Program for Training and Educating Employees Of State Highway Departments

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Under the auspices of the Highway Research Board, a study of state highway practice in employee training and education and in the hiring of highschool and college students and graduates was made by questionnaire mailed August 3, 1953.

Eight states reported an organized plan of in-service training for new employees not including the engineering college graduates. With the exception of Ohio, the program offerings in this area of training were limited and spotty. Formal in-service training programs for the older employees were reported by 12 states. These programs are designed to reach administrative and clerical workers in some states, though the more-extensive programs are developed only for professional employees.

Eleven states have adopted, since 1946, training programs of 12 to 48 months' duration for the newly hired engineering-college graduate. In the main, these programs consist of supervised on-the-job rotational work, so designed as to give the graduate experience in all the main engineering activities of the department.

Kentucky reported a plan of scholarship awards to college students, both graduate and undergraduate. The 17 states maintaining cooperative agreements with the "co-op" technical colleges, reported a total of 136 to 152 student-employees who alternate college terms with full-time employment with the highway department.

For special hire during the summer of 1953, approximately 40 states hired 4,227 highschool students, and 3,012 college students.

The lowest starting salary paid graduates of engineering colleges is $200 a month, the average is $308, and the highest is $376. These salaries are based upon the lowest end of the range in those states that maintain a starting range. Using the highest starting salary in these states, the above three monthly starting salaries for engineering graduates become $250, $318, and $376. An analysis of the starting salary paid and the number of engineering graduates hired, expressed as a percentage of the number desired to have hired in 1953, indicates that a salary less than $300 a month may materially reduce the number of graduates hired. The overall percentage hired by 37 states was 31.3 percent of the number of graduates wanted.

Of the engineering graduates hired during the past three years, 10 to 14 percent are now on leave to the military service. The graduates hired in 1948 and 1949 have remained in employment relatively better than those hired in 1951 and 1952. The World War II veteran is continuing his employment with state highway departments better than are the more-recent graduates. Of the 1953 graduates hired, 19 percent had resigned by the time the questionnaire was answered, about August 20, 1953.

● THE manpower shortage that has faced the county, city, and state highway departments since 1946 does not show much promise of improvement within the foreseeable future. The shortage is most critical in professional engineering and other technical areas, although the full depth and breadth of the organization table is in need of more and better trained employees. If the highway departments are to improve their situation in employment, or to even hold their present position, greater attention must be given to their management of personnel. The relatively low salary scale

is not the only competition that they face in securing the employment of engineers, technicians and administrative workers. Overall personnel policy, retirement and other social benefits, and the opportunity for self-improvement are factors.

Two major problems are involved in improving the employment in highway departments: (1) qualified persons must be hired and (2) the employee must find employment conditions so much to his liking that he will remain with the department on a long tenure. In-service training and opportunities for further education are factors of importance in both securing and in holding the services of employees. Opportunities offered by industry and certain branches of government for further training have proved to be of great advantage to those organizations providing such opportunities. In addition to the betterment of hiring and keeping employees, the concerns carrying on a reasonably good in-service training program are finding marked improvement in the quantity and quality of the productive effort of their employees.

The training of employees at company expense has had rapid and extensive development during the past 8 years. The federal government has expanded its training programs rapidly in the same period. What has been found advantageous in the training of employees by industry and by federal government will likewise be found advantageous to state highway departments.

The author presented a paper at the 1953 Annual Meeting of the Highway Research Board (Highway Research Abstracts, Vol. 23, No. 4, pp. 30-40, April 1953) on the subject of in-service training. The paper enjoyed a wide circulation; interest therein was greater than had been anticipated. As a result of this initial expression of interest, the Highway Research Board thought it well to conduct a survey of the state highway departments to gather information on the practice within highway departments in the area of employee training and education. This present paper is a report of the findings of that survey.

One of the main objects of this report is to point out those state highway departments that have programs and provisions for the training and further education of their employees. With such information available, any department wishing to study the possibilities of adopting a training program of its own will have available the list of other highway departments active in training. In adition to the training activities, this paper reports on the experience in hiring and keeping the engineering-college graduate.

THE QUESTIONNAIRE SURVEY

A 5-page questionnaire was mailed to the state highway departments August 3, 1953. Some form of reply was received from each of the 48 states, District of Columbia, Puerto Rico, and Hawaii. Unfortunately, each state did not supply complete information, and about six of the state returns were hardly more than superficial replies. Certain differences in interpretation of the questions, variations in state practices not specifically provided for on the questionnaire, failure to supply complete information, and other items made it somewhat difficult to prepare a detailed summary on certain questions. In general, however, the information submitted is sufficient to provide an adequate view of the various forms of employee training now active in the state highway departments.

Most of the reports submitted by the states were received between August 10 and September 10. Three or four were dated in October.

The number of state highway departments now engaged in formal and programed activities of training employees is relatively few. Furthermore, the number of states that have placed training under the direction of a full-time supervisor to develop and oversee all phases of the training program is practically nil. If the in-service training program of a state highway department is to fulfill its major objectives, it is essential that it be directed by one especially qualified in the area of adult education and one who can give it adequate attention.

The questionnaire of August 3 stressed: (1) the training programs given to newly hired employees exclusive of the new engineering college graduates; (2) refresher or continuous training programs for the older employees; and (3) a training program for the newly hired engineering college graduate.

Training for New Employees

Table 1 summarizes the training programs for new employees in eight states reporting such programs. The lengths of

TABLE 1

FORMAL IN-SERVICE TRAINING PROGRAMS FOR NEW EMPLOYEES

Employee Class or Subject	Ill.	Kans.	Mass.	Minn.	Nebr.	Ohio	Vt.	Wis.
a. Clerical & administrative employees	-	-	-	-	-	-	-	-
b. High school graduates—surveying	-	-	-	-	4 yr.	6 mo.	1 yr	6 wk.[c]
c. High school graduates—Materials lab	-	-	-	-	4 yr.	6 mo.	1 yr.	-
d. High school graduates—drafting	4 mo.[a]	1 wk.	-	-	4 yr.	2 yr.	1 yr	-
e. Other draftsmen	4 mo.	1 wk.	-	120 hr.	-	3 yr.	-	-
f. Road design engineers	-	-	-	-	-	4 yr.	-	-
g. Bridge design engineers	-	-	-	-	-	4 yr.	-	-
h. Construction inspectors	-	-	-	-	4 yr.	1 yr.	-	-
i. Resident engrs. & assistants	-	-	-	-	-	-	-	-
j. Maint. supervisors or foremen	3 da.	-	1 da.[b]	-	-	6 mo.	-	-
k. Equipment operators	3 da.	-	1 da.[b]	-	-	3 mo.	-	-

[a] Whenever several new employees are available at one time, otherwise on-the-job training is given.
[b] School on use of snow removal equipment.
[c] Formal course is 6 wk., over-all on-the-job training is for 18 mo.

New Mexico is developing a program.
Montana considers the first six months of employment of an inexperienced employee as on-the-job training. Salary is slightly less than at the end of this training period.
Virginia encourages off-hour study, requires it for survey parties. Cost of night school and approved correspondence courses is reimbursable to employee.
The University of Michigan operates an 8-week summer surveying camp in Wyoming for high school graduates selected by the Michigan State Highway Department.

time devoted to the various classes of employees or subjects indicates no particular pattern as between the eight states. Ohio has a rather complete program, but information furnished is insufficient to disclose the detail with which the training is handled. With the exception of provisions for training of highschool graduates and for the training of draftsmen, Ohio is the only state which has a program reaching a fair number of its professional employees. Not a single state reported any employee training for newly hired clerical and administrative workers. All training emphasis for new employees seems to be in the technical areas.

Refresher Courses for Older Employees

The questionnaire was designed to bring out any differences in the training program operated for the new employees as contrasted to the older employees. Older employee, in this sense, means length of time of employment rather than age of employee. Table 2 summarizes the activities of 12 states reporting information on this question. As with the summary in Table 1 for new employees, Table 2 for older employees discloses no particular pattern and no full-range program by any of the states. California and Vermont reported good pro-

TABLE 2

FORMAL IN-SERVICE TRAINING PROGRAMS OR REFRESHER COURSES FOR OLDER EMPLOYEES

Employee Class or Subject	Calif.	Conn.	Ill.	Kan.	Minn.	Neb.	N. J	N Y	Ohio	Ore	Vt.[e]	Va.
a. Clerical & administrative employees	-	-	-	2 da	12 hr.	-	40 hr.	b	-	48 hr.	-	-
b. Instrument men & survey parties	12 hr.	-	-	-	-	4 yr.	-	b	-	120 hr.	30 hr.	1 wk.
c. Road design engineers	-	-	-	-	3 da.	-	-	b	-	-	30 hr.	-
d. Bridge design engineers	72 hr.	-	-	-	3 da.	-	-	b	-	-	30 hr.	-
e. Construction inspectors	12 hr.	-	-	3 da.	3 da.	-	-	b	c	-	30 hr.	1 wk.
f. Resident engineers & assistants	12 hr.	-	-	3 da.	3 da.	-	-	-	c	-	30 hr.	-
g. Maint. supervisors & foremen	12 hr.	-	3 da.	2 da.	-	-	30 hr.	-	c	15 hr.[d]	-	1 wk.
h. Maint. or const. equipment operator	8 hr.	-	3 da.	-	-	-	-	-	-	5 hr.	-	1 wk.
i. Mechanics (lubrication procedures)	12 hr.	-	-	-	-	-	-	-	-	-	-	-
j. Stenographers	-	22 hr.	-	-	-	-	-	-	-	-	-	-
k. Accountant-auditors	-	150 hr.	-	-	-	-	-	-	-	-	-	-
l. Supervisory training	-	20 hr.[a]	-	-	-	-	-	-	-	-	-	-
m. Electrical mechanics & foremen	-	-	-	-	-	-	30 hr.	-	-	-	-	-
n. Central files	-	-	-	-	-	-	10 hr.	-	-	-	-	-
o. Laboratory technicians	-	-	-	-	-	-	280 hr.	-	-	-	-	-
p. Equipment foremen	-	-	-	-	-	-	20 hr.	-	-	-	-	-
q. State Park supervisors & custodians	-	-	-	-	-	-	-	-	-	10 hr.	-	-

[a] Includes items f and g.
[b] Many classes conducted, usually 2-hr., 2 evenings a week. Includes also soils, landscape, safety, and refresher courses for candidates for professional registration.
[c] Construction and maintenance schools held once each year.
[d] Maintenance supervisors, foremen are given 8 hr. training.
[e] Evening courses, optional with employee, hours are 30 plus or minus.

New Mexico is developing a program
Colorado has a good program, but did not report any details.

grams for technical employees but nothing in the clerical and administrative areas. On the other hand, Connecticut reported no training in the technical field but has a reasonably satisfactory program for stenographers, auditors, and supervisors. The New York program is of special character, insofar as special classes are arranged outside of working hours in many of the technical fields. Participation in the classes has been optional. Vermont has a similar program.

A review of Tables 1 and 2 indicates that there is ample opportunity for the development of a complete program of in-service training for all classes of employees in the state highway departments.

adopted their programs in 1953. The starting dates for the 11 states indicate that the training programs for engineering college graduates are all of post war development.

In general, the in-service training program for civil engineering graduates consists of a rotational plan of on-the-job training, covering the range of jobs from survey work on preliminary location through all stages of highway design, construction inspection, and maintenance. The length of the program ranges from 12 to 48 months. Seven of the states have a program of 2 years or more, with two states (Idaho and Virginia) having a 4-year program. Connecticut, Michigan, Missouri, and Wisconsin have programs of less than 2 years.

TABLE 3

TRAINING PROGRAM FOR NEWLY HIRED ENGINEERING COLLEGE GRADUATES (IN MONTHS)

Type Job or Subject	Conn.	Fla.[a]	Ga.[b]	Ida.	Ill	Mich.	Minn.[e]	Mo.	Ohio	Va.	Wis
Year program adopted....	1948	1953	1950	1952	1952	1949	1953	1952	1949	1946	1953
On-the-job rotation											
a. Prelim. location & surveys	1	4	6	6	3	1 6	2	1	3	6[f]	2
b. Planning surveys & research	2	1	-	-	2	1. 6)	1	1	3	g	1
c. Traffic & safety	2	-	-	-	½	)	1	-	3	g	1
d. Right of way	3	1	1	6	1	-	2	-	3	-	1
e. Road design	5	4	7	6	6	1. 6	3	1	6	6	2
f. Bridge design	-	4	7	6	c	1. 6	3	2	3	6	3
g. Construction survey taking)	1	8)	-	3	3	3. 2)	2	1	3	f	-
h. Construction inspect ı	3	)	3	3	10	)	2	2	6	15	-
ı. Asst. to proj. or res engr.	-	-	9	6	-	-	1	-	-	12	2
j. Maintenance operatic ɜ	3	6	-	6	2	1. 6	2	2	3	-	1
k. Office engineering (adm.)	-	2	-	-	1	-	1	-	-	-	-
l. Materials & tests	2	4	3	6	6	1. 6	2	2	3	12	1
m. History, legal, organ., policies	-	-	1	-	d	-	2	-	-	-	-
n. Special assignments	-	2	-	-	-	-	-	-	-	-	4
o. Local road & st. inspection	-	-	-	-	½	-	-	-	-	-	-
p Vacation	-	-	-	-	1	-	-	-	-	-	-
TOTAL, Months	22	36	37	48	36	13	24	12	36	48	18

[a] Program open to 30 employees each year chosen through competitive written examinations. Not restricted to newly hired college graduates, but open to anyone of engineer-inspector grade or higher.

[b] A different program is followed by trainees electing the highway bridges option.

[c] Trainees assigned to bridge office at main headquarters are given 36 months field and office training covering all aspects of bridge work

[d] Above program includes 15 days of class work in administration, policy, and technical lecture.

[e] In process of development.

[f] Construction surveys (item g) included with preliminary location and surveys (item a).

[g] May be scheduled for 3 months by reduction in time elsewhere.

Programs for Newly Hired Engineering College Graduates

American industry has, for many years, conducted special programs for the training of the newly hired engineering college graduates. The programs range in length from 6 months to 2 years and include a considerable amount of home study and classroom work. The state highway departments are now entering this same area of training to the extent that 11 states have such a program under way. A summary of these programs is given in Table 3. Virginia instituted a program in 1946 followed by Connecticut in 1948. Three of the 11 states

There is a similarity of pattern in the details of the program for the engineering college graduates. The length of time, however, assigned to the various types of on-the-job training varies from state to state. Further, the amount of training given in the central office, as compared to that given in field offices, varies in accordance with whether the state operates on a centralized or decentralized basis.

Details of how the training programs for college graduates are administered was not furnished by each of the 11 states. Usually, the general policy is to depend on supervisors and department heads to lay out a detailed program for the trainee adequate

to give him experience with all of the normal types of operations handled by that section, bureau, or department. The amount of specific instruction given to the training of the supervisors in the discharging of their responsibilities to the trainees who may be assigned to them is perhaps a minimum. Since success of the training of the graduates depends so largely on the work and attitude of the supervisors, the better programs will provide for the proper instruction and guidance of the supervisors.

The Bureau of Public Roads has in operation a 3-year trainee program for civil-engineering graduates. The Bureau has been successful in hiring about 25 trainees a year since the start of this program in 1946. Of the 187 hired for the program to date, only 24 (or 13 percent) have resigned. Of 78 graduating from the 3-year training program, 74 are still in active employment with the bureau, and one is on leave to the military service. Considerable credit is given to the bureau training program in attracting to civil-service employment with the bureau those graduates hired each year. In fact, many of the graduates so hired have stated that the training program was the main attraction that led to their desiring employment with the Bureau of Public Roads. Further, the high rate of retention in employment upon completion of the 3-year training program is further evidence of the soundness of the training program. Starting annual salary for the trainees at Grade GS-5 is $3,410. At the end of the first year of training they are promoted to Grade GS-7 at a salary of $4,205. Upon completion of the training program, the policy is to promote these men to Grade GS-9 at a salary of $5,060.

The Virginia Department of Highways has as complete a program of in-service training as any of the highway departments. The program begins with the hiring of engineering graduates who, upon reporting for duty, are assigned to the 4-year training course. Supplementing this 4-year training for college graduates is a series of special courses and training activities for engineers throughout the department. These courses include: inspectors' training course; a course for superintendents, foremen, and operators; a soils course for inspectors and soils engineers; a 2-week bituminous school for inspectors; a course for junior materials engineers; a school for landscape superintendents; a school for right-of-way engineers and agents; a materials conference for district materials engineers; a yearly meeting of the administrative engineers of the main office and field offices; and similar types of in-service training schools.

Educational Programs

Table 4 indicates that 16 states have a cooperative plan with a college or university to employ undergraduate students under the "co-op" plan of alternating college resident terms with employment in industry. The 16 states have a combined total of 136 to 152 students employed on the cooperative basis.

California, Illinois, Maryland, and New York have cooperative plans by which university staffs are engaged to teach special classes made up of highway department employees. Vermont and Kentucky have also used this plan for special subjects. Washington encourages the taking of extension and correspondence courses.

A review of the answers pertaining to refresher courses for older employees as summarized in Table 2, and on road schools, short courses, conferences, and extension schools, indicates that overlapping in the answers exists. Some states reported activities under their own refresher training programs which other states reported in less detail under a separate question on extension services by state colleges.

The following states reported that certain of their employees attend an annual road school or highway conference sponsored by the state highway department, a state institution of higher learning, or jointly sponsored: California, Colorado, Georgia, Illinois, Indiana, Kentucky, Maryland, Massachusetts, Louisiana, New York, Ohio, Oregon, South Dakota, Virginia, and Wisconsin. Fourteen states reported participation in professional society meetings, highway association meetings, good-roads associations, and similar events. No doubt, every state highway department has employees attending meetings of this character, to a greater or lesser extent.

The following states reported conferences, schools, and institutes on such subjects as materials, soils, concrete, construction, maintenance, asphaltic concrete, planning, traffic, and materials testing: Idaho, Iowa, Louisiana, Missouri,

TABLE 4

STATES HIRING COLLEGE STUDENTS UNDER THE COOPERATIVE EDUCATIONAL PLAN

State	Cooperative School Students
California	4
Connecticut	1 or 2
Delaware	1
Georgia	18
Idaho	25
Illinois	3
Massachusetts	10 - 20
Michigan	15
New Hampshire	4 - 5
New Mexico	20
New York	Considering Plan
Ohio	4 - 8
Tennessee	0 - 6
Vermont	1
Virginia	7
West Virginia	4
Wisconsin	8 - 10
TOTAL	136 - 152

Oregon, Texas, Utah, Vermont, Virginia, West Virginia, and Wisconsin. Utah gives a 2-week school in material testing for newly hired personnel, especially for resident engineers and inspectors.

The Kentucky Department of Highways has an excellent program of training and education. Basically, its program includes a plan for additional training for employees already on the job, the recruiting and training of new employees, graduate training for young engineers leading to a masters degree in civil engineering, and part-time employment for engineering students during vacation periods. The educational program includes the offering of scholarships for selected students who enroll in civil engineering at the University of Kentucky. Under this plan the student alternates school work with on-the-job training such that each student receives approximately 36 months in school and 36 months in practical work.

Although Kentucky reported the only plan of college scholarships offered by a state highway department, in some states the contractors or other organizations sponsor selected students in getting their college education. Such plans are in operation in Alabama, Georgia, Ohio, and Wyoming. Florida is developing a plan similar to that used in Alabama. In Minnesota, the Surveyors and Engineering Society offers a $750 scholarship for graduate study and a $250 scholarship to a third-year undergraduate student.

Under certain provisions, the employees' salaries may be paid while on assignment to a college to pursue formal college work. The states having this provision are Connecticut, Iowa, Kentucky, and Washington. Washington's privilege seems to be restricted to the traffic-engineering school at Yale University.

Michigan, Minnesota, Nebraska, and Wisconsin reported an organized plan for hiring and training highschool graduates. Arkansas has such a plan under study, and Illinois occasionally sets up the plan when there is need for a large number of draftsmen. In the summer of 1952, Vermont conducted a successful highschool training program for the development of survey-party personnel.

In 1953 the University of Michigan, in cooperation with the Michigan State Highway Department and the Michigan Road Builders Association, conducted an 8-week training course in surveying for highschool graduates. This course was given at the university's summer surveying camp at Jackson, Wyoming. The course is to be repeated for the summer of 1954.

Highschool students interested in taking this summer training in surveying are selected on a basis of applications and from the list passing the Engineering Aide B examination of the Michigan State Civil Service Commission. The Michigan Road Builders Association grants some financial aid to the students selected for the work.

The Virginia Department of Highways sponsors night school and correspondence courses and pays the cost of the course and related expenses under certain conditions. The department also pays the expense for special courses at the University of Virginia, and will pay half salary plus tuition for employees who may be assigned to the Bureau of Highway Traffic at Yale University.

Summer Hire of Highschool and College Students

In Table 5 is given the number of highschool and college students hired for the summer of 1953. Provision in the questionnaire was made for separating the highschool students into temporary hire for the summer and permanent hire (graduates). The answers were not satisfactorily classified on this basis, so the total number hired is given. The table shows that highschool students are used extensively in the summers. The number hired in 1953 bears no particular relationship to the size of the state, size of the highway department, or

other known condition. The matter seems to rest upon policy. From other sources it is known that the hiring of highschool graduates and highschool students has led to later employment with the highway department. Perhaps a planned program of hiring the highschool student would lead to increased employment either of the highschool graduate or of the college graduate who had had the previous employment experience with the state highway department.

Associated with the hiring of the highschool students for summer work is the hiring of college students (not college graduates) also for summer work. Table 5 shows that in 1953, the 43 states reporting on this question hired a total of 3,012 college students. A general review of Table 5 indicates that those states who hired highschool students in fair sized numbers also hired the college student to a similar extent.

Hiring of 1953 Engineering Graduates

For a number of years, state highway departments have not succeeded in hiring

TABLE 5

HIRE OF HIGHSCHOOL AND COLLEGE STUDENTS FOR SUMMER OF 1953

State	No. of high school students hired[a]	No. of college students hired[b]	State	No. of high school students hired[a]	No. of college students hired[b]
Alabama	nr	nr	Nevada	57	10
Arizona	10t	10	New Hampshire	15t	20
Arkansas	75t	35	New Jersey	70t	80
California	146	120	New Mexico	nr	nr
Colorado	120	35	New York	39t	94
Connecticut	115	300	North Carolina	nr	nr
Delaware	23t	4	North Dakota	75t	40
Florida	62t	22	Ohio	800t	200
Georgia	53t	54	Oklahoma	73	54
Idaho	60	21	Oregon	35	21
Illinois	?	229	Pennsylvania	150	390
Indiana	nr	nr	Rhode Island	30t	10
Iowa	60	50	South Carolina	nr	nr
Kansas	42	42	South Dakota	56	6
Kentucky	196	174	Tennessee	80	10
Louisiana	0	15	Texas	225	100
Maine	10t	50	Utah	?	50
Maryland	66t	29	Vermont	5t	16
Massachusetts	25	75	Virginia	190	140
Michigan	130	65	Washington	0	28
Minnesota	500t	85	West Virginia	34	6
Mississippi	213	29	Wisconsin	110	90
Missouri	13	88	Wyoming	nr	nr
Montana	210	32	Hawaii	3	3
Nebraska	51	80			
Totals				4,227	3,012

[a] Includes highschool graduates. Permanent and temporary employment included; the "t" indicates temporary employment. The distinction reported between temporary and permanent status was not consistent, state to state, and so the two groups are combined in this table.

[b] Does not include college graduates; number employed was reported as temporary for summer only.

nr = Information not reported.

TABLE 6

HIRE OF ENGINEERING-COLLEGE GRADUATES IN 1953

State	Number Hired B. S. Deg	Number Hired M. S Deg.	Number desired to hire	Monthly starting salary
				dollars
Alabama	nr	nr	nr	nr
Arizona	1	0	nr	297
Arkansas	5	0	20	250
California	45	2	350	376
Colorado	0	0	10	290
Connecticut	?	0	42	325
Delaware	3	0	9	302
Florida	2	0	30	325
Georgia	7	0	15	296
Idaho	7	1	8	320
Illinois	140	1	250	350
Indiana	13	0	50	300 - 375
Iowa	4	1	40	325
Kansas	4	0	50	358
Kentucky	7	1	nr	300
Louisiana	14	1	30	325
Maine	7	0	30	332
Maryland	7	0	30	334
Massachusetts	10	0	50	290 - 340
Michigan	13	1	50	350
Minnesota	4	0	10	340
Mississippi	8	0	30	300 - 310
Missouri	16	0	25	325
Montana	0	0	12	350
Nebraska	12	2[a]	25	320 - 345
Nevada	3	0	10	325
New Hampshire	3	0	40	275
New Jersey	?	?	60	276 - 348
New Mexico	nr	nr	nr	nr
New York	?	?	?	264 - 311
North Carolina	nr	nr	nr	nr
North Dakota	2	0	10	300 - 325
Ohio	35	0	100	315 - 360
Oklahoma	10	0	25	350
Oregon	26	0	44	336
Pennsylvania	0	0	50	248 - 278
Rhode Island	0	0	15	200 - 250
South Carolina	1	0	nr	275
South Dakota	0	0	15	275
Tennessee	2	0	nr	nr
Texas	44	0	100	300
Utah	6	0	15	325
Vermont	1	0	20	280
Virginia	21	1	20	312
Washington	14	0	14	343
West Virginia	0	0	13	300 - 325
Wisconsin	32	1	40	325
Wyoming	nr	nr	nr	nr
Hawaii	0	0	0	262
Totals	529	12	1,757	-

[a] Includes one Ph. D degree.
nr = Information not reported

the number of civil-engineering graduates they needed to staff their many technical offices. One question was devoted to a determination of the relationship between the number of engineering graduates hired in 1953, the number desired, and the salaries paid. Forty-four states and Hawaii submitted answers to this question although some answers were not complete. Table 6 summarizes these answers. The 42 states reporting usable information on the question reported a hiring of a total of 529 bachelor-degree graduates and 12 with graduate degrees.

The 40 states reporting their needs for engineering graduates had a combined requirement of 1,757 bachelor graduates. Restricting these totals to only those 37 states that reported the number of bachelor-degree graduates hired and the number desired, gives 518, and 1,655, respectively. Thus, these 37 states hired only 31.3 percent of their needs.

Forty-four states reported the starting salary paid newly hired, recent college graduates. These salaries are shown in Table 6. They may be summarized as follows:

	Based on Lowest Starting Rate	Based on Highest Starting Rate
Lowest salary	$200	$250
Median salary	314	325
Average salary	308	318
Highest salary	376	376

Only six states reported starting salaries of $350 or more a month. The engineering graduates of 1953 averaged above $350 a month at most of the engineering colleges.

Table 7 shows the number of graduates hired expressed as a percentage of the number desired and the corresponding starting salary. The 37 states furnishing the necessary information were arranged in sequence by increasing salary rates. The first group is composed of those states with starting salaries of less than $300, the second group of 10 states paid starting salaries of $300 to less than $325, the third group of seven states paid a starting salary of $325, and the fourth group is composed of ten states paying above $325 starting salary. The table gives some evidence that starting salaries below $300 a month seriously decreased the number of graduates hired, expressed as a percentage of the number wanted.

TABLE 7

ENGINEERING GRADUATES HIRED IN 1953 RELATED TO MONTHLY SALARY

No. of States	Number Hired	Number Wanted	% Hired of Number Wanted	Average Monthly Salary[a]
9	26	235	11.1	$ 267
10	145	365	39 7	307
7	77	190	40.5	325
11	270	865	31.2	347
37	518	1655	31.3	312

[a] Based on lowest amount for states reporting a range in starting salary.

Hiring and Tenure of Engineering-College Graduates

The experience of 27 states in the hiring of graduates in civil engineering, beginning with 1948 and extending through 1953, is given in Table 8.

Table 8 shows a high rate of resignation. Even from those graduates hired in June 1953, many resignations took place by the end of August. Note that the retention, as of August 1953, of graduates from the 1948 and 1949 classes is higher than for the classes of 1950, 1951, and 1952. The comparatively low percentage of the 1951 and 1952 classes still employed is partially accounted for by the 14.3 and 12.4 percentages on leave to military service. Resignation, though, has been high from the 1951 and 1952 classes (45.4 percent in two years and 48.8 percent in one year, respectively) as compared to the 1948 and 1949 classes (44.0 percent in 5 years and 45.2 percent in 4 years, respectively).

TABLE 8

NUMBER OF COLLEGE GRADUATES HIRED AND THEIR TENURE - 27 STATE SUMMARY

	Year Hired					
	1948	1949	1950	1951	1952	1953
Number hired	496	816	848	637	557	395
Percentage now on military leave	1.6	3.5	8.3	14.3	12.4	10.4
Percentage resigned	44.0	45.2	48.2	45.4	48.8	19.0
Percentage still employed	54.4	51.3	43.5	40.3	38.8	70.6

States included above and total number hired during the 6 years

Arizona	5[a]	Kentucky	35	Ohio	414
Arkansas	53[b]	Louisiana	102	Oklahoma	69
California	829	Massachusetts	52	Oregon	182
Connecticut	36	Michigan	125	South Dakota	2
Delaware	18	Mississippi	82	Texas	554
Georgia	51[a]	Missouri	250	Vermont	45
Idaho	25	Montana	110	Virginia	78
Indiana	84	Nebraska	123	West Virginia	18
Iowa	43[a]	New Hampshire	48	Wisconsin	316

[a] 1948, 1949, 1950 not included
[b] 1948 and 1949 not included.

The trend to be expected is that the percentage resigned would decrease materially from the 1948, or oldest class, to the 1952, or recent class. The percentages, however, for the classes of 1948 to 1952 vary irregularly from 44.0 for 1948 to 48.8 for 1952, which indicates that the World War II veterans, who composed most of the 1948 and 1949 graduating classes, have held their employment better than those younger engineers graduating in 1951 and 1952. The rate of resignation is so high as to warrant special measures to effect a greater employment retention.

Methods of Hiring the Graduating Senior

The state highway departments use a number of methods of reaching and interesting the college graduating senior to accept employment with the highway department. There appears to be no one best system, but whatever success is achieved results from a number of direct and indirect approaches. Some of the methods used, with the number of states mentioning the method indicated at the end, are: interviewing the seniors on the campus, 25; visits to the school to discuss employment with the dean, head of department, and professors, 9; general announcements in newspapers, posters, radio, television, and other normal publicity channels, 9; summer employment before graduation, 5; talks given to the senior class or to the student chapter of American Society of Civil Engineers, 4; direct correspondence with the college, 4; direct correspondence from the senior student, 3; invitations to the senior class to visit the highway department operations, laboratories, and construction projects, 3; colleges contacting the highway department, 1; and cooperative education programs, 1.

Return of Employees on Leave to Military Service

The return to state highway department employment of former employees released on leave to active military duty is under way. For the 6 months of July to December 1952, 32 states reported the return of 64 service men. In the following 6 months, 32 states reported the return of 70; and in the period from July to December 1953, 26 states reported an expected return of 71 employees. Thus, the average return was 2.1 employees per highway department in the 6-month period of July to December 1952; an average of three returnees per state highway department is expected in the last six months of 1953. California is the exception to the above figures. The number of service men returning to employment is reported by California to be 25, 25, and 30 individuals respectively, for the three 6-month periods.