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ECONOMIC COMMISSION FOR WESTERN ASIA

Ad Hoc Expert Group Meeting on
Co-ordination of Building Research
Beirut, 11-15 November 1974

Draft Report of the Meeting

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- a) research on rocks, gravel and sand, as components of concrete used in the construction of buildings or in road construction;
- b) research into the shrinkage and creep of Portland cement concrete in the different climates of Lebanon;
- c) research on the effects of earthquakes upon existing structures, so as to lay down the safety regulations to be followed when designing and calculating structural foundations;
- d) participation in discussion of a code of practice for reinforced concrete to be adopted by all Arab countries;
- e) research into environmental conditions in towns and rural settlements; and
- f) research into road and traffic problems.

28. In the Yemen Arab Republic, building research is very new. No proper scientific research has been conducted. The country faces problems from lack of adequately trained personnel, equipment and finance.

29. In the United Arab Emirates, building research is also new. Up to now no research has been conducted. However, the subject generated considerable interest and, accordingly, an agreement was signed between the UAE government and the United Nations to engage three United Nations experts in the fields of housing, building materials and planning. Unfortunately, none have yet arrived, due to unforeseen difficulties in recruitment.

30. There is as yet no building research centre in Democratic Yemen due to lack of funds, adequate personnel and equipment. Thus, Democratic Yemen has to start from the beginning.

31. Observing the rising cost of providing homes, the Royal Scientific Society of Jordan responded to proposals made by the Jordan Valley Commission and Housing Corporation and other Government agencies to initiate a research activity at the Royal Scientific Society aimed at improving construction methods and saving materials. A steering committee was

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established in September, 1974 and the objectives of the Project defined. These are to review experimental work done by the Commission and, through research, develop a housing system flexible enough to suit low and middle income groups. The system depends on a modular reinforced concrete panel system for walls, roofs and floors. It contains a minimum of materials and lends itself to labour intensive or industrialized production. When fully developed, this system can be produced either in a central mechanized plant (for urban areas) or through labour intensive techniques in remote rural areas.

32. Kuwait inaugurated its building research programme in 1952 at the start of its development with the main object of guiding its physical expansion along scientific lines. A geological survey of the surface deposits within the State was completed in 1953. Sand gravel and lime were found in abundance but very little else of use to the builders. There were no clays suitable for brick manufacture or for making cement. Ground waters were brackish and the few outcrops of sandy limestone rock excessively fragile. The only building unit which could be manufactured entirely from indigenous materials was a sand-lime brick; laboratory and pilot plant tests were instigated and a factory went into production in 1955 with a capacity of 50 million standard bricks a year.

33. At the same time, a meteorological station was set up, for at that time little was known about the climatic extremes encountered in the region. Coupled with this, a full scale experiment into the thermal response of buildings to the climate was carried out. The relationship of internal living conditions to colour, mass, thermal conductivity of materials, surface, textures orientation, window and door openings and other factors were tabulated and have since been used to provide a more scientific approach to building design in order to achieve thermal efficiency.

34. During the 1950's, the rate of building accelerated rapidly and quickly outstripped the means to control it. After a number of failures had occurred, it became evident that Kuwait's first need was not a search for new and better materials but an organization to control the manufacture and use

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of existing ones. Thus for the next few years, the Building Research Station was forced by circumstance to become a materials testing station. In no way however could the work be termed 'research'. It was only possible to observe and record the behaviour of materials insitu and the viability of different methods of construction. It was possible however as a result of accumulated experience to devise a series of standards which has led to much closer control of building throughout the State. The extensive laboratory facilities have undoubtedly assisted in the creation of back-up industries for building, notably paint factories, an asbestos cement industry, prefabricated housing, precasting yards, tile manufacture and a clinker grinding plant.

35. It was not until 1972 that the Kuwait Institute for Scientific Research was set up. This covers all aspects of research which are of interest to Kuwait's economy and future advancement. No attempt has been made in this new organization to duplicate testing facilities already available in the State, its equipment and staff being utilized entirely for specific research projects, enlisting the co-operation of existing facilities as these are required. On the building side, work has been carried out into the manufacture of improved sand-line units including lightweight blocks, interlocking units and preformed brick panels. A study is currently being undertaken to improve the quality of the sand-cement block and sand-cement products generally. Fibre-reinforced alkalai resistant glass fibres, which although more expensive than normal steel reinforcement at the present time, are likely to be cheaper in future as steel becomes more expensive.

36. The Syrian Arab Republic faces the same building research problems as many other ECWA countries. In 1970, the United Nations assisted the country in organizing a centre for housing and construction. Some technical reports were prepared, e.g. (a) rationalization of existing building methods and preparation for the introduction of new building methods, particularly (partial prefabrication and self-help building technology, (b) rural housing in Syria; and (c) application of building materials hitherto not

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sufficiently utilized. Due to a shortage of funds, the Centre closed down as the Government of the Syrian Arab Republic decided that other projects were of greater importance. It is hoped that the Centre will be reopened in the near future. In the meantime, it was emphasized that the closure of the Centre did not affect the United Nations' desire to respond to the requests of the Syrian Arab Republic Government. It was explained that each country has its own "country programme" and has its own set of priorities; thus, it is not possible to undertake all the projects and a selection often has to be made.

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IV. SOME ISSUES CONNECTED WITH BUILDING RESEARCH ACTIVITIES IN THE ECWA REGION

37. The importance of evaluating the engineering properties of local soils and the special design needs of foundations subject to earthquakes was stressed.
38. The question was raised whether countries, which up to now have not established a building research centre, should attempt to do so or should rely on other countries of the ECWA region to provide them with the necessary information and thus avoid duplication of efforts. There should be careful examination of the possibilities for co-ordination with relatively more developed countries within the ECWA region.
39. For the utilization of traditional building methods, the project in Nubia, Upper Egypt, was discussed. There extensive use of traditional building methods was employed. The Egyptian architect, Hassan Fathy, wrote a book on the use of this particular type of housing for low-income groups. The meeting showed interest in finding out how far this type of traditional building could be adapted to other countries, since an attempt to introduce these houses into Saudi Arabia failed due to the higher costs involved. There was agreement that the Meeting should concentrate on building materials and building techniques including the possible revival of traditional techniques.
40. The Meeting emphasized the differences between building in urban and rural areas. It was observed that there should be greater stress on rural housing, since approximately 70% of the population in the ECWA region live in such areas, most belonging to the low-income group. Unfortunately, most countries seem to spend more time on urban planning.
41. It was noticed that there is a problem in concrete control on the work-site. Publication of an elementary code preferably in Arabic, could contribute to construction safety.

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42. One function of research establishments is to disseminate knowledge. The participants expressed interest in co-operating with one another in this regard and agreed that research is of little value if it cannot be brought down to "on site" level.
43. A note for discussion purposes was introduced (See Annex III). Since only a few building research institutes are at present operative in the ECWA region, no real co-ordination could be established at this stage. It would therefore be advisable to orient discussions towards two objectives: a) the possible creation of new building research units or organizations; and b) the best ways and means to establish a network for the exchange of information. The note for discussion enumerated fourteen different questions intended to assist the participants in clarifying problems and formulating recommendations.
44. Developing countries seem to ignore the fact that development in the developed countries was preceded by extensive research. Developing countries should make use of research made in developed countries, but must establish their own priorities, taking their own local particular problems into account. There is too much emphasis on testing which is erroneously mistaken for research. Testing is a by-product of research and is essentially important for quality control. Most laboratories in developing nations concentrate on the collection of data rather than on its subsequent analyses. There should be strong emphasis on the dissemination of knowledge. Governments in the region should take the initiative and encourage such efforts. Two types of research were identified: informational or basic research and developmental or applied. Many developing nations can build on technologies already existing. New processes can also lead to the development of existing ones.
45. The importance of the human factor, demography, social links, social needs, labour, market possibilities, personal income, capacity to create

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new enterprises, climate, availability of raw materials, infrastructure, needs to be taken into account and all of them have to be studied in order to produce a concerted policy. Each country must analyze its own particular needs. The question of whether to improve traditional methods or whether to import new ones is also relevant. Research requires its own special environment; research in isolation is useless. Five different types of research should be considered: a) research for improving traditional ways of construction; b) research for the adaptation of foreign systems; c) research to study the greater use of local raw materials; /and d) innovative research to find entirely new ways of building; / e) research to develop new ideas of improving the production and use of building materials. Items a and b are important for rural housing but if the possibilities of developing a new building industry exist, then c, d and e are also relevant.

46. In summary, the Meeting emphasized the following points: 1) the need to reduce the cost of housing and building materials and its relevance to low-income groups; 2) the importance of traditional building materials and techniques; 3) the distinction between the rural and urban environment in planning for housing and conducting building research; 4) the dissemination of knowledge to the building sites; 5) the proper relationship between testing and research; 6) the importance of relating building research to other research disciplines; 7) the relating of building research to social conditions and the economic potential of a country; 8) clear definition of the purpose of research.

47. One of the issues extensively discussed was whether each country should have its own research centre or whether there should be a single centre serving the region as a whole. As regards question eleven of the note for discussion, the main problem involved in identifying areas of building research is the lack of a regional system of information. There is a need for a network of information exchange. This is closely related to question fourteen of the note for discussion regarding which organization will receive the information in each country and will be responsible for

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its distribution to others. All organizations in the region concerned with this field can play a part. ECWA's role should be in helping to channel this information. This would contribute to the promotion of a regional building research activity in the ECWA region. This exchange of information should not stop at regional level, but such information should find its way to the UNCHBP which will in turn channel it to other regions.

48. There ensued a short discussion on fellowships made available by the United Nations and the procedure of applying for these fellowships was explained and discussed. Training fellowship candidates was cheaper than importing experts, but many governments do not have enough skilled staff and cannot afford to send those it already has for further training. There have been cases of young people, sent on fellowships to highly developed countries, having no incentive to return to their country. One remedy could be to create training centres within the region. Training within the region itself would have the advantage of mitigating the negative effect of different sets of educational systems acquired by young people through study in different countries.

49. The importance of documentation as a prerequisite to research was discussed and it was agreed that it should be a first step in any research activity. The participants agreed to provide one another with names of experts and put each other on a mailing list, which was in effect one of the main tasks of ECWA and UNCHBP, which could serve as clearing houses for information.

V. MACHINERY FOR CO-ORDINATION OF BUILDING RESEARCH AND CONCLUSIONS

50. An informal meeting of the participants preceded the session devoted to finalizing the conclusions of the meeting. Discussions centered on possible methods of co-ordinating research efforts in the individual countries. Each participant gave the full particulars of that organization in his own country authorized to take the responsibility for co-ordination of building research matters. A list of proposed institutions is given in Annex IV. The proposals put before the formal session as a result of this meeting were as follows:

- a) The time was not considered ripe for the creation of a central research institution to serve the whole ECWA area. Instead, it was considered preferable to strengthen existing testing laboratories or create testing laboratories in each country to serve as a nucleus for building research;
- b) To set up a co-ordinating organization in the National Council for Scientific Research of Lebanon in Beirut working with ECWA for the exchange of information such as: technical problems and needs of the individual countries; results of research work carried out and material resources and surpluses;
- /is c) The co-ordinating organization/to issue a questionnaire to participants for the purpose of planning research needs within the area. This will result in a proper assessment of research priorities thus enabling individual research establishments to organize more profitable research activity;
- d) Working groups should be established. These groups would meet periodically for personal discussion.

51. In the ensuing discussion these proposals were accepted by the Expert Group. The appointment of the National Council for Scientific Research of Lebanon as co-ordinating body was considered to be particularly convenient

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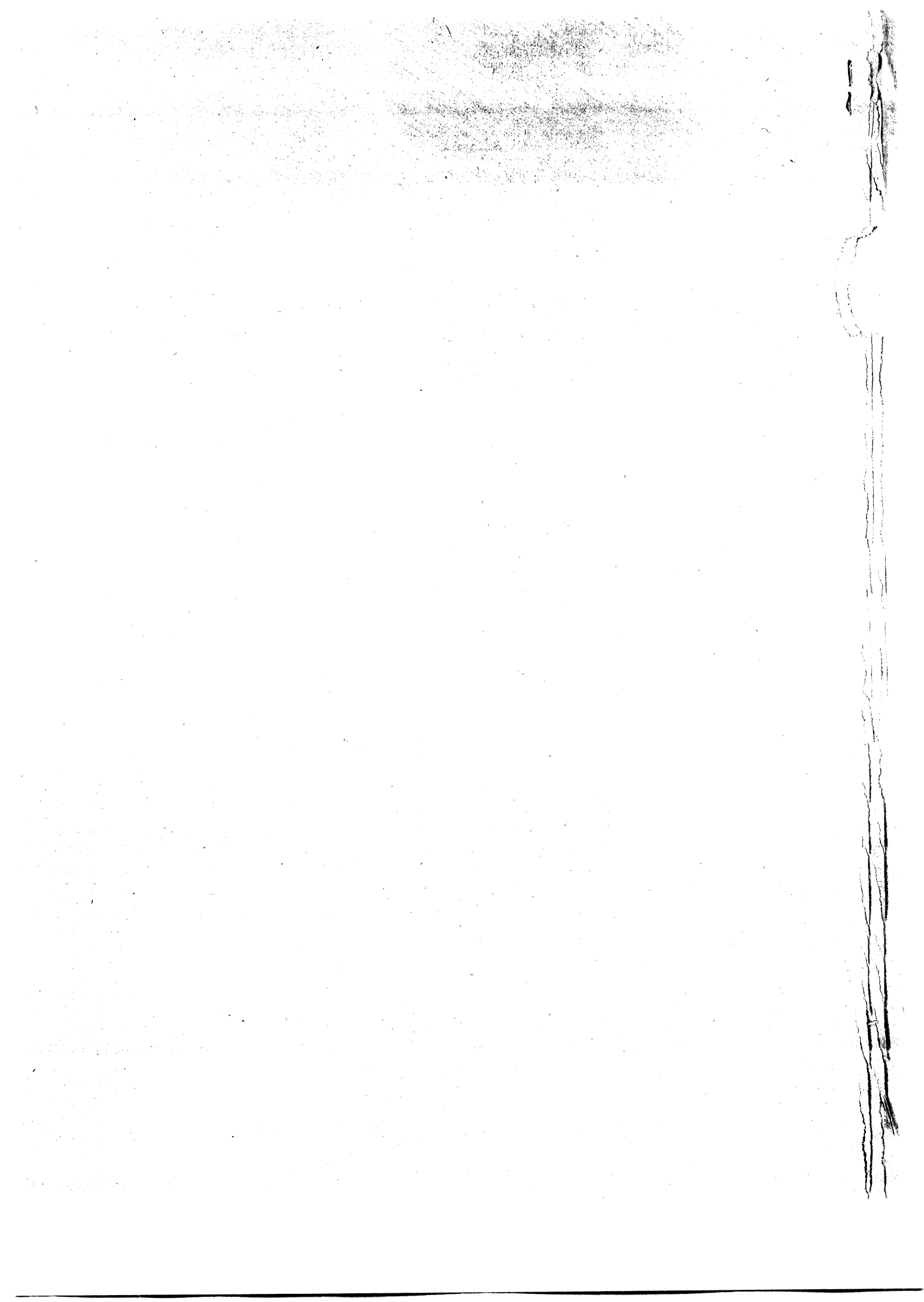
for its close proximity to ECWA Headquarters. The question of financing laboratories or strengthening existing ones was raised. It was suggested that where funds were not locally available, some assistance might be obtained from the United Nations as part of an inter-country project which will have to be applied for formally by interested countries through ECWA.

52. Despite the desire on the part of some of the participants to establish building research in their countries, it was pointed out that such organizations were unlikely to produce useful results until such times as routine testing facilities were adequate to meet day-to-day needs.

53. It would be advisable, however, to appoint at least one individual in each such establishment who would be responsible for analyzing results obtained in the course of routine testing, collect research information and serve as a nucleus for future expansion of research activities.

54. It was pointed out that research does not necessarily require sophisticated equipment. This specially applies to the developing countries of the region, where there is great shortage of skilled and trained staff to operate and maintain such equipment.

55. In view of the intensive building activity going on in the region, the participants expressed the desire for holding, in one of the countries of the region, an interregional seminar concerning building techniques in order to exchange experiences with professionals from other developing regions of the world.



Annex II

List of Documents

1. "Present Status and Machinery for Co-ordination of Building Research within the United Nations System", prepared by the Centre for Housing, Building and Planning, United Nations, New York.
2. "Plan of Action for Co-Ordination of Building Research, 1971-1975", prepared by the United Nations Secretariat. ESA/HBP/AC.11/1.
3. Report of the Meeting of Directors of Building Research Institutes and Development Organizations in the Economic Commission for Asia and the Far East Region. E/CN.11/1&NR/BR/L.5.
4. Report of the Meeting of the Ad Hoc Group of Experts on Co-ordination of Building Research in Latin America, Economic Commission of Latin America. ESA/HBP/AC8/2.
5. Report of the Ad-Hoc Expert Group on Co-Ordination of Building Research in Africa, Economic Commission for Africa. E/CN14/524.
6. "Co-Ordination of Building Research in the Countries of the Economic Commission for Western Asia (ECWA) Region", preliminary note prepared by the ECWA Secretariat.
7. "Brief Description of the Royal Scientific Society", by Sami Al-Rashid, Manager of Building Materials and Research Projects, Royal Scientific Society, Jordan.
8. "Housing and its Available Building Materials in Jordan", by Sami Al-Rashid, Manager of Building Materials and Research Projects, Royal Scientific Society, Jordan.

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9. "A Brief Description of Research on Building Materials Used for Low-Cost Housing Projects in Jordan", by Sami Al-Rashid, Manager of Building Materials and Research Projects, Royal Scientific Society, Jordan.
10. "Report on the Activities in the Housing, Building and Planning Domain in Lebanon", prepared by the National Council for Scientific Research, Lebanon.
11. "Building and Construction Materials Industry in Lebanon - Some Statistics", prepared by the National Council for Scientific Research, Lebanon.

Annex III

Note for Discussion

The first session of the Ad Hoc Expert Group Meeting on co-ordination of Building Research, has given clear indications on the present situation of building research in the region. It is evident that only a few building research organizations are at present operating in the region. As a result of it, no co-ordination can be established. Consequently, it would be advisable that discussions be oriented towards two objectives: a) possible creation of new building research units or organizations; and b) best ways to establish a network for the exchange of information. The following questions are intended to assist the participants in clarifying problems and formulating recommendations.

1. What is building research and which are the types of research?
2. Is building research necessary in every country?
3. If it is necessary, how can building research be started?
4. What are the first steps?
5. Are the selection of construction problems affecting good performance of materials and structures, and total costs of primary importance?
6. Is the selection of information on possible solutions to problems under (5) equally important?
7. Which is the minimum set-up for a building research unit?
8. Which is the maximum set-up for a building research institute?

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9. What is the optimum set-up recommended for each country in the region?
10. Would it be advisable to have a complete building research institute serving the region?
11. As co-ordination of building research does not seem to be possible to establish at present, is it recommended that a network for the exchange of information be put into operation?
12. Which are the particular problems in each country requiring specific information on successful solutions found elsewhere?
13. Which organization will provide and distribute such information?
14. Which organization will receive the information in each country and will be responsible for distributing it to other national organizations, the building industry and professionals?

Annex IV

List of Organizations with Building Research
in the Countries of the ECWA Region

Democratic Yemen

Ministry of Housing, Aden.

Iraq

Building Research Centre, Baghdad.

Jordan

Royal Scientific Society, Amman.

Kuwait

National Housing Authority (for housing), Kuwait.

Kuwait Institute for Scientific Research, Building Division (for building research), Kuwait.

Lebanon

The National Council for Scientific Research, Beirut.

Syrian Arab Republic

Housing Institute, Damascus.

United Arab Emirates

Ministry of Housing and Town Planning, Dubai.

Yemen Arab Republic

Physical Planning and Housing Division,
Municipality of Sana'a, Sana'a.

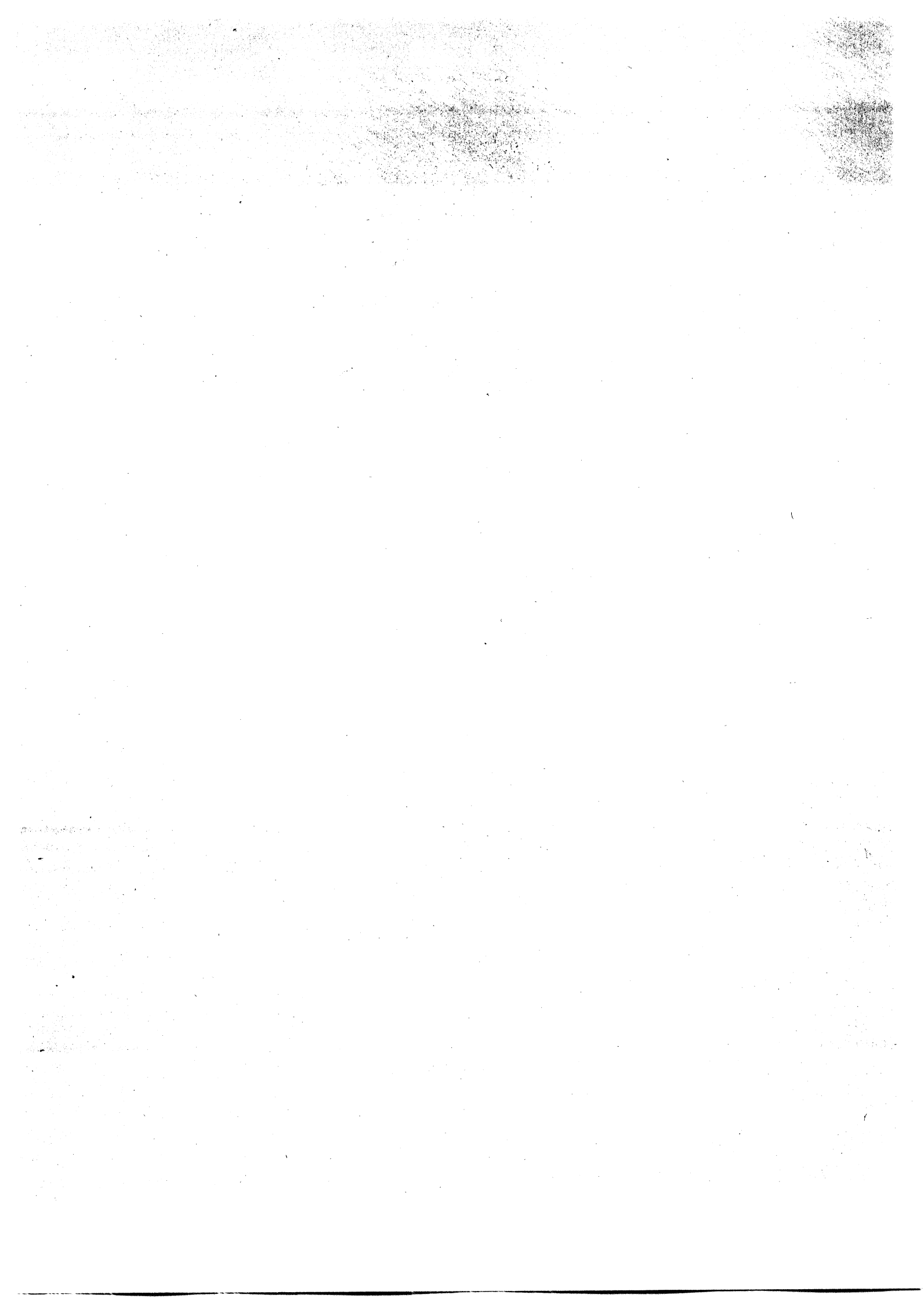


Annex V

Programme for Opening Session

Monday, 11 November 1974, 10:30 to 11:30 a.m.

1. Opening of Meeting by the Executive Secretary of the Economic Commission for Western Asia (ECWA), Dr. M.S. Al-Attar.
2. Statement on behalf of the Government of Lebanon by the Chairman of the Meeting, Dr. Joseph Naggear, President of the National Council for Scientific Research (NCSR).
3. Statements by the two Co-Directors of the Meeting:
 - Mr. Alberto Gonzalez-Gandolfi, Chief, Building Section, UN Centre for Housing, Building and Planning, New York.
 - Mr. V.J. Ram, Chief, Social Development and Human Settlement Division, ECWA, Beirut.



Annex VI

Report on Study Tour in Lebanon

On 14 November 1974, a field trip was organized to four building materials factories in the Tripoli area. Participants saw the Société de Ciments Libanais cement factory, a plastics factory and an asbestos cement products factory which is part of the same complex, and later visited a wood-working factory and a steel rolling mill.

This enabled experts from other countries in the ECWA region to learn something of the progress made by Lebanon in providing materials for the construction industry.

The cement factory, the largest in the country, produces clinker from materials which are (except for gypsum) entirely indigenous. Its present output of one and a quarter million tons is inadequate to meet demands and the plant is being greatly expanded and computerized. The asbestos cement factory adjacent turns out a wide variety of pipes and fittings, sheets, tiles, water tanks and other products, while the plastics factory concentrates on polyethylene tubes, P.V.C. joints and fittings.

The visitors were most impressed by the efficiency displayed in each of these plants and expressed their gratitude to the company concerned for their kindness during the visit.

The wood-working factory produces plywood, blockboard, chipboard and veneers from a variety of imported timbers. The rolling mill made all sizes of steel reinforcing bars from imported billets.

The group was again impressed by the scope of these operations and with the excellent management of these plants.

All participants are grateful to the National Council for Scientific Research of Lebanon for their organizing the visits and enabling them to learn something of the techniques used in the host country in these very important fields.

Apart from the poor quality, another feature of the building materials industry is the absence, or rudimentary and insignificant production of certain materials which are in common use in other countries. This may in certain cases be due to a lack of raw materials, or to high costs resulting from local conditions, but is usually a consequence of public indifference to the introduction of new materials and new methods.

Thus it may be said that the only materials extensively produced are cement, gypsum, bricks, cement and terrazzo tiles. The addition to these of the natural materials, such as stone, sand, gravel, mud and some other materials which are utilized in their natural condition, without processing, complete the list of the materials widely in use.

Throughout the region, of the three key building materials, namely cement, iron and steel, and wood, only the former is being produced on a large scale. It is hardly necessary to stress the overriding importance and universal applicability of cement in construction throughout the world. No viable construction industry in any country is likely to develop without the extensive use of cement.

The prosperity by the growth of national income in the region has stimulated the development of cement industry. Cement and cement products have been gradually replacing stone, mud, bricks and other indigenous building materials. With this background, it is not too surprising to discover that construction in this region follows this same pattern, using concrete slabs and reinforced concrete for framing concrete decks for sand blocks for partitions and concrete for facing.

In 1972, cement production in thousands of tons amounted to above 1,500 in Iraq, 980 in Saudi Arabia, 500 in Jordan, 300 in Kuwait, 1,640 in Lebanon, and 95 in Qatar. Syria's output in 1971 amounted to 910 thousand tons. Total production of cement in the region, in 1972, amounted to about

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6 million tons, whereas total consumption reached 7.5 million tons. However, planned capacity expansions are expected to increase total production to about 13 million tons by 1977.

In Syria, plans are underway for building a reinforced concrete poles factory with a capacity of 2,500 poles in a year. In Iraq, tenders have been called for establishing 100,000 tons per year cement plant. In Oman, a cement plant is being established near Muscat. In Democratic Yemen, a cement plant is under consideration. In Saudi Arabia, the three operating cement plants will be expanded to a total capacity of 1.18 million tons per year by the end of 1974. In Dubai, one of the largest cement plants in the region is nearing completion; it will have a capacity of 500 thousand tons a year. In Abu Dhabi an agreement has been reached to set up a 200,000 tons per year cement plant. In Ras Al-Khaimah, a cement factory with a capacity of 700 tons per day was scheduled to start production in 1974.

The impressive rate of growth for cement production in the countries of the region was made possible by an increased demand for the material, by the relatively much lower investment required per ton of output, the comparatively simple technical knowledge and skill required, and by the ready availability of raw materials in most countries of the region. Although cement does not present any particular problem from the viewpoint of adequacy of production or quality in the region, the expected over-production for the coming years demands further research and encouragement of the wider use of cement and concrete products such as prefabricated building elements, lightweight-aggregate concrete, cellular concrete, etc.

II. Research in Building Materials

Most countries of the region have laboratories attached to various establishments where research in building materials may be conducted, but, except for Iraq, none of them is completely equipped for specialized studies.

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So far, relatively little progress has been made; and hence the great need for the conduct of fuller research.

From the information available to ECWA, it may be gathered that the Baghdad Building Research Centre which is attached to the Council of Scientific Research, has been actively engaged for the past decade in building research aiming at producing better or more economic structures. It has been involved not only in abstract problems of research but also in all the operations of the entire construction industry as well as improved co-ordination between the various government agencies concerned with the use of materials in construction. The United Nations has constantly collaborated in the work of the Centre and has provided technical assistance through experts.

Besides the Building Research Centre in Iraq, the Ministry of Industries has a laboratory for examining general industrial products. The Roads & Bridges and the Housing laboratories also have mobile units for soil testing and borings in the field.

In Lebanon, the National Scientific Research Council is focusing its attention mainly on the problems of standards and specification with the collaboration of the technical universities in the country.

Also for development work, laboratory activities are performed throughout the region in large building materials factories, e.g. cement, brick, glass, ceramics, etc. These plants are equipped with laboratories for controlling raw materials and finished products since such tests in general cannot be made in central material testing laboratories due to lack of facilities or to the considerable distance between the plants and the control laboratory, if available, and the urgency of the tests. These laboratories are generally financed by the plants themselves and in some they have the function of quality control.

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As mentioned earlier, in all the countries of the region, there are laboratories attached to Government departments like public works or roads and bridges which provide material testing services to public and private organizations. But this routine standard testing of materials and structural elements for quality control should not be considered as research work. Research of operational significance is required in many fields. Given the limitation of staff and equipment in most of the testing laboratories, their contribution can comprise only a very small portion of the total. The immediate objective accordingly is a blend comprising analysis of project experience, a function designed to keep abreast of research being conducted elsewhere, and limited original research to fill gaps not covered by others when needed to support project activity. Co-ordination and collaboration within a region and other agencies is particularly important for economizing in staff and avoiding dissipation and duplication of efforts.

In fact, in most countries of the region, each building authority has its own technical staff. Each department construction proposes its own specifications and materials standards, often adopting some European standards. Since some local materials cannot be covered by foreign standards, more uniformity is very essential. Technical regulations differ from one material to another and from one job to another. For the countries of the region, in order to get the full benefit of any programme of material research and standardization, some institutional reorganization is imperative. The problem is not one of management within any department but rather horizontal co-ordination between departments at the technical level. The few technical staff in the various departments concerned are so burdened with various exacting and routine duties that they have little time for outside co-ordination.

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III. Problems Affecting the Fulfilment of Building Research Programms

It is advisable that investment, standardization, material testing, quality control, educational and informational activities, should be provided through especially appointed bodies such as development committees with additional facilities in the form of laboratories, technical universities, and information centres.

A. Skilled technicians: The technical universities in Iraq, Lebanon, Saudi Arabia and Syria, are not able to perform their duties fully regarding research in building materials mainly due to the lack of proper financing and shortage of technical personnel. The universities require well-equipped libraries, equipment and technicians which should also be allowed to be used by other institutions. The provision of a laboratory is useful also to the university for educational purposes as well as necessary for material testing.

While unskilled manual labour is relatively abundant in most of the countries of the region, administrative, professional and intermediate technical personnel are particularly scarce. An adequate supply of trained personnel is essential for the mobilization and improved use of the requisite resources in building materials and manpower. Training and research go together. Both are complementary in the struggle for development. There is an acute shortage of skills in the construction industry, and there is a need to establish new technical institutes and/or improve the existing ones for this level.

Currently, much of the subject matter is covered at the region's technical universities, similar to the subject matter covered in the universities of the industrialized countries. The aim of this education, however, is to train specialists to solve the local problems which, on

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the other hand, requires the knowledge of home problems and of their solutions. The countries of the region lack, or are short of, experts qualified to elaborate these studies. Therefore, sometimes, experts of more developed countries are invited to do so. For the development of building materials industries of the countries of the ECWA region, however, it is important to share, if possible, the work of the experts elaborating these studies in the home staff, gradually reducing the proportion of foreign experts who should deal increasingly with special problems only.

Due to the shortage of specialists, it is necessary that university instructors should be given grants and aids in order to take part, as a complement to their educational work, in solving the practical problems of building materials and construction industry. They should then, in the light of their experience, incorporate into their curricula an ever-increasing number of examples taken from home practice, and systematically obtain data concerning local raw materials and their practical use. The students themselves - provided they get appropriate guidance - may be involved in this work, thus contributing to the solution of problems important for the industrial development of their countries. In addition to its material value, this involvement of the students would contribute highly to their training.

B. Construction Programmes: A certain amount of assurance as to the scope, composition and continuity of future construction activities provides the essential basis for efficient production of building materials and components and for correct investment decisions in this sector. The great variety of construction work needed and the heavy investments involved undoubtedly make this establishment of long-term programmes of construction activities an intricate and difficult task.

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So far, the absence of assured long-term construction programmes appear to have been a major impediment to the planned development of the building materials industry in the ECWA region. Although national long-term plans for economic and social development have been recognized in most countries of the region as being necessary for creation of new branches of industry, due attention has not yet been paid to the building materials and component sectors.

Despite some difficulties, the countries of the region must begin to prepare long-term construction programmes with increasing precision and certainty. This start is further encouraged by certain characteristics of construction investment. The first characteristic is that a large share of construction investment in the region is carried out by public bodies, either as total investor or in partnership with private investors. This offers a unique opportunity to develop long-term programmes - even if provisional - in sufficient detail to provide a basis for estimating building materials needs. The establishment of long-term construction programmes is also facilitated by the fact that construction needs over a long period can be foreseen from surveys of existing deficiencies in infrastructure, housing, hospitals, schools, etc.

Conclusion

The present accumulated deficit in housing and community facilities in the region can be covered only in stages, in view of scarce economic resources in some countries, limited human resources in terms of skills in others, and limited technological resources in terms of the capacity and productivity of the building materials and construction industries.

In the task of organizing the building materials and construction for the job of housing, urban reconstruction and economic development,

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research has a most important place. Scientific research should lead to practical productivity and make it possible to set forth recommendations regarding short-term and long-term practices. It is essential that large-scale experimentation should first be carried out to confirm the scientific findings, and that only thereafter the proposals should be put in practice. To take advantage of standardization and mass production, such practices should be kept in use for a sufficiently long period. The results of technical and scientific advance are beginning to be exchanged through the medium of international professional organizations, observations and study tours and fellowships, as well as in workshops and seminars.

Building research, being a continuous process, a single effort in a short time will not be satisfactory, because in many cases a long period is required and also because even solved problems need follow-up actions.

There is only one building research centre as such in the region. To rely solely on foreign research institutes is no solution as very close contact has to be kept between those who sponsor the research and those who carry out the job.

To establish a building research centre in every country of the region is not feasible because of the size of the countries, financial and technical difficulties. Therefore, a basic requirement is the establishment of a regional centre for building research and the creation of a network of sub-regional stations with suitably qualified and properly trained staff for research, study and training covering a geographic area.

This project would ensure mutually beneficial technical co-operation and exchange of experience and practices in a field crucially important for economic and social development.



