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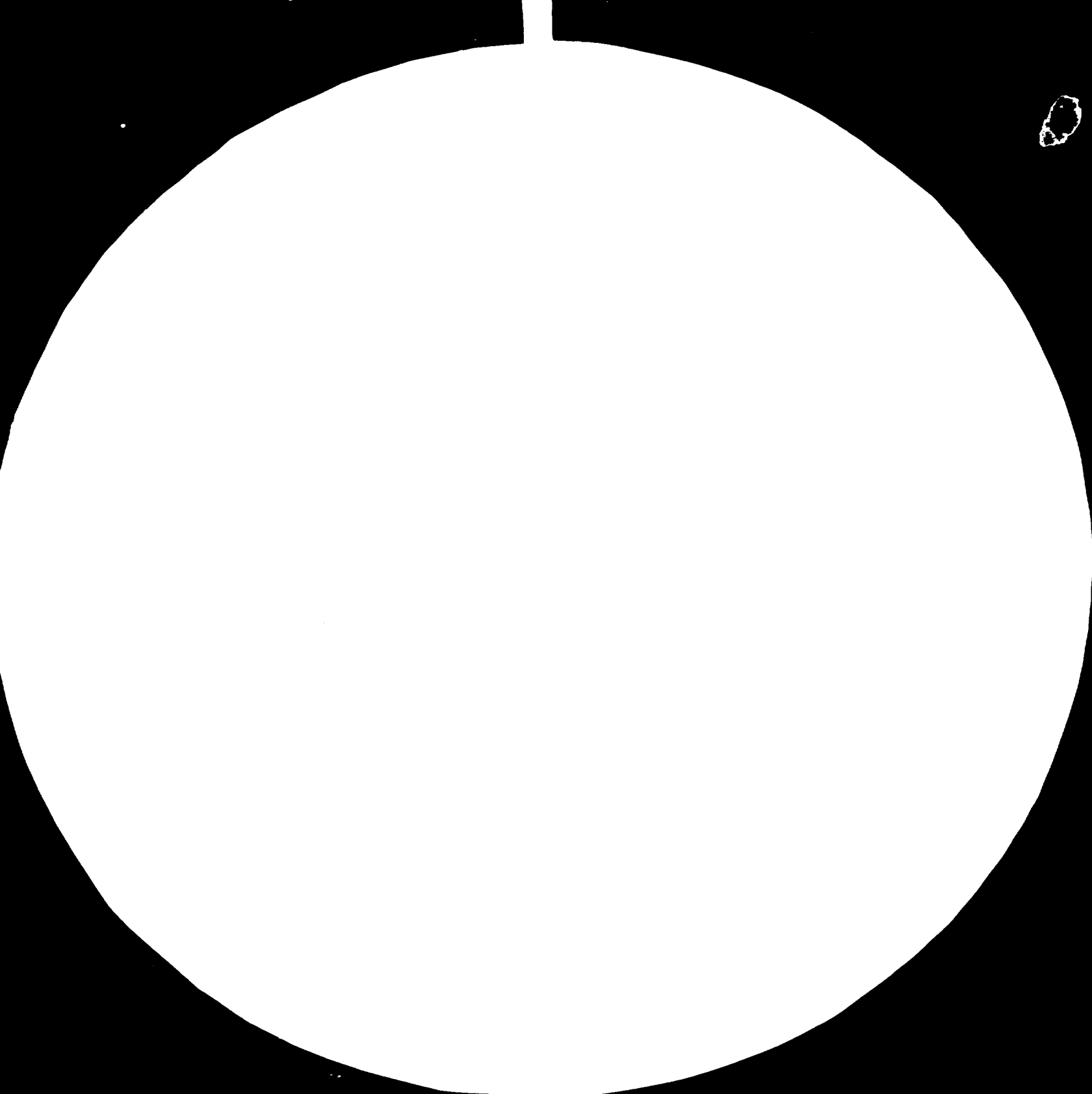
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MICROCOPY RESOLUTION TEST CHART

NATIONAL BUREAU OF STANDARDS
STANDARD REFERENCE MATERIAL 1010a
ANSI Z39.18-1963 TEST CHART No. 2

December 1983

English

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Kuwait.

STRENGTHENING STANDARDIZATION AND
QUALITY CONTROL
IN
BUILDING MATERIALS .

Final Report *

by

A.V.Rao

DP/KUW/83/001/11-01

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I. SUMMARY

The project "Strengthening Standardization and Quality Control in Building Materials" (DP/KUW/83/001) was carried out in response to a request from the Government of Kuwait in 1980 by the United Nations Industrial Development Organization (UNIDO) acting as executing agency for the United Nations Development Programme (UNDP). The counterpart agency was the Standardization and Metrology Department (SMD) of the Ministry of Commerce and Industry. The six months' duration of the project was split into two missions of three months each at the request of the Government.

During the first part of the mission from August to November 1980, which formed a part of project DP/KUW/79/009, a survey of standardization and quality control activities in the field of building materials at the in-plant and national levels was conducted. Out of over 500 factories for building materials, 31 factories in the medium and large-scale sector were visited and most of the others in the small-scale. The factories which are set up in the public sector producing hydrated-lime and sand-lime bricks, cement and concrete products, concrete prefabricated building elements, steel pipes, asbestos-cement products, cement from imported clinker, are well established and have adopted good quality control methods and possess adequate testing facilities for testing according to KSS/BS/ASTM standards. Kuwaiti Foundry, which is in the private sector produces manhole covers and has excellent quality control and testing facilities. Large-scale factories producing sanitary-ware, paints, and prefabricated houses depend entirely on foreign collaborators for quality control and do not have testing facilities. A large number of factories which are on a small-scale producing aluminium, wooden door and window frames, kitchen furniture and fittings, gypsum products and glass reinforced products, do not have any testing facilities.

At the national level, routine testing facilities are available for concrete and cement products, steel and soils at the laboratories of the Ministry of Public Works. The Kuwait Scientific Institute for Research (KISR) and College of Engineering are manned by qualified staff and possess testing equipment in the building material field.

Training of the counterparts in carrying out the survey indicated above was carried out during visits to factories and by lectures. Details of the survey were reported in the progress report with annexes of the first part of the mission in November 1980. Measures for strengthening the standardization and quality control activity at the in-plant level and laboratory equipment and technical books required for the laboratory of SMD were covered in the report.

In the intervening period between the first and second part of the mission a laboratory building for SMD of 200 m² was built, equipment suggested for testing building materials were ordered and most of them received. During the second part of the mission, the layout of the building materials laboratory equipment was prepared, equipment was installed, erected and tested. Trial testing and training of counterparts in the use of equipment were conducted. Regular testing could not be carried out as the laboratory was not commissioned and the building was not officially that of the SMD.

Lectures on the introduction of certification of products produced in Kuwait according to KSS standards. Schemes for quality control of lime and calcium silicate bricks, cement and concrete products were prepared (Annexes VII and VIII).

Assistance was provided in preparing the curriculum for the two year course for technicians on standardization and quality control. Technical advice was given on the proposal of the KISR for training the officers and technicians of SMD in the use of equipment in building materials, paints and chemistry laboratory for testing, for a period of one year.

A broad plan for the development of the SMD laboratory and measures for future strengthening the standardization and quality control activities for the next five years have been prepared and discussed with the SMD. A questionnaire to elicit the views of industry in Kuwait regarding the introduction of a certification marking scheme was prepared and discussed with the SMD and industry. A major portion of the second part of the mission was spent in the erection of equipment received and the testing of such.

II CONCLUSIONS AND RECOMMENDATIONS

It is the desire of the SMD that its laboratory should be developed into an apex laboratory in Kuwait for standardization and quality control, together with the introduction of a certification marking scheme in order that other national laboratories and industrial laboratories may seek guidance and reference to the SMD laboratory for the calibration of their equipment, confirmation of their test results and for the issue of test certificates for products produced in Kuwait and also for imported products. To achieve this objective, a number of steps are required to be taken by the Government for strengthening the standardization and quality control activities for industry and the SMD for which the following recommendations are made, based on the conclusions arrived at by the expert during his first and second missions.

The SMD laboratory is now equipped for testing cement, concrete products sand-lime bricks, hydrated lime, asbestos-cement products paints. For the testing of some of these products additional equipment is required, as given in Annex VI. Laboratory equipment for testing sanitary-ware, glazed tiles, metallurgical products, steel and other building materials are also required as outlined in Annex VI.

Recommendations:

1. Equipment indicated in Annex VI should be procured in stages;
2. Detailed specifications of the equipment to be purchased should be drawn up with the experts experienced in the specified field and their assistance should be taken in time in the selection and placing orders for the equipment;
3. All the accessories', spares required for the equipment to be purchased should be included at the time of placing the order.

The SMD Laboratory has provision for metrology, electrical and engineering testing sections for which some equipment was already obtained during the last few years. These sections have to be considerably strengthened. Testing equipment for food has not been considered so far and this section may have to be included. The calibration of laboratory equipment is a necessity. The SMD must consider opening a separate section for calibration in the laboratory.

Recommendations:

4. The SMD must strengthen the metrology section considerably, the equipment for this section should be obtained from well-known firms in this field;
5. The general engineering and electrical sections of the laboratory should be strengthened;
6. The SMD should open a separate section for calibration and a completely equipped section for food products testing.

Regular maintenance of laboratory equipment and their calibration from time to time are required for which adequate facilities and expertise are lacking in Kuwait (particularly items such as 1,2,7,13 of Annex V).

Recommendations:

7. The SMD may enter into contract with manufacturers, suppliers of sophisticated equipment for the maintenance of the equipment for the first two years in order that experience is gained and expertise developed.

The SMD is not manned with enough technical personnel for the laboratory to undertake testing in various fields. The laboratory has to recruit personnel at various levels (experts, engineers, chemists and technicians). The technical officers-engineers and chemists do not have adequate experience in testing according to standards and execution of certification marking schemes. Training of the engineers and chemists employed is a must for which certain actions have been initiated with the KISR. Adequate training of the officers, particularly in the standardization, and quality control and application of certification mark in building materials is necessary, such training could be provided by countries such as the U.K., India.

Recommendations:

8. The SMD technical officers should be sent for training in quality control and testing of building materials for a minimum period of three months, either in the U.K. or India. The Building Research Station, Watford and British Standards Institute in the U.K. and the National Buildings Organization, Indian Standards Institution, Central Building Research Institute in India could provide such training.

After the operation of the laboratory for a year or so and having manned it with trained and experienced personnel, the SMD could introduce a certification scheme for products such as hydrated lime, sand-lime bricks, cement and concrete blocks and tiles initially and later extend to other products depending upon the experience gained to run the laboratory, assistance of experts are required in various fields.

Recommendations:

9. The SMD, through the Government and UNDP may request technical assistance from UNIDO for:-
 - a) operation of the laboratory;
 - b) organizing the certification marking scheme;
 - c) training of Kuwait counterparts in the U.K. or India.

The experts required in various fields are:

- a) ceramic building materials (one year)
- b) metrology (six months)
- c) food and allied materials (one year)
- d) electrical materials (six months)
- e) application of certification marking scheme (one year)
- f) chemical analyst (six months)
- g) project manager/co-ordinator (two years) to establish standardization and quality control activities in Kuwait.

All the experts need not be recruited at the same time, but as and when necessary after the procurement of the equipment for each section.

The SMD is a department of the Ministry of Commerce and Industry and has to follow procedures and rules which are time-consuming and hinder the efficient running of the laboratory.

Recommendations:

10. The Manager of the SMD should be delegated with more financial powers and the SMD should have imprest cash of at least K.D. 2,000/- for the purchase of immediate requirements which could perhaps not be anticipated much in advance for following the normal procedure for procurement;
11. The Government must provide an adequate budget for developing the SMD laboratory into a premier laboratory in standardization and quality control during the next five years, and to become a model institute in the Gulf Countries and Middle East.

The SMD does not have a good library. The ASTM, ISO and BS plus other specifications from various countries which are available are out of date. The library needs to be properly organized, technical books on various subjects have to be procured and the latest standards must be made available. A good library is a necessity for being able to carry out activities correctly.

Recommendations:

12. The SMD should procure technical publications, books on various fields in which it is dealing and the latest standards issued from ASTM, BS, ISO, ISI and other countries on a continuous basis. The books and publications should be properly indexed and the library should be organized on modern lines for which a qualified librarian and the necessary staff should be recruited.

III. INTRODUCTION

Kuwait is one of the major oil producing countries, and revenues from oil constitute the majority of the total revenues of the country. The diversification of the country's economy is an important objective of its' development policy. In this connection, the substitution of nationally manufactured goods for imported products and the establishment of viable industries are recommended.

The Industrial Development and Consulting Bureau, which was established in 1973 under collaboration between the Ministry of Commerce and Industry in Kuwait under DP/KUW/79/009 promoted industrial development. The Government also gave considerable attention to standardization and quality control of goods produced in the country and imported goods. For this purpose the help of a UNIDO expert (Dr. A. Geneidy) was requested to draft a law pertaining to standardization which was passed in 1977 and a Department for Standards and Metrology (SMD) was formed. The services of another expert (Mr. Cheema) were requested to prepare a scheme for a national system of quality control and inspection for imported and domestic products together with a proposal for setting up testing laboratories for chemical testing, paints, electrical, general engineering and legal metrology in 1976.

The industry producing building materials is the second largest in Kuwait, after petroleum products. Over 500 factories, most of them in the small-scale are in operation and some of the units registered with the Ministry of Commerce and Industry are classified as follows:

Cement block bricks	19
Cement mosaic tiles	46
Wooden door and windows, furniture	63
Aluminium door and windows, kitchen fittings	13
Metal works, steel fabrication	89
Lime and sand-lime bricks	2
Asbestos-cement products	2
Prefabrication housing factories	4
Insulation for buildings	5
Cast iron foundries	2
Mineral and steel pipes	3
Marble and artificial marble	7
Sanitary-ware (Ceramic)	1
Water-proof felts	1

The Government, taking into consideration that the existing laboratory facilities in the State of Kuwait do not meet the requirements of industry in quality control and standardization, had planned to strengthen the activities in the field of building materials at the national level as well as in-plant. The fulfilment of this task was planned in two phases. During the first phase (DP/KUW/79/009) a UNIDO expert in Standardization and Quality Control in 1980 made recommendations for the strengthening of standardization and quality control activities in building materials based on a survey of facilities available at the in-plant and national levels.

The second part of the expert's mission commenced in September 1983 after the new laboratory building of the SMD was constructed and some of the equipment suggested had been received.

The counterpart agency, SMD, is located in a Ministries' complex in the centre of Kuwait city together with the Ministry of Commerce and Industry and five other ministries (Housing, Social Welfare, Finance, Justice and Religious Affairs). The laboratory building of the SMD is located in the Rai area, 10 kilometres from the SMD offices.

The SMD is headed by Mr. Adnan Al Shalfan and has three main sections (a) Standards, (b) Quality Control and Certification and (c) Metrology. Each section is headed by a controller with two or more assistant controllers/technical officers attached to each controller. Mrs. Sheika Al-Bader, Controller Quality Control and Certification Section is in charge of the laboratory. The total strength of the SMD, including secretariat staff, is about 40. This however, does not include the staff working in the Metrology section and its six centres located in six provinces of Kuwait.

The development objectives of the project are to improve the quality of production and create premises for a rapid development of the national building materials industry through standardization and quality control activities in the field of building materials.

Immediate Objectives

The expert was expected to:

1. Make a survey of standardization and quality control activities in the field of building materials at the national and in-plant levels;
2. Suggest measures for strengthening the standardization and quality control activities in the building materials industries;
3. Prepare a scheme of certification marking for building materials and assist in the operation of such a scheme;
4. Advise on the establishment of a national system of quality control for imported building materials;
5. Examine the possibility of preparing a five-year plan for the formulation of national standards for modular co-ordination, materials specifications, test methods and codes of practice for building and construction and formulate recommendations on such a plan;
6. Train national counterparts in carrying out the above-mentioned duties.

IV WORK ACCOMPLISHED

Survey of Standardization and Quality Control Activities in the Building Materials Industry in Kuwait

Thirty-one factories in the medium and large-scale sector were visited together with counterparts to study the quality control methods adopted on the raw materials used, different stages of manufacture of

semi-finished products and on the final products and the facilities available for testing. The information collected is grouped together and the findings are given below:

Lime and Sand-Lime Bricks

This industry is based on local raw materials - lime and sand. Both the factories were established in the public sector, National Industries Co. (NIC) and have a total capacity of 1.5 million bricks of size 21x11x7 cm and 240 tonnes of hydrated lime per day. Quality control is maintained by testing the raw materials, lime kiln feed and outlet, hydrated lime, sand-lime mix and the finished product. Quality Control charts are maintained at each stage of manufacture. Adequate testing facilities are available to test the product according to British Standards and Kuwait Standards KS II-1970 and KS 50-1974 for sand-lime brick and hydrated lime respectively. The bricks produced are of a standard quality and have a strength of over 150 kg/cm.sq. and are now being used mostly as facing bricks. It is suggested that the use of bricks for load bearing walls should be encouraged for achieving economy in construction.

Cement Products

The cement products industry is well established in Kuwait. Four factories in the public sector and two in the private sector were visited. Four of the units visited were producing solid and hollow concrete blocks and one of them is also producing reinforced concrete pipes and ordinary concrete pipes.

The largest and modern plant set up by the NIC has a capacity of 720m³ of blocks and 1000m³ of ready-mixed concrete per day. Good facilities for testing and quality control during various stages of manufacture are available in the factories set up in the public sector and the products are therefore of standard quality. Factories in the private sector have not set up any laboratory and the quality of the products is only maintained by the experienced skilled workers.

Asbestos-Cement Products

The two plants producing asbestos-cement pressure pipes (50-200mm diameter) and joints in Kuwait were visited. These plants owned by the NIC have a total capacity of 90 thousand tonnes per year but are working at a reduced capacity due to competition from alternative products such as cast iron, steel, pvc pipes. Quality Control is maintained during the various stages of product and adequate testing facilities are available to test the products according to ISO 160. A code of practice for laying the asbestos pipes is required and needs to be prepared by the SMD in consultation with industry and consumers, such as Public Works, Housing Authority, Water and Power Ministries.

Cement

Cement is produced in the only plant of the Kuwait Cement Co., set up in the public sector, by grinding the imported cement clinker. Ordinary Portland Cement Types I and II, sulphate resisting cement (Type V) and white cement are produced according to British and Kuwait Standards. The plant has an installed capacity of 7000 tonnes cement per day. Proper quality control for the raw materials, during the process, and of the final product, is maintained.

Sanitary-ware

The production of sanitary-ware started in 1978 for the first time in Kuwait in the public sector with the technical collaboration of an Italian firm. The plant continues to depend upon the collaborator for the selection of raw materials and batch compositions etc., as adequate facilities are not available. Laboratory equipment has been installed only for the routine checking of the products and not enough for testing according to standard specifications. The Kuwaiti industry has entered a new field for which adequate experience or training facilities are not available in Kuwait. These facilities need to be created by procuring sufficient laboratory equipment and training the staff.

Prefabricated Housing Factories

Three plants in the private sector and one plant in the public sector were visited (Kuwait Prefabricated Building Co.). All the plants are in the large-scale sector and were established with foreign collaboration. Well-qualified and experienced people run the plants. The factory in the public sector produces pre-stressed hollow cored concrete slabs, Tbeams, wall panels by batter casting (vertical and horizontal) and all types of concrete prefabricated building units and good quality control and testing facilities exist. The other three plants produce complete prefabricated housing units of various sizes using steel channels, I_beams, steel corrugated sheets, plywood or partical boards etc. Box-type prefabrication units complete with electrical and kitchen fittings are made at the factory and transported in special vehicles. All the components are imported and no testing facilities are available in the private sector units.

Paints

The paint industry is well-established in Kuwait and two large-scale factories - Hempels Paints and GTC Paints were visited. Both the plants are run with foreign collaboration and the first is run by the technical personnel of the Danish parent-company. Good quality control is maintained during manufacture. Laboratory facilities are available for routine checks such as specific gravity, viscosity, drying time and are not adequate for complete testing according to Kuwaiti specifications.

Steel Pipes

The Kuwait Metal Pipe Industry in the joint sector was visited. It is a modern large-scale plant and produces 15cm to 150cm diameter steel pipes and galvanized iron pipes of a total annual capacity of 100,000 tonnes. Excellent quality control methods are employed and good testing facilities including hydraulic tests complying with ASTM and PAWA standards are available.

Foundries

A large-scale modern foundry with French collaboration was set up in the private sector by the Kuwait Foundry Co. The factory produces 4000 tonnes of castings of grey cast iron, aluminium and produces manhole covers and sanitary fittings according to Kuwait standards. Excellent quality control and modern laboratory equipment including a spectrometer with a computer have been installed. Another foundry producing cast iron manhole covers was also visited but it did not have any laboratory.

Aluminium and Wooden Doors and Windows

Doors and windows are fabricated from imported aluminium sections, plywood and timber in the private sector. No laboratory testing facilities exist in these units.

Insulation Materials

A modern plant with a capacity of 8000 tonnes of glass wool and resin products - insulation materials for buildings, air-conditioning and industrial and pipes have been set up in the public sector in 1980 with French collaboration. A laboratory is being installed. Good quality control is maintained. Other factories producing glassfibre reinforced water tanks, bath tubes, gypsum tiles and building units, artificial marble, bitumen waterproof felts, vermiculite were visited. None of them had any laboratory testing facilities.

Laboratories at the National level for testing building materials

Laboratory facilities available in the Government Research Station (Ministry of Public Works), Kuwait Institute of Scientific Research (KISR) and the College of Engineering and Petroleum (Kuwait University) were studied. The Government Research Station has equipment for routine testing of soils, concrete, bricks, paints, etc., and issues certificates. Equipment for hydraulic tests for pipes has not been installed, the total staff is 52. The KISR is manned by well-qualified staff in the field of building materials and equipment is available for testing cement, concrete, soils, ceramic materials and has a good library and analytical laboratory. The College of Engineering has sophisticated equipment for testing concrete, steel soils etc., and is manned by well qualified staff.

SMD Laboratory

The SMD had planned to set up a laboratory and this was constructed during the period 1981-1983. It is a two-storey building of an area of 2000 m² and is located in the Rai area, 10 kilometres away from the SMD offices. It has been planned for the following sections:

- Ground floor:
- (i) Building materials: two rooms
(13.80x14.00 and 13.80x9.45)
 - (ii) Engineering testing
(6.82x14.25)
 - (iii) Measurement for heavy equipment
(6.82x14.25)
 - (iv) Hydraulic testing: curing chamber
(11.70x5.15)
 - (v) Sample receiving room and stores
(6.10x5.60)
- First floor
- (vi) General chemical laboratory
(15.80x13.80)
 - (vii) Analytical fine measurements
(6.82x6.80)
 - (viii) Physical testing
(6.82x6.80)
 - (ix) Electrical testing
(6.82x15.50)
 - (x) Measurement laboratory for light equipment
(6.82x15.50)
 - (xi) Offices

(all dimensions are in metres)

The building materials section on the ground floor and the general chemical laboratory on the first floor have so far been equipped with all the laboratory facilities such as working benches, gas, power, water, etc., other sections have yet to be furnished.

Laboratory equipment

A number of different equipment for general chemical testing, paints, general engineering and electrical testing were purchased as early as 1978-1979 following the recommendations of Mr. Cheema and the list of equipment purchased was reported in the preliminary report of the first part of the mission. This equipment was not installed so far by the SMD as the laboratory was not until recently completed.

Following the suggestions given by the expert in the progress report submitted in November 1980, the SMD had procured equipment for testing building materials during 1982-1983.

Library

The SMD has a small library containing mainly standards pertaining to ASTM, BS, ISO, Indian, Egyptian and other countries. These standards are not up-to-date. The expert during the first part of his mission suggested a number of technical books and the latest ASTM and BS specifications, which should have been purchased and as yet have not been. The library is not properly indexed and needs to be considerably expanded. A librarian and adequate staff must be recruited to properly organize and make use of the library. The KISR library is much bigger and better organized. SMD must have a good library and adequate steps should be taken towards this. The laboratory of SMD must also possess all the standards and technical books required.

Standards

The SMD has issued 154 standards on various materials and 36 standards pertain to specifications and testing of building materials - hydrated lime, sand-lime bricks, cement bricks and concrete blocks, asbestos-cement products, gypsum, aggregates, marble, wooden doors, bitumen felts, paints, cast-iron pipes and fittings, manhole covers, pvc pipes, steel pipes etc.

The work programme

The work programme for the expert's second part of the mission was modified which includes:

- 1) To prepare a scheme of certification marking for building materials and to assist in the operation of such a scheme;
- 2) To strengthen the existing laboratory for testing building materials with equipment already received;
- 3) To assist in erecting and testing the laboratory equipment received;
- 4) To train national staff of the SMD in the field of quality control and standardization of building materials;
- 5) To advise on the establishment of a national system of quality control for imported building materials;
- 6) To assist in the preparation of a five-year plan for the formulation of a national standardization system in building materials.

Certification Marking Scheme

The detailed scheme of certification marks prepared by a former UNIDO expert was reviewed and a synopsis of the scheme (Annex IX) was prepared and lectures were delivered to the counterparts. Training was provided during visits to factories in the first part of the mission and during the collection of samples of products from factories - hydrated lime and sand-lime bricks, cement and concrete products. Schemes for the quality control of lime and calcium silicate products and cement and concrete products are given in Annexes VII and VIII. Operation of the scheme can only be started when the SMD laboratory is commissioned and has been in operation for at least one year and after the SMD laboratory staff have obtained adequate experience in testing the products according to KSS specifications. To begin with, the SMD could introduce a certification marking scheme for products such as, hydrated lime, sand-lime bricks, cement and concrete products and tiles where proper quality control facilities are available at the factories. Later, the scheme could be extended to other products depending on the experience gained. A questionnaire soliciting the information regarding the interest of the industry in SMD certification schemes was prepared and is given as Annex IX. Further assistance could not be provided due to the shortness of the assignment and because most of the expert's time was spent in the erection and testing of the equipment received.

Laboratory equipment erection and installation

Although the laboratory building was constructed, the building materials and general chemical laboratory sections have been equipped

with work benches, power and water, the SMD Has not taken charge of the building. However, installation of the equipment received on the recommendations of the expert during the first part of the mission in 1980 was taken up. At the request of SMD, most of the expert's time during the second part of the mission was spent in the erection, installation and testing of the equipment in the building materials section. Often the expert and the counterparts had to put in extra effort and work outside normal working hours to complete the erection and testing. The list of major equipment received, erected and tested at the SMD Laboratory is given as Annex V. Trials in the testing and calibration of the equipment such as compressive testing machine, tensile tester, flexural testing machine, burst and creep tester for pipes took considerable time and training was provided for the counterparts in the use of the machines. Lectures were also given in the use of the equipment for the testing of cement, sand-lime bricks, concrete products etc. Samples of products from factories producing cement and concrete products, and hydrated-lime and sand-lime bricks and asbestos cement products for testing were collected. Regular testing of building materials could not be started as the laboratory building was not taken in charge by the SMD from the contractors and had not been commissioned. Various other equipment such as laboratory glassware, chemicals, moulds, and working implements have been ordered but were not yet received. The expert assisted in preparing a list of chemicals, glassware, moulds and other equipment for cement and concrete testing which had not been ordered earlier and these were indented.

Operation of the laboratory

The SMD has to follow lengthy procedures for obtaining simple, miscellaneous equipment which is not costly and which involves a time-consuming procedure since all the rules for the purchase of costly items have to be followed for these items as well. For the purchase of items which are urgently required and for which the need could not be anticipated much in advance for following the normal procedure, no imprest cash was available. The SMD is run as a department of the Government and the Manager of the SMD has no financial powers. Adequate financial powers should be delegated to the manager of the SMD for the smooth running of the laboratory.

Training

The expert participated in meetings and assisted in preparing the curriculum for a two-year course for technicians in standardization and quality control by the Kuwait Institute of Training. Candidates who have completed secondary school are proposed to be given a 4 semester course - 3 semesters for lectures and practicals at the Institute and the last semester for actual training in the use of equipment for testing at the SMD laboratory. The course is to start in 1984 and the intake will be 40 trainees. The course includes lectures in chemistry, physics, physical chemistry, mathematics, standardization and quality control. A proposal for training officers and technicians of the SMD in the use of equipment available in the SMD laboratory for testing building materials paints, chemical analysis for a period of one year at a cost of US\$120,000 was under consideration. Discussions were held with the KISR and SMD about the proposal and advice was given regarding the type of training to be provided by KISR.

Although the SMD is taking action for training, the SMD staff may not be adequate to run the SMD laboratory as a premier laboratory for standardization and quality control and for the application of certification marking schemes for which the SMD laboratory staff should have full knowledge of quality control at various stages of the manufacture of products and adequate experience and confidence in testing according to KSS/ASTM/BS standards and issue test certificates. Often they may have to check and confirm the results and test certificates issued by other laboratories. To develop expertise to this level, training of technical staff (engineers/chemists) in countries where this field is well established is a must. Since Kuwait standards are based on BS/ASTM/ISI/ISO, adequate training could be held either in the U.K. or in India. In the U.K., the Building Research Station (BRS), Watford, and the British Standards Institution (BSI), in India the National Buildings Organization (NBO), Indian Standards Institution (ISI) and the Central Building Research Institute (CBRI) could provide training in building materials. In the field of building materials, it is suggested that two engineers/chemists of the SMD should be sent for training in the U.K. or India for at least a period of three months.

Maintenance of Laboratory equipment

Adequate facilities and expertise are not available for the maintenance of laboratory equipment, which is a necessity. The SMD may enter into a maintenance agreement with costly and sophisticated suppliers of equipment such as Tonipact, Frank, Siemens, for a period of two years so that the local staff could acquire experience and expertise in the maintenance of this equipment.

Operation Manuals

Operation manuals were supplied by the manufacturers for the major and important items of equipment, the contents of which were explained during the trial operation and testing of the equipment. Copies of the manuals and test certificates were taken for safe keeping for future record and reference. It was noticed that some of the equipment which had been purchased four-five years ago had no operation manuals, catalogues of technical literature were available and some parts of the machinery were also missing.

Technical staff

The SMD had recruited five chemical engineers, one mechanical and one electrical engineer, who are fresh from college during the last three years. They need training in standardization and quality control. One engineer in the field of metallurgy was also recruited. The technical staff attached to the expert for training are given in Annex II. Skilled workers and technicians, unskilled workers for the operation of the SMD laboratory were not recruited. It is necessary that at least ten more engineers and chemists are recruited for the laboratory for work in various fields which the SMD will take up in the near future such as electrical testing, food products, general engineering, calibration, metrology. etc.

The SMD is at present equipped with equipment for testing cement and concrete products, lime and sand-lime bricks, tiles, asbestos-cement products and for some of these products further equipment is required which has to be indented and is given in Annex VI. For the procurement of

equipment in other fields, detailed specifications have to be worked out with the assistance of experts in these fields. It is suggested that experts who have knowledge of the equipment in these fields should be associated for the selection of proper equipment while placing orders. It has been noticed that in some of the equipment purchased, a better type could have been procured. Depending upon the specifications supplied by the manufacturers, sometimes the equipment selected will not be the cheapest. Equipment for calibration and metrology must be procured from the most reputable firms even if this equipment is more costly than the others since calibration and testing is an expensive operation for the machine suppliers and it is a necessity for secondary and working standards.

Equipment for general chemical testing such as photo electric calorimeters, polarographs, spectro photometer (UV type), balances, ovens, refractometers, hydrometers, and for paints, viscometers, flash point testers, glass meter, hardness tester, bend test apparatus were received four years ago and have yet to be put to use since the SMD laboratory has not yet been commissioned.

Equipment for general engineering and electrical testing, metrology (secondary and working standards) were also received five years ago and have yet to be unpacked and put to use since the laboratory for these sections are not ready and the experts were not available, no action has been taken by the SMD. A complete list of the equipment received by the SMD in these sections was reported by the expert in the preliminary report of the first part of the mission.

Five year plan

The expert held discussions concerning the preparation of a five-year plan for the SMD laboratory in that it could be developed into an apex laboratory in Kuwait for standardization and quality control and as a model laboratory for the Gulf and Middle East countries as per the desire of the SMD. In the next two years the operation of the laboratory should be given preference so that the SMD technical staff are properly trained and acquire confidence in the field as mentioned previously. A certification marking scheme could be started after one year of the operation of the laboratory by taking action as previously indicated.

Other sections of the laboratory - electrical and mechanical testing, metallurgical products testing, metrology section food - should be equipped with a complete set of equipment, with the help of experts. The food laboratory section has not been considered so far, which will ultimately have to be included. Sections for rubber, plastics, textiles, air-conditioning and refrigerator testing, non-destructive testing and industrial safety may have to be included. A calibration section has to be introduced as the SMD laboratory may take up the calibration of testing equipment in industry and other laboratories. This activity is very important.

Technical Assistance

The SMD, through the Government and UNDP, may approach UNIDO for long-term assistance in the operation of the SMD laboratory, the introduction of a certification marking scheme and the enforcement of standards and quality control for Kuwaiti products and for imported goods. Accordingly, the following experts and training of SMD staff are required:

1)	Project co-ordinator in operation of SMD laboratory	24 months
2)	Expert in building materials	12 months
3)	Expert in electrical testing	6 months
4)	Expert in food and food products	12 months
5)	Expert in metrology calibration	6 months
6)	Short-term consultants (4)	12 months
7)	Training of Kuwaiti staff in the U.K. or India for three months each in building materials, metrology, paints and food.	12 months

Acknowledgement

The expert would like to express his deep appreciation and thanks to Mr. Adnan Al-Shalfan, Head of the SMD and his colleagues, particularly Mrs. Sheika Al-Bader and Mr. Gaith Al-Gaith for assistance and support during his mission. Grateful thanks also to Mr. Osman Hashim, Resident Representative of the UNDP and his colleagues, particularly Mr. Ali Al-Zatari and the secretariat staff without their guidance and assistance it would not have been possible for the expert to complete his mission and prepare this report.

ANNEXURE I

INTERNATIONAL STAFF

Agency : U N I D O

Total period : Six Months

Name of the Expert
and Nationality

Post Description Arrived Departure

ATTOTA V. R. RAO
INDIAN

Expert in Standardisation August 80 November 80
and Quality Control (First Phase)

of Building Materials September 83 December 83
(Second Phase)

ANNEXURE II

Government Personnel

	<u>Name of the Incumbent</u>	<u>Designation</u>	<u>Full/ Part time</u>	<u>Period (Month/Year)</u>
1	Mr. Adnan Al-Shalfan	Head of SMD	part time	8/80 to 11/80 9/83 to 12/83
2	Mrs. Shekha Al-Bader	Controller	F. Time P. Time	8/80 to 11/80 9/83 to 12/83
3.	Mr. Gaith Al-Gaith	Asst. Controller	F.Time	8/80 to 11/80 9/83 to 12/83
4	Mrs Aziza Malallah Ahmed	Chemical Eng.	F.Time	9/83 to 12/83
5	Mr. Mahmoud Bader Aldenn	Mechanical Eng.	F.Time	9/83 to 12/83
6	Mr. Ahmad Abdullah Malallah	Asst. Controller	P.Time	8/80 to 11/80
7	Mr. Ali Al-Aryan	-do-	P.Time	8/80 to 11/80
8	Mr. Fahed Al-Turki	-do-	P.Time	8/80 to 11/80
9	Mr. Khalaf Abdul Karim	-do-	P.Time	8/80 to 11/80
10	Mr. Ahmed Malallah	Chemist	P.Time	9/83 to 12/83
11	Miss Salwa Mubarak	Chemical Eng.	-do-	9/83 to 12/83
12	Mrs. Zakiyah Al Shanre	-do-	-do-	-do-
13	Miss Onayma Shalaby	-do-	-do-	-do-
14	Miss Sana Ahmed	-do-	-do-	-do-
15	Miss Nodar Hasan	Metallurgical Eng.	-do-	-do-

ANNEXURE III

Project Inputs

UNDP/UNIDO INPUTS

Experts (Man months) Six in two phases

Government Inputs

Counter-part Staff (Man months)	:	36 months in two phases
Supporting Staff (Man months)	:	6 months -do-
Equipment Received (U.S.dollars)	:	500 000 (approx.)
Buildings	:	Two storey building of covered area 2000 sq.m. (approximately)
Finances	:	100% financed by the government.

ANNEX IV

List of Building Materials Factories visited during the Survey
 August-November 1980

No.	Name of Industry, Location	Public/Private	Products
1.	NIC, Lime Industries Rai	Public	Hydrated lime sand-lime bricks
2.	NIC Lime Industries Mina-Abdullah	-do-	- do -
3.	NIC Cement Products Factory Shuwaikh	-do-	Ready-mixed concrete (RMC) concrete pipes up to 2000 mm, cement concrete blocks, tiles
4.	NIC Prestressed Concrete Factory Sulaibiah	-do-	- do - kerb stones
5.	Kuwait Building Materials Manufacturing Co. Sulaibiah	Private	solid + hollow cement +concrete blocks, colour
6.	Massella Industrial Cement Bricks East Ahmady	-do-	RMC, solid + hollow concrete blocks
7.	Naki + Wazzan Co. Shuwaikh	-do-	Mosaic tiles
8.	Kuwait Asbestos Industries Rai	Public	Cement, asbestos pipes up to 200 mm dia
9.	Kuwait Asbestos Industries Mina-Abdullah	-do-	- do -
10.	Gypsum Products Shuwaikh	Private	Plaster tiles
11.	Bader Radhan Fibre Glass Factory Shuwaikh	-do-	Fibre-glass resin, insulation materials
12.	Hasam Al-Sarroj-Sons Sabhan	-do-	Artificial marble
13.	NIC Cement Products Factory Sulaibeh	Public	RMC, cement tiles, solid +hollow concrete blocks
14.	Buran Kuwait Trading + Contracting Co. Shuwaikh	Private	plywood wooden doors + windows
15.	Kuwait Aluminium Co. Rai		aluminium sections for doors + windows
16.	Kharifi Tidwell Housing System Shuwaikh	Private	Prefabricated housing units with steel, aluminium + wood
17.	Kuwait Prefabricated Building co. Shuwaikh	Public	prefabricated building elements with RMC
18.	Burham Kuwait Trading + Contracting Co. Shuwaikh	Private	steel prefabrication building elements

No.	Name of Industry, Location	Public/Private	Products
19.	Kirby Building Prefab. Mina-Abdullah		Prefabrication building elements with steel
20.	Hempel Paints Shuwaikh		Paints for marine, buildings etc.
21.	G.J.C. Paints Shuwaikh		- do -
22.	KUBIC Ahmadi	Private	Aluminium door + window frames
23.	Kuwaiti Steel Reinforcement	Joint	reinforced steel bars + mesh, galvanizing
24.	Sanitary-ware Co. Mina-Abdullah	Public	sanitary-ware, glazed tiles
25.	Kuwaiti Foundry Co. Rai	Private	cast iron + aluminium casting manhole covers
26.	Kuwaiti Aristic Foundry Shuwaika	Private	manhole covers, cast iron
27.	Kuwaiti Metal Pipe Industries Shuwaikh	Joint	steel + g.i. pipes up to 1500 mm
28.	Al-Waheed Trading Co. Shuwaikh	Private	aluminium window + door frames
29.	Kuwaiti Insulating Materials Manufacturing Co.	Private	glassfibre resin + insulation materials
30.	Kuwaiti Cement Factory Shuaibah	Public	Portland cement Type I + V, white cement
31.	Ahmadi Quarry + Fitter Unit	Public	

ANNEXURE - V

LIST OF LABORATORY EQUIPMENT RECEIVED ERECTED AND TESTED AT SMD
LABORATORY FOR BUILDING MATERIALS TESTING DURING SEPT-NOV.1983

S.NO.	Description of the equipment its make and specifications	Remarks
1.	Compression testing machine 'Model 1514 TONIPACT 1000' Manufacturer: TECHNO TEST, W.Germany Capacity: 3000 KN Two scales: 0-1000 KN and 0-3000KN for testing cement and concrete products sand-lime bricks 3 phase, 380V, 50Hz, Power:2KW	a)installed and erected, foundation bolts in concrete b)calibrated with 2000KN load column elastic proven ring model No.A-1608 c)Trial testing with concrete cubes. d)Training of counter parts. Testing of sand-lime bricks & concrete products
2.	Frank Tensile Strength Tester Model 85654 Manufacturer: KARL FRANK GMBH W.Germany Equiped with a mechanical load and electromagnetic elongation measuring system for testing polymers, elastomers metals, tissues, conveyor belts etc., fitted with 3 load ranges 0 to 10KN, 0 to 5KN and 0 to 2KN with Hysteresis device. 220/380, 3-phase, 50 Hz	a)installed and erected foundation bolts in concrete. b)trial tests carried out with samples supplied rubber rings, plastic strips for tensile and elongation compression tests with light weight concrete cubes and insulation materials. c)Training.

3. Vibrating table for concrete and motors cubes with motors etc.,
Table dimensions:
Vibrations per minute: 2400
Power: $\frac{1}{2}$ H.P.
3 phase, 50 Hz
Max load: 150 kg.
4. Concrete Mixer
Make: RISITENZE MACHINE UNIFICATE
(RMV) Italy
Capacity: 90 lit
Power: 0.35 H.P.
5. Laboratory mixer for motors
Make: HOBART, U.S.A
Capacity:
Power: 1/6 HP. 220 V 50Hz
RPH 1425 3 speed
6. Motorized flow table for determining the consistency of paste and motors.
Make: RMV-Italy
as per C-230-80 ASTM with moulds and timer
Power: 380V, 3PH
Dimensions: 200x350x250
7. Flexural and Tensile Test Machine for cements according ASTM C-190
Make: 'RMU', Italy
Power: 220V, Single phase 50Hz, 30W with accessories for tensile test and flexural test conforming to BS/150 specifications
Capacity: 600 da N. with two Scales 0 to 118 and 0 to 590
- a) installed with foundation bolts in concrete.
b) Tested; working in good condition.
- a) operated for mixing concrete.
b) In good working condition.
- a) operated, in good working condition.
- a) operated in good working condition.
- a) Installed working in good condition
cement motors were tested, training

- | | | |
|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|
| 8. | Vicats apparatus with moulds, needless for testing consistency and setting time of cements. | Tested; good condition. |
| 9. | Anderson pipette for particle size analysis
Make: Normondic lab. France | tested good condition |
| 10. | Mechanical Sieve Shaker
Make: IECHNO Test, France with timer (Make RMV, Italy)
Complete 200mm dia sieves
a) ASTM Sieves (2nos) from 87.5mm to 37microns
b) Tyler Sieves (20nos) from 100mm to 37 microns
c) Sieves with test certificates according to B.S.410 for 5 test sieves
3.35mm, 1.40mm, 106micron, 75 micron and 53 micron | installed, tested, working in good condition. |
| 11. | Lechatelier tester for determination of soundness of cement, with water bath according to B.S.12: Part 2, 1971
Make: WEKOB, West Germany | Tested in good working condition. |
| 12. | Jaw Crusher for crushing rocks, minerals like lime stone, quartzite etc.
Make: Retsch, Adolf Irrek, W. Germany
Opening: 60x60 mm
Power: 380V, 3 phase. 50Hz
0.75KW | installed and erected with foundation in good working condition. |

13. Burst/creep test unit for testing plastic, asbestos and metal pipes
Make: SIEMSEN West Germany with automatic control panel for pressure generation, temperature control with recorders, pressure gauges etc.
Capacity: 100 bars
Max.Temp.: 80°C
Test pressure: burst test < 100bar
 creep test < 67 bar
Specimen tank: 100x40x150cm with sample holder plugs for 100,150 and 200 mm dia pipes. Complete with spares for operation for 5 years and hoist assembly. Detailed instructions for operation has been supplied with the manual.
- Installed and erected with foundation, water supply, power and hoist assembly.
- Tested for burst test with pvc pipes. Very sophisticated equipment costing one thousand US\$. Operation easy but the Kuwaiti counterparts need more training. Sample holder plugs for asbestos and metallic pipes supply indented The unit is good working condition.
14. Humidity chamber for concrete cubes.
Capacity: 1300l
Dimensions: 855x830x2195mm fitted with temperature control and relative humidity
Max temperature: 50°C
Relative Humidity: 95%
Make: RMU, Italy
Power: 1500 Watt, 220V, single phase, 50Hz
- Installed, tested, in good working condition.

15. Electric Furnace
Dimensions: 350mmx350x350mm
Max.temperature: 1400C
Make: WEKOB, W.Germany
Power: 3 phase, 50Hz
with spare heating element
- To be installed as
electrical connection
to be supplied.
16. Autoclave
Make: TONI TECNİK West Germany
Capacity: 81 Type:6892
Max: Pressure: 25 bar (P.S.I)
Working Pressure: 20.6 bars
corresponding to 215 C.
Basic load : 700W
Control load: 1.400KW
with heating, manometer regulator
- Installed and tested
in good working
condition.
17. Blaine Apparatus for determining
the specific surface of cements
according to BS12: Part 2: 1971
and B.S.4550 Part 3: 1978
Make: RMU, Italy
- Tested, in good
working condition.
18. Curing chamber for cement and
concrete cubes with heating
arrangement
Dimensions: 1600x800x500mm
Max Temp: 80C
Power: 6KW 240, single phase, 50Hz
Burgan Equipments
- Installed, tested, in
good working
condition.
19. Impact testing machine for
Aggregates; 'TECNO TEST'
Type 13D
Drop hammer method supplied with mould
- In good working
condition.

- | | | |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| 20. | AIR ENTERTAINMENT METER
Apparatus for determining
Air content of freshly mixed
concrete/motors as per
ASTM C-231-1971 or BS1881 Part 2: 1970
Make: WYKEHAM FARRANCE
England
Model: WF 52800 | In good working
condition. |
| 21 | Sampel splitter
Make: HUMBOLDT - U.S.A.
Model: H-3992 | In good working
condition. |
| 22 | 2000KN Load Column
(Elastic proving divice) for
force measurement and calibration
Model No. A1608, S.No. L.C.143
Scheid EUROMATEST | Used for testing &
calibrating the
compressive testing
machine item one
supplied with
calibration
certificate. |
| 23 | Proving Ring
Capacity: 20KN
Reference No. PR4309
Ring No. 4787
Sheid Euroma test | Supplied with
calibration
certificate. |
| 24 | Proving Ring for compression
and tension
Capacity: 5KN
Reference No. A1623
Ring No. 4788
Sheid Euromatest | - do - |

ANNEX VI

List of Equipment to be Procured for the SMD Laboratory

<u>Item</u>	<u>Number</u>
<u>Cement + Concrete Testing</u>	
1. Speedy moisture tester	1
2. Storm hydrometer for gravel	1
3. Volume measure for aggregates specific gravity	1
4. Balance (pan type, capacity 20kg, accuracy to 1gm)	1
5. Balance (capacity 1000kg)	1
6. Tension dynamometer from 100 to 100,000kg	1 set
7. Unit weight measures 51, 101, 141, 281 capacity	
8. Slump test for concrete ASTM C-143-71 a) abrams slump cone b) k slump	
9. compaction factor apparatus	1
10. concrete settling time apparatus	1
11. deflectometers (Techno-test)	1 set
12. concrete test hammer with calibration anvil	1
13. concrete packet penetrometer	1
14. automatic grinding machine for cubes	1
15. supersonic instrument for checking concrete structures	1
16. marshal testing machine with recorder + proven rings, 5000kg with moulds, compactor etc.	1
17. stainless steel mixing pans, bowls, scoops	
18. electric saw	1
19. Jar-mill with different capacity jars	1
20. Loas Angels testing machine for abrasion of aggregates	1
21. Thermostatic heat ovens forced heat convection Max. temp. 300°C, capacity 800 litres	
<u>Asbestos cement pipes</u>	
22. Apparatus for crushing and bending tests of pipes according to BS 486-1973	1
<u>Metallurgy Section</u>	
23. Laboratory cutting machine for metal, rocks with diamond rim wheels + spares	1
24. grinding machine for preparing samples	1
25. machines for polishing + etching	1
26. emery papers of different grades for metallurgical purpose	
27. Pressing machine with bacalite for samples	n

<u>Item</u>		<u>Number</u>
<u>Metallurgy Section (Cont'd)</u>		
28.	Ultrasonic testing machine for tracing cracks	1
29.	General laboratory microscope with different magnifications	1
30.	Metallurgical microscope with photographic attachment and with different magnifications	1
31.	Hardness tester, Vickers hardness	1
32.	Spectrophotometer for analysing elements like C, Si, Mn in cast iron and steel	1
33.	Speedy moisture tensometer	1
34.	Apparatus for determining Green compressive strength of sand samples	1
35.	Permiability tester for sand samples	1

ANNEXURE VII

SCHEME FOR QUALITY CONTROL OF LIME
AND CALCIUM SILICATE (SAND-LIME) BRICKS
IN KUWAIT
.....

1.0 Scope

This scheme is a guide for carrying out quality control and standardisation required for application of certification scheme on sand-line bricks, quick and hydrated lime produced according to KSS 11-1970, KSS 50-1974 respectively, and testing as per KSS 86-1974 and KSS 100-1979. It covers the quality control measures required at various stages of manufacture: from raw materials to finished products at the factory, drawing of samples from the factory and testing at the SMD laboratory.

2.0 General Information

The lime and sand-line brick industry is based on local raw materials and imported raw materials. Two plants in public sector of total capacity 1.5 million bricks per day, 700 tonnes of quick lime and 240 tonnes of hydrated lime per day in operation at rai area and Mina-Abdulla. The Hydrated lime is packed in paper bags and quick lime produced is consumed for sand-line production and hydration. The size of the bricks produced are 22 X 11 X 7 cm, 22 X 22 X 22 cm and 29 X 19 X 14 cm in white and various colours.

2.1 The process of manufacture consists of calcining lime stone in gas fired rotary kiln to temperatures 1100-1200^oc. The calcined lime (quick lime) after cooling and grinding is mixed with sand in a premixer with a definite quantity of water and left in a reaction chamber for about two hours. The moisture content and Ca (OH)₂ content of the mix is controlled and checked for each batch. After final mixing and correction of moisture and lime content in the mix, it is fed to automatic presses which would mix to desired size bricks under pressure. The bricks are stacked in cars automatically and the cars loaded with bricks are pushed

into autoclaves where bricks are cured at 14 atmospheres steam pressure for 5 hours. The bricks after autoclaving are transferred to storage yard for despatch. For production of hydrated line the quick line is hydrated in a hydrator where quantity of water added is controlled. The hydrated line which is in dry and powdered form is packed in paper bags.

3.0 Quality Control

3.1 Quality control is required to be maintained at each stage of manufacture starting from

- (a) raw materials
- (b) processing of raw materials
- (c) intermediate products
- (d) final products.

3.2 Quality control of raw materials purchased

The raw materials used are line stone and silica sand. Line stone locally available is a friable stone and supplied in the form of size of sand and gravel less than 9 mm. It contains considerable quantities of silica and other insoluble matter. The imported line stone is hard and obtained in 3-9 mm size and contains more than 95% CaCO_3 where as local line stone has only 80% CaCO_3 . High CaCO_3 content line stone is preferred for sand line brick manufacture. MgO content should be less than 3.0%. The silica sand containing over 75% silica and less in silt and clay content is preferred. Higher silica content gives a better product. The strength of sand-Line brick depends upon the particle size and shape of sand, quantity of line added, water content of mix, pressure applied and autoclaving. The type of quality control tests have to be carried out is given in the following paras and quality control charts are maintained.

3.2.1 Line stone

(a) Chemical testing

- (i) Ca CO_3 content as per B.S. 4550 part 2:1970 (EDTA method). - daily for each consignment.
- (ii) Insoluble matter as per B.S. 890 - weekly.
- (iii) soluble silica as per B.S.890 - weekly.
- (iv) loss on Ignition as per B.S.4550 part 2 - daily

(b) Physical testing

- (i) Sieve analysis - daily for each consignment
- (ii) Bulk density - daily

3.2.2 Sand

(a) Physical testing

- (i) grading by sieve analysis
- (ii) Bulk density
- (iii) clay and silt by volume
- (iv) colour

(b) Chemical

- (i) Silica content - weekly
- (ii) Carbon dioxide % - daily

3.3 Line Production

3.3.1 Kiln feed % CaCO_3 in every shift

Smoke chamber

- (i) % CO_2
- (ii) % O_2
- (iii) % CaO

3.3.2 Kiln out let : % CaCO_3 Every hour

3.3.3 Ball mill : % passing thru 75 micron - every hour
% CaCO_3 - Every hour

3.3.4 Slaking : rise in temperature - and time taken for every shift..

3.4 Lime Hydrator

3.4.1 Hydrated Lime

- (i) moisture % hourly
- (ii) reactive lime Ca(OH)_2 hourly
- (iii) carbonate % per shift

3.5 Sand-line brick production

3.5.1 Sand-line mix

- (i) % moisture each batch for each press
- (ii) % Ca(OH) - do -

3.5.2 Sand-line brick samples are collected from each press for each shift for the following properties to conform B. S. 187-1970 / KSS 11-1970

- (i) general appearance
- (ii) dimensions
- (iii) weight
- (iv) bulk density
- (v) drying shrinkage
- (vi) compressive strength

3.6 The hydrated lime is tested for the following to conform B.S.890-1972 KSS 50 - 1974 specifications :

(a) Physical tests

- (i) residue on 90 micron sieve
- (ii) soundness as B.S. 890
- (iii) workability -do-
- (iv) bulk density -do-
- (v) hydraulic strength -do-
- (not applicable for high calcium lines)

(b) Chemical tests

- (i) carbon dioxide as per ASTM C-25
- (ii) insoluble matter as per B.S.890
- (iii) soluble silica as per - do -
- (iv) Available lime index -ASTM C-25
- (v) $\text{CaO} + \text{MgO}$ content B.S.4550 part II

4.0 Sample Collection

4.1 Sand-line bricks

Method of sampling is carried out as per B. S. 187:1978

4.1.1 Sampling in motion

Wherever practicable take samples while units are moved, for example, during loading or unloading. Take 2 bricks from each of 10 approximately equal sections of delivery to be tested.

4.1.2 Sampling from a stack

Divide the stack into 10 real or imaginary sections and draw 2 bricks from each. Bricks are taken from top and sides of section which are accessible and also from the inside of the stack, which will require removal from upper layers.

4.1.3 A minimum of 20 bricks constitute a sample for complete tests. 10 will be required for compressive strength test and 4 for drying shrinkage test, leaving 6 as reserves for use in the event of damage.

4.1.4 Each sample of 20 shall represent not less than 2,000 or or more than 10,000 bricks.

4.1.5 If separate samples are taken from different deliveries or part consignments these shall be marked to identify them as such.

4.1.6 Treatment of sample

keeps the bricks in dry and free from contamination by deleterious substances and from extreme conditions of temperature, both before and during transit to the laboratory and until they are tested.

4.2 Hydrated lime

Method of sampling of hydrated lime is carried as per B.S.890:1972.

4.2.1 Sampling from stream in motion

where practicable collect at a discharge point e.g. of a conveyor or sack filling machine by filling a container so as to collect a sample representative of the whole

4.2.2 Sampling from packages

Take approximately equal increments from at least 5% of packages or 12 packages. Take not more than one increment from one package. Use sampling tube (as per B. S. 890) for collection of sample by inserting the tube into package so that it takes a core of material from substantially the entire length of the package.

4.2.3 sampling from hoppers or bins

Use a sampling tube of suitable diameters and of sufficient length to permit taking of a core from the top to the bottom of the mass being sampled. Take cores at least 12 separate places distributed throughout the mass of the material, so that the total sample is not less than 10 kg.

4.2.4 Preparation and marking of bulk sample

Thoroughly mix the bulk sample and reduce it by using a sample splitter to give duplicate samples each consisting not less than 5 kg.

4.2.5 Preparation of samples at the laboratory

Reduce the sample to obtain a representative sample of at least twice the amount required for all the tests to be made by using sample splitter. From this take a small representative sample of about 50 g and grind it to pass 185 micron (B.S.410) test sieve and place it in an air tight container.

5.0 Testing at S M D Laboratory

5.1 The sand-line brick samples and hydrated onelime samples will be tested for specification as given in paras 3.5.2 and 3.6 according to Kuwait/B.S. specifications. The test results are reported as per the proforma given in the appendix.5.2

5.2 In case the samples collected do not conform fully with the Kuwait specifications. The lot/batch of bricks or hydrated lime should be segregated and should not be released for sale. If by mistake, they have been supplied the goods should be withdrawn from the market. The manufacturer should be advised to correct the defects or deficiencies by following and checking quality control starting from raw materials to the stage of final product.

5.3 The laboratory staff and inspectors should have complete knowledge of various stages of manufacture at the hydrated lime and sand-lime production of the factory and the various requirements of the specifications and the test methods for determining these requirements.

....

Proforma for test report for test evaluation of sand-lime-brick and
Hydrated lime.

STANDARDIZATION AND METROLOGY DEPARTMENT
MINISTRY OF COMMERCE AND INDUSTRY

TEST REPORT

Serial No. _____ Date _____

Classification of sample _____

Description _____

Quantity _____

Date of collection _____

Date of Receipt at the Laboratory _____

Address of factory or market/stores)
from where the sample collected)

Name of the person who collected the sample _____

S.No.	Test	Result	D.S. 187/1976 or KSS 11/1970 Requirements	Remarks
1	General appearance			
2	Dimensions Length Breadth Thickness			
3	Weight			
4	Bulk Density			
5	Compressive Strength (K/cm ²)			
6	Classification according to strength			
7	Drying Shrinkage			
8	Any other information			

Conclusion _____

S.M.D. Seal _____

Signature of Investigator _____

Signature of Laboratory

-11-
TEST REPORT
FOR HYDRATED LIME

SERIAL NO.

DATE

SAMPLE DESCRIPTION

Quantity of Sample collected :

Date of collection
Date of Receipt at the Laboratory
Address of the factory or market/stores)
from where the sample collected }

Name of the person who collected the sample

S.No.	Test	Result	IS 390 KSS 56 Requirements	Remarks
-------	------	--------	----------------------------------	---------

Physical

- 1 Residue on 160 micron sieve
Total Residue on 90 micron sieve
- 2 Soundness
Le Chatelier expansion
- 3 Pct test
- 4 Density
- 5 Workability

Chemical

- 6 Carbon dioxide
- 7 Insoluble matter
- 8 CaO + MgO
- 9 MgO
- 10 Soluble salts
- 11 Soluble silica

Conclusions

CHD Seal

Signature of Investigator

Signature of Laboratory-
-in-charge

ANNEXURE VIII

Scheme for Quality Control of cement and concrete products in Kuwait.

- 1.0 Scope: This scheme is a guide for carryin out quality control and standardization required for certification scheme for cement-sand blocks and concrete bricks produced in Kuwait according to K.S.S10 and B.S.1180-1972 respectively. The KSS standard for concrete bricks is under preparation. It covers quality control required at various stages of manufacture from raw materials to finished products at the factory, drawing of samples from the factory and testing at the SMD laboratory.

- 2.0 General Information: Number of factories are producing cement-sand blocks and concrete bricks in the small scale sector and four in the large scale sector out of which two are established in public sector by National Industries Co. (N.I.C.) were visited by the expert. Good quality control facilities are available with the N.I.C. and the two large scale factories in private sector and others in small scale do not have any testing facilities.

- 2.1 The raw material sand locally available in Kuwait, cement from Kuwait cement Co. and aggregates locally available from the quagrries and portable water from water distillation plant are used.

2.2 The manufacturing process of cement-sand/concrete blocks is as follows:

Sand conforming to B.S. 882 or 1201 is obtained in lorries and stored in open storage yard. Sieving of the sand is rarely done except in one or two factories before it is conveyed to storage silos by belt conveyors. Ordinary portland cement complying to B.S. 12 or A.S.T.M. C-150 type I is received in bulk containers from Kuwait Cement Co. and pneumatically transferred to storage silos.

Gravel complying to B.S. 862 is also used when bigger blocks and hollow blocks are made. Automatic batching plants are used for weighing and mixing the raw materials: cement and sand, gravel and water in predetermined quantities. The cement-sand gravel-water mix is moulded into blocks/bricks of different sizes and shapes by vibration and hydraulic pressure either by automatic presses (factories) or by egg-laying machines (factory e). The blocks/bricks are set on pallets or on finger cars and transported to curing yards.

3.0 Quality Control

3.1 Quality control is to be maintained at each stage of the process of production starting from

- (a) raw material and their processing
- (b) intermediate products
- (c) final products

3.2 Quality control of raw materials: The following tests are required to be carried out on raw materials.

<u>Material</u>	<u>Test</u>	<u>Periodicity</u>
<u>Sand:</u>		
a) grading of sand	by sieve analysis as per B.S.S.882	daily

b) Clay and silt by sedimen-
 in sand tation.

Aggregatee:

Grading by sieves daily

Cement

Test certificates
from supplier Kuwait
Cement Co.

3.3.1 Concrete:

Crushing strength as per B.S. each batch
of concrete cubes and A.S.T.M
after 28 days
curing.

3.3.2 Blocks: Dimensions as per K.S.S10 and
 density K.S.1180-1972
 water of
 absorption
 drying
 shrinkage
 compressive
 strength

4.0 Sample Collection

The method of sample collection for concrete blocks are carried out as per B.S. 1180-1972 and details are similar to that given in para 4.1 of Annexure VII.

5.0 Testing at SMD Laboratory

The cement sand blocks and cement concrete blocks will be tested according to KSS10 and B.S.1180-1972 respectively. The test results are reported as per the proforma indicated in Appendix of Annexure VII for sand-lime bricks and action taken as mentioned in para 5.2 of the said Annexure.

ANNEXURE IX

QUESTIONNAIRE FOR SOLICITING THE INFORMATION REGARDING
INTEREST OF THE INDUSTRY IN SMD CERTIFICATION MARKING
SCHEME.

1. Name of the factory
2. Address
3. Whether the factory is in Public Sector or private sector?
4. In case of private sector unit, please give the name and address of the owner.
5. TYPE OF PRODUCTS PRODUCED
 - a) Annual capacity of each product
 - b) Production of each type of product for the last three years.
 - c) Annual sales for the last three years please give total value of the products in K.D.
6. Do your products conform to :
 - a) Kuwaiti Standards
 - b) A.S.T.M. Standards
 - c) B.S. Standards
 - d) Any other Standards
7. Have you laboratory facilities to test your product according to standards?

8. Do you depend upon the laboratories in Kuwait or abroad for quality control and standardization if you do not have adequate testing facilities?

If so, please mention the laboratories and their addresses.

9. Have you any problem in selling your products either in Kuwait or abroad?

10. Do you know the advantages in obtaining KS certification marking scheme for your products? Please '✓' the following:

- a) Better image of your product in the market
- b) Winning consumers confidence and good will
- c) Streamling your production process by introduction of quality control system.
- d) Economy by introduction of quality control system.
- e) Preference of KS - marked good by organized purchasers like government agencies

11. Are you interested in obtaining KS certification mark on your products?

12. Your views on introduction of KS certification scheme in Kuwait.

SIGNATURE

NAME

DESIGNATION

DATE

SEAL OF THE
COMPANY

Certification Marks Scheme

Synopsis

1. Certification is a process of determining by independent evaluation that the products conform to relevant standards.

2. Marking Scheme provides

- i- independent assurance of quality
- ii- reliability
- iii- safety in some cases

3. Advantages

The main advantages to

(i) Manufacturers (a)

- (a) Streamlining of production process and introduction of quality control system.
- (b) Better image of the products in the market (internal & abroad)
- (c) Winning consumers good will and confidence.

(ii) Consumers

- (a) Guarantee of quality as per Kuwaiti Standard
- (b) Helping in making a choice - protection from sub-standard quality product.
- (c) Free replacement in their being found to be sub-standard quality.

(iii) Organised Purchasers - (Government agencies in particular)

- (a) Elimination of the need for inspection and testing of goods - Saving time, labour and money.
- (b) Free replacement of sub-standard products.

4. PRE-REQUISITES FOR OBTAINING LICENCE BY THE MANUFACTURER.

For obtaining licence for KS marking on the products, the following pre-requisites are necessary for the manufacturer:

- (a) Full testing facilities are available at the factory or with the manufacturer.
- (b) products conform to Kuwaiti standards
- (c) formal acceptance of the scheme of testing and inspection and payment of fees.

5. Procedure for Granting Licence

- (i) Enquires for certification mark
 - (a) short write up of the scheme to be supplied to the manufacturer.
 - (b) Check list of equipment required for testing to be supplied.
- (ii) Registration of application
 - (a) Application should be submitted in the form prescribed separately for each product with prescribed fees.
A register is maintained as per appendix 2. A letter of registration is issued.

(iii) Preliminary Inspection

After receiving the application and registration SMD shall arrange a preliminary inspection.

During inspection of the factory the inspector will collect information :

- on raw materials used and source of supply, test certificates of the supplier, sampling and testing at the factory.
 - type of products produced, brief description of the process
 - how quality control maintained
 - method of disposal of substandard product
 - type of packing and marking, batch, date etc., for identification.
 - laboratory, quality control staff and testing of finished products.
 - metrology control
 - sample
 - any other information.
- (iv) Random samples will be drawn by the inspector and tested in the SMD laboratory as per Kuwaiti standards.(Appendix 3).
 - (v) Report of preliminary inspection is prepared as given in a Appendix 4.
 - (vi) All information obtained and afterwards is to be treated as confidential.

6. A draft scheme of testing and inspection which indicates the control to be maintained by the manufacturer at the factory for obtaining and maintaining the licence is supplied to the applicant.
7. Then licence is granted when
 - (a) full testing facilities are available
 - (b) samples conform to kuwaiti standards
 - (c) formal acceptance of the scheme of testing and inspection and fee received.
8. Licence is granted for one year for using KS-Mark on the products. Prior approval of SMD is required for the design of KS-Mark. (Appendix 7 and 8).
9. Period Inspection:

The SMD will organise periodic inspection visits-both surprise and pre-intimated to check the scheme of testing. Samples are drawn by the inspectors from production line/store for testing in the SMD laboratory.
10. Purchase of samples from market or consumers and getting them tested.
11. a-A guide of the preliminary inspection report is given in Appendix 4.
 - b- General scheme of testing and Inspection to be followed is given in Appendix 5.
 - c- A guide on the outline of Report of Periodic Inspection by SMD Inspector is given in Appendix 9.
12. Follow-up : on receipt of report from Inspector SMD may take action as follows:
 - a) issue a warning to the licensee asking to remove the lapses.
 - b) suspend marking the product temporarily if the scheme is not operated satisfactorily.
 - c) issue notice for cancellation of licence when the lapses are serious or reptitive nature and cancellation after due notice.

13. Renewal of Licence :

The licence is renewed for another one year after receipt of renewal application with fees provided that

- (a) the performance of the licence is satisfactory
- (b) proper action taken to remove the lapses

If there is some lacuna in performance

- (a) licence may not be renewed
- (b) renewal may be deferred and licensee asked to remove drawbacks.
- (c) may be renewed for limited period and the inspection may be tightened.

14. Handling of complaints :

All complaints are investigated on priority to maintain creditability of the mark. Free replacement of defective material by the licence as is carried out according to the result of investigation.

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