



APPRAISAL REPORT NO. 8
CONSTRUCTION AND
THE BUILDING MATERIAL INDUSTRY OF THAILAND

PART IV
BUILDING MATERIALS RESEARCH IN THAILAND

PREPARED FOR
ECAFE SEMINAR ON THE DEVELOPMENT OF BUILDING MATERIALS
BANGKOK, JANUARY 1968

BY
MILAN M. PAJEVIC
UNITED NATIONS EXPERT
MATERIALS OF CONSTRUCTION GROUP
TECHNOLOGICAL RESEARCH INSTITUTE

ASRCT, BANGKOK 1967

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APPLIED SCIENTIFIC RESEARCH CORPORATION OF THAILAND

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PART IV. BUILDING MATERIALS RESEARCH IN THAILAND

By Milan M. Pajevic*

1. PRESENT STATUS OF BUILDING RESEARCH IN THAILAND

There is no central building research organization at present in Thailand. Until recently organized building research was practically non-existent and consisted only in sporadic investigations carried out as part of the thesis preparation or post-graduate training programmes of the Chulalongkorn University's Civil Engineering and Architecture Departments and the SEATO Graduate School of Engineering.

Material testing is carried out by a number of agencies such as laboratories of the Department of Science, Public Works and Highway Department and OICC. Most of the mentioned laboratories are equipped for routine concrete and soil testing. Only a small number of building material industries have their own laboratories. Worth mentioning are laboratories of the cement, cement-asbestos and glass industry. Industrial laboratories are mainly equipped for process control and only a few have also facilities for product development. There is no central material testing institute.

Materials of Construction Group, TRI

This group is the first unit specialized for building materials research. Technological Research Institute (TRI), a part of the Applied Scientific Research Corporation of Thailand (ASRCT), is a project of the Government of Thailand assisted by the United Nations Industrial Development Organization and the United Nations Special Fund. Project operations have started in 1965 and the organization of laboratories is in the final stage.

Research programmes have been outlined and the work on following

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projects has started:

- Cement-stabilized soil wall construction;
- Cement-stabilized soil construction of kenaf-retting ponds;
- Materials for concrete;
- Design of high early strength concrete mixes;
- Accelerated concrete testing;
- Chemical and physical properties of gypsum;
- Fibrous plaster sheets;
- Plywood and particle board adhesives.

Further studies are being designed at present to include paint materials, based on local resources, application of electronic computers to structural design and use of stressed skin techniques for lightweight roofing and paneling.

In the absence of other specialized organizations and national standards considerable attention is given to the evaluation of testing methods and advisory work in the preparation of building materials standard specifications. The study of brick manufacture in Thailand and comparative laboratory tests of compressive strength and measurements of bricks were of major importance in the drafting of Thai National Standard Specification No. 1 on dimensions of clay building bricks. A project on the concrete quality control has also been undertaken.

The interests of this group which were originally restricted to materials have also been extended to structures and user requirements.

Division of Building Research of the C.S.I.R.O. in Australia has helped in preparing solar position and radiation tables for Bangkok. A study of the principles of sunshading, including charts for different hours and seasons for four latitudes in Thailand has been completed. An investigation is also carried out into housing needs and minimum space requirements.

M.C.G. has actively participated in the formation of the Thai team and preparatory work for the Development Cycle Course of the Bouwcentrum in Rotterdam. Thai team composed of representatives of M.C.G. and Housing Division of the Department of Public Welfare will attend the course which will take six months starting from January 1968, under the bilateral

technical assistance programme with the Government of Netherlands. Main subjects will be the study of rational construction methods, analysis of completed and preparation of future low-cost housing projects.

The main difficulties, M.C.G. is facing are the lack of senior research officers and frequent staff changes mainly due to resignations for higher salaried jobs.

Department of Science

The Department of Science is one of the five departments in the Ministry of Industry. In addition to the Office of the Secretary it includes five divisions, i.e.; Chemistry, Biological Sciences, Physics and Engineering, Analytical Chemistry Training, and Research.

The Department is responsible for providing services to the Government, industry and the public and for carrying out research and development work of the natural resources. The library and the documentation services of the Department are among the best equipped in Thailand.

Only a relatively small part of the work carried out at present is related to building materials research and development.

Studies undertaken by the Research Division include an investigation on the utilization of rice husk and diatomaceous earth for the manufacture of lime-silica bricks, formulation of a chlorinated rubber based traffic paint and durability studies of alkyd and dehydrated castor oil paints. A study is also being made on the use of kenaf stems for concrete shuttering.

The Department in cooperation with the Department of Mineral Resources and the Technological Research Institute carries out surveys of raw materials for the ceramic industry.

Ceramic laboratory is studying at present the suitability of local clays for the manufacture of wall and floor tiles.

Research Division is also conducting a study on the economic utilization of galvanized iron sheeting.

Forest Research Institute

Forest Products Research Division of the Royal Forest Department conducts research into structure and properties of wood, timber seasoning, wood protection and manufacturing techniques of paper, plywood, particle-fibre, and wood-wool board.

One of the most important projects so far was the survey of raw materials for pulp and paper. The project assisted by FAO and the United Nations Special Fund included a complete survey of raw materials for pulp and paper. Results of this investigation include a great deal of information of interest for the building materials development. Data on the availability of materials such as bagasse, rice-straw and others should prove of particular interest for future studies on the utilization of agricultural waste and bush materials for low-cost construction.

The new building of the Forest Research Institute has been opened recently and facilities of the existing forest products laboratory expanded under the bilateral technical assistance programme of the F.R. of Germany.

Investigations conducted at present and related to the building materials development, include the study organized with the aim to assist the "Cellocrete" wood-wool board manufacturer in replacing somphong (Tetrameles nudiflora) with yang phara (Hevea brasiliensis) and other species. A simple rapid test to determine the suitability of wood for the manufacture of wood-wool boards has been devised and used for this investigation.

Considerable amount of data has been compiled from tests on strength, durability and other properties of Thai timbers. The cooperation between this Institute, Materials of Construction Group TRI and other agencies concerned with structural utilization of timber should be initiated. Completion of available data and additional strength tests should provide the basis for the needed strength grouping. This work should also ultimately result in the publication of design tables and manuals for users and designers of timber structures.

Upon the completion of laboratories which is expected in the near future, this Institute will be well equipped to conduct research into

manufacture, design and behaviour of all building material related to forest products.

2. STANDARDIZATION

The first Thai National Standard Specification - "Dimensions of Common Clay Building Bricks", was published in September 1967. The Centre for Thai National Standard Specifications (CTNSS) was formed as part of the Applied Scientific Research Corporation of Thailand (ASRCT) in 1965 and became active in 1967. The Centre prepares and issues standard specifications relating to materials products and services, and codes of practice. Prior to the establishment of the Centre standardization work was carried out by various government ministries and agencies, such as Ministry of Industry, National Energy Authority, Ministry of Economic Affairs, etc. This work primarily organized to provide a basis for the control of exported agricultural products, electrical safety standards and certification of industrial products, did not include building materials.

The building materials industry still depends on foreign standard specifications. Most frequently used are United States (A.S.T.M.) and British (B.S.) standards, but many others are also applied.

The Centre received until now about fifty proposals from Government and private organizations for drafting building materials standard specifications. Proposals, scrutinized at present by the Advisory Committee, include a large number of topics, such as water pipes, clay sewer pipes, concrete pipes, modular co-ordination, etc.

CTNSS is a member body of the International Organization for Standardization (ISO) and whenever possible ISO Recommendations are considered when drafting new standards.

3. FUTURE DEVELOPMENT OF BUILDING RESEARCH IN THAILAND

Building and construction constitutes the largest component of the Economic Development Plan of Thailand. In 1966 the share of construction in the capital formation in Thailand was 48.5 per cent involving an

investment of over 10,191 million baht. Out of this figure 60 to 70 per cent is accounted for by the expenditures on building materials.

The progress of the construction sector required a simultaneous development of the building material industry which is expanding at a high rate. During the period between 1955-1965, thirty four factories producing building materials have received promotional privileges and started operations. In terms of capital investment cement industry is by far the most important of all industries in Thailand. The total capital investment in this industry alone is estimated at about 1,000 million baht.

Rapid development of the building material industries and of the construction sector as a whole was not followed by the development of other activities vital for optimal utilization of resources. Architectural and structural design is often not adapted to local conditions and materials. Building techniques are with the exception of some projects mainly carried out in Bangkok and bigger cities still insufficiently advanced. Until recently National Standard Specifications and Codes of Practice for building did not exist and their preparation is at present only in the starting phase. Government construction programmes are not sufficiently co-ordinated, and the only organization dealing with the low-cost housing construction is the Housing Division of the Department of Public Welfare. A striking example of the damages occurring due to lack of regulations and research are losses caused by fire. Losses due to fire in Bangkok alone have mounted from 34 million baht in 1964 to 185 million baht for the first ten months in 1967. (For losses for the whole of Thailand, see Table 1).

The survey of building materials research in Thailand shows the wide gap between the needs and the existing research facilities. Building materials research is not co-ordinated, it is carried out on a small scale and in a number of different organizations. None of these has been organized as building research institutes.

As already mentioned most of the facilities for building materials research are located in three organizations: Technological Research Institute (ASRCT), Department of Science of the Ministry of Industry and the Forest Research Institute of the Royal Forest Department.

TABLE 1
LOSSES DUE TO FIRE IN THAILAND 1964-1967

Year	No. of fires	Causes			Damage in baht
		Negligence	Accident	Arson	
1964	908	469	202	237	79,512,970
1965	774	594	110	70	183,869,970
1966	758	590	113	52	217,878,687
1967 ^{1/}	692	578	61	53	269,821,477 ^{2/}

Source: Division of Fire Protection, Police Department, Ministry of Interior.

Forest Research Institute when completed will be able to deal with most of the problems related to timber, timber products and wood-based products. Department of Science has a well equipped ceramic laboratory, paint testing equipment, and good although incomplete general testing facilities. Materials of Construction Group, TRI is mainly equipped for research on cement and cementitious materials, bricks and structural clay products and concrete technology. None of the mentioned organizations has fully equipped laboratories for work on plastics, adhesives, paints, varnishes, bitumen and bituminous materials and sealants. Lack of the building materials research organization on the national level and absence of co-ordinating body is further aggravated by the acute shortage of senior research personnel and frequent staff changes. How to recruit, train and keep research personnel will probably remain one of the major worries of those responsible for building research. Unless this problem is satisfactorily solved, even the equipment now available will not be used as expected.

^{1/} First ten month only.

^{2/} The value of this figure can be better appreciated when compared to a total of 173 million baht spent during the period 1964-1967 on the low-cost housing programme of the Department of Public Welfare.

Building materials research can not be treated as an isolated subject and it requires close cooperation of different disciplines in order to ensure its maximum practical value. Manufacture, design and use of building materials are interrelated and the research on building materials proper must be complemented with the investigations into its optimal constructional uses, its physical and chemical behaviour under specific conditions, etc. The establishment of all mentioned facilities is in developing countries usually carried out, due to limitations of finance and qualified personnel, through a formation of a Central Building Research Institute.

The establishment of such an entirely new and autonomous organization in Thailand, however beneficial, would not be justified at this stage. Already mentioned difficulty of recruiting qualified research personnel, large outlay needed and the time required for the realization of such a project all speak against this approach.

The basic requirement seems to be a better coordination of existing activities and planning for building research expansion on a national level. Central body co-ordinating building materials research should make the maximum use of existing facilities. The facilities of one of the existing research units should be gradually expanded to include the sections not provided at present. Time and funds could be saved by using the large amount of available knowledge accumulated in developed countries and library and convenient reproduction services are therefore of greatest importance.

Materials of Construction Group, TRI, fulfills most of the above mentioned requirements. In addition to laboratories specialized for materials research it can rely on support of other ASRCT units such as well equipped library and excellent document reproduction services (Thai National Documentation Centre), Centre for Thai National Standard Specifications (CTNSS), Minerals and Metallurgy Group, Economic Evaluation Group, Analytical Laboratory, etc.

The process of establishing the Building Research Centre as part of the ASRCT is already under way. The Materials of Construction Group is, as already mentioned, actively cooperating with the Bouwcentrum in Rotterdam in the application of the Development Cycle idea to low-cost

housing, school, hospital, industrial, and office buildings. The development cycle team for the first time in Thailand, includes the representatives of all parties concerned with building, i.e., architects, planners, structural engineers, municipal and building commission authorities, specialists in different spheres, fire brigade officers, contractors, social workers, economists, etc. The idea of the Building Research Centre has received so far the undivided and active support of all concerned. The meeting organized by the ASRCT to discuss the formation of the Building Research Centre, was attended by the representatives of all government departments related to building as well as representatives of the University and professional organizations. All of those who attended expressed their full agreement with the proposal. This initiative also received a valuable support from the Housing, Building and Planning Section of the U.N. Economic Commission for Asia and the Far East.

In the light of all the circumstances outlined above, the following action appears desirable:

(1) Formation of a National Building Research and Development Advisory Committee (N.B.R.D.A.C.). The committee should determine objectives of building research and provide a research and development policy on a national level.

(2) Formation of a Building Research Centre as part of the Applied Scientific Research Corporation of Thailand.

The Centre should:

- Advise the N.B.R.D.A.C. on the technical problems and choice of investigation and development work;
- Coordinate work of different technical committees;
- Cooperate with other organizations concerned in building research and development;
- Carry out investigations within its own laboratories and those incorporated in ASRCT; and
- Compile, publish and disseminate knowledge of all building research and development activities.

One of the activities of the Building Research Centre should be to organize a permanent building materials exhibition. The exhibition should be self-supporting and have as its main source of income fees received from the exhibitors.

The N.B.R.D.A.C. should upon formation review the present status of laboratories equipped for building research and put forward conclusions regarding completion of existing laboratories and establishment of new research units.

Following are some of the topics to be considered in this context:

- Geological surveys of raw materials for building material industries;
- Building physics laboratory. (Heat and sound insulation, ventilation, air conditioning, shading devices, etc.);
- Structural research laboratory;
- Soil mechanics laboratory;
- Plastics, paint and sealants laboratory;
- Fire research.

The importance of fire research in Thailand has already been mentioned. The considerable financial means required for the establishment of a well equipped laboratory of this type may require action on a regional level.