

His studies should also include engineering subjects in general, building in wood, brick, stone, &c., quarrying, road-making, railway construction, bridges, waterworks, drainage, docks, harbours, &c., giving particular attention to that subject which he may feel he has a special liking or aptitude for, and never losing opportunities of personal inspection of any such works in course of progress.

The above remarks, you will observe, bear more on the question of what should be learned than on the manner of providing the information.

The Rev. W. J. Habens,

Secretary, Royal Commission on Education.

I have, &c.,

JOHN BLACKETT,

M. Inst. C.E.

B.—MEMORANDUM BY MR. W. N. BLAIR ON THE EDUCATION OF CIVIL ENGINEERS IN NEW ZEALAND.

WITH reference to the general question of education for the profession of engineering, this is a subject on which there has been for many years a difference of opinion, and it has from time to time caused considerable discussion at Home. The difference of opinion arises from the fact that there is no prescribed training or qualification for admittance into the profession; any person can style himself "C.E.," and set up in practice as an engineer at a day's notice. The only recognized standard is the membership of the Institution of Civil Engineers; but this may, under certain circumstances, be obtained independently of a regular engineering pupilage, the qualification being practically five years in responsible charge of works. A lower grade of members of the Institution, called "associate members," was established about a year ago. A candidate for admission into this class must have been regularly educated as a civil engineer, and be actually engaged in the design or construction of engineering works as defined by the charter of the Institution.

Although this rule does not prescribe an engineering curriculum, it establishes the necessity for one, and in this way raises the standard of the preliminary training. At the same time, it does not preclude the admission into the Institution of engineers who have had no regular training; they will still be admitted as full members when they have by their works shown themselves to be worthy of the distinction.

Like medicine, seamanship, and many other professions, engineering is essentially one in which theory and practice must be combined. A student fresh from an engineering school or college in Europe would, in all probability, be quite incapable of laying-off a road or a railway through the rough New Zealand country; and, on the other hand, the most experienced practitioner cannot move a step without resorting to the theoretical principles he learnt in the earlier stages of his education.

In England the majority of engineers are trained in offices, an ordinary liberal education being all that is required beforehand. Occasionally the curriculum embraces a year or two in a machine-shop. On the Continent of Europe the whole of the education is usually obtained at a Government engineering school or college. The result of the two systems is, that the English engineer is, as a rule, well up in the practice of his profession, but weak in theoretical principles; and *vice versa* with his Continental *confrère*. As English engineering undoubtedly takes the higher place, it shows that, although admittedly defective in some points, our system of education is nearest the correct one.

There are about ten colleges and similar institutions in the United Kingdom where engineering is specially taught; some of them, notably the Irish Colleges, give diplomas in civil engineering. These diplomas are not, however, generally recognized in the profession as a proof of engineering qualification; they are simply accepted as evidence of a very good preliminary training—the method of applying the knowledge obtained at the colleges has yet to be acquired.

So far as the engineering instruction received in offices in New Zealand is concerned, I am of opinion that it is in most cases inadequate. Few of the private engineers have works of sufficient importance or variety on which pupils can gain experience; and the system now in operation in the Public Works Department is not a good one. Some years ago arrangements were made under which cadets were taken into the department. They passed the usual Civil Service examination, but no inquiry was made as to their aptitude for engineering studies. They were generally kept at the Head Office for a few months to learn drawing, and then sent to some local officer to be utilized as he might see fit during the remainder of the cadetship of four years. The defect of this system is that proper care is not taken in the selection of the cadets, and that no one is responsible for teaching them. The consequence is that, unless the youth has a special aptitude for the work, or unless his superior officer chooses, as a matter of grace, to teach him, he learns little of real practical value to him as an engineer. Under the circumstances just mentioned, some of the cadets have turned out remarkably well; but in other cases the result is not satisfactory. The question of taking engineering cadets into the Public Works Department is now being re-considered, with the view of remedying the defects above alluded to.

With reference to the desirability of instituting a chair of engineering, I am clearly of opinion that no such chair is at present required in New Zealand. There might ultimately be room for a lecturer on engineering at one of the colleges; but I see no necessity for the full chair, unless the constitution of the colleges is very much modified. At present provision is made for three chairs bearing on the subject—viz., (1) mathematics and mathematical physics, (2) chemistry and experimental physics, and (3) natural science. As already stated, no university can turn out a ready-made engineer, and the subjects just enumerated comprise nearly all the theoretical training required from a university. Indeed, most engineers start in life with a much less store of the knowledge they require than is already obtainable in New Zealand. Of course the necessary theoretical instruction embraces many subjects not included in the above curriculum; but these are generally of an elementary character—consequently they ought to be taught at some institution of less standing than a university. They consist principally of drawing, mensuration, the elements of surveying and levelling, and the use of instruments.

Assuming that a professor or lecturer in engineering science was appointed, the principal subjects he would have to teach are—properties of materials in relation to their use in engineering works, requirements of structures, and construction generally, including applied mechanics. For the most