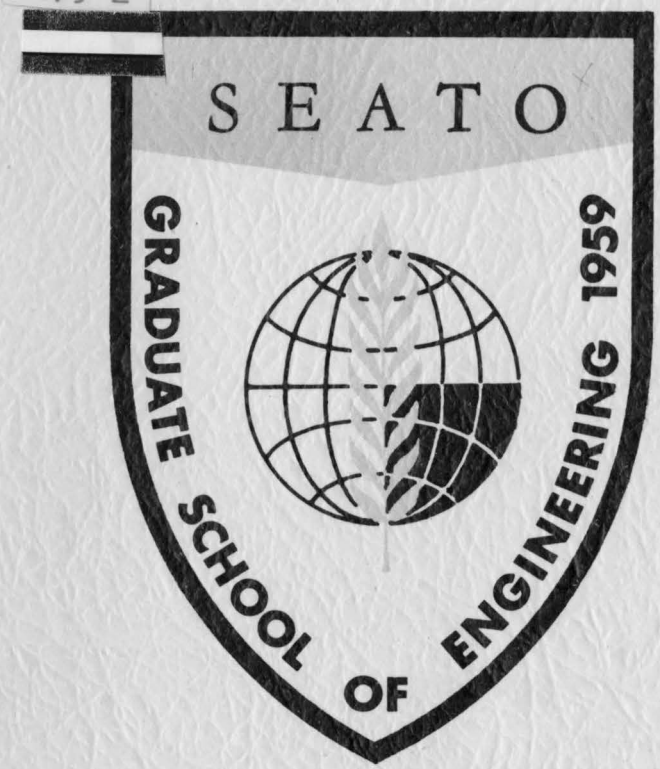

THE SECOND TWO-YEAR PROGRESS REPORT

July 1961- June 1963

by

Richard T. Shen and

Maurice L. Albertson

Prepared for the
Agency for International Development
U.S. Department of State

OFFICE OF INTERNATIONAL PROGRAMS • COLORADO STATE UNIVERSITY • FORT COLLINS

SECOND

TWO-YEAR PROGRESS REPORT

on

THE SEATO GRADUATE SCHOOL OF ENGINEERING

Bangkok, Thailand

July 1961 - June 1963

by

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Prepared for the
Agency for International Development
Department of State

Colorado State University
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FOREWORD

This report is prepared in fulfillment of Colorado State University Research Foundation's contract with the Agency for International Development (AIDc-1290) for assistance in the establishment and administration of the SEATO (Southeast Asia Treaty Organization) Graduate School of Engineering in Bangkok, Thailand. The project was initiated in June, 1959, and its progress has been reported to the sponsor at six-month intervals. In June, 1961, after two years of operation, an initial two-year report* was written to render an over-all account of the accomplishments. Another two years have since elapsed and it is now time to make another two-year report in order to provide perspective for appraisal of the achievements and for planning the future.

This report, therefore, covers the two-year period beginning July, 1961. A brief account of the history of the project from its inception through June, 1961, is given in the introductory chapter. For details of the earlier period, the reader may refer to the initial two-year report previously mentioned.

The authors of this report are those who have had primary responsibilities of administration of the contract since its beginning in June, 1959.

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* Evans, T. H., Shen, R. T., Albertson, M. L., Initial Two-Year Progress Report on the SEATO Graduate School of Engineering in Bangkok, Thailand, July, 1959 - June, 1961, (Fort Collins, Colorado: Colorado State University Research Foundation).

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View of the Hydraulics Laboratory, the pond in the foreground is used for rating meters.

I. INTRODUCTION

Since World War II, the global power struggle has led to the formation of diverse mutual defense treaties among various countries of both East and West, such as the Warsaw Pact on the one hand and the NATO and SEATO on the other hand. It is common knowledge that military alliance comprises the primary purpose of these treaties. However, the details of individual treaties frequently escape public notice.

In the case of SEATO, the world sees it as a pact to promote defense activities while few realize that, apart from military functions, economic cooperation and cultural exchange also constitute a part of the treaty. *

Purpose

The SEATO Graduate School of Engineering is one such activity of the SEATO nations, completely divorced from military operations and free of political indoctrination. The School exists solely for the purpose of providing advanced engineering education and research specifically designed to serve the economic and social development of the Southeast Asia region. The goal of the project is engineering education, entirely devoid of political overtones.

Origin

In 1958, during the meeting of the SEATO Council of Ministers in Manila, a plan was approved to establish a regional engineering school on the post graduate level setting a priority for water resource development, irrigation, transportation and communications. The State Department requested Colorado State University to make a preliminary survey of the feasibility of such a project, which was undertaken early in 1959. Thereafter, a rapid sequence of events took place that culminated in the opening of the School on September 8, 1959, with an initial enrollment of 15 students.

Accomplishments

During the ensuing two years, the School graduated its first class of students, conferring upon them the Master of Engineering degree. Three options of study were introduced: hydraulic engineering, transportation engineering, and structural engineering;** laboratories were built and equipped; a technical library was established; and special lecture courses and conferences were made available to the practicing engineers in Bangkok as well as in other cities in Southeast Asia.

These accomplishments had been achieved within the short span of the first two years of operation as described in the initial report. Further developments and expansion of the School's activities are described in the following chapters.

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* Article III of the treaty pledges the signatory parties to undertake "to strengthen their free institutions, and to cooperate with one another in the further development of economic measures, including technical assistance, designed both to promote economic progress and social well-being, and to further the individual and collective efforts of Governments towards these ends."

** For a detailed description of curricula and courses offered, see Appendices 1 and 2.

II. REGULAR PROGRAM

A major effort was made during the report period to increase the enrollment of the School. The success of this undertaking may be attributed to:

1. The strong reputation the School has been able to build within the initial two years through its uncompromisingly high standards of admission and instruction, and its excellent facilities for instruction and research.

2. The full cooperation on the part of the member nations through their various government agencies and educational institutions.

3. The untiring effort of Dean Robert M. Holcomb who placed the student enrollment drive at the top of his priority list.

Enrollment Record

The following tables show the enrollment statistics for the report period.

TABLE 1

Registration Record - School Year 1961-62

	COUNTRY				MAJOR			TOTAL
	India	Pakistan	Philippines	Thailand	Hyd.	Trans.	Struct.	
Second Yr. Students	1	5	2	19	8	10	9	27
New Students	-	3	2	16	7	6	8	21
TOTAL	1	8	4	35	15	16	17	48

TABLE 2

Registration Period - School Year 1962-63

	COUNTRY						MAJOR			TOTAL
	India	Malaya	Pak.	Phil.	Free China	Thailand	Hyd.	Trans.	Struct.	
Second Year Students	-	-	-	2	-	13	4	5	6	15
New Students Regular	1	2	6	8	1	29	18	12	17	47
New Students Special	-	-	3	-	-	-	2	1	-	3
TOTAL	1	2	9	10	1	42	24	18	23	65

Degrees Conferred

While a predominant part of the students are on a full-time basis, it usually requires two full academic years of resident study to complete the Master's degree requirement. Most of the students finish within two years and only a small portion of them have taken a longer period of time. The School has had a remarkable record of very few drop-outs.

At the graduation ceremony in March, 1962, twenty-two students who had completed their degree requirements were given certificates of completion. At the graduation ceremony in March, 1963, sixteen students who had completed their Master's degree requirements received certificates of completion. Four more have since completed their requirements.

Current Applications

At the beginning of the fifth year of operation, the School received a significantly increased number of applications despite stringent requirements for admission, as indicated in the following table:

TABLE 3

Summary of Applications for Admission Received

COUNTRY	APPLICANTS	INELIGIBLE	ELIGIBLE
Borneo	1	-	1
Burma	1	1	-
Cambodia	1	1	-
India	34	19	15
Malaya	8	4	4
Pakistan	43	21	22
Philippines	23	11	12
Taiwan (Free China)	41	19	22
Thailand	52	31	21
Vietnam	4	4	-
MAJOR			
Hydraulic Engineering	67	41	26
Transportation Engineering	48	26	22
Structural Engineering	93	44	49
TOTAL	208	111	97

The quality of the applicants has improved each year. In 1963, many applicants who were certainly qualified for graduate study were denied admission because of the limits on staff and on scholarship funds.

The following table shows the first semester enrollment of the fifth year of operation.

TABLE 4

First Semester Registration Record
School Year - 1963-64

	COUNTRY					MAJOR			TOTAL
	Malaya	Pakistan	Phil.	Free China	Thai.	Hyd.	Trans.	Struct.	
Second Year Students	2	4	5	1	24	8	13	15	36
New Students	3	15	11	2	21	10	19	23	52
Post Second Year Students	-	-	-	-	4	-	-	-	4
TOTAL	5	19	16	3	49	18	32	38	92

Students visiting Dr. and Mrs. Banks, January 1, 1962 -- a tradition of the School is for all the students to visit each professor and his family on New Year's Day.

III. SPECIAL TRAINING PROGRAM

The report period saw the gradual expansion of the activities of the Special Training Program. This program involves several types of activities conducted in various cities of Southeast Asia. Because of the complex arrangements necessary for successful operation in the cities throughout the Southeast Asia region, it had taken the initial two years for planning and organization. Very few activities actually took place during the initial two years. During the report period, however, the painstaking preparations began to bear fruit and plans have been laid to carry the program to places beyond big cities.

Period April to October, 1961

Eighteen special lectures were given in Bangkok, Karachi, Lahore, New Delhi, Pilani, and Roorkee, with a total attendance of approximately 2,050.

Courses have been given to 498 engineers in Pakistan, the Philippines and Thailand, making a total of 531 lecture hours.

Eight conferences on sedimentation problems, water resources development, and hydraulic engineering problems were held in Calcutta, India; Lahore, Pakistan; and Bangkok, Thailand; with approximately 842 in attendance. Further conferences of similar nature were planned for Manila.

Period November, 1961 to May, 1962

Outstanding special program lectures given during this period included those by Dr. Hans Albert Einstein and Dr. Arthur T. Ippen on Erosion and Sedimentation, by Dr. Seng-Lip Lee on the Design of Thin Shell Structures, and by Dr. Morris Asimow on Engineering Management and Design. The following table summarizes these and other activities presented during the period:

TABLE 5

Special Training Program Activities November, 1961 to May, 1962

	SPECIAL LECTURES		SPECIAL COURSES		CONFERENCES	
COUNTRY	Number	Total Attendance	Enrollment	Lecture Hours	Number	Attendance
India	1	140	-	-	-	-
Pakistan	5	330	-	-	-	-
Philippines	4	260	46	26	1	475
Thailand	5	211	240	276	-	-
TOTAL	15	914	286	302	1	475

Period June, 1962 to May, 1963

The popularity of the program made further expansion possible. A marked increase in lectures and courses occurred in this period and activities were carried beyond the big cities. In Thailand, a course was given in Khon Kaen; and in the Philippines courses were given in Cebu City and Davao City. The following table summarizes the program during the period:

TABLE 6

Special Training Program Activities June, 1962 to May, 1963

	SPECIAL LECTURES		SPECIAL COURSES			CONFERENCES	
COUNTRY	Number	Total Attendance	Courses	Enroll.	Lecture Hours	Number	Total Attendance
Pakistan	30	978	5	146	180	-	-
Philippines	8	488	11	302	319	-	-
Thailand	23	915	21	682	1037	1	167
TOTAL	61	2381	37	1130	1536	1	167

IV. RESEARCH PROGRAM

During the first two years of operation, a major effort was extended in equipping and organizing the School's laboratories. After this initial phase, it was possible to devote some time to promote research activities. The laboratories were ready to offer their facilities to a number of research projects. The first projects were, of course, for student thesis work. Later, research projects by faculty and other organizations were added.

The School became an institutional member of the International Association for Hydraulics Research. Membership in the International Association for Bridge and Structural Engineering was soon added. By April, 1962, the first "List of Research Studies" was published, containing 55 projects, most of which were student thesis projects. This list was increased to 75 in October, 1962.

Sponsored Research and Testing

In order to serve the research needs of the Southeast Asia region, the facilities and staff of the School were offered to government agencies and private companies who are in need of such services. Students have been assigned to work on contract research in order to gain experience and familiarize themselves with problems encountered in the field. The School also availed itself of the opportunity of earning additional income for the expansion of laboratory facilities as well as employing more staff for research in order to provide a truly competent engineering research center for the entire region. Contract research and testing include the following.

1. Testing of concrete specimens for Bhumibol Dam.

2. Testing of steel strength from the tower of the transmission line used in the Bhumibol Dam Project.

3. Current meter calibration and sediment grain size distribution studies for the Bangkok Harbor Improvement Study.

4. Construction of an experimental blood oxygenator for Bangkok Sanitarium and Hospital.

5. Provision of facilities and assistance for the Combat Development and Test Center, which is a cooperative venture jointly sponsored by the United States and Thai Armies.

V. PARTICIPANT TRAINING PROGRAM

It is the intention of the project to select outstanding students from the SEATO Graduate School to proceed to other countries for further training in preparation for their return to the School to serve as faculty. Initially, it was, of course, not possible to send our own graduates before the first graduation and since the process of replacing imported faculty by locally available talent should be underway immediately with no loss of time, it was necessary to select from Chulalongkorn University faculty members for further training. As the School began to turn out graduates of its own, it became our policy to select only from our own graduates who had been under our close supervision for at least two years while studying at the School.

Returned Participants

The first participants who successfully completed their Ph.D. programs and returned to serve the SEATO School were Niwat Daranandana and Pairoje Teerawong. Dr. Niwat received his Ph.D. degree from Colorado State University on June 8, 1962. His specialization is in Sedimentation. Dr. Pairoje Teerawong received his Ph.D. degree from Colorado State University on June 5, 1963 (he had fulfilled all of the requirements at the end of the fall quarter, December 13, 1962, but degrees are conferred only at the end of the spring quarter.) He wrote his doctoral dissertation on the Consolidation of Soils.

Both of these participants returned to Bangkok during the report period. They are now assigned by the Thai Government to serve the SEATO School part time and Chulalongkorn University part time. Under the guidance of the more experienced faculty members, they are assuming duties in handling lecture courses, laboratory courses, research projects, student advisers, and various academic and administrative committees.

New Participants

During the report period, four of our most outstanding students who graduated from the SEATO Graduate School of Engineering were selected to come to the United States for further training.

1. Srisakdi Charmonman ranked first in the first graduating class. He was brought to the United States, December, 1961, where he enrolled at the Georgia Institute of Technology to study for the Ph.D. degree. He has made satisfactory progress and is expected to complete his training by June, 1964.

2. Pichai Boonyakanjana was an outstanding student in the first graduating class and served as research assistant in the hydraulics laboratory after his graduation. He was brought to the United States in September, 1962, and enrolled at the University of California at Berkeley. His progress has not been as satisfactory as expected because of difficulties of health and acclimation. It is expected that he will be transferred to Colorado State University so that closer supervision of his training program will be possible. Pichai's interests are in open-channel hydraulics.

3. Victor Pulmano was a brilliant student from the School's second class. He ranked first in the structural engineering option and was brought to the United States to enroll at Northwestern University to study for the Ph.D. degree in September, 1962. So far he has made very satisfactory progress and is expected to complete his training program by June, 1964.

4. Anat Arbhabhirama ranked first in the hydraulic engineering option of the School's second class. He worked as research assistant in the hydraulics laboratory of the SEATO Graduate School before he was brought to the United States in March, 1962, to enroll at Colorado State University for a Ph.D. program. He is making satisfactory progress.

5. Subin Pinkayan graduated from the SEATO School's first class. He was not selected for the U. S. participantship program but was given a scholarship to go to France. Under this scholarship he entered Genoble in October, 1961, for nine months' training. Since his scholarship was for non-credit training and no commitment was made on his part to serve at the SEATO Graduate School after training, he decided to go from France to the United States and now holds a research assistantship at Colorado State University where he is studying for a Ph.D. degree, specializing in hydraulics.

Niwat Daranandana taking a coffee break during his training at Colorado State University - Dr. Niwat was the first participant to return to serve at the SEATO School.

VI. STAFF

The School derives its staff from the contributions of the various member countries. Although the recruitment of competent staff has never been easy even for engineering colleges in the United States, the SEATO Graduate School has been extremely fortunate in obtaining top-quality professors to serve on its faculty ever since its inception. We are also blessed with a most agreeable location so that many of the professors and staff, having served their two-year tour of duty, offer to extend their tours. In all cases, the only ones who decided to terminate their tour have been those who either had definite commitments elsewhere or had to leave Bangkok for health reasons. Table 8 provides a record of faculty service since the inception of the School.

In addition to the academic staff listed in Table 8, the School employs a staff of considerable size in support of the regular program, special program, and research program. The staff size is indicative of the bustling activities at the School throughout the report period. Some of the staff have been paid from U. S. funds; others from Thai or SEATO funds. After the return of the machinist, Theodore Whittington, who was a British contribution, the British VSO (Voluntary Service Organization) supplied us with two Rolls-Royce-trained mechanics, B. W. Wilson and M. E. Broadbent, who have been extremely valuable in the shop in helping the students build their thesis equipment. A number of research staff have been added who are paid from funds earned through sponsored research and other contracts.

Table 7 gives a summary of the non-academic staff for the report period:

TABLE 7

Record of Non-Academic Staff

A. Administrative Staff

Administrative Assistant (Wallace E. Peterson)	1
American Secretary (Lois Desmond)	1
Accountant (Somsong Tiasomboon)	1
Shipping Expeditor (Uthai Isarangul)	1
Assistant Registrar (Mrs. Mai Charoensupya)	1
Librarian (Virginia P. Schickele)	1
Assistant Librarian (Boonsri Suvanajata)	1
Clerical Help	9
	16

B. Research Staff

Field Engineers	5
Engineering Aide	1
Machinists (Wilson & Broadbent)	2
Research Associates	2
Student Research Asst.	1
Secretaries	2
Typists	3
Mechanics	5
Electrician	1
Carpenter	1
Laboratory Helpers	2
U. S. Trainee	1
	26

C. Operational Staff

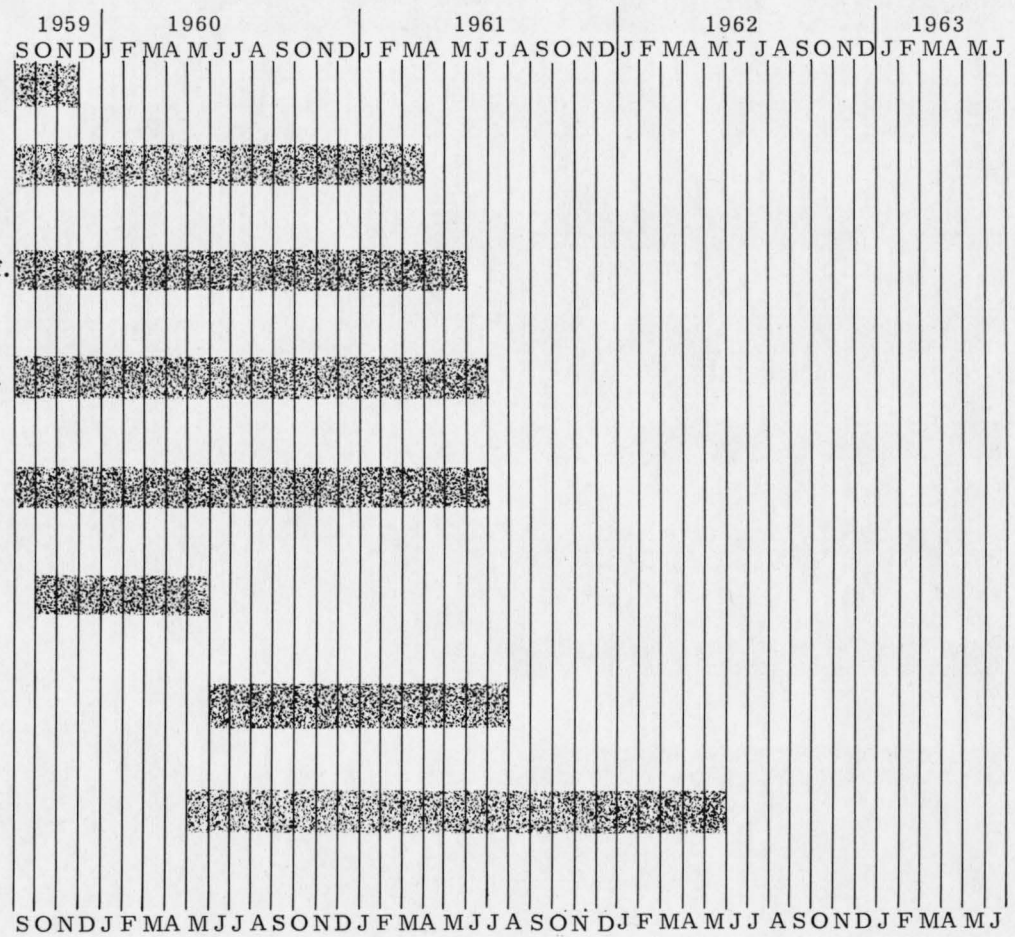
Drivers	7
Janitors	4
Watchmen	2
Gardener	1
	14

GRAND TOTAL 56

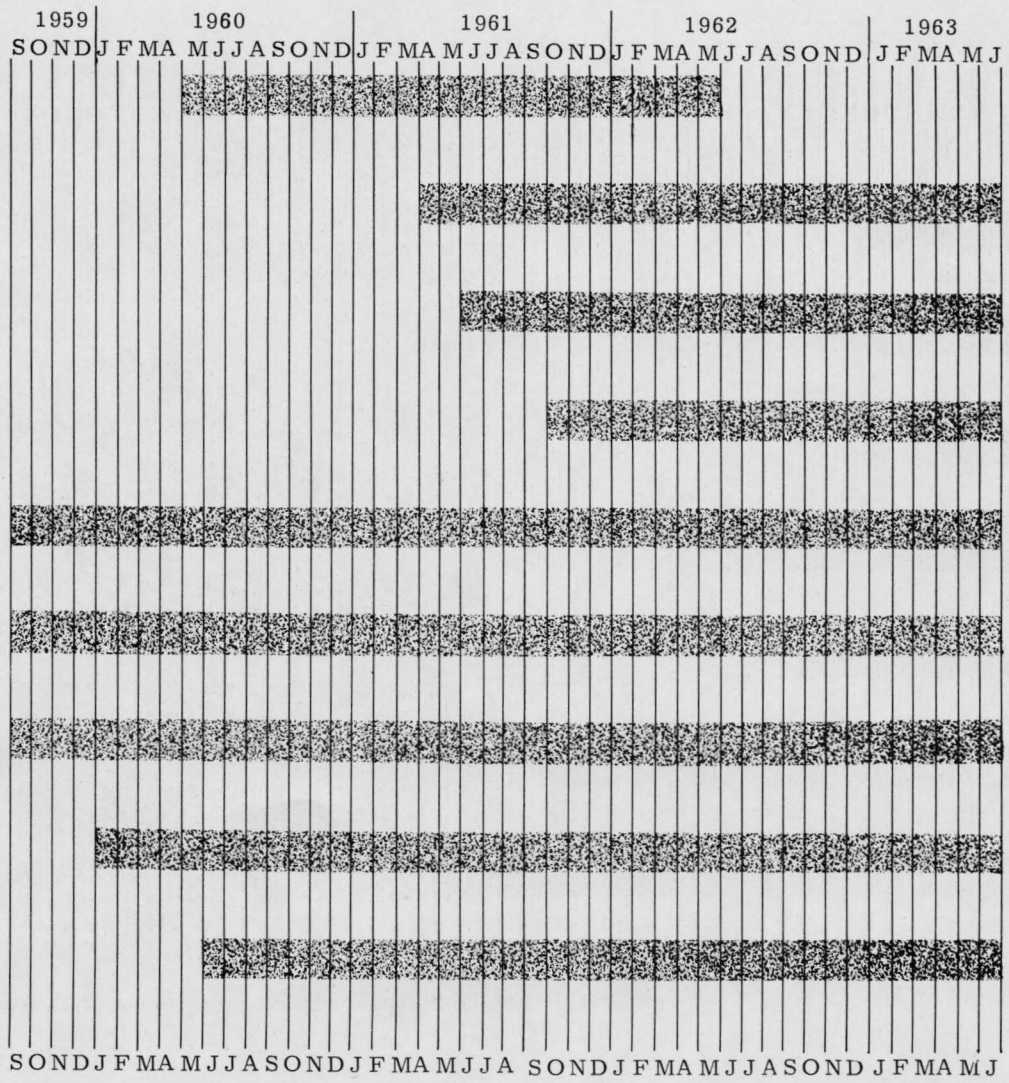
TABLE 8

Record of Faculty Members (arranged according to time of service)

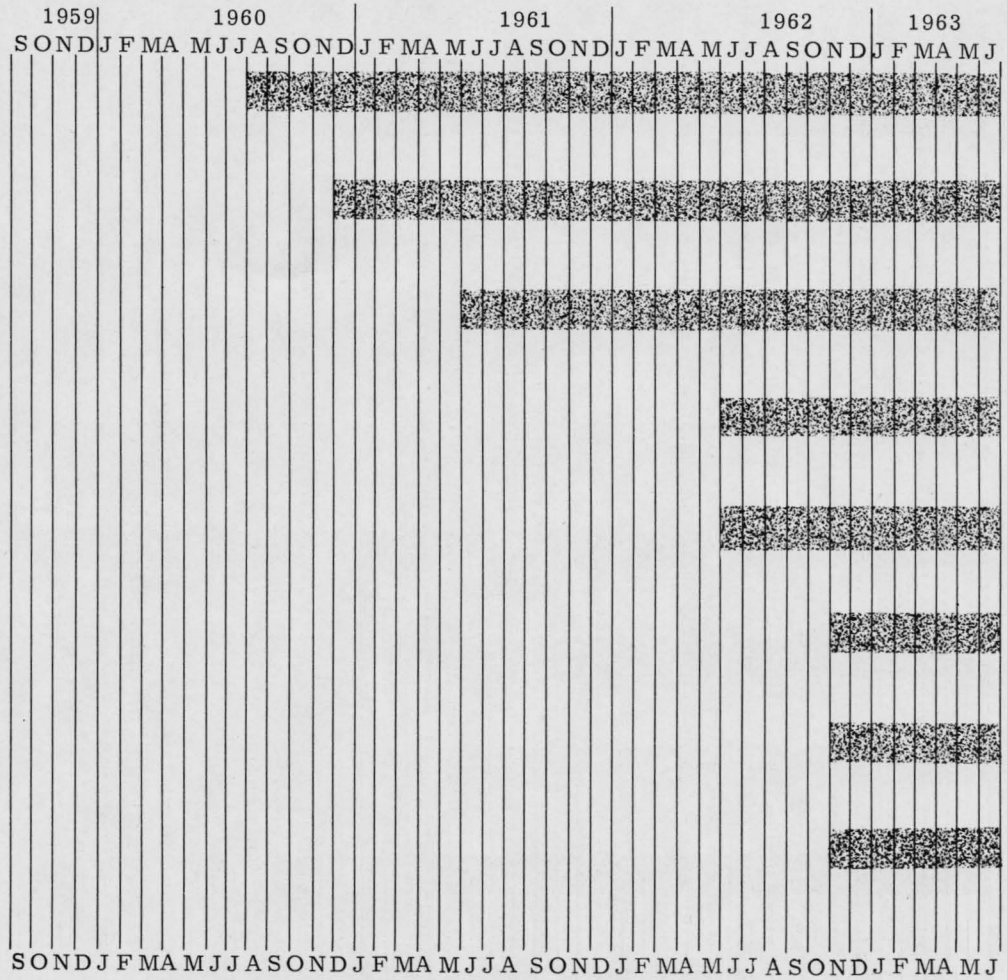
Name	Origin	Position
Sol D. Resnick, B.S., M.S., Wisconsin	U.S.A. U. of Ariz.	Asst. Prof. Hyd. Eng.
Rachot Kanjanavanit B.Eng., Chula.; M.Eng. Ph.D., Sheffield	Thailand Chula. U.	Asst. Dir. of Res. Str. Eng.
Arthur T. Corey, B.S., Maryland; M.S., CSU; Ph.D., Rutgers	U.S.A. CSU	Assoc. Prof. Hyd. Eng.
Marion R. Carstens B.S., Washington; M.S., Ph.D., Iowa	U.S.A. Georgia Tech.	Dir. of Res. Hyd. Eng.
Thomas H. Evans B.S., M.S., Caltech.	U.S.A. CSU	Dean and Party Chief Str. Eng.
Norman H. Brooks A.B., M.S., Harvard; Ph.D., Caltech.	U.S.A. Caltech.	Asst. Prof. Hyd. Eng.
Franklin O. Rose B.S., M.S., Stanford	U.S.A. Texas A&M-- Ahsanulah	Prof. Hyd. Eng.
Elihu Geer, C.E., Cincinnati; M.S.E., Ph.D., Michigan	U.S.A. U. of Detroit	Prof. Str. Eng.



Dick H. Holze B.S., Nebraska M.A., California	U.S.A. U. Of Wyo. -- U. of Kabul	Asst. Prof. Math.
Robert B. Banks, B.S., M.S., Northwestern; Ph.D., California	U.S.A. Northwestern University	Dir. of Res. Hyd. Eng.
Robert M. Holcomb B.S., Arizona; M.S., Ph.D., Iowa State	U.S.A. Texas A&M	Dean and Party Chief Str. Eng.
Richard H. J. Pian B.S.C.E., Kung Shang U.; M.S., Ph.D., Cornell	U.S.A. Arizona State	Prof. Str. Eng.
Chai Mukatabhant, LL.B., Thammasart; M.Eng., Yale; D.Sc., Michigan	Thailand Chula. U.	Snr. Lectr. Soil Mech.
J. B. Smith B.S., Oklahoma	U.S.A. U. of Ariz. U. of Baghdad	Dir. of Sp. Progm.
Utai Voodhigula B.Eng., Chula.; S.B. MIT; M.S., Illinois	Thailand Chula. U.	Asst. Dean Hwy. Eng.
Alan D. Benham B.E., M.Sc., New Zealand	New Zealand Ministry of Public Works	Prof. Hyd. Eng.
Anthony R. Cusens B.Sc., Ph.D., London	United Kingdom	Prof. Str. Eng.



John Hugh Jones B.S., M.S., California	U.S.A. Northwestern University	Assoc. Prof. Hwy. Eng.
Fernand S. Michelin Bordeaux Ing. T.P., Paris	France Ministry of Public Works	Prof. Hwy. Eng.
Norbert L. Ackermann B.S., M.S., Northwestern Ph.D., Carnegie Tech.	U.S.A. Northwestern University	Assoc. Prof. Hyd. Eng.
Kenneth D. Cummins B.C.E., Detroit; M.S.E., Michigan	U.S.A. Amer. Conc. Institute	Assoc. Prof. Asst. Dir. of Sp. Progm.
Donato T. Teodoro B.S., Michigan M.A., Detroit	U.S.A. U. of Detroit	Asst. Prof. Math.
Niwat Daranandana B.Eng., Chula.; D.I.C., London; Ph.D., CSU	Thailand	Lecturer Hyd. Eng.
Vithya Pienvichitr B.Eng., Chula; M.S., Illinois; Ph.D., London	Thailand	Lecturer San. Eng.
Pairoje Teerawong B.Eng., Chula.; M.S., Texas; Ph.D., CSU	Thailand	Lecturer Civil Eng.



VII. FACILITIES AND EQUIPMENT

During the first two years of the School's existence, the rapid program of construction of buildings and furnishing of equipment provided impetus for an accelerated rate of growth for the School. The subsequent phenomenal increase of enrollment and research demands not only substantiated the soundness of the original planning, but also necessitated a continued effort to expand the building program, improve the grounds and acquire additional equipment. During the initial two years, emphasis was given to putting the classrooms, offices and laboratories into working condition so that the students and staff could make use of them. During the report period, it was possible to introduce some refinements in addition to maintaining the rapid rate of the building program.

Hydraulics Laboratory

Mr. M. A. Plint was sent by the British Government to visit the School once more. He had been the initial representative from the United Kingdom who had given valuable assistance in acquiring hydraulics laboratory equipment from Britain.

As a result of Mr. Plint's visit, new pieces of equipment were ordered from the United Kingdom and gradually arrived during the report period. In addition, some items of equipment have also been acquired from the United States and others have been assembled in the School's own machine shop.

New acquisitions during the report period include the following:

1. Sediment Channel - 15 ft. x 2 ft. x 1 ft.
2. Sediment Channel - 50 ft. x 15 ft. x 0.5 ft.
3. Water Tunnel
4. Wave Generating Mechanism for the River Model Basin
5. Filtering system for the water used in the laboratory
6. 30 ft. fixed slope open channel
7. 100 ft. wave channel (under construction)

Structural Engineering Laboratory

In this laboratory, a large quantity of equipment arrived from the United Kingdom during the report period, notably, a 300-ton compression testing machine, a vertical milling machine, and ultrasonic testing equipment. The laboratory now includes a concrete laboratory with aggregate preparation room, a models laboratory, and a photoelasticity laboratory which has a photographic dark room.

Transportation Engineering Laboratory

Thailand completed the construction of the transportation engineering building early in the report period and later added a second story to it. With the arrival of equipment from the United Kingdom and France, this laboratory became operative. The first floor of the building serves as a highway materials laboratory and a traffic engineering laboratory. The second floor is being outfitted to make a soil mechanics laboratory. Additional soil mechanics equipment will be acquired with United States funds.

Classroom and Dormitory Buildings

Remodeling and improvements have been made of the classroom buildings. Air conditioning and additional parking space have been added. A service and storage tower has been built. A new telephone system has been installed for better operational efficiency.

The Thai Government has completed a new dormitory for the School in which 40 students may be housed.

Library

The building of a technical library must be a steady and continuing process. The School's library has continued to expand during the report period at a good pace. Air conditioning has been installed and other improvements have been made to the library to make it a very pleasant and usable facility to serve the students, faculty, and to some extent, the practicing engineers in Bangkok.

Sizable donations have been received from individuals and organizations, particularly in the field of transportation engineering. Donors include the Institute of Transportation and Traffic Engineering of the University of California, the Purdue University Joint Highway Research Project, De Leuw, Cather and Company, and the United States Army Ordinance Command's Land Locomotion Laboratory. Other notable contributions have come from the Australian Government, the French Embassy, the West Pakistan Irrigation Institute, the Thailand Department of Science, and the ECAFE Committee for Coordination of Investigations of the Lower Mekong Basin.

At the end of the report period, the library contains just under 10,000 catalogued items and almost 200 periodicals under review. Monthly accession lists are distributed to the faculty, and the Highway Research Library of the Royal Thai Highway Department.

VIII. PUBLICATIONS

It is essential for a technical college on the graduate level to produce a sound publications program. Such a program must rely heavily on student thesis research, faculty research and contract research. The conspicuous lack of technical publications from both the schools and professional societies of Southeast Asia makes it imperative for the SEATO Graduate School to assume leadership in this field and introduce the concept of stimulating technological advancement and research in the region.

In this connection, the School has embarked upon a most ambitious program and, to insure its success, there must be continued strong support from the staff and the students. For this reason, a Publications Committee has been appointed to coordinate all matters regarding publications. The Committee undertakes to establish various series of technical and non-technical publications, review manuscriptions and coordinate operational details of printing and distribution.

As a result of the work of the Publications Committee, a wealth of publications have appeared.

Technical Publications *

1. Research Reports - A series of research reports has been introduced to report comprehensively on each individual research project conducted in the School.

2. Technical Notes - This series comprises information on research and other professional activities. The contents are of a technical nature; however, the materials are less extensive as those contained in the research reports.

3. Special Programs Reports - Because of the nature of the Special Training Program, various activities such as class reports and conferences are worth noting. Publications are under preparation to compile significant class notes and conference proceedings. The publication of this type of material will, of course, be irregular as each occasion arises.

4. Student Theses - Student theses are printed and bound and made available to researchers and engineers, both at the SEATO School Library and at Colorado State University Library. Requests have already been answered for the loan of student theses from various interested research workers in institutions in the United States.

5. Reprints - The faculty and students have begun writing professional papers to be published in various technical periodicals. Several papers have been accepted for publication and are, therefore, distributed internationally. When these articles appear in print, a quantity of reprints are ordered and are supplied with individual covers bearing the name of the SEATO School for further distribution. In this way, the research activities of the School may be brought to the attention of the engineering profession all over the world.

Research Summary

Periodically, a summary of the research activities of the School is published in tabulated form. In this way, the School can engage the interests of the professional world and keep it informed of the past and current research activities at the School.

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* For an extensive list of the School's technical publications, see Appendix 3.

General Information

In order to build a name for the School, it is necessary to produce a number of non-technical informative publications to provide general information, both for the public and for prospective students and other educators.

1. As a public relations piece, an attractive general information brochure was prepared in Fort Collins, intended for wide distribution to all those who wish to learn about all aspects of the School in general.

2. A catalog is published on an annual basis in which information is given in detail for the students who are interested in applying for admission at the SEATO School as well as prospective faculty members.

3. A research facilities brochure is prepared for distribution to organizations and individuals who are interested in the research service at the School that can be made available to them.

4. A general description of the various special training programs that are made available to the practicing engineers in the region is given in a separate brochure which is distributed to all interested engineers.

5. A quarterly newsletter is prepared for distribution to an extensive mailing list, giving current activities and miscellaneous news about the School.

IX. FUTURE CONSIDERATIONS

In the Initial Two-Year Progress Report, a detailed analysis was made of future plans and aspirations for the SEATO Graduate School of Engineering. This has provided a challenge for the past two years, despite the fact that we have not accomplished all that we desired. A number of factors contributed to the slow progress of the School.

1. It was difficult to overcome various problems in the selection process of the students from the various countries of Southeast Asia.

2. Uncertainty has always loomed over the hope for continued support and assurance of future support from the sponsoring countries which prevented intelligent long-range planning.

3. Additional faculty members from the various SEATO member countries have been difficult to obtain and it has been even more difficult to obtain future staff commitments.

4. A centralized and permanent organization has been lacking for the School's operation.

5. The absence of well-defined organization of the Advisory Panel has made it difficult to ascertain its role. Recommendations of the Panel have lacked active governmental support.

The past two years have seen a continued economic growth in Southeast Asia and a consequent intensified pressure for local engineers to carry the engineering load for this growth. There is such a dearth of well qualified local engineers that foreign engineering companies have continued to expand in number to help meet the demand.

As a result of these factors, the SEATO Graduate School of Engineering and its graduates are even more in demand than ever before. The demand is both for engineers in various aspects of civil engineering and other branches of engineering as well as for engineers trained even beyond the master's level. In view of the existing situation and the serious need, it is of great importance that all aspects of the SEATO Graduate School of Engineering program be expanded -- namely, academic offerings, research facilities, contract services and special programs.

Relations to SEATO and SEATO Countries

The Southeast Asia Treaty Organization has continued to provide an integrating influence among the many diverse interests, organizations, and individuals associated with the SEATO Graduate School. It is evident that the School will continue to need this integrating force for many years to come. Eventually, however, the School must be able to stand on its own feet. If it cannot do so, then there will be a serious question whether it is really serving a very important purpose. Therefore, we must plan the direction for the School as it gradually becomes less and less dependent upon SEATO for strength and stability. Regardless of how independent the SEATO School becomes, the operational cost of the School will be so great that assistance will be necessary for a number of years from the countries outside of Southeast Asia.

Closer relations both with SEATO member countries and with others can be promoted by inviting leading engineering educators from various universities in Southeast Asia to visit the School for inspection, evaluation and exchange of ideas. One of the roles of the Advisory Panel should be the promotion of this activity.

Objectives

The objectives of the School continue to be essentially the same as those originally set forth for it. Furthermore, it is increasingly manifest that changes in these objectives will be primarily in the means of attaining them, rather than the objectives themselves. The School must be able to graduate a large number of students of high quality who can play a significant and practical role in the furthering of the economic development of the area.

Advisory Panel and Board of Management

Many an educational institution has found that its success and perpetuation depend in a large measure upon a strong, high-level board, which acts in the combined capacity of establishing primary policies and representing the various interests which are concerned with the objectives and products of the School. The authorization of an Advisory Panel by the SEATO Council representatives in February, 1961, was a step made in this direction. In addition the SEATO School has a Management Board. The inter-relations among the Advisory Panel, the sponsoring governments, the Management Board, etc., are not well defined so that no effective operation could be promoted to further the interests of the School. It is recognized by educators and engineers concerned with the School at the present time that the School will lack stability and substantial growth until a well-conceived organization is established.

Name of the School

Since the SEATO Graduate School of Engineering was fathered by the Southeast Asia Treaty Organization, it is only logical that it should bear the name of SEATO, at least at the outset. However, experience hitherto has shown that several of the more sensitive countries in Southeast Asia are not willing to have any association with the School as long as it bears the SEATO name. Furthermore, many individuals who have the interest at heart of both SEATO and the School have stated that the SEATO name attached to the School is making it difficult to accomplish the worthwhile objectives of serving all of Southeast Asia. The governments of the non-member countries must be made to understand that this project is completely non-military and there is absolutely no political indoctrination in the curriculum. Further consideration should be given to various possible alternatives of solving this problem.

Faculty

The quality of the faculty of the SEATO Graduate School must be maintained at a very high level. In fact, the faculty must be among the best that each contributing country has available. In the future, greater emphasis should be placed on a larger faculty and a greater diversification of the faculty with respect to contributing countries. In other words, each SEATO-member country should be willing to provide several faculty members for the SEATO School. Continued stress should be placed on the provision of faculty who have the rare qualities of being able to work with the students from the Southeast Asia region and being able to encourage them effectively to apply the information they have learned in class to practical use for the development of their country's economy.

Now that participants are returning after training abroad, a specific plan should be developed for each one to be integrated into the faculty and administration of the School, with increasingly heavy responsibilities with a view to having the faculty members from the Southeast Asia region assume the full responsibilities of the operation of the School in the future.

Students

The high quality of the students in the School must be maintained. There must be a rapid increase to the optimum number of students; a special effort should be exerted to increase the number and improve the quality of the applicants for admission to the School.

Academic Program

It has become increasingly evident that there is a need in the SEATO Graduate School for various specialties of not only Civil Engineering, but also Electrical, Mechanical, and Industrial Engineering. At the meeting of the Advisory Panel, a proposed future expansion program was recommended to include such courses as Materials, Power and Industrial Management. Little or no follow-up action on the part of the sponsoring governments has been made in support of this recommendation. *

In addition to developing new curricula, the SEATO School should provide the impetus to develop post-graduate engineering programs elsewhere in Southeast Asia. As these are developed, there will be a need for the SEATO School to offer a doctor's degree in order to accommodate the more promising students.

Publications

One of the great needs with respect to engineering in Southeast Asia is publications which disseminate scientific and technological information resulting from research and special studies. The existing publications provide an excellent beginning, but they need to be expanded both in scope and depth. There is also a need for an engineering news journal to report developments in technology, both around the region and throughout the world. The SEATO School is the logical organization to perform this function.

Research Program

The research program of the School has been established on a firm basis through the various theses of the graduate students. However, to meet more fully the needs of Southeast Asia, it is necessary to plan a vast expansion in research, both at the School and at other engineering institutions in Southeast Asia. To accomplish this, there is a need for promotion of programs in fundamental research sponsored by the governments and the industries of Southeast Asia. Furthermore, there is a need for conducting applied research which has direct bearing upon immediate developmental problems of that part of the world. While the School may need to subsidize research momentarily through a budget revision, a concerted effort should be made to rally support from business, industry and the governments of the Southeast Asian region so that research sponsorship can eventually come from these sources.

Library

There is a great need for an extensive and complete technical library in Southeast Asia which can serve that part of the world in its problems of development. Such a library should be provided as a service by the SEATO Graduate School. In order to accomplish this, however, it is necessary to provide sufficient library staff to manage the ever-increasing collection of technical publications and to establish techniques and procedures whereby the library can serve the entire Southeast Asia region. In this connection, there is also need for increased equipment budget to provide such special services as microfilm, microcards and photostats.

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* For recommendations made by the Advisory Panel, see Appendix 4.

Contract Relations

Colorado State University is prepared to continue serving this worthwhile project to the best of its ability. In the execution of the contract, continual cooperation and support have been received from AID/Washington and USOM/Thailand. Assistance from the USAID in other Southeast Asia countries has also been helpful. It is hoped that even closer cooperation between Colorado State University and AID/Washington and between the School and the USOM can be achieved in the future so that all important activities which frequently require immediate attention can be pursued without unnecessary encumbrances.

APPENDICES

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August, 1962

APPENDIX 1

Curricula

Highway Engineering Major

Course No.	Title	Credits 1st Sem.	2nd Sem.	3rd Sem.	4th Sem.
101	Highway Planning and Design I	3			
125	Hydrology I	3			
143	Foundations and Earth Structures	3			
144	Engineering Testing of Soils	1			
163	Introduction to Probability and Statistics	2			
		12			
102	Highway Planning and Design II		2		
107	Bridge Engineering		3		
109	Airphoto Interpretation		2		
110	Advanced Highway Materials		2		
	Electives		2		
			11		
111	Pavement Design			3	
117	Transportation Project Design			2	
	Electives			2	
	Research and Thesis			-	
				7	
	Electives, optional with consent of adviser				-
	Research and Thesis				-

Elective Courses

		Credits
105	Traffic Engineering	3
113	Airport Engineering	2
115	Transportation Project Planning	2
121	Fluid Mechanics I	4
138	Water Resources Development	3
141	Structural Engineering	4
147	Prestressed Concrete Design	3
148	Advanced Reinforced Concrete Design	3
153	Concrete Technology	2
164	Introduction to Numerical Analysis	2

Hydraulic Engineering Major

Course No.	Title	Credits 1st Sem.	2nd Sem.	3rd Sem.	4th Sem.
121	Fluid Mechanics I	4			
125	Hydrology I	3			
161	Applied Mathematics I	3			
		10			
122	Fluid Mechanics II		3		
123	Fluid Mechanics Laboratory		1		
124	Flow in Open Channels		3		
126	Hydrology II		3		
			10		
127	Flow Through Porous Media			3	
135	Hydraulic Design			3	
	Electives			4	
	Research and Thesis			-	
				10	
	Electives, optional with consent of adviser				-
	Research and Thesis				-

Elective Courses

		Credits
129	Erosion and Sedimentation	3
130	Coastal Engineering	3
131	Irrigation and Drainage Engineering	3
133	Waterpower Engineering	3
137	Hydraulic Project Planning	3
138	Water Resources Development	3
162	Applied Mathematics II	3
163	Introduction to Probability and Statistics	2
164	Introduction to Numerical Analysis	2

Structural Engineering Major

Course No.	Title	Credits 1st Sem.	2nd Sem.	3rd Sem.	4th Sem.
141	Structural Engineering	4			
143	Foundations and Earth Structures	3			
144	Engineering Testing of Soils	1			
149	Structural Laboratory	1			
161	Applied Mathematics I	3			
		12			
145	Advanced Strength of Materials		3		
148	Advanced Reinforced Concrete Design		3		
151	Experimental Stress Analysis I		1		
	Electives		5		
			12		

Structural Engineering Major (continued)

Course No.	Title	Credits 1st Sem.	2nd Sem.	3rd Sem.	4th Sem.
147	Prestressed Concrete Design			3	
150	Structural Model Analysis			1	
	Electives			2	
	Research and Thesis			-	
				6	
	Electives, optional with consent of adviser				-
	Research and Thesis				-

Elective Courses

		Credits
142	Advanced Structural Theory	3
152	Experimental Stress Analysis II	2
153	Concrete Technology	2
155	Plastic Design of Steel Structures	3
156	Design of Structures for Dynamic Forces	2
158	Theory of Elastic Stability	2
159	Design of Thin Shell Structures	2
160	Design of Folded Plate Structures	2
162	Applied Mathematics II	3
163	Introduction to Probability and Statistics	2
164	Introduction to Numerical Methods	2

APPENDIX 2

Description of Subjects

101 Highway Planning and Design I, 3, (3-0).*
Prerequisite: Undergraduate course in Highway Engineering.
Principles of highway planning, finance, economics, and programming of improvements; capacity, alignments, cross sections and intersections at grade and interchanges.

102 Highway Planning and Design II, 2 (0-6).
Prerequisite: Highway Planning and Design I.
Planning and design problems selected to illustrate the principles and techniques studied in Highway Planning and Design I.

105 Traffic Engineering, 3 (2-3).
Prerequisite: Highway Planning and Design I.
Analysis of traffic problems including field studies, surveys and the interpretation of survey data; regulation and control methods and equipment; traffic and transportation planning and design.

107 Bridge Engineering, 3 (2-3).
Prerequisites: Hydrology I and undergraduate courses in Fluid Mechanics, Structural Design, and Soil Mechanics.
Design of flood openings, study of flow through bridge openings; survey and selection of bridge sites, clearance requirements for navigation. Design of piers, abutments and superstructures.

109 Airphoto Interpretation, 2 (1-3).
Prerequisites: Undergraduate courses in Route Surveying and Highway Engineering.
Principles of aerial photography and photogrammetry; the use of airphotos in identifying land forms, in highway location, and in the interpretation of soil and drainage conditions for highway design.

110 Advanced Highway Materials, 2(1-3).
Aggregates, bituminous materials, asphaltic concrete mixtures and cement concrete mixtures.

111 Pavement Design, 3 (2-3).
Prerequisites: Foundations and Earth Structures, Highway Planning and Design I and II.
Theories of pavement design; methods of design of rigid and flexible pavements. Practical consideration of materials, construction methods, field control and their effect on design. Airport pavements.

113 Airport Engineering, 2 (2-0).
Growth of air commerce, governmental organizations concerned with air transport, financing airport projects; air navigation facilities; the airport master plan; zoning; performance characteristics of transport aircraft; airport geometric design requirements; lighting and marking; functional design of terminals, heliports.

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* The number behind each course indicates credits given for successfully completing the course. The first number in parentheses shows the hours of lecture given per week; the second number shows the hours of laboratory work given per week.

115 Transportation Project Planning, 2 (0-6).
Prerequisites: Highway Planning and Design I and II and Traffic Engineering.
A projects course in which students collaborate as teams on selected problems which serve to integrate previously acquired knowledge; planning the work to be accomplished, gathering the necessary data, analyzing and drawing conclusions, writing reports on the projects, and defending the results before members of the class.

117 Transportation Project Design, 2 (2-0).
Prerequisites: Highway Planning and Design I and II.
Project design studies including route location, drainage, design criteria and economic selection.

121 Fluid Mechanics I, 4 (4-0).
Dynamic effects of pressure, shear and gravity on a fluid particle; introduction to the theory of irrotational flow; one-dimensional method of analysis; drag on submerged bodies; flow in pipes and channels; hydraulic machinery, fluid-flow meters; introduction to dynamic similitude.

122 Fluid Mechanics II, 3 (3-0).
Prerequisite: Fluid Mechanics I.
Introduction to ideal and real fluid theory; derivation of the Euler, Navier-Stokes, and Bernoulli equations; the complex potential and conformal mapping; problems of viscous flow including boundary layers and turbulence; applications to problems in hydraulics.

123 Fluid Mechanics Laboratory, 1 (0-3).
Prerequisite: Fluid Mechanics I.
Experimental verification of the principles of fluid mechanics; preparation of reports on experiments.

124 Flow in Open Channels, 3 (3-0).
Prerequisite: Fluid Mechanics I.
Uniform flow in open channels; the hydraulic jump and surges; non-uniform flow; subcritical and supercritical flow around bends and through transitions; unsteady flow in canals, rivers and tidal estuaries.

125 Hydrology I, 3 (3-0).
The hydrologic cycle; climatic elements; precipitation intensity-frequency-duration and depth-area relationships; infiltration, evaporation and transpiration; stream gauging practice; analysis of the hydrograph; flow-duration characteristics; seasonal and long-term variations; the runoff coefficient; specific yield; the unit hydrographs, flood estimation, flood routing.

126 Hydrology II, 3 (2-3).
Prerequisite: Hydrology I.
Water resources development; hydrologic networks; statistical hydrology; hydrometeorological correlations and covariations; the unit hydrograph; synthetic unit hydrographs; backwater curves; flood routing; sedimentation; characteristics of the rivers of Southeast Asia.

127 Flow Through Porous Media, 3 (3-0).
Prerequisite: Fluid Mechanics I.
Mechanics of fluid flow in porous media; Darcy's law; continuity and Laplace equations; steady and unsteady flow in isotropic and anisotropic media; problems of flow to wells, drains and ditches, through and under dams and levees; flow in partially-saturated media; multi-phase and multi-layered systems; numerical, analog and graphical solutions.

129 Erosion and Sedimentation, 3 (3-0).
Prerequisites: Fluid Mechanics I and Flow in Open Channels.
Nature and properties of waterborne sediment; soil erosion; transportation theories of suspended load; transport of sediment in canals and rivers and the effect of sediment on irrigation canals, reservoirs and structures. Erosion-control structures; stable-channel design; desilting and diversion structures.

130 Coastal Engineering, 3 (3-0).
Prerequisites: Fluid Mechanics I and Flow in Open Channels.
Estuary hydraulics and tides; deep and shallow water waves; reflection, refraction and diffraction of waves; wave forecasting; wave forces on structures; harbors and breakwaters; beach erosion and littoral drift.

131 Irrigation and Drainage Engineering, 3 (3-0).
Prerequisite: Fluid Mechanics I.
Requirements of plants for water, soil as a reservoir for available water; sources, storage, conveyance, and handling of irrigation water; application of water to crops; land preparation, drainage, organization of irrigation and drainage projects.

133 Waterpower Engineering, 3 (3-0).
Prerequisite: Second year standing.
Regional power assessments, types of developments, hydraulic and topographic surveys, sub-surface exploration, preliminary investigation and design, economics of development; layout of dams, powerhouses, tunnels, canals, spillways, surge-chambers and penstocks; selection of turbines; construction practices; preparation of reports.

135 Hydraulic Design, 3 (1-6).
Prerequisites: Fluid Mechanics I and Flow in Open Channels.
Hydraulic design of structures used in the storage and control of water; canals and flumes, spillways, stilling basins, transitions and control structures, locks and breakwaters; the use of models in hydraulic design.

137 Hydraulic Project Planning, 3 (1-6).
Prerequisite: Second year standing.
Planning of engineering projects pertaining to public water supply, irrigation, flood control, navigation improvement, or water power from inception to adoption of final plans; preliminary investigation, data gathering, preparation of comparative preliminary plans and estimates, and the preparation of a final report.

138 Water Resources Development, 3 (3-0).
Prerequisite: Second year standing.
Main elements in water resources development; single-purpose and multi-purpose projects; principles of development; physical, economic and other aspects of river basin development; appraisal of water resources; investigation and planning; benefit-cost analysis; studies of T.V.A. and other multi-purpose schemes.

141 Structural Engineering, 4 (3-3).
Introduction to advanced topics in structural engineering. Interdependence of subjects in structural engineering. Methods of analysis for statically indeterminate structures. Principles of advanced design in steel, concrete and timber. New techniques in analysis, design and construction. The future of structural engineering.

142 Advanced Structural Theory, 3 (2-3).
Prerequisite: Structural Engineering.
Analysis of complex statically indeterminate structures including space frames, long-span bridges and curved beams.

143 Foundations and Earth Structures, 3 (3-0).
Prerequisites: Undergraduate courses in Soil Mechanics and Fluid Mechanics.
Application of soil mechanics theory to earth and foundation engineering including retaining walls, sheet piles, embankments, footings, piles, piers, abutments, culverts and earth dams; settlement problems.

144 Engineering Testing of Soils, 1 (0-3).
Soil survey and sampling; soil testing including gradation, permeability, capillarity, consolidation, compaction and shear tests.

145 Advanced Strength of Materials, 3 (3-0).
Prerequisite: Applied Mathematics I.
Advanced topics in strength of materials including an introduction to theory of elasticity. Generalized Hooke's law, principal planes and principal stresses in three dimensions, general theory of flexure, theories of failure, creep, fatigue and impact properties.

147 Prestressed Concrete Design, 3 (2-3).
Economics of prestressing; properties of relevant materials; methods of prestressing; elementary theory and design of beam sections; losses of prestress; deflections of prestressed concrete beams; composite construction; indeterminate structures of prestressed concrete.

148 Advanced Reinforced Concrete Design, 3 (2-3).
Critical review of the general principles and assumptions used in the design of reinforced concrete structures; ultimate strength design; moment redistribution; design of complex reinforced concrete structures, with emphasis on topics of current interest.

149 Structural Laboratory, 1 (0-3).
Experimental verification of principles in structural engineering. The preparation of technical reports.

150 Structural Model Analysis, 1 (0-3).
Small-displacement and large-displacement methods in the analysis of indeterminate structures using models; use of the dynamometer method of model analysis.

151 Experimental Stress Analysis I, 1 (0-3).
Experimental stress and strain analysis; the use of electrical resistance strain gages for static and dynamic loads; strain rosettes; stress field determination by photoelasticity and brittle lacquers.

152 Experimental Stress Analysis II, 2 (0-6).
More advanced techniques in stress and strain analysis; three-dimensional photoelasticity; torsion analogies and other methods.

153 Concrete Technology, 2 (1-3).
Properties of constituent materials; mix design, batching, placing, finishing and curing of concrete; workability; quality control; properties and uses of concretes and mortars.

155 Plastic Design of Steel Structures, 3 (2-3).
Plasticity; development of plastic analysis for steel structures; ultimate loads for beams and frames; deflections of beams and frames; design of continuous beams and frames including their connections.

156 Design of Structures for Dynamic Forces, 2 (2-0).

Forces resulting from moving loads, machinery, blast and earthquake; dynamic behavior of structures under the action of these forces; design to minimize and resist the effect of dynamic forces.

158 Theory of Elastic Stability, 2 (2-0).

Prerequisite: Advanced Strength of Materials.

General and local buckling of structural elements in compression; criteria for stability; design to avoid buckling failure.

159 Design of Thin Shell Structures, 2 (2-0).

Membrane theory; design of spherical, cylindrical, and hyperbolic-paraboloidal shells; edge effects; supporting structures. Aesthetic, economic and constructional considerations.

160 Design of Folded Plate Structures, 2 (2-0).

Design of structures composed of thin plates placed at angles to each other. Procedure for various depth-to-span ratios; diaphragms; combined stresses; buckling of thin elements. Aesthetic, economic and constructional considerations.

161 Applied Mathematics I, 3 (3-0).

Fourier series, selected problems in ordinary and partial differential equations, introduction to complex variables including conformal mapping, vector analysis.

162 Applied Mathematics II, 3 (3-0).

Infinite series; Gamma, Bessel and Legendre functions; selected problems in partial differential equations; the Laplace transform; determinants and matrices.

163 Introduction to Probability and Statistics, 2 (2-0).

Organization and analysis of data, distributions, selected topics in probability and statistical inference, curve fitting.

164 Introduction to Numerical Analysis, 2 (0-6).

Finite differences, approximations of various types, solution by numerical methods of equations met in engineering analysis, use of computing machines.

APPENDIX 3

List of Technical Publications

1. Hydraulic Engineering Research

Ackermann, N. L., Virtual Mass Investigations for the Motion of Two Concentric Spheres, Technical Notes No. 2 and No. 8. (Project No. 2015)

Ahmad, Bashir, Flood Magnitude in Thailand in Relation to Return-Period, Mean Flow and Catchment Area, Thesis No. 20. (Project No. 2023, supervised by Professor A. D. Benham)

Alam, A. F. M. S., Lateral Oscillation of Disks of Variable Thickness and Diameter, Thesis No. 17. (Project No. 2018, supervised by Dr. R. B. Banks)

Arbhabhirama, Anat, Theoretical Study of the Flow and Discharge Characteristics of a Two-Dimensional Orifice Placed Unsymmetrically in an Approach Channel, Thesis No. 18. (Project No. 2002A, supervised by Professor D. H. Holze)

Banks, R. B., and Jerasate, Somsakdi, Dispersion in Unsteady Porous-Media Flow, Journal of the Hydraulics Div., Am. Soc. Civil Engrs., May, 1962. (Project No. 2017)

Banks, R. B., Interfacial Mixing in Unsteady Porous Media Flow, Research Report No. 1. (Project No. 2017A)

Banks, R. B., Dispersion and Adsorption in Porous Media Flow, Research Report No. 1 and Technical Note No. 4. (Project No. 2017B)

Banks, R. B., and Alam, A. F. M. S., Lateral Oscillation of Disks of Variable Thickness and Diameter, Technical Note No. 9, prepared for presentation at the First Asian Conf. in Hydraulics & Hydraulic Machinery, Bangalore, 1963.(Project No. 2018)

Banks, R. B., Experimental Investigation of the Penetration of a High Velocity Gas Jet through a Liquid Surface, Journal of Fluid Mechanics, Vol. 15, 1, January 1963, pp. 13-34, Research Report No. 2. (Project No. 2020)

Banks, R. B., High Velocity Gas Jet Penetration into Liquids, Technical Note No. 3, prepared for presentation at the Conf. of Hydraulics and Fluid Mechanics, Australia, December 1962. (Project No. 2020)

Bhavamai, Anusornant, Impingement of a Plane Liquid Jet on the Surface of a Heavier Liquid, Thesis No. 48. (Project No. 2020A, supervised by Dr. R. B. Banks)

Boonpirugsa, Sommart, Conduction of Water from Seepage Pits, Thesis No. 9. (Project No. 2009, supervised by Dr. A. T. Corey)

Boonyakanjana, Pichai, An Analysis of Unsteady Flow in Open Channels, Thesis No. 4. (Project No. 2004, supervised by Dr. M. R. Carstens)

Charmonman, Srisakdi, The Design, Construction and Performance Evaluation of an Axial-Flow Pump for Use with Thai-style Outboard Boat Motors, Thesis No. 6. (Project No. 2006, supervised by Dr. M. R. Carstens)

Chatuthasry, Chakri, Sedimentation Diameter as a Function of Reynolds Number, Thesis No. 7. (Project No. 2007, supervised by Dr. A. T. Corey)

Chowchuveh, Sumana, Flow and Discharge Characteristics of a Two Dimensional Orifice Placed Unsymmetrically in an Approach Channel, Thesis No. 2. (Project No. 2002, supervised by Dr. M. R. Carstens)

Chulajata, R., The Derivation of the 24-hour Unit Hydrograph for the Me Ping River at Chiengmai, Thesis No. 11. (Project No. 2011, supervised by Professor A. D. Benham)

Husain, Nazim, Storage Requirements in the Chao Phraya River System, Thesis No. 21. (Project No. 2024, supervised by Professor A. D. Benham)

Hutachitta, Wisist, The Effect of Concentration on the Fall Velocity of a Sphere, Thesis No. 44. (Project No. 2027, supervised by Dr. N. L. Ackermann)

Jerasate, Somsakdi, Dispersion of a Fresh Water - Salt Water Interface During Drainage from a Porous Medium, Thesis No. 16. (Project No. 2017, supervised by Dr. R. B. Banks)

Jog, Prabhakar M., Self-Priming by Hydraulic Jump of Box Culverts on Mild Slopes, Thesis No. 14. (Project No. 2014, supervised by Dr. N. L. Ackermann)

Khunvasi, Varoon, Transfer of Energy and Momentum from Suspended Solid Particles During Flow through an Abrupt Expansion, Thesis No. 5. (Project No. 2005, supervised by Dr. M. R. Carstens)

Mabini, Teofilo P., An Assessment of the Hydro-Electric Potential of the Upper Chao Phraya River Basin, Thesis No. 12. (Project No. 2012, supervised by Professor A. D. Benham)

Molagool, Asni, An Investigation of the Water Balance in Northeastern Thailand, Thesis No. 32. (Project No. 2026, supervised by Professor A. D. Benham)

Niyomthai, Chaleo, Design and Development of a Two-Phase Flow Meter, Thesis No. 40. (Project No. 2005B, supervised by Dr. N. L. Ackermann)

Nutasara, Vichit, The Prediction of Falling-Stage Discharges in the Upper Chao Phraya River and its Tributaries, Thesis No. 13. (Project No. 2013, supervised by Professor A. D. Benham)

Pinkayan, Subin, Hydraulic Characteristics of the Wooden Paddle Pump, Thesis No. 3. (Project No. 2003, supervised by Dr. M. R. Carstens)

Quimpo, Rafael G., Geographic and Seasonal Variation of Specific Yield in Northern Thailand, Thesis No. 22. (Project No. 2025, supervised by Professor A. D. Benham)

Rahman, Quazi Hamidur, Permeability and Capillary Pressure in Sands, Thesis No. 8. (Project No. 2008, supervised by Dr. A. T. Corey)

Sutabutra, Prathet, Two Problems in the Hydrodynamics of Salt Water Intrusion, Thesis No. 19. (Project No. 2022, supervised by Professor D. H. Holze)

Svankadatta, Dejswat, Shaft Spillway Conduit Size Determination, Thesis No. 1. (Project No. 2001, supervised by Dr. M. R. Carstens)

Thimakorn, Prida, Pressure Recovery in a Two-Phase Solid-Liquid Flow through a Sudden Expansion, Thesis No. 15. (Project No. 2005A, supervised by Dr. N. L. Ackermann)

Yuktanuntana, Thongterm, Runoff in Relation to Rainfall in Northern Thailand, Thesis No. 10. (Project No. 2010, supervised by Professor A. D. Benham)

2. Transportation Engineering Research

Cusens, A. R., Testing of Soil Samples for Advanced Research Projects Agency, Reports 3028/1-7. (Project No. 3028)

Danvivadhana, Vicharn, Stress Distributions Due to Vertical and Tangential Forces in a Homogeneous Isotropic Elastic Solid, Thesis No. 39. (Project No. 3010A, supervised by Professor U. Voodhigula)

Jones, J. H., and Kulprapha, Somnuk, Economic Potential for Helicopter Service between Don Muang Airport and Bangkok, Paper presented at the Air Transport Eng'g Conference Bangkok, 1962. (Project No. 3004)

Kasirasksa, Wisit, Economic Effects of the Friendship Highway, Thesis No. 41. (Project No. 3012, supervised by Professor J. H. Jones)

Khoachphoom, Praphatsorn, Consolidation of Soft Marine Clay by Electro-Osmosis, Thesis No. 34. (Project No. 3008, supervised by Professor U. Voodhigula)

Kulprapha, Somnuk, Economic Potential for Helicopter Service between Don Muang Airport and Bangkok, Thesis No. 33. (Project No. 3004, supervised by Professor J. H. Jones)

Laksanakoses, Yos, Aspects of Traffic Behaviour on Two-Lane Rural Highways, Thesis No. 46. (Project No. 3002, supervised by Professor J. H. Jones)

Michelin, S. F., The Use of Lateritic Materials in Road Construction, Technical Note No. 7. (Project No. 3005)

Muktabhant, C., A Study of Low Cost Roads, Report prepared for National Research Council. (Project No. 3007)

Peetathawutchai, Ahtorn, Justification and Effect of a Speed Limit on Road Traffic, Thesis No. 38. (Project No. 3013, supervised by Professor S. F. Michelin)

Petchprapa, Niyom, An Analysis of Speeds, Volumes, Densities and Gaps of Traffic on Memorial Bridge, Bangkok, Thesis No. 36. (Project No. 3003, supervised by Professor J. H. Jones)

Swathiparnich, Pramote, Investigation of the Stress-Strain Characteristics of Compacted Clay at Various Rates of Strain, Thesis No. 35. (Project No. 3009, supervised by Professor U. Voodhigula)

Teerachaichayuti, Somsak, Relationships Between Approach Volume and Delays on Round-About Junctions, Thesis No. 45. (Project No. 3001, supervised by Professor J. H. Jones)

Voodhigula, U., Stress Due to Tangential Force, Technical Note No. 1. (Project No. 3010)

3. Structural Engineering Research

Abbasi, A. F. G., Influence on Transverse Prestress on the Ultimate Strength of Prestressed Concrete Bridge Slabs, Thesis No. 26. (Project No. 4005, supervised by Dr. A. R. Cusens)

Cusens, A. R., Testing of Concrete Cores from Bhumipol Dam, Report 401-S, Nos. 1-5. (Project No. 4001)

Cusens, A. R., and Trirojna, Supachai, An Experimental Study of a Reinforced Concrete Helicoidal Staircase, Journal American Concrete Institute, Vol. 60. (Project No. 4004)

Cusens, A. R., and Abbasi, A. G. F., Influence of Transverse Prestress on the Ultimate Strength of Prestressed Concrete Bridge Slabs, Magazine of Concrete Res., 14, 41, July 1962, 119-120. Magazine of Concrete Res., 15, 44, July 1963, 107-114. (Project No. 4005)

Cusens, A. R., The Strength of Concrete Test Cylinders Cast in Waxed Paper Molds, Journal American Concrete Institute, Vol. 60, Technical Note No. 6. (Project No. 4009)

Cusens, A. R., Testing of Steel Specimens from Yanhee Transmission Line, Reports 401-S Nos. 1 and 2. (Project No. 4018)

Cusens, A. R., Testing of Steel Samples for Thai Textile Organization, Report to Thai Textile Organization, 27th September, 1963. (Project No. 4031)

Cusens, A. R., Testing of Steel Samples for East Asiatic Company, Report to East Asiatic Company, 3rd July, 1963. (Project No. 4037)

de Jesus, Giovanni C., The Influence of Transverse Prestress on the Strength of Composite Slab Bridges, Thesis No. 47. (Project No. 4016, supervised by Dr. A. R. Cusens)

de Vera Cruz, Leonardo, An Investigation of the Stress Distribution Due to Axial Forces on Concrete Cubes and Prisms, Thesis No. 37. (Project No. 4002A, supervised by Dr. A. R. Cusens)

Hongladaromp, T., The Strength of Nailed Plywood Gusset Plates, Thesis No. 29. (Project No. 4008, supervised by Dr. E. Geer)

Hongladaromp, Tongchat, Use of Washers in Nailed Timber Joints with Plywood Gusset Plates, Technical Note No. 11. (Project No. 4008A)

Karasudhi, Pisidhi, Behaviour and Strength of Concrete Beams with High Strength Bars, Thesis No. 50. (Project No. 4017, supervised by Dr. A. R. Cusens)

Majid, Md. Fazlul, Analogy between Stress Trajectories and Streamlines of Fluid Flow, Thesis No. 27. (Project No. 4006, supervised by Dr. E. Geer)

Niyomvit, Saksit, An Experimental Study of a 180 Degree Fixed Ended Helicoidal Staircase of Reinforced Concrete, Thesis No. 49. (Project No. 4004A, supervised by Dr. A. R. Cusens)

Phanasomburana, Suthep, Design and Behaviour of a Folded Plate Reinforced Concrete Roof, Thesis No. 43. (Project No. 4015, supervised by Professor K.D. Cummins)

Pian, R. H. J., Simplified Design of Metal Beam-Columns, Technical Note No. 10. (Project No. 4012)

Pulmano, Victor A., Impact of a Falling Mass on a Beam, Thesis No. 31. (Project No. 4011, supervised by Dr. R. H. J. Pian)

Rizvi, Syed S. A., A Study of Increased Mechanization in Building Construction, Paper presented at the Conference of Architecture and Structural Engineering in Relation to the Construction of Large Buildings, Bangkok, 16th-19th October, 1963. (Project No. 4026, supervised by Dr. A. R. Cusens)

Sithichaikasem, S., The Mechanism of Deformation of Concrete under Axial Forces, Thesis No. 23. (Project No. 4002, supervised by Dr. A. R. Cusens)

Sroikeree, Somboon, The Use of Circular Reinforcement in Reinforced Concrete Slabs Spanning in Two Directions, Thesis No. 24 and Technical Note No. 5. (Project No. 4003, supervised by Dr. A. R. Cusens)

Trirojna, Supachai, The Design and Behaviour under Load of Reinforced Concrete Helicoidal Stairs, Thesis No. 25. (Project No. 4004, supervised by Dr. A. R. Cusens)

Vijitakula, Narong, Analysis of a Suspension Bridge by Considering the Cable in Straight Segments, Thesis No. 30. (Project No. 4010, supervised by Dr. R. H. J. Pian)

Watakeekul, Sombuan, Analysis and Rating of Existing Highway Bridges in Thailand, Thesis No. 42. (Project No. 4014, supervised by Dr. R. H. J. Pian)

Weesakul, Wera, Analysis of Multi-Storied Frames by the Panel Method, Thesis No. 28. (Project No. 4007, supervised by Dr. E. Geer)

APPENDIX 4

Report of the Advisory Panel of the
SEATO Graduate School of Engineering
Bangkok, Thailand
August, 1962

A) AUTHORITY

The Panel was formed under the terms of SEATO document (unclassified) Annex B to IX(12-10/3)/61. "Constitution of the Advisory Panel of the SEATO Graduate School of Engineering" (also Annex A to SCR/62/D-29).

B) TERMS OF REFERENCE

The terms of reference of the Panel are:

The functions of the members shall be to: -

(a) advise the Dean of the SEATO Graduate School on any matters of academic policy or practice which he shall refer to them collectively or individually;

(b) promote the improvement of the academic standards of the School and their recognition by academic and professional institutions throughout the world;

(c) obtain for the School the widest possible support from educational and professional bodies and the public; and

(d) stimulate interest among able students in attending the School; and assist graduates of the School academically and professionally.

C) CONSTITUTION OF PANEL

The Panel, as presently constituted, consists of:

W. Fisher Cassie, Chairman (England)
V. G. Desa (Pakistan)
Muni M. Vejyant-Rangsrisht (Thailand)
Wesley L. Orr (United States)
Crisostomo A. Ortigas (Philippines)

D) REGULAR PROGRAMS

(1) MAJORS

The Regular Programs lead to the degree of Master of Engineering in two years. There are three such programs: highway engineering, hydraulic engineering (and hydrology) and structural engineering.

(2) TYPE OF STUDENT

The student entering for the Master's Degree must have a Bachelor's Degree in engineering before acceptance. The course is not restricted to SEATO countries, but the non-SEATO countries have, so far, sent few students. This shows signs of improvement, and we consider that every effort should be made to attract the best students regardless of country.

(3) STANDARDS

Whatever steps are taken to increase the numbers of applicants, we urge that this should not be done at the expense of the standards of instruction and attainment. The better students will be attracted by intensive and widespread publicity (on which a good start has already been made) but more particularly by the reputation gained by the School as an institution of high calibre in staff, equipment, publications and standards.

(4) PRESENT NUMBERS OF STUDENTS

The present number of regular students is 62, the new entry for 1962-63 being 47. With a similar entry next session, the total number under instruction should increase to 90 or slightly more. This number could be handled by the present staff since the student/staff ratio would then be between 8 and 9 (11 full-time equivalent members of faculty). We consider that, in the conditions of a School whose courses lead to a Master's Degree, this ratio represents the highest acceptable figure. Any increase in student numbers beyond about 90, or the founding of additional majors, will demand an increase in faculty and staff.

(5) FUTURE NUMBERS OF STUDENTS

The number of students can be increased to about 150 with the present buildings but only if suitable increases in staff, equipment and student facilities are made. We recommend that this increase should be one of the aims of the School. Further, it has been estimated that with student numbers in the region of 150, the cost of training a student (including travel and books) would be reduced and become less than the cost of sending him to North America or Europe for a Master's course.

(6) FACULTY STAFF

We have no hesitation in stating that the quality of personality and attainment of all the present members of the faculty is high. It is not a foregone conclusion, however, that this quality will be maintained. At present the rate of turnover is disturbingly rapid, most members leaving after two years' service. Only a few have remained for two terms of office (four years). We refer to Dean Holcomb's recent "Special Report on Future Staff Needs" which is bound as an Appendix with this Report.

We consider that it will be difficult to obtain ex-patriate staff either on leave-of-absence or on secondment. The alternative, on which an experiment has already been commenced, is that of sending graduates of the School of the U.S.A. or Europe for further advanced university study and training, on the understanding that these participants will return as faculty members to the School.

This replacement scheme which should be continued will stabilize, to some extent, the faculty-staff establishment but, if the School is to make a decisive educational contribution to South East Asia, some means must be found to develop a permanent core of staff. Our discussions have led us to the conclusion that this may well be accomplished only by the provision of funds which are even more substantial and dependable than at present.

(7) CURRICULA

We find no serious criticism of the present curricula except to note the lack of courses general to all three majors. If further majors are later founded, it may be impossible to provide all the training by courses distinctive to each option. At present

only Applied Mathematics I and Hydrology I appear in the required courses for two options. Probability and Statistics and Applied Mathematics II appear as electives in the structural engineering major and also in another option. All other courses apply only to one option.

General topics of use to engineers of South East Asia, and which cannot easily be studied elsewhere in the Region, might be considered as possible required or elective courses. We instance Industrial Organization and Management as one of the fields which could well be studied in proportion as it relates to each of the options. The lack of management studies in the Region has been drawn to our attention.

There is also a need for more emphasis on the application of theory to the needs of nations in South East Asia by means of project-design work considered as an essential part of each course. Design, on a broad scale, is as important for the students of the School as is experimental research if they are to play leading roles in their respective countries.

It would be advisable that the committee of each academic major should have a corresponding member or advisor in each of the SEATO countries. The function of such an advisor would be to put before the committee the academic conditions in his own country, and to keep the Graduate School aware of changes in undergraduate curricula in the universities of his country.

(8) FINAL THESIS REQUIREMENTS

At present the final thesis requirements of the students relate entirely to experimental laboratory research of a high order. In the light of the needs of developing countries, consideration might be given to design projects, not only as a subject for formal study as suggested in (7), but also as a form of creative original work. Some of the students may be, by training and inclination, well adapted to collecting facts relating to a possible specific design problem, and producing a design suited to the requirements of the area concerned. This could be creative work of a high order and, for a proportion of the students, as rewarding as a thesis on experimental work in a section of a narrow field.

(9) DEVELOPMENT OF FURTHER OPTIONS

It is clear that if the School is to develop in size and prestige, as it shows every sign of doing, further majors or options, in addition to the present three, must be developed. There are two problems: first, to determine priorities amongst the many possible topics and, secondly, to consider how the physical expansion can best be implemented. In both of these, the chief criteria must be (a) the maintenance of the present high standard of the School, and (b) the imperative necessity of remembering the needs of all the countries for which the School forms a focus of advanced engineering education.

The chief fields in which further study and training, at advanced level, will be required for many years to come are:

Materials, Transportation, Power, Communications, Production and Public Health Engineering. In all of these, the emphasis should be on new concepts and creative design rather than on analysis of already known methods and facts.

We recommend that the first three options which should be considered (as they are of more importance at present than the others) are:

Materials, Public Health Engineering and Transportation (alphabetical order).

The Materials studied should be not only those needed for highway construction as has been suggested, but should include all materials used in engineering in South East Asia with particular reference to naturally-occurring materials. Especially should methods of improving the usefulness of abundant but low-grade materials, such as laterite, form a part of the training and research program. Modern methods of design in timber can be developed in the Region only after a thorough study of available materials.

In developing countries it would be inadvisable to restrict advanced training in Transportation to highways only. Although we recognize the serious difficulties which can be encountered, we consider that an opportunity is presented by the presence of the School to initiate a thorough study of all types of transport and to try to determine suitable methods or combinations of transportation adapted to the countries of the Region.

Public Health Engineering must be considered as a graduate topic. Water supply, drainage and the treatment of trade wastes are vital matters for the immediate future.

We were told of proposals to develop Mechanical and Electrical Engineering, but consider that these must take a later place in the program to the three topics above. The engineering study and training should be directed to a consideration of Power, Communications and Production rather than be limited to the older divisions of "Mechanical" and "Electrical" engineering. By "Production" we imply the manufacture of products necessary to the Region, and especially the utilization and processing of agricultural produce.

(10) LOCATION OF FURTHER REGULAR COURSES

Proposals have been made for the setting up of branches of the School in other SEATO countries. It has also been suggested that similar SEATO Schools might develop in these countries independently of the present Graduate School. Although both of these proposals might be given consideration in the future, we think that it would be inopportune, at this stage, to disperse the efforts of the School. The aim should be to build up a vigorous body of staff and students and to develop an academic reputation and standing. We recommend, therefore, that all developments in the Regular Courses for the Master's Degree of the SEATO Graduate School should be concentrated at the present location and that the position be reviewed at a later date.

Further courses for Master's Degrees may well, in the meantime, be set up at universities in other SEATO countries. In view of the likely demands of the Region for trained technologists, we do not consider such developments to be in competition with the present School, but complementary to it. It is expected that the SEATO Graduate School and these other University Graduate Schools would cooperate as far as possible.

In E) we propose the establishment of a special Master's course for university teachers in cooperation with other universities but we consider this course to be in a special category.

E) TEACHERS' COURSES

As the reputation of the School increases, many university teachers in the countries of the Region will wish to study at the School. Several have already done so, but are not awarded a degree of the Graduate School.

We consider that it might be found advisable to set up special Master's Degree courses for university teachers or workers in recognized research institutions from the countries of South East Asia. These courses might take the form of one calendar year of residence in the Graduate School, followed by an academic session at the teacher's own institution. During the year at the Graduate School, study and research would be carried out. In his own institution the teacher would, in his second year, complete and present his research or design project. He would, during this time, be required to be in close consultation with his supervisor, and would present an interim report monthly.

F) STUDENT WELFARE

We visited the dormitory used by the students of the Graduate School, and also saw a new one under construction. All except local students are in residence, and the total number which can be accommodated when the new dormitory is ready will be at least 40. We have all talked to students of the School and found no more than the usual difficulties. The living accommodation seemed to receive general approval, but the problem of food looms larger. Both Pakistani and Filipinos have cooks who prepare their special meals, and this procedure is, understandably, expensive. Representations were also made that the total cost of living in the School is high. We suggest that this problem should be studied by the School. We do not have enough data on which to base a firm conclusion. With the increase in School enrollment we expect that cost will tend to decrease.

We understand that the School has now arranged for free medical care for regular students and we welcome this. We consider, however, that the further step of appointing members of staff as personal supervisors of the students is needed. Each such supervisor should not look after more than about a dozen students. He would be expected to advise and assist the students with personal and health problems.

G) SPECIAL PROGRAMS

We have been impressed by the progress made in the Special Programs scheme, and consider that this work is of value to the School. We consider that the scheme, as now developing, does much to further the aims of (b) and (c) of the Terms of Reference. We recommend that the scheme be continued and expanded.

The proposal put to us that local committees might be set up in individual countries to organize the programs, is not, we consider, the best method of organization. We suggest, instead, the appointment of additional individual agents in localities in which it is found that Special Programs are required. These agents would be in consultation with the Director of Special Programs, and would assist him in organizing lectures and courses.

We consider that an important aspect of the Special Programs scheme should be the participation of lecturers and instructors resident in the South East Asian countries. These have a wider knowledge of the regional problems than do visiting lecturers. As common problems are thus discussed, research themes would emerge, and necessary experimentation and study at the Graduate School would result.

H) RESEARCH

The facilities for experimental research in the School are excellent. We have been

impressed by the progress which has been made, and the standard of publications already produced. In view of the rapid turnover of staff, however, it seems to us that a declaration of research policy should be promulgated.

This may take the form of a skeleton program describing the general fields in which it is intended that research should be conducted. Some of these fields should be in fundamental topics and some should be directed to the needs of South East Asia. The existence of such a skeleton program would assist in recruitment of academic staff in allowing possible new members to visualize, before leaving their countries, their possible place in the program. It would also ensure that new academic majors would fit into the general policy.

There should be more industrial cooperation in the form of ad hoc assistance and advice on problems encountered by industry. This would have a beneficial influence on the growth of the School and on the industrialization of the area. It might well stimulate more fundamental research projects in fields otherwise unrecognized or undiscovered. We noted with interest that two such items of cooperative testing had already been accepted.

We observed that a number of items of sponsored research are being pursued. At the present stage of the development of the School, we do not consider it essential that a determined effort should be made to increase the number of these projects. "Sponsored" research on contract terms will undoubtedly develop as the reputation of the School is heightened and programs of industrial cooperation extended. Moreover, close integration with the Special Programs scheme should result in further fields of research being disclosed.

I) LIBRARY AND PUBLICATIONS

One of the real advantages gained by students in the School is that of access to a well-stocked and efficiently controlled Library. To reach such a well-established position in such a short period is much to the credit of the School.

In concurring with plans for extension of Library facilities, we make two suggestions. First, that acquisition of books and periodicals dealing with the advancing topics mentioned in Sections D) and H) should have particular emphasis. Secondly, that technical publications of all SEATO countries, relating to topics in the School's programs, should be acquired to afford a balanced presentation of knowledge in appropriate fields. It is hoped that all member Governments can contribute to the building up of the Library by presenting books and periodicals published in their respective countries.

The developing program of publications of the School is on the right lines and should be expanded. Technical Notes, Research Reports, and a brochure on the Research Facilities of the School show what is being done in the laboratories. The Prospectus and other information about the regular courses are on the right lines, but we have individually proposed a number of slight alterations in presentation which would enhance prestige. We would particularly comment on the excellent production of the Newsletter, two issues of which have already appeared. This new development, at such a good standard, cannot fail to have a beneficial effect.

J) FINANCE

The limiting factor in the development of the School is undoubtedly finance. The School receives staff and equipment directly from the member countries of SEATO. We are particularly impressed by the substantial contribution made by Thailand in the excellent site and buildings put at the disposal of the School. Sums of money are also provided by member countries.

So far as physical accommodation is concerned, the School is, at present, operating at about 40% of capacity. Increase in student numbers to full capacity as described in Section D) (5) would require more funds but the cost per capita would decrease. In further development towards an economic complement of students, new contributions to allow for such advance might be attracted from other member countries particularly concerned.

There are also unearmarked funds available to the School, but these are very small in amount. This limits flexibility in the day-to-day running of the program, and restricts the number of changes and developments which can be set on foot by the Dean and his staff. Some way should be found to increase the funds at the disposal of the Board of Management and the Dean.

No approach has yet been made on a broad front to various Foundations which could well help substantially. These ought to be approached where such approach is appropriate. Large industrial organizations, particularly those operating in the Region, might also provide a source of funds. The members of the Board of Management who are in touch with industry could represent the School's needs for funds and scholarships. It is important that independent funds for the development of the School should be so attracted, for it is clearly not feasible for member Governments formally to guarantee stability of contributions for a set period of years.

Financial assurance is essential before any long-term planning can be continued. By means of funds obtained from diverse sources, and by substantial and continued interest by all member Governments, advance can be made towards confidence in the rationale and stability of the School.

K) ACKNOWLEDGEMENTS

We are impressed by the progress made by the School in its brief period of operation. We express our appreciation of the facilities offered to us by Dean Holcomb and his staff, and of the willing cooperation which made our task a pleasant and stimulating experience. Further, we extend our thanks to all those groups and individuals who afforded us their warm hospitality.

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To the Secretary-General
The SEATO
Bangkok, Thailand

13 August 1962