and busy stay at Ankara.

ANALYSES OF ALBIAN OF BEDS AT LICHIN

Depth at which samples were taken (metres)	Laboratory No. Lithological Laboratory No.	SiO_2	Fe_2O_3	MgO	SO_3	P_2O_5	Al_2O_3 + TiO_2	CaO	Na_2O+K_2O	MnO
53,50-55,50	83420/10621	4,27	0,94	1,10	3,98	0,06	1,93	66,25	0,13	0,02
55,50-57,50	83421/10622	3,20	0,93	1,18	6,12	0,08	1,32	65,20	0,14	0,022
57,50-59,50	83422/10623	2,64	0,53	0,03	3,35	0,10	1,32	68,10	0,10	0,01
59,50-61,50	83423/10624	2,38	0,46	0,82	3,11	0,06	1,24	68,47	0,10	0,01
61,50-63,50	83424/10625	2,49	0,53	0,98	2,68	0,09	1,37	68,42	0,13	0,01
63,50/65,50	83425/10626	2,80	0,56	0,95	3,30	0,11	1,64	67,60	0,10	0,01
65,50-67,50	83426/10627	4,30	0,94	1,25	6,70	0,12	2,61	64,80	0,13	0,02
67,50-69,50	83427/10628	7,08	1,22	1,18	4,06	0,06	3,23	65,50	0,20	0,02
70,75-72,75	83428/10629	27,70	4,26	2,96	19,47	0,15	13,59	29,54	0,81	0,02
77,60-79,60	83429/10630	5,61	1,04	1,08	6,20	0,11	2,61	69,05	0,21	0,02
79,60-81,60	83478/10631	3,02	1,50	1,36	5,54	0,38	0,92	86,70	0,31	0,10
81,60-83,60	83473/10632	8,64	1,75	1,52	9,02	0,37	3,84	74,12	0,32	0,12
83,60-85,60	83474/10633	19,26	3,51	2,30	15,38	0,44	9,56	48,30	0,38	0,15
85,60-87,60	83484/10643	21,10	3,98	2,18	15,20	0,52	9,51	46,68	0,46	0,21
87,60-89,60	83466/10644	20,44	4,62	2,09	12,32	0,57	8,22	50,85	0,41	0,25
89,60-91,60	83486/10645	23,74	6,03	2,87	17,03	0,53	11,67	37,32	0,48	0,26
91,60-93,60	83481/10640	20,76	3,50	2,12	18,12	0,53	9,75	44,36	0,40	0,20
93,60-95,60	83482/10641	32,36	5,58	3,24	18,76	0,58	16,36	20,20	0,49	0,16
95,60-97,60	83483/10642	31,50	5,57	2,19	15,82	0,70	15,81	27,66	0,49	0,20
97,60-99,60	83475/10634	7,70	2,40	1,46	10,03	0,38	3,14	73,82	0,35	0,16
99,60-101,60	83476/10635	7,07	1,92	1,46	8,49	0,33	3,01	77,26	0,33	0,14
101,60-103,60	83477/10636	9,42	2,23	1,57	6,72	0,30	3,29	75,40	0,31	0,18
103,60-105,60	83478/10637	20,40	3,51	2,04	12,21	0,45	9,74	50,49	0,39	0,20
105,60-107,60	83479/10638	12,48	3,19	1,76	12,31	0,56	6,25	61,71	0,33	0,19
107,60-109,60	83480/10639	21,54	4,32	2,11	19,10	0,60	9,32	41,87	0,42	0,22
109,60-111,60	83499/10646	43,88	9,36	2,80	11,21	0,30	18,28	12,40	1,20	0,05
111,60-113,60	83500/10647	44,66	4,38	1,61	1,11	0,08	12,52	28,04	1,15	0,05
113,60-115,60	83501/10648	52,48	8,41	2,36	4,14	0,21	21,84	7,76	1,40	0,04
123,50-125,50	83502/10649	54,56	8,48	2,58	3,96	0,21	21,87	5,38	1,65	0,06
130,80-132,80	83503/10650	46,46	11,55	2,79	7,88	0,31	19,80	8,90	1,45	0,08
132,80-134,80	83504/10651	52,80	9,54	2,60	4,26	0,18	22,08	6,20	1,66	0,08
134,80-136,80	83505/10652	41,50	9,15	2,53	12,44	0,32	18,53	14,06	1,22	0,08
136,80-138,80	83506/10653	49,20	9,23	2,78	5,93	0,36	21,13	8,70	1,50	0,07
138,80-140,80	83507/10654	49,56	8,41	2,72	6,72	0,033	20,58	9,64	1,36	0,08
140,80-142,80	83508/10655	42,66	8,55	2,68	12,05	0,34	17,76	14,16	1,38	0,09
142,80-144,80	83509/10656	55,52	9,78	2,46	3,30	0,31	21,61	4,52	1,55	0,06
144,80-146,45	83510/10657	41,90	8,25	2,51	14,69	0,41	14,94	15,70	1,34	0,08

C-700



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