

SOCIETY FOR THE  
PROMOTION OF ENGINEERING EDUCATION



REPORT OF THE INVESTIGATION  
OF ENGINEERING EDUCATION  
1923-1929

ACCOMPANIED BY A SUPPLEMENTAL  
REPORT ON TECHNICAL INSTITUTES  
1928-1929



IN TWO VOLUMES  
VOL. I

*Office of the Secretary of the Society*  
F. L. BISHOP  
UNIVERSITY OF PITTSBURGH  
PITTSBURGH, PA.

1930

REPORT OF THE CHAIRMAN OF BOARD OF  
INVESTIGATION AND COORDINATION

CHAS. F. SCOTT

I. INCEPTION OF THE PROJECT

This movement to better engineering education arose from a belief that the Engineering Schools should take concerted action in studying their new and common problems. It was seen that Engineering is continually assuming larger importance in modern affairs and that the Engineer of the future "will be called upon to take a more important part in great enterprises . . . , in organization and leadership as well as technical service in the solution of new problems (industrial, economic, governmental and social) which the engineering applications of science have produced."

It was also realized that there had been a relatively static condition in engineering education for a decade, following a half century of rapid expansion in the number of schools—the increase was from less than half a dozen to well over a hundred—with corresponding increase in attendance and a notable expansion in the scope of the curricula. This relatively stabilized condition occurred while other groups of schools, some in fields related to engineering, were going through a period of rapid expansion. Medical education, also, following radical change in educational policy, enjoyed enlarged public recognition and financial support. Among the influential schools of law there was pronounced advance in educational standards.

Engineering schools were undergoing no essential modifications, possibly because of the sound status already attained, although scientific research was productive and the growth of industry was unparalleled.

In the World War the achievements of science and engineering and industry were most impressive. Engineers, individually and collectively, had notably demonstrated their capability in technical and administrative service. Then came

the after-war reaction. The validity of the older order was doubted. Educational systems in general were questioned as to objectives, methods and results.

The situation in engineering education was presented to the Society in several editorials in the *Journal of Engineering Education* followed by the Presidential address\* at the June Convention in 1922. A Development Committee was then appointed to formulate an answer to the question "What can the Society do in a comprehensive way to develop, broaden and enrich engineering education?" The committee recommended that the Society undertake a comprehensive survey directed by a Board, which should have authority to appoint a Director of Investigation and a staff, and to secure funds for carrying out a comprehensive program. Later the members of the Committee were appointed members of the Board of Investigation and Coordination. The report of the Development Committee was then sent to the heads of Engineering Schools and received constructive comment. A year later funds were secured and a Director appointed.

#### Negotiations for Securing Funds

##### (a) The Carnegie Grant for 3-year Period

A former project of the Society, initiated by Professor D. C. Jackson when President of the Society in 1907, resulted in a report by Dr. C. R. Mann, entitled a "Study of Engineering Education" published in 1918.† This study was made under the auspices of the Carnegie Foundation for the Advancement of Teaching. As this report indicated that a further investigation was desirable, it was fitting that the new project should be presented to Dr. Pritchett, President of the Foundation, who had personally taken an active interest in the prior study and who was acting temporarily as President of the Carnegie Corporation. He received the new project cordially. He suggested some modifications in the program and proposed that we consult with other Foundations regarding their sharing in

\* By Chas. F. Scott.

† Bulletin No. 11 of the Carnegie Foundation for the Advancement of Teaching.

support of the project. The several foundations gave our proposal thorough and discriminating consideration. An objection to our plan of investigation of engineering education by engineering educators was raised on the ground that it might result in nothing more than a mere "reconciliation of views." The President of the General Education Board suggested that a study of education in European countries might be helpful in engineering as it had been in other fields; a suggestion which resulted in a most fruitful part of our project. Representatives of the several foundations agreed that the engineering project merited support which could appropriately be continued by the sponsors of the earlier study, particularly as Dr. Pritchett had been president of one of the leading engineering schools. Conferences with him resulted in an outline for the proposed study which he approved in a letter, May 29, 1923, which concluded with these words "and I shall heartily recommend that the Carnegie Corporation participate in its support." Favorable action was taken in October of that year and a grant of funds was made covering the first three years of a proposed five-year program.

A condition of the earlier study was that the investigator should be chosen and the report approved and issued by the Foundation; the committee of educators and engineers served merely as consultants and advisors. In the new project, however, full authority was vested in the Society for the Promotion of Engineering Education, including selection of staff, conduct of the enterprise, form and contents of reports. Presumably the fact that this Society had been in existence for thirty years and had accustomed engineering educators to work together on their common problems gave assurance that engineers whose province it is to make investigations and formulate sound conclusions might be entrusted to study their own problems. This method characterizes this enterprise as a radical departure from the plan upon which educational investigations and surveys had been commonly conducted in the past and the results show that an analysis of a field of education with constructive aims may be conducted by the schools and individuals directly concerned.

The meeting of the Carnegie Corporation, at which the grant of our funds was made, was presided over for the first time by its new President, Dr. F. P. Keppel, and our subsequent dealings have been with him. He has been cordially sympathetic and constructively helpful in consultation and as the scope of our activities has at times extended beyond the fairly definite initial objectives he has gladly sanctioned the larger plan. He recognized in the proposal for summer schools for engineering teachers an immediate and fruitful outcome of the investigation and his sympathetic and financial endorsement put that project into action. His further endorsement of a new proposal resulted in a contribution to the supplemental investigation of Technical Institutes which enabled our staff to render signal service in a closely related field of technical education.

#### (b) Funds for Concluding the Project

Upon completion of the initial three year period financed by the Carnegie Corporation and devoted largely to factfinding, it was evident that many of the benefits which should follow the work already completed were contingent upon the continued activities of the Board and Staff for a further period of two years thus rounding out the period initially planned. The headquarters of the staff were in the Engineering Societies Building and the close contact which had been maintained with the National Engineering Societies and their participation in the project had impressed them with its significance. They, thereupon, took the initiative in making contributions when funds were needed for the second period. Mr. Alfred D. Flinn, Director of Engineering Foundation, the organized research agency of the profession joined actively with the Chairman of the Board in presenting the situation to various industries and individuals interested in engineering education whose contributions supplemented that of the engineering societies in supplying funds for the completion of the undertaking.

## II. PERSONNEL: THE BOARD AND STAFF; COOPERATING AGENCIES

The Society for the Promotion of Engineering Education in undertaking the present project placed the responsibility on a Board of Investigation and Coordination.

### The Board

The Board has consisted of five members appointed by the Council of the Society, also the President (changing annually) and the Secretary, F. L. Bishop, ex-officio, also two non-engineering members representatives of education.

The five originally appointed members who also had constituted the Development Committee were:

Dean M. E. Cooley, University of Michigan,

Secretary J. H. Dunlap, American Society of Civil Engineers (formerly Professor, State University of Iowa),

Professor D. C. Jackson, Massachusetts Institute of Technology,

President F. W. McNair, Michigan School of Mines,

Professor C. F. Scott, Yale University.

The term of one member expired each year but he was usually reappointed to succeed himself. President McNair and Secretary Dunlap met death in a railway accident on their return from the Boulder Convention of the Society in 1924. This was indeed a sad blow to the Board as their enthusiasm and idealism and practical service were outstanding. They were succeeded by Dean F. E. Turneure, University of Wisconsin, and Dean D. S. Kimball, Cornell University.

Dean Cooley, on his retirement from active university duties, resigned his place on the Board in 1928, which was filled by Dean R. L. Sackett of Pennsylvania State College.

Other members who have served on the Board during their term as President have been

Dean P. F. Walker, University of Kansas,

Dean A. A. Potter, Purdue University,

Dean G. B. Pegram, Columbia University.

Dean O. M. Leland, University of Minnesota,  
General R. I. Rees, American Telephone and Telegraph Company.

The two members of the Board serving particularly in an advisory capacity in the field of education were President Frank Aydelotte, Swarthmore College, and Dean C. E. Seashore, University of Iowa.

President Aydelotte, with wide experience and contacts in the educational field, and Dean Seashore, expert in the field of psychology, took a keen and active interest in the work of the Board and rendered signal service in advising as to the initial policies and plans and later on in the formulation of conclusions and reports.

The Board as thus constituted has contained some members continuously which has given continuity to the enterprise. The President of the Society, changing from year to year, and the Secretary have kept the Board in close touch with the active administration of the Society, while the non-engineering members gave the Board the service of experts in the field of general education and psychology.

#### The Staff

W. E. Wickenden was appointed Director of Investigation in November, 1923. He had been on the engineering staffs of the University of Wisconsin and the Massachusetts Institute of Technology. In the war period he directed recruitment and education for the research laboratories of the Western Electric Company and later became Assistant Vice-President of the American Telephone and Telegraph Company, directing the educational activities of the Bell System.

Mr. Wickenden retired as Director and assumed the Presidency of the Case School of Applied Science, September 1, 1929.

H. P. Hammond was appointed Associate Director in the spring of 1924. He had been Chairman of the Committee on Educational Policy of the Brooklyn Polytechnic Institute and was therefore specially qualified to take charge of the relations with the colleges, particularly in organizing their cooperation

in the assembling of data. Professor Hammond was placed in charge of the Summer Schools for Engineering Teachers (inaugurated in 1927) and in June, 1929, was designated as Director of Summer Schools for Engineering Teachers.

R. H. Spahr, of wide educational and industrial experience, served as special investigator in connection with the supplemental study of Technical Institutes. John T. Morris, formerly director of the College of Industries of the Carnegie Institute of Technology, and later a member of the Division of Higher Education of the University of Pittsburgh, aided in the studies. This work was under the general direction of a committee of which Frederick B. Pratt was chairman. The work was conducted under the immediate direction of Mr. Wickenden.

#### Cooperating Agencies

Reference has been made to the cooperative principle under which this investigation was conducted. Principal among the participating groups have been the following:

- a. Several general committees of the Society dealing with the following subjects: Students and graduates; admissions and eliminations; teaching personnel; services, facilities and costs; economic content; cooperative courses.
- b. One hundred and fifty cooperating colleges in which committees including over seven hundred individuals participated.
- c. National Engineering Societies: American Society of Civil Engineers, American Institute of Mining Engineers, American Society of Mechanical Engineers, American Institute of Electrical Engineers, and American Institute of Chemical Engineers.
- d. Eta Kappa Nu Honor Society.
- e. United States Bureau of Education.
- f. National Industrial Conference Board.

#### III. THE PROBLEM

A definite statement of the problem to be undertaken and the specific objectives sought was found surprisingly difficult and baffling. When the Development Committee set about to

find a way to "develop, broaden and enrich engineering education" it considered its task nearly completed at the end of the first half day. But on careful review its proposed resolutions appeared general and commonplace; they did not reflect the idealism and spirit of the early discussion nor did they emphasize the vital participation by which the schools were to make this undertaking quite different from the ordinary compilation of a formal report on prevailing conditions. The committee continued its deliberations for three days and held a final session a week later.

The tenor of several pages of the Report † devoted to the general situation and the objectives of the project are indicated in these extracts.

"The problem of engineering education is to determine and to meet the progressive demands of a rapidly changing civilization. What constitutes these demands is a question being considered by the educators, by engineering societies, by organizations of industries and public utilities and by others. Unfortunately, there has been almost no coordination of effort, and there is lack of agreement on even fundamental objectives. The first necessity then would seem to be an investigation to determine just what the facts are. . . .

"The fundamental requirement is to investigate comprehensively the facts bearing on engineering education in its several fields and to arrange and present the results. . . .

"There shall be coordinated as far as possible the various agencies interested in engineering education." These ideals were emphasized by incorporating them in the descriptive title "Board of Investigation and Coordination." A unique feature is found in this sentence in the list of objects for which the Board and staff were created: "To maintain close contact with engineering schools enabling them to participate in the investigations; and reporting to them from time to time; to the end that the developments may be continuous from the initial contact between the colleges and the agencies of the Board." This idea is elaborated in the letter transmitting the Report of the Development Committee to the Council of

† See *Engineering Education Bulletin* of the S.P.E.E., Sept., 1922.

the Society: "Our real function as a Society is to develop teachers who can train engineers. Real progress must come largely from inward growth. The greatest gain must come from better teachers and stronger faculties. The present plan is not something apart from the schools; it is not a scheme by which some super-committee shall evolve a solution to engineering education in a formal report. The movement contemplates active participation by the schools and the proposed organized effort should have its richest results in directing attention, awakening interest and securing participation of engineering teachers and faculties in this work."

In our first interview Dr. Pritchett remarked that the elaborately prepared program of the Development Committee was too defuse in its aims and he proposed beginning with a specific problem, such as the curriculum.

Five months later the decisions reached in several conferences took shape in the following memorandum § which was presented to and accepted by Dr. Pritchett.

"The Society for the Promotion of Engineering Education proposes during the next three years to make a discriminating study of the present state of engineering education.

"In undertaking this work, the Society realizes the need of bringing it within a designated field in order that the investigation may lead to definite results. It is also clearly recognized that other studies on the same subject being made at this time should be related to that which the Society for the Promotion of Engineering Education has in view—particularly the investigation now under way by the National Industrial Conference Board,|| which approaches the subject from the stand-

§ *Proceedings, S.P.E.E.*, Vol. XXXI, 1923, pp. 22-28.

|| As the outgrowth of a conversation between the President of the Society and Mr. Alexander, President of the National Industrial Board there resulted a joint committee on Engineering Education comprising representatives of industry and of the Society. A statement regarding this committee appears in *Engineering Education*, Bulletin of the S. P. E. E., Sept., 1922. Under the general direction of this committee the National Industrial Conference Board conducted a number of important investigations and issued reports, some general in char-

point of the man in industry who employs engineers and from the standpoint of practicing engineers themselves. The inquiry proposed by the Society is primarily from an educational point of view.

"It is therefore proposed that the investigations of this Society be directed to a study of the objects of engineering education and the fitness of the present-day curriculum for preparing the student for his profession. It will study the process by which the curriculum of fifty years ago has come to its present form; it will seek to set forth the nature and the weakness of the curriculum as at present administered; and it will indicate such modifications or developments as would seem to make for sound, well-balanced, and fruitful course of study of engineering students."

The memorandum also proposed that the inquiry should be carried on by a Board appointed by the Society and containing two non-engineers "whose point of view will be primarily that of the trained teacher"; a Director should have active conduct of the study, organizing cooperative committees in engineering faculties and visiting European engineering schools.

Beginning in the Fall of 1923 the newly appointed Director of Investigation devoted much time during the first year to reconnaissance, visiting schools and interviewing students in a search for common aims and ideals to be incorporated in the explicit program for betterment of engineering education. He counselled with members of engineering societies and industry. He compared engineering with other professions and engineering education with other types of education. A study of "the objects of engineering education" as a necessary prerequisite to the determination of curricula *did not however*, acter and others relating to specific industries. These include papers presented to the Society as follows:

"The Engineering Graduate in Industry," A. C. Jewett, Vol. XXXII, 1924, p. 424.

"The Engineer as a Leader in Industry," O. S. Lyford, Vol. XXXI, 1923, p. 136.

"The Problem of Engineering Education from the Standpoint of American Industry," M. W. Alexander, Vol. XXXIV, 1926, p. 586.

*converge on a definite point, but seemed to open up an unbounded area.*

#### IV. BROADER OBJECTIVES OF THE INVESTIGATION

The expanding functions of engineering in modern life and the enlarging activities of engineering graduates in semi-technical and administrative fields indicates that engineering education prepares for a far more comprehensive field than that of specific professional practice.

During the very decade in which we have been making our studies and trying to get our bearings progress has been so phenomenal as to justify a commission headed by Mr. Hoover to report upon recent economic changes in the United States. The unprecedented acceleration in recent economic developments is based on engineering achievement.

It is one thing to determine how the engineer should be trained to do the things which tradition and past practices have prescribed as his normal work. It is quite another thing to picture his place in the New Epoch which power and machinery, science and engineering and productive industry is initiating.

In our new industrial, our so called "machine" civilization, our modern life has become more complex and its activities are on a far larger scale and are more intimately interrelated. A student of modern trends says that even the axis of our civilization has shifted. The direction of the new economic forces which are shaping our modern life is passing from the field of politics into that of economics. As emphasized by Dean Kimball in his recent presidential address before the Society the new conditions in which production exceeds needs, in which working hours are reduced and the hours of leisure are increased, in which for the first time in history it is possible to eliminate poverty and to provide a competence for all and in which universal education is open to all—all these things are the outcome of the application of science by the engineer. It is not surprising, therefore, that the functions of the engineer have become more complex and are interrelated with many activities of modern life. Engineering edu-

cation must deliberately provide the way for the solution of problems in the field of social utility as well as the application of scientific principles to specific technical problems. The strictly technical professional activity is comprised in engineering but it is not a definition of it. What engineering education must have is a guiding philosophy based on a clearer visualization of the place of engineering in modern life.

It was this problem which challenged the Society in its study of engineering education. One's conception of the field expands as he explores in this country and abroad the professional, technical, industrial and social significance of engineering in the new economic order. We have endeavored to clarify the situation, not by attempting to draw conclusions so rigid that they may be formulated in precise rules but rather by presenting the underlying facts and the views and conclusions resulting from the general study of the situation. Dr. Wickenden's report in particular epitomizes the results of the intensive study of engineering education for which this investigation has afforded unusual opportunities.

In engineering education we seek a unity of purpose rather than standardization. This report aims to present the problems involved in training the engineer of the future in such form that every school and every teacher may find the guiding principles by which to shape the best individual solution as a contribution to our continuously expanding civilization.

#### V. CONCLUSION; FUTURE

During the progress of the investigation it became increasingly evident that engineering education cannot be cast in a fixed mold. Engineering educators must be alert to meet the conditions created by fruitful scientific research, expanding industry and the enlarging dependence of modern life upon engineering activities. The work of the Board has demonstrated that the faculties of engineering schools can cooperate effectively in dealing with the problems of engineering education when aided and guided by a central directing board and staff. It is to be assumed that individual educators and faculties will be alert to the changing problems which confront

engineering education, but our experience makes clear to us that the best results can be obtained, and obtained most economically in the long run, by concerted action through a central agency. Certainly the effective coordination of 150 engineering schools, when they are called upon to deal with the professional engineering societies and various industrial groups, calls for such a central agency. Furthermore, our present general scheme of technical education emphasizes certain types to the neglect of others. A balanced National policy by which the various branches of technical education may meet the needs of our changing industrial and economic life calls for coordinated efforts of many groups.

In presenting its report in final form the Board believes that the survey of the situation and the resulting interest and constructive activity on the part of engineering schools constitute a substantial contribution in answer to the question, What can the Society do in a comprehensive way to develop, broaden and enrich engineering education? What has been accomplished is not to be regarded as a completion of the task but rather as the first step in dealing with a continuing problem.

Two auspicious things have occurred which promise continuation of certain important features. The Society has undertaken to continue the Summer Schools for Engineering Teachers which were proposed and inaugurated by the Board, thus putting into practical operation an affective means of developing engineering teachers, which is the key to the problem of developing engineering education.

Secondly, a new study of the status of engineering education has been undertaken for determining the progress that has been made since the survey conducted by the Society through its Board and Staff was completed. This will afford a comparison over a five year period. At the request of the Society for the Promotion of Engineering Education the United States Bureau of Education is conducting this survey. Blanks issued to the schools were accompanied by a letter, January, 1930, signed by William John Cooper, Commissioner of Edu-



ation. This recognition and cooperation is a significant achievement.

The Board believes that the type of activity it has initiated should be continued. While much may be accomplished by individuals and faculties, engineering societies and industrial leaders to all of whom engineering education is of vital importance, it is believed that a formal representative general agency, possibly an Engineering Education Foundation, would be of outstanding value in developing continuously engineering education as a potent factor in the progress and stabilization of a civilization based upon machinery and power and applied science.

#### CONTRIBUTORS TO FUND FOR IMPROVEMENT OF ENGINEERING EDUCATION

Carnegie Corporation  
 Carnegie Foundation  
 Adams, Edward Dean  
 American Society of Civil Engineers  
 American Institute of Electrical Engineers  
 American Institute of Mining and Metallurgical Engineers  
 American Society of Mechanical Engineers  
 American Brown Boveri Electric Corporation  
 American Telephone and Telegraph Company  
 American Water Works & Electric Company  
 Babcock & Wilcox Company  
 Brown & Sharpe Company  
 Detroit Edison Company  
 Engineering Foundation  
 General Electric Company  
 Guggenheim Fund for Promotion of Aeronautics  
 Insull, Samuel  
 Lewisohn, Samuel A.  
 McGraw, James H.  
 Sangamo Electric Company  
 Sharpe, Henry D.  
 Stone & Webster Corporation  
 Sullivan Machinery Company  
 Union Carbide Company  
 United Shoe Machinery Corporation  
 Western Union Telegraph  
 Westinghouse Electric & Manufacturing Company

#### CONTRIBUTORS TO FUND FOR INVESTIGATION OF TECHNICAL INSTITUTES

Carnegie Corporation  
 Ohio Mechanics Institute  
 Pratt, Frederick B.  
 Pratt, George D.  
 Pratt, Harold I.