

# THE PENNSYLVANIA RAILROAD SYSTEM

Broad Street Station  
PHILADELPHIA, PA.

Pennsylvania Station  
PITTSBURGH, PA.

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## How Can the Colleges and the Industries Co-operate?

Address of Ivy L. Lee, Executive Assistant, Pennsylvania Railroad Company, before Annual Meeting of Society for the Promotion of Engineering Education, at Minneapolis, Minn., June 26, 1913.

You have asked one who is not an engineer to give you suggestions as to how, as teachers of engineering, you can produce better results. I can, however, possibly qualify for my task in the manner of a candidate for the judiciary in one of our western States, who was urged for election upon the ground that he would make a most excellent judge because he had no preconceived notions of the law.

Though without direct personal experience in either the employment or training of technical men, I have enjoyed the opportunity of frank consultation with many of the higher officials of the railroad system with which I have the honor to be connected, I feel, therefore, that I cannot do better than essay the presentation to you of a composite of the views of these men of wide experience and great breadth of view.

The college is both a training school and a laboratory. The industries of the world not only look to you to train men who can

take up the work of directing and guiding great enterprise, but to a constantly greater extent, industries are looking to you to solve their broader problems. When President Taft wanted a man to report on what should be the proper system of charges on the Panama Canal, he sent Prof. Emory R. Johnson, of the University of Pennsylvania, to make the inquiry. Some of the finest work in the study of the transportation question is being done by Prof. W. Z. Ripley, of Harvard. The astonishingly able accounting analyses of Prof. Henry C. Adams have been of priceless value to the Interstate Commerce Commission.

Right here, however, I would direct your attention to the point brought out in a conversation I once had with Mr. W. M. Acworth, the distinguished English railway economist, who, after returning to London a few years ago, from attendance upon a meeting of the American Economic Association, made this observation:

"I was surprised, hearing the college professors discuss the transportation question, to note how little they really knew of it. They understood the theory, but not the practice. And later, discussing the subject with many railroad presidents, I was astonished at their lack of breadth. They understood the practice, but few knew the theory."

And that, gentlemen, leads me to the chief thought I wish to present to this gathering. The demand of industry is for men who understand both the practice and the theory.

Let me be concrete. It is the experience of Pennsylvania Railroad officers that graduates who come to them from technical schools are deficient in three general particulars :

(1) Lack of practical experience and judgment.

(2) An idea that they are far superior to the rest of mankind; and

(3) A certain narrowness of mind, inculcated through a too exclusive attention in college to mathematics and theoretical science, and a too great neglect of those broader subjects, such as political economy, history and general literature.

With your indulgence, therefore, I will make a few suggestions as to how these deficiencies may be met.

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1. The question of practical experience might be remedied by the man serving two or three years as a machinist prior to going to a technical institute. Of course, this is not feasible in a large number of cases, and the man must get his actual experience after he starts regularly to work. But the college can implant in his mind certain sound fundamental ideas. A man who has had a good engineering education and has absorbed commercial ideas will make a good commercial engineer. One who is a theorist and scientific man only, with no commercial ideas, will make a good investigator, and possibly a good man in a test department, especially when engaged in scientific research; but even a good test department man requires some little idea of business, because test room questions are not settled on quality alone. The best quality for the same cost is the real question at issue. The man of great value to an industry is he who does not merely attempt to follow a theoretical ideal, but who adapts his theories to the actual limitations of the moment, and secures the best practicable result.

2. Men leaving technical institutions should be made to have a thorough understanding of the fact that they are necessarily almost completely lacking in a real knowledge of the practical application of the principles they have been studying. If a student can be trained by the time he completes his college course to have real openness of mind, he will be well on his way toward success when he leaves college. Young technically educated men leaving school should, at the start, forget that they are men of scientific training, and tackle work precisely as do other workmen, knowing that when they have mastered that part of their education, the time spent in doing so will not have been wasted.

While it is not expected that technical men entering railroad shops shall have to consume as much time on menial or trivial work as those not possessing such advantages, nevertheless, to regard time spent in the shops as time lost in the pursuit of their true vocation is a very grave mistake, and results in many technical men not being advanced to a position of managing other men.

It is of the greatest importance, too, that students be impressed with the human elements in all industrial work; that is, they must realize that whatever their college education may have been, they are of very little real value until they have acquired something which few colleges teach. Too often young men come from our colleges with the feeling that they know too much to be told anything by men who have not had a college education. By assuming such a stand they close the mouths of men who could and would give them very useful information.

A beginner in the practical end of any line of work should be taught beforehand that college education is not everything, and that results can only be accomplished through other men. Therefore, he must get the viewpoint of other men before he can secure that sympathy from these other men on which his success as a manager will depend. In

doing this he will get much misinformation, which he will know to be such, but this knowledge he should keep to himself. We see all around us men holding the highest positions, who have come up from very small beginnings, with no apparent advantages. Yet we find that these men have their business at their finger tips, because they have been through all of its grades. The feeling that the possession of an education relieves a man from the necessity of going into these details has resulted in many men becoming nothing but technical advisers to carry out the wishes of other men who thoroughly understand the details of their work. Such merely technical advisers never share in the great rewards which come to the men who combine a mastery of both theory and practice.

3. It is of prime necessity, of course, that a man who is trained to practice engineering shall have a good engineering education. Successful men in railway engineering work must necessarily be familiar with the laws of nature and the fundamentals of mathematics. This information can be obtained, however, outside of technical colleges, and the man who obtains his information in this manner, by the necessarily more concentrated application on his part, is generally a better engineer than a large percentage of college graduates. Many competent judges believe that technical courses in the majority of the colleges lay too much stress on details. If more time were spent on the study of fundamental principles, it would result in developing more resourceful men. Some of our officers, in advising young men, have suggested to them that they devote their entire time to the study of mathematics, physics, chemistry, English, and one foreign language, and not take up any particular branch of engineering. A student who is well grounded in the above studies can take care of any proposition which will come before him. His resourcefulness will be developed by reason of his being compelled

to work from principles rather than trying to fit the problem before him to some particular detailed case which he has learned in his engineering course.

Many of our officers hold the view that the best shop work for college men is that which can be obtained during the summer in the various shops where actual work is done, rather than having the time of the student taken up by the more or less imitation shop work that is done at some of the schools. The most valuable part of shop experience to a student is the coming in contact with men and absorbing their experience.

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I asked not long ago the man who, I believe, is conceded to be the greatest expert in this country in railway electrification, to tell me what he really learned in college. His reply was :

“I am inclined to think that the most valuable asset that I brought out of my college course was the habit of studious application to the job in hand rather than a finished knowledge of any subject.”

In the final analysis the technical student has only time to acquire a fairly good grounding in principles of engineering. The college-trained man, however, has an immense advantage, after he obtains some experience, over the non-technical man in being able quickly to grasp the relation between the theory and practice, and to apply correct principles to practice.

I would urge that you not only see to it that students receive a broad general education, but that they be made to see that it is of great importance not to be in too big a hurry to commit themselves to a particular life work. College professors can be of great value to their students, and also to industries, by advising men frankly as to their limitations, and also as to their strong qualities. The principles enunciated in Prof. Hugo Munsterberg's remarkable book, "Psychology and Industrial Efficiency," will, I believe, receive more and more application as time goes on.

Young men are frequently placed in positions for which they are entirely unsuited, while if they were moved to other positions more adapted to their make-up, they would often prove successful. Some of the very best men in certain departments in our shops at Altoona can never go higher because there is nothing else that is suitable for them to do in general railroad work. In some of these cases no other men on the road could fill their present positions as well as they do. The only thing for such men to do is to leave the railroad and seek positions with concerns that can afford to pay more for the particular kind of ability which these men possess.

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So much for suggestions as to how colleges can the better equip men for taking their part in building and directing our industries. You have all noticed, however, that this is a day of social service. Never before were so many men being called for to act for the people at large in the control of industry, and particularly transportation. The Interstate Commerce Commission has just advertised for a large number of engineers to assist in the pending federal valuation of railroads. Never did a situation more strikingly illustrate the need for men with practical training. If the proposed valuation is carefully and wisely made, it will do great good. As Mr. Thomas F. Woodlock said, in a most illuminating article in the New York Times Annalist of June 23d: "Practical confiscation—partial at least—of property actually invested in railroads will be quite possible by 'valuation' if the public is determined to do it, or if the 'valuers' are permitted to run riot among the technicalities." It is an occasion when practical men are needed, men capable of seeing facts as they are—and not with reference to any theories or past prejudices.

So men are being demanded for work with public service commissions, in colleges as

teachers, in University settlement and municipal health work, in city governments, and in all those capacities where men can serve their fellow creatures. This is one of the hopeful signs of our times. But this is a period of great unrest. Many strange economic and political theories are being preached. It is a time when our young men should see that things cannot be always as they should be, but that our duty is to make them as good as we can.

Railroad managers, for instance, would be delighted to equip every mile of road with automatic block signals, to make every car of all steel, to remove all grade crossings, and otherwise avail themselves of every device to insure safety. But this cannot be done without the necessary money. So in all things it is well to hitch our wagon to a star, but be sure that the connecting rope is long enough and elastic enough to let us keep the wheels on terra firma. We cannot go through life on an aeroplane.

The manager of every industry would be glad to allow his employes a short work day, and surround them with every comfort and luxury. But here again are limitations which must be regarded, and which it is of particular importance to have deeply embedded in the minds of the men you send out into the world to work and to direct the labor of other men. Amidst all the efforts for social betterment, and for adding to the general welfare of men, we are forced to realize the old fashioned doctrine that, in the long run, men can reap only as they sow. I leave with you, then, these lines of Kipling's:

"From forge and farm and mine and bench,  
Deck, altar, outpost lone—  
Mill, school, battalion, counter, trench,  
Rail, senate, sheepfield, throne—

"Creation's cry goes up on high  
From age to cheated age;  
Send us the men who do the work  
For which they draw the wage."