

## EDUCATION IN PHOTOGRAMMETRY

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*Synopsis:* The author gives his reasons for believing that the subject of photogrammetry should be offered in every civil engineering curriculum. Suggestions are offered for overcoming some of the obstacles that often prevent the subject from being taught.—*Publication Committee.*

A GENERAL lack of information exists among civil engineers as well as the public concerning the use and limitations of aerial photographs for map making. Occasionally an engineer has made the costly mistake of regarding the photographic print as the solution to all of his surveying problems. On the other hand, many engineers are not aware of the possible savings that can be made by a more complete use of the information existing on available photographs. We are cautioned by the industrial photogrammetrist against overselling photogrammetry in our enthusiasm, lest some hapless stranger to the science be sadly misled. Such faults are obviously due to a lack of education and information.

The best time and place for planting information about photogrammetry into the mind of an engineer is probably during his college training. The next best way is through the engineer's reading matter. Obviously, the latter is neither as effective nor as impressive as a professor's explanation and demonstration, together with the facilities for the student to actually construct a map.

Education in photogrammetry should have as its primary purpose, the presentation of the uses and limitations of photographs for mapping, and the merits of the various methods that are required for compiling a map from photographs. Whether this training requires one or six semester hours of classroom participation depends on the desired thoroughness and available time. Perhaps the engineer who does not wish to specialize in photogrammetry could operate satisfactorily with a very small amount of theory and detail, and with a greater emphasis on the practical applications of photogrammetry to engineering problems, including the economical aspects. Such information at the command of every civil engineer would certainly increase his value to his employer.

Most civil engineers have an opportunity to use aerial photographs in their professional activities. A recent poll<sup>1</sup> of the engineering profession indicates that more than 70 per cent of the civil engineers are employed in lines of work that require some sort of ground surveys, maps, plans, topographic surveys, or other data for depicting the details of a part of the earth's surface. The regional and city planner, the highway engineer, the planner of domestic water distribution and sewerage disposal systems, the construction engineer as well as the professional map maker, are all users of maps. The country engineer and the cadastral surveyor are map makers as well as map users. Whether the civil engineer be employed in mining, forestry, geology or agriculture, he requires a map on which to plan and to record his operations. Photographs are of economic usefulness to each of these categories of engineers, although the usefulness may be to a different degree, involve the compilation of different types of information, or require the use of different methods or instruments for compilation. Considerable information and accurate measurements can be determined from photographs without the use of any special instruments in addition to the ordinary drafting room implements. The use of special instruments enables the user to compile contours also from photographs.

<sup>1</sup> Andrew Fraser, *The Engineering Profession in Transition*, 1948, Engineer's Joint Council, 33 W. 39th Street, New York, N. Y.

All the larger government mapping agencies now use photographs in some part of their mapping work. In the U. S. Geological Survey, which is probably the largest civilian maker of topographic maps in the United States, photographs to a large extent have taken the place of the planetable for the compilation of map features and for the delineation of contour lines. The results are a better map at no greater cost, or even at a smaller cost. Several large engineering firms are now consistent users of photographs, and a few smaller companies have found photographic mapping to be of definite value. The use of aerial photographs has expanded to the private engineer and to the smaller country engineer very slowly because they are not cognizant of how to use the photographs, or how much cost is involved in their use, and are frightened by the high price tags on the super-plotting instruments, which may or may not be required for his type of work. Therein exists an opportunity for the educator.

Educational institutions as a whole are somewhat slow in meeting the challenge of this delinquency in the curriculum of the civil engineer. The reasons at first appear to be plausible. The schools are waiting to see whether or not photogrammetry is merely a passing fad. Few conservative institutions are willing to pioneer in a new and uncharted field of using snapshots for making maps. Instructors of the proper background are virtually unobtainable because of the intense activity in private and governmental positions. Present civil engineering faculties are not well informed on the subject and are not prepared to teach such a course. No appropriate textbook exists even for the well-informed instructor. The civil engineering curriculum is already too compressed and too crowded with special courses, making it difficult to insert even one semester-hour of added study. Special equipment for training purposes is frequently beyond the modest budgets of the colleges. Let us examine each of these reasons more closely.

Certainly, photogrammetry is a proven method for making many types of maps. The records of the various governmental mapping agencies for the past ten years and more indicate that no large mapping program, civil or military, is undertaken without the use of aerial photographs. Several private companies are in the business of making maps from photographs, manufacturing photogrammetric instruments, and providing control surveys for governmental use in photogrammetry. The Maryland State Road Commission uses photographs for making topographic maps for preliminary route locations in the planning of new highways. The Production and Marketing Administration (formerly the Agricultural Adjustment Administration) has photographs of practically all the farm land with which it is concerned. State planning boards and other planning groups base their studies on aerial photographs, maps, and mosaics made from photographs. The complete list of users of aerial photographs is indeed an impressive one, indicating that photogrammetry is a serious time-saving technique that is continuing to grow in usefulness.

An institution that inaugurates a course in photogrammetry can scarcely be considered a pioneer because the subject is taught by at least the following schools:<sup>2</sup>

University of California  
University of Chicago  
University of Cincinnati  
Cooper Union  
Cornell University

Harvard University  
University of Idaho  
University of Kansas  
University of Maine  
Massachusetts Institute of Technology

\* The author would appreciate being informed of any additions to this list.

University of New Hampshire  
Ohio State University  
Princeton University  
Purdue University  
Rensselaer Polytechnic Institute

St. Louis University  
Syracuse University  
Washington University  
West Virginia University  
Worcester Polytechnic Institute

One of the schools has been conducting the course for almost 20 years and its graduates are among the leaders in the field. Most of these schools offer a single course for the purpose of acquainting the students with the possibilities, limitations, and some of the techniques of science. One school has specialized in the subject, offering extended training, and conducting research study.

The difficulty of obtaining instructors is indeed an acute problem. Obviously, such instruction would not require one's full time, and the instructor would be expected to do other teaching or other work in the department. The use of photographs is frequently entirely new to existing faculty members. However, this deficiency can be met in at least two different ways. First, there might well be conducted a short summer session at one or more of the universities offering training to faculty members for teaching purposes. This type of training has been used frequently in the past in a wide variety of subjects. Second, a faculty member who desires training in photogrammetry can usually obtain permission from any one of the governmental or private mapping agencies to observe and to perform the practices of the science. Two or more months of such observation, at not one but several of the agencies, would indeed be an enlightening experience which, if done carefully, would give an instructor ample practical and theoretical information for teaching the subject.

An adequate textbook for teaching photogrammetry is not available at the present time, which is certainly a different type of problem than confronts the older sciences where the instructor must select from a host of authors. The Society's *MANUAL OF PHOTOGRAMMETRY* is out of print and the revised edition is only in its primary stages of compilation. Also, the *MANUAL* is not intended to be used as a textbook, but is more of the type of a handbook. American literature on the subject of photogrammetry has been accumulating in a random manner for more than half a century,<sup>3</sup> and there is a large amount of material in the countries of Western Europe. A number of American books have been published on the subject, but few are in textbook style. At least one author is now giving his personal attention to the matter, but this is of little consolation for the immediate present. One solution to the problem in the meantime is for the instructor to be well informed, to assign reading in a well-supplied library on the subject, and to require that each student keep a good permanent notebook.

The college curriculum is a full and crowded one with no space left for pure specialization if the student desires a well rounded education in civil engineering. Efforts have been made to extend the course to five years instead of four. Because photogrammetry has become of such major importance in the life of 70 per cent of the civil engineers, I believe the subject should be included in every curriculum as a course of general and necessary information even if overcrowding is unavoidable or if some other course must be eliminated. It seems to me that a civil engineer of today who has no knowledge of photogrammetry is handicapped in his profession, and that an employer of today's graduate without photogrammetric training is getting a man who is not equipped to meet today's problems in an economical manner.

<sup>3</sup> Deville, *Photogrammetric Surveying*, 1889, was not the first American literature on the subject.

Perhaps, also, the time of non-specialization is past, and perhaps the field of civil engineering needs to be sub-divided into its quite widely separated categories, each of which might be worthy of a degree: surveying and mapping; structural engineering design; construction engineering; city planning; hydraulics; etc.

The cost of equipping a course in photogrammetry can be managed to fit the limitations of any budget. The barest needs may consist of only a few simple lens stereoscopes, together with 10 photographs per student, and a limited amount of transparent acetate sheeting that the student can furnish. This is sufficient for the study of photo-interpretation and the making of a true-scale planimetric map. The satisfactory addition of contour lines, without any special instrument, is exceedingly tedious and impractical but is an excellent exercise. The stereometer type of instrument<sup>4</sup> is the lowest price gadget for the addition of contour lines. Perhaps the best up-to-date training in the drawing of contours can be obtained from a two-projector type multiplex.<sup>5</sup> The University may be able to utilize these instruments in State or public work when the instruments are not actually being used in training. Since diapositives can be purchased, the reduction printer is not required. This might be the extent of equipment for an excellent, practical, non-specializing course in photogrammetry.

I have attempted to point out the tremendous importance of photogrammetry to the civil engineer and in what way it might be practicable for every engineering school in the country to begin some instruction in this valuable science. In this "twig" of learning, particularly, the practice is far ahead of the educational facilities. It is hoped that these remarks may hasten the day when the informative facilities will be adequate.

## ADVANCE ANNOUNCEMENT

### 15th ANNUAL MEETING OF THE AMERICAN SOCIETY OF PHOTOGRAMMETRY

On January 12, 13, and 14, 1949, your Society will convene for its 15th Annual Meeting at the Shoreham Hotel in Washington, D. C.

Prominent national and international experts in photogrammetry, surveying and mapping will present valuable technical papers on the most up to date phases of our rapidly expanding industry. There will be open discussions and participation by the members.

The largest collection of exhibits from commercial and governmental establishments engaged in photogrammetry will be shown in the spacious Main Ballroom.

The Annual Meeting provides the best opportunity to renew your friendships and to increase your knowledge in this important industry. Many attractive social events are being planned.

Plan to attend with your friends.

JANUARY 12, 13, and 14, 1949—SHOREHAM HOTEL—WASHINGTON,  
D. C.

<sup>4</sup> About \$400 plus the cost of a drafting machine, which most universities already possess. For additional information and price quotations, write Abrams Instrument Corporation, Lansing, Michigan; or Fairchild Camera and Instrument Corporation, Jamaica, N. Y.

<sup>5</sup> Price, about \$4,000. For further information write Bausch & Lomb Optical Company, Rochester, N. Y.