<table>
<thead>
<tr>
<th><strong>Title:</strong></th>
<th>Your Future in Engineering</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Creators:</strong></td>
<td>Fenwick, Joe</td>
</tr>
<tr>
<td></td>
<td>Brown, Elgar</td>
</tr>
<tr>
<td><strong>Issue Date:</strong></td>
<td>Jul-1939</td>
</tr>
<tr>
<td><strong>Publisher:</strong></td>
<td>Ohio State University, College of Engineering</td>
</tr>
<tr>
<td><strong>Citation:</strong></td>
<td>Ohio State Engineer, vol. 22, no. 7 (June, 1939), 2-7.</td>
</tr>
<tr>
<td><strong>URI:</strong></td>
<td><a href="http://hdl.handle.net/1811/35633">http://hdl.handle.net/1811/35633</a></td>
</tr>
<tr>
<td><strong>Appears in Collections:</strong></td>
<td><a href="http://hdl.handle.net/1811/35633">Ohio State Engineer: Volume 22, no. 7 (June, 1939)</a></td>
</tr>
</tbody>
</table>
THE things that a person tries hardest to assure in his life are probably his own happiness and security. Most of us, whether we will admit it or not, think that money will be the basis of most of our happiness and security in later life and regardless of everything that we are told to the contrary, we shall endeavor to accumulate as much money as possible. Almost every student in engineering, when asked why he intends to pursue that particular profession, will say that he is studying engineering because he thinks that he will like that type of work. Perhaps that is true, but it is also undoubtedly true that the amount of income he will get for his work will determine to a great extent how well he likes it.

With the possible exception of a few survey courses the student has no chance to get a broad view of the engineering profession as a whole and then only the type of work to be expected is explained in these courses while authentic facts about the incomes and security of engineering college graduates are little discussed. As a result the student can only go through his college course hoping for the best and depending on hearsay in learning what his particular type of engineering has to offer to him as far as security of employment and income are concerned.

In 1935, at the request of the American Engineering Council, the Federal Bureau of Labor Statistics made a survey of the engineering profession, receiving data from 52,589 engineers who replied to their questionnaire. This is, no doubt, the most extensive survey of the engineering profession in recent years and the conclusions drawn from it would undoubtedly give a college student a general idea of what he can expect after graduation.

On looking at the statistics compiled in this survey one of the first things that one would ask himself is whether it really pays to graduate from college. Many of the present engineers had only secondary school educations, or took a non-collegiate technical course and seem to be as successful in their work as college graduates. Also many men who took non-engineering courses in colleges have followed the engineering profession very successfully. The following table gives the relative incomes of engineers with different types of educations.

<table>
<thead>
<tr>
<th>Type of Education</th>
<th>Year after Graduation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2</td>
</tr>
<tr>
<td><strong>Median annual earnings, '34</strong></td>
<td></td>
</tr>
<tr>
<td>Secondary school education</td>
<td>$1,550</td>
</tr>
<tr>
<td>Non-collegiate technical crse.</td>
<td>1,475</td>
</tr>
<tr>
<td>College course incomplete</td>
<td>1,350</td>
</tr>
<tr>
<td>Non-engineering graduate</td>
<td>1,275</td>
</tr>
</tbody>
</table>

First degree engineering graduates:

- Chemical and Ceramic: 1,250, 2,750, 5,050
- Mining and Metallurgy: 1,200, 2,550, 3,980
- Mechanical and Industrial: 1,180, 2,490, 3,780
- Electrical: 1,080, 2,500, 4,250
- Post graduates: 940, 2,610, 4,175
- Civil and Architecture: 1,325, 2,350, 3,330

It is obvious from the table that the college graduate in engineering has no advantage over engineers with other types of education as far as starting salary is concerned, nor is there an appreciable difference after ten years in the profession. After thirty years the engineering graduate holds a distinct advantage over the others in some fields but in other departments there is no great spread in salaries even after this many years in the profession.

Neither did the engineering graduate hold any advantage over the others with respect to employment during the worst years of the depression. 37.8% of the graduates reported a period of unemployment during the years 1930-34 while 35.7% of those with college course incomplete and 35.6% of those with a non-collegiate technical course reported periods of unemployment.

It is obvious that until recent years the engineer with a college degree in engineering had no particular advantage over other engineers but, nevertheless, at the present time it is highly advisable to graduate from college if one expects to be an engineer at all. A few years ago, when competition was not so keen, it was much easier to get an engineering job than it is now. For all the years up to 1927, 27.6% of all engineers were not college graduates. However, only 1.57% of the engineers who started practice between 1930 and 1934 were not college graduates. So, even though the men without college educations who broke into the engineering profession a few years ago have been as successful as college graduates, at present the odds are better than 98 to 1 that you cannot become an engineer without a college diploma.

Warranted that it is necessary to graduate from col-
FUTURE IN ENGINEERING

By Joseph Fenwick and Elgar Brown

In college to become an engineer one might wonder whether
the engineering profession pays one well enough to go
to the bother of attending an engineering college for
four years or whether some other college course might
offer more opportunities. Although it is difficult to
say what kind of training is most advantageous, it can
be pointed out that in 1929 only about 6% of the in-
comes in the United States averaged more than the in-
come of the average engineer with ten years experience.
Furthermore, engineering is a profession in which earn-
ing capacity advances and is substantiated until late in
life.

But if in these respects the profession appears attrac-
tive on the average, its rewards are not particularly at-
ttractive to the poorer and less fortunate engineers. Even
in 1929 the lowest paid 10% of the engineers could
hope for no more than $2,500 to $3,000, though they
might stay in the profession for 40 years. Judged from
the basis of money income there can be no question but
that the best group of skilled wage earners are in a better
economic position than those who struggle to maintain
a position on the fringes of the engineering profession.

Since the economic status of some engineers is not too
favorable, one wonders if it might be some weakness in
college training that might be the cause. Many engin-
eers recommend greater stress on Economics and English
in college but outside of that the classroom training it-
self seems to be sufficient. Participation in activities
seems to have an effect on what the engineer is likely
to learn, however. It seems quite probable that very
often lack of success in the engineering profession may
be blamed upon some weakness in classroom curriculum
when in reality the cause lies within the engineer himself
for not getting as much out of college as he might.

After graduation the engineer finds that he not only
has to make use of his technical knowledge, if any,
but must also be successful in his relations with a large
variety of individuals. To do this he should cultivate
those qualities which may best be described by such
terms as:

- Personality
- Loyalty
- Patience
- Humility
- Breadth of interest
- Business ability
- Leadership

- Promptness
- Accuracy
- Judgment
- Aptitude
- Proper estimate of own value
- Executive ability

It is quite evident that as school is now conducted
many of the above traits are not born in the classroom, but
rather are the responsibility of the student himself, inso-
far as their development is concerned.

Although the aforementioned qualities are largely a
result of many years of training in the home, in industry,
and in our public schools, the best means for their
development in college seems to be through extra-curri-
cular activities. In activities a student may meet fellow
students, professors, and business men upon an equal
basis and express himself in a way that is utterly impos-
ible in the classroom. The training in ability to deal
with people successfully is probably responsible more than
any other one thing for the fact that salaries seem to
vary almost proportionally with the number of activities
that one participates in while a student. The following
table shows a comparison of income vs. grades and in-
comes vs. activities. An index number of 100 is used.

<table>
<thead>
<tr>
<th>Grades</th>
<th>Income</th>
<th>Activities</th>
<th>Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>T 3 1/2</td>
<td>101</td>
<td>Many</td>
<td>108</td>
</tr>
<tr>
<td>Over 3.5</td>
<td>105</td>
<td>Intermediate</td>
<td>102</td>
</tr>
<tr>
<td>3.0-3.5</td>
<td>98</td>
<td>Few</td>
<td>101</td>
</tr>
<tr>
<td>2.5-3.0</td>
<td>101</td>
<td>Worked</td>
<td>97</td>
</tr>
<tr>
<td>2.0-2.5</td>
<td>95</td>
<td>None</td>
<td>95</td>
</tr>
</tbody>
</table>

To the mind of the student who is considering en-
gineering as a profession comes the question, "Just what
do engineers do and what are their earnings in general?"
Also blanketing the scene is the ever present cloud of
possible unemployment.

Engineering employment may very well be divided
into three classes; those employed in private industry,
those employed regularly by different government agen-
cies, and those unemployed or engaged in governmental
work relief. During the depression a very decided shift
has been and is now taking place from employment by
private industry to government work. The shift of en-
gineering employment during the depression can be an-
alyzed by a table.

June, 1939
Employment in Engineering Profession
1929-34

<table>
<thead>
<tr>
<th>Employment Status</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering Employment</td>
<td>93.0</td>
</tr>
<tr>
<td>Private</td>
<td>71.9</td>
</tr>
<tr>
<td>Public</td>
<td>21.1</td>
</tr>
<tr>
<td>Non-Engineering Employment</td>
<td>6.4</td>
</tr>
<tr>
<td>Unemployed (Including relief work)</td>
<td>0.7</td>
</tr>
</tbody>
</table>

From the above table it might be indicated that in the depression years from 1930 to 1935 there was considerable total unemployment in the engineering profession. However, never at any one time were more than 3% of the engineers totally unemployed, although almost 40% of the members of the profession reported a period of unemployment during the five year period. From this we may conclude that although temporary unemployment was rather common, unemployment of the more serious nature was relatively rare.

Nothing seems to indicate that such a low percentage of unemployment will continue, however, because the number of men graduating is far in excess of the number of men being accepted into industry at present. In fact there were 141% more men graduating in the period 1930-34 than in the period 1925-29 while there were only 34% more young men accepted in private industry in the 1930-34 period than in the 1925-29 period.

Since we have conclusive proof that up until the present only a small percentage of the engineers are without jobs one might wonder how much those who are employed are making.

By tabulating the available statistics on the matter we can get a general idea of what a person contemplating a life work of engineering can expect to make both during prosperity and depression.

Median Annual Earnings with Respect to Years After Graduation for all Engineers

<table>
<thead>
<tr>
<th>Years After Graduation</th>
<th>1929</th>
<th>1934</th>
</tr>
</thead>
<tbody>
<tr>
<td>At graduation</td>
<td>1,313</td>
<td>598</td>
</tr>
<tr>
<td>After 5 years</td>
<td>3,145</td>
<td>1,858</td>
</tr>
<tr>
<td>After 10 years</td>
<td>3,674</td>
<td>2,569</td>
</tr>
<tr>
<td>After 20 years</td>
<td>4,588</td>
<td>3,211</td>
</tr>
<tr>
<td>After 40 years</td>
<td>4,968</td>
<td>3,497</td>
</tr>
</tbody>
</table>

With a general idea of what income to expect in the engineering profession the next question one might ask is what type of engineering work brings the largest income. Types of work with respect to income can be rated in the following way:

1. Sales
2. Technical
3. Non-technical
4. Education

It is obvious that, as far as salaries are concerned, teaching offers the least opportunity. This phase of work may, however, offer inducements that can hardly be measured in terms of a slight difference in earnings.

Knowing now that sales engineering looks like the most promising type of engineering work we wonder what department of engineering in which it is most advisable to matriculate. There are several angles at which this question may be viewed. The wages of various types of engineers may be compared at any particular time. The change in wages due to the depression might be noted. The increase in graduates with respect to the increase in jobs is also an important aspect. Data has been accumulated which can give the inquisitive college student a view from all of these different angles. For instance the relative incomes of various branches of engineering and the change of incomes due to the depression are as follows:

Median of annual earnings in each professional class including both graduates and non-graduates

<table>
<thead>
<tr>
<th>Department</th>
<th>1929</th>
<th>1934</th>
<th>% decrease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mining and Metallurgy</td>
<td>$4010</td>
<td>$2628</td>
<td>34.5%</td>
</tr>
<tr>
<td>Chemical and Ceramic</td>
<td>3803</td>
<td>2047</td>
<td>46.5%</td>
</tr>
<tr>
<td>Mechanical and Industrial</td>
<td>3699</td>
<td>2324</td>
<td>37.2%</td>
</tr>
<tr>
<td>Civil and Architecture</td>
<td>3291</td>
<td>2297</td>
<td>30.2%</td>
</tr>
<tr>
<td>Electrical</td>
<td>3277</td>
<td>2218</td>
<td>32.2%</td>
</tr>
</tbody>
</table>

This table shows what kind of engineers make the most money and also the department affected the most by the depression. Then if one is anxious to know what branches of engineering are overcrowding the fastest, and all of them are overcrowding, he may refer to the following table.
Percentages of increase in each professional class 1929-'34

<table>
<thead>
<tr>
<th>Professional Class</th>
<th>Increase in Total</th>
<th>Increase in Employment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemical and Ceramic</td>
<td>62.5%</td>
<td>35.1%</td>
</tr>
<tr>
<td>Electrical</td>
<td>32.8%</td>
<td>3.1%</td>
</tr>
<tr>
<td>Mechanical and Industrial</td>
<td>25.5%</td>
<td>5.5%</td>
</tr>
<tr>
<td>Civil and Architectural</td>
<td>18.7%</td>
<td>1.1%</td>
</tr>
<tr>
<td>Mining and Metallurgy</td>
<td>17.6%</td>
<td>2.5%</td>
</tr>
<tr>
<td>Total U.S.</td>
<td>25.3%</td>
<td>4.4%</td>
</tr>
</tbody>
</table>

Increase in Total Employment: 35.1%, 3.1%, 5.5%, 1.1%, 2.5%, 4.4%

Stability of employment in the various fields may interest the engineering student and data on this aspect can be tabulated as follows:

Percentage reporting a period of unemployment and average period of unemployment with respect to departments from 1930-34.

<table>
<thead>
<tr>
<th>Department Graduated from</th>
<th>Reporting a Period of Unemployment</th>
<th>Average Length of Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Civil and Architectural</td>
<td>41.8%</td>
<td>11.8 mos.</td>
</tr>
<tr>
<td>Electrical</td>
<td>36.9%</td>
<td>11.5 &quot;</td>
</tr>
<tr>
<td>Mechanical and Industrial</td>
<td>35.0%</td>
<td>11.1 &quot;</td>
</tr>
<tr>
<td>Mining and Metallurgy</td>
<td>33.9%</td>
<td>12.3 &quot;</td>
</tr>
<tr>
<td>Chemical and Ceramic</td>
<td>33.5%</td>
<td>9.4 &quot;</td>
</tr>
</tbody>
</table>

Comparison of Annual Earning for Non-Engineering and Engineering Work in 1934

<table>
<thead>
<tr>
<th>Type of Work</th>
<th>All Graduates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Engineering</td>
<td>$617</td>
</tr>
<tr>
<td>Engineering</td>
<td>$744</td>
</tr>
</tbody>
</table>

So far in this article it has been shown that at present, although it has not been the case until the last few years, the college graduate has a distinct advantage over the man without a college education. There has been definite proof that participation in extra-curricular activities will have more effect on the engineer's income than grades. It is also likely that the graduate choosing to take up sales engineering will probably make more money than the graduate who goes into teaching. Much data has been given on the respective merits of different departments of training and differences of income has been noted. It has been shown that the graduate in engineering will probably make more money if he sticks to the work for which he was trained. But the most significant differences in income revealed by the survey are not the differences in average income received by individuals who have received a college degree or those who have not. Nor are they the differences as between individuals who have entered one professional class rather than another. These differences on the whole are moderate though they are large enough to prove the
desirability of choosing well both the field of endeavor and the type of training best adapted to advancement in that field. The most striking differences are those which exist within each profession and within each group classified on the basis of its educational background. One out of every ten of the engineers in each such group secures an income several times as great as the average for the group as a whole. At least one out of every ten at the bottom of each group whether a college graduate or not, whether a chemical engineer or a civil engineer, whether a man of many years of service or freshly out of college, is hardly to be distinguished as regards income from a skilled wage earner. For instance in 1939 in mining and metallurgical engineering the average income of the upper 10% of the profession was $7,530, while the average income of the lower 10% of the profession was only $1,308. No man can expect his choice of type of engineering education to make that much difference in his income. The biggest difference in income will be due to the man himself.

Undoubtedly college courses are becoming increasingly difficult in order to weed out those undesirable to the profession. Now as never before employers are differentiating between college graduates and non-graduates. However, even yet many individuals of limited capacities secure college degrees. As a result employers must develop more selective processes in employing men. Now simply graduating from an engineering school does not guarantee a satisfactory income, but the man who graduates with indications of outstanding capacity will undoubtedly earn several times as much as the man who merely slips through, regardless of the department under which either has been instructed. So even if one is a junior or senior in engineering and for some reason or other feels that another type of engineering is more promising, he should remember that the best men in every type of engineering earn much more than the average men of the type of engineering in which salaries are highest. So one's success will not be due to what kind of engineering he has learned but to what he is able to do with this knowledge after he gets it.

It is a matter of common belief that college training has economic value for the prospective engineer. What there is about the college training that helps most is hard to tell.

Even after 30 years in the profession the spread between the salaries of college trained men and non-college trained men is increasing. It can hardly be argued that the scholastic background of engineers who entered the profession in 1900 is a controlling factor with reference to their earnings in 1929 and 1934. Certainly, the value of their services is no longer primarily dependent upon the odds and ends of information which they acquired in college, although it is possible that habits of thinking and study which the engineer received in his college days constitute a permanent legacy. By and large the factors controlling the value of a man's engineering services after 30 years or more of experience must be primarily his native capacity and the training which he has received on the various jobs that he has performed.

As regards native capacity, there is reason to believe that, on the average, better material will be found among college graduates than among those who failed to complete a college course. There are, of course, many individuals who are unable to complete an engineering course for financial reasons. There are also many individuals of limited capacity who receive degrees. But there is also a wholesale process of weeding out that goes on in the engineering schools. Thus even the differences in income shown in the earliest years of experience may reflect differences in capacity rather than differences arising from the value of formal training.

It is a matter of common knowledge that for a number of years a college education has been thought of as a normal prerequisite to engineering work. Many employers of engineers deliberately differentiate between the college graduates and the non-graduates. In this sense status is gained by graduation, to some extent no longer with regard to the value of a formal education as such. In other words the employer may hire the young graduate engineer not because he has possession of the formal knowledge given in a formal engineering course, but because he promises capacity for work since he was able to graduate.

It was stated, however, that many individuals of limited capacity secure engineering degrees. As a result many employers have already developed a highly selective process of employment in interviewing candidates from engineering colleges. They may assume that college graduates are more promising material than non-graduates, but no longer do they recognize the mere fact of graduation as evidence of employability and give special status only to those who graduate with a standing substantially better than the average of the class. Thus the advantage of status which may have occurred a number of years ago through the fact of college graduation alone now accrues in equal measure only to graduation with exceptional standing. So, graduation from an engineering school is no guaranty of a satisfactory income, while there is still apparently an opportunity for a man of outstanding capacity to secure far better than an average engineering income even though he has not attended college.

It is hard to advise a boy just out of high school or a freshman or sophomore in college just what the future holds in store for him and what type of training will be most advantageous. It can be pointed out, however, that in 1929 the average income of graduate engineers with 10 years experience ranged from $3600 to $4600 in the various professional classes. In 1929
only 6.4% of the incomes in the U. S. exceeded $4000. Furthermore, engineering is a profession in which earning capacity advances and is sustained until late in life. But if in these respects the profession appears attractive to the average, its rewards are not particularly attractive to the poorer or less fortunate engineers. Even in 1929 the lowest paid 10% of the engineers could hope for no more than $2500 to $3000 though they might stay in the profession for 40 years. In 1934, exposed as the profession was to the risks of unemployment, the lowest paid 10% of the engineers with less than 5 years experience after graduation earned less than $1000. Even with 10 to 30 years experience they earned no more than $1000 to $1500. Judged from the basis of money income, there can be no question but that the best of a group of skilled wage earners are in better economic position than those who struggle to maintain a position on the fringes of the engineering profession.

BIBLIOGRAPHY