HELP FROM THE ACCREDITATION PROCESS

by

Andrew Baracos
Head, Department of Geological Engineering
University of Manitoba
Winnipeg, Manitoba, Canada. R3T 2N2

ABSTRACT

A case history is presented of a Geological Engineering Program, and an entire Faculty of Engineering facing possible loss of accreditation. The accreditation review process recognized curriculum and administrative deficiencies in the program, and serious underfunding of the Faculty. Correction of the curriculum was made possible by incorporating nationally-established guidelines for design and synthesis, engineering science, basic science, mathematics and the humanities. A Department of Geological Engineering was established to assure scrutiny of the Program by the Faculty of Engineering. Unprecedented action by the Dean in publicizing the problem of serious underfunding, and the strong support from industry, and practicing engineers, resulted in direct government support to the Faculty through an Industrial Development Grant.

INTRODUCTION

The purpose of this paper is to present an example of how an Engineering program has received help from the accreditation process. Geological Engineering has been offered at the University of Manitoba for almost 40 years except for an interruption caused by World War II. Loss of accreditation of the program nearly resulted when two successive accreditation board visits, five years apart, found serious deficiencies in curriculum, and inadequate control and scrutiny of the program by the Faculty of Engineering. The accreditation board also found that the entire Faculty of Engineering was inadequately funded. The review process, however, not only revealed weakness, but made suggestions for improvement. In the case of Geological Engineering, it helped define on a national basis, what constitutes a Geological Engineer, and what courses should be included in a curriculum.

When the possibility of loss accreditation was made public, it brought forward the friends of the Faculty. The combined appeal of professional engineers, industrial management, the Faculty, including teaching staff and students, and University administration, resulted in an Industrial Development Grant from the Province of Manitoba Government directly to the Faculty. The improved finances, and the changes in curriculum and administration, have markedly improved the program, and offer the prospect of continued accreditation.

GEOLOGICAL ENGINEERING OF THE UNIVERSITY OF MANITOBA

The Geological Engineering program at the University of Manitoba had its first two graduates in 1942. It was established at the request of the mining industry in Manitoba as an interdisciplinary program involving Civil Engineering and Geology, with the Faculty of Engineering granting a B.Sc. degree. At that time, engineering students took the equivalent of High School Grade XII at University, and then four years of engineering. Classes were small. The entire graduating class in 1942 numbered only 30 students of which 15 were Civils, 13 Electricals, and the 2 in Geological Engineering.

During the war years, interest in geological engineering appeared to have lapsed and it was not until 1948 when students again registered for the program. Curriculum used to be established by a committee of staff from the Civil Engineering and Geology Departments, with a chairman traditionally from Geology. The curriculum primarily followed the examples of curricula used elsewhere. Student enrolment, until recently, continued relatively small, averaging about 9 to 12 students per year.

The intervening years saw many changes. By 1950, students were required to complete Grade XII before University entrance. The Faculty of Engineering enrollment grew, with First Year alone averaging about 400 students. In 1948, the Faculty expanded to include Mechanical Engineering. Agricultural Engineering was introduced in 1968, as a Department under the Faculty of Agriculture, but with curriculum control under the Faculty of Engineering. The Department of Geology became the Department of Earth Sciences. Many of the staff members originally interested in the Geological Engineering program reached retirement age. New academic staff in Engineering and Earth Sciences were more specialized. They operated in different buildings, and often with very little opportunity for meeting each other. This was the stage as set for the first accreditation visit in 1973.

ACCREDITATION IN CANADA

Since 1965, accreditation of Canadian engineering curricula has been undertaken by the Canadian Accreditation Board (CAB), a standing committee of the Canadian Council of Professional Engineers (CCPE). The constituent members of the CCPE are the Provincial Associations in each of the provinces and territories. The Associations are established under provincial acts, but are self-governing with Councils elected from and by the Association members. The Associations are responsible for the registration to practice (license) of professional engineers in their respective province or territory. The stated main objective of the CAB is to promote in cooperation with the constituent members of CCPE, uniformity of accreditation of educational qualifications for registration in the provinces and territories to the greatest degree practicable. In addition, the Board has the compatible objective of fostering a high standard of engineering education in Canada.

The CAB has formulated well-defined but reasonably flexible criteria for the accreditation of engineering programs leading to a Bachelors Degree. The criteria are designed to ensure curricula will produce engineers capable of meeting present and future professional registration standards in Canada.

Accreditation is normally undertaken by the CAB at the request of a particular educational institution, and with the consent of the Professional Association of the province in which the institution is located. It is undertaken by a visiting team consisting predominantly of senior academics of high standing in the profession. Also included, where possible, are well-qualified members selected from industry or government agencies. The team members are selected on the basis of breadth of outlook, and capacity to over-all assess modern curricula. A manual of evaluation procedure is issued by the CAB (1980 most recent), to guide the visiting team and the institution being accredited.

While each Provincial Association has its own academic, experience, and residence requirements for registration to practice, graduates of an accredited program anywhere in Canada are considered to meet the academic requirements of all the provinces. Graduates of non-accredited programs are required to write a series of examinations to establish academic qualification. There is thus considerable benefit to graduates from accredited programs, and this in turn adds to the prestige of schools offering accredited programs. Conversely, a lack or loss of accreditation does damage the reputation of a program. There is also a matter of pride in having an accredited program.

CAB REPORT ON PROGRAMS

The accreditation of any specific program, e.g. Civil, Electrical or Geological Engineerng, entails a report based on the visit by the accreditation team, which rates the following points: the faculty, administration, facilities and method of instruction, curriculum, and graduates of the program. The ratings with accompanying detailed comment constitute an outside independent appraisal of a program. They can be specially helpful in detecting deficiencies in a program, and in providing suggestions for improvement. It should be noted that the

accreditation report is a confidential document between the CAB and the Engineering Faculty concerned. The Dean of Engineering has, however, the right to make the document public, if he so wishes. The remainder of this paper deals with how the CAB reports have been used to help the Geological Engineering program at the University of Manitoba.

THE FIRST ACCREDITATION VISIT

The first accreditation visit to the University of Manitoba took place in 1973, at a time when the CAB had not fully resolved a policy on programs in departments not entirely under faculties of engineering. The accreditation of the Geological Engineering program was held in abeyance pending studies by the CAB on a national basis of Geological Engineering curricula. The CAB, at that time, had determined a wide divergence of engineering content in Geological Engineering curricula across Canada, and in the involvement of professional engineering academic personnel in the administration of programs. The CAB wished to give these matters further study with a view to possibly initiating more uniformity, compared to programs in other engineering areas. The degree in Geological Engineering from the University of Manitoba was, however, accepted as meeting the educational requirements for registration by all examining boards of the provincial and territorial Associations while accreditation was held in abeyance.

The accreditation team did voice concern in 1973 regarding a number of points. It felt that the administration of the program by an interdepartmental committee simply did not permit enough attention to such matters as curriculum, staffing and planning. It noted with surprise that the interdepartmental committee had met only once in about two years. It noted that the main interests of Earth Sciences staff involved with Geological Engineering were in the fields of Precambrian geology, advanced structural geology, geophysics and geochemistry -- rather than in surficial geology and the terrain sciences, which are fields attractive to most practicing geological engineers. Mining geology and mineral exploration, however, were considered to be well represented. Additional contact with geohydrology, environmental geology, terrain science, and rock mechanics was suggested, in order to increase the engineering components of the program. Similarly, greater utilization of Civil Engineering courses in the curriculum was considered a possible means of increasing synthesis and design.

By 1975, the CAB had initiated investigation of, and had partly resolved the question of programs not entirely under a Faculty of Engineering. It had on a temporary basis defined the components of Basic Mathematics, Basic Natural Sciences, Social Sciences, Humanities and Administrative Studies (SSH); Engineering Sciences, and Design and Synthesis, that should be included in a program. It was then agreed that accreditation of the University of Manitoba Geological Engineering program be extended to June 30, 1977, with a report on corrective measures taken to be received by the CAB by June 30, 1976. The severity of this criticism can be judged from the fact that the Civil, Electrical and Mechanical Engineering Departments at the University of Manitoba, which were also visited by accreditation teams, received unconditional accreditation up to 1978.

PREPARATION FOR THE SECOND ACCREDITATION REVIEW

Three basic deficiencies existed in the Geological Engineering program according to the CAB. Immediate corrective measures were necessary in order that the program would achieve at least minimum requirements. The deficiences were:

1) While the degree was granted by the Faculty of Engineering, there appeared to be inadequate participation by the Faculty of Engineering in the administration and control of the curriculum.

2) The curriculum analysis pointed out a low content in synthesis and design. The temporary minimum requirement of 37.5% (later raised to 50%) for engineering sciences and synthesis and design was met by considering the spring field courses as being entirely synthesis and design and giving them a relatively high rating. The visiting team members recommended that there should be at least one additional course in each of third and fourth years that would be oriented primarily to the area of synthesis and design.

3) The humanities and social sciences content of the curriculum was highly deficient since it was less than 4% of the program and included only two electives in the third year.

The 1973 Accreditation found other deficiencies in the Engineering Faculty as a whole. A required course in Engineering Economics was lacking in all of the Engineering curricula at the University of Manitoba. The most serious deficiency was, however, that "there is a clear consensus that the quality of the degree programs assumed have been seriously weakened by lack of adequate financial support, both directly and indirectly in recent years".

A start on corrective measures was undertaken in 1974. It was not too difficult to provide more engineering in the curriculum. Applicable Civil Engineering courses, such as Foundation Engineering, Earth Structures, Applied Hydraulics, Water Supply and Distribution, Water Resources Development were introduced either as core courses, or as electives in fourth year. The number of humanities courses was increased to three one-term courses. The committee responsible for the program was strengthened in 1977 by including two members appointed from both the Civil Engineering and Earth Sciences Departments, student representatives from each of second, third and fourth year, and most importantly, one professional geological engineer from industry. In order to provide scrutiny of curriculum proposals, student examination results, and recommendations for degrees, the Geological Engineering committee was to report through the Civil Engineering Departmental Council to the Faculty Council of Engineering. These measures proved sufficient to maintain accreditation until 1978, but in essence they were only interim measures. The criticism of the first accreditation visit had not been fully met. This became most evident when, during 1977, the second accreditation visit took place in anticipation of accreditation renewal in 1978.

THE SECOND ACCREDITATION VISIT

This visit took place in 1977 at a time when, as previously mentioned further administrative and curriculum changes were underway for the Geological Engineering program. The second accreditation team saw that the three areas of deficiency noted in 1973 would continue until proposals being prepared were put into effect. For this reason the accreditation of Geological Engineering was extended for only one year. It was requested that a report be submitted in 1978 to the CAB detailing the corrective measures taken.

The second accreditation visit also noted that no funds had been specifically allocated to Geological Engineering and suggested that the budget should provide such funds. The major CAB criticism however, was that the entire Faculty of Engineering was under-funded and that accreditation of the Faculty would be extended only for four years, instead of the normal five years. Needless to say, the report of the second CAB visit was received with much gloom, although it did provide time for corrective measures to be taken. These included measures specifically for Geological Engineering, and also unprecedented action by the Dean of Engineering to make public the CAB criticism of the Faculty.

1977 PROPOSALS FOR GEOLOGICAL ENGINEERING

To overcome the CAB criticism, proposals were made in 1977 by the Geological Engineering Committee to the University Senate after approval by Faculty Council. These proposals, and their acceptance by the University, resulted in the following:

1) The Department of Geological Engineering was established in 1978, as a constituent department of the Faculty of Engineering. This placed matters of curriculum, academic scrutiny of program, student progress and allocation of Faculty resources, directly under the Faculty of Engineering.

2) The position of Department Head of Geological Engineering was established. The writer was appointed Department Head on October 1, 1978, following regular search committee procedrures outlined by University policy. The appointment was for a normal term of five years.

3) The Departmental council of Geological Engineering was established to report through the Head to the Dean of Engineering. The Department's academic staff membership was to be by cross-appointments between the Civil and Geological Engineering departments. New appointments would be made directly into the Geological Engineering Department. The Department Council was to meet periodically to consider matters of curriculum, equipment, graduate studies, etc., and the appointment of sub-committees.

4) The Department was given a small budget of its own to cover the Head's salary, a half-time secretary, office supplies and small equipment purchases. Effective April 1, 1979, an operating baseline of $20,000. was established to acquire part-time instructors for new courses. (The University was however unable, as recommended by the Dean of Engineering, to divert sufficient funds to the new Department to provide for a full-time instructional position for new courses).

5) The Department was given office space for the Head and secretary, and about 100 square metres of classroom/laboratory space to serve as a "home" for staff and students.

6) The curriculum of Geological Engineering underwent major changes. The 1978-1979 calendar listing incorporated the changes made to meet the CAB requirement for engineering science, and design and synthesis. Additional changes approved by Senate for 1979-1980 and 1980-1981 included a required course in Engineering Economics, and raising the total of Social Sciences, Humanities and Administrative Studies to a total of five courses, or to 12.5% of the total curriculum. Geohydrology was introduced as a fourth year technical elective during the 1978-1979 term, and as a required course in 1979-1980. Rock Mechanics was introduced as a required course during 1980-1981.

Implementation of the above changes resulted in the accreditation of Geological Engineering being extended to 1982, the same as for the other University of Manitoba Engineering programs. It should be noted that the changes were guided by the report prepared for the CAB by Blais, R.A., Ham, J.M., Smith, J.D., Moore, A.D.,(1978), which specifically provided accreditation criteria for Geological Engineering and Engineering Physics. In addition, the report recommended that all engineering curricula were to have the same minimum requirements for basic mathematics, basic sciences, HSS, engineering sciences and design and synthesis. These requirements are shown in Figure 1, as reproduced from the CAB (1980) annual report. The Blais, Ham, Smith and Moore report was particularly helpful in identifying the synthesis and design components that exist in such subjects as applied geophysics, or structural geology.

ACTION BY THE DEAN

Following receipt of the report, Dr. Martin Wedepohl, the then Dean of Engineering, informed the President of the University regarding the findings of the 1977 accreditation visit. The Engineering Department Heads prepared budgets for a 5-year plan to rectify the short comings in academic staff, course offerings, technican and support staff, and supplies., Convincing arguments for more funds for Engineering were made to the President, but because no increase in funds appeared forthcoming to the University from the Government of Manitoba through the University Grants Commission, the President could only promise to transfer funds to Engineering as quickly as funds could be diverted from other programs. This fell much short of what was necessary. Dean Wedepohl, who had only joined the University in 1974, then submitted his resignation.

The University Administration was brought under much pressure by meetings of Faculty, students, and members of the Association of Professional Engineers of Manitoba. Much could be written of the events that transpired. However, it suffices to say that it brought together the friends of the Faculty of Engineering. An Industry-University Liaison Committee was established with representation from engineering consultants, and key industrial management. With support from the president and administration of the University, the Liaison Committee, the Association of Professional Engineers, and the new Dean of Engineering, Dr. E. Kuffel, an appeal was made to the Manitoba Government. The role of the Faculty of Engineering in developing industry in Manitoba was stressed. Attention was drawn to such areas as industrial and computer engineering, and enhanced Geological Engineering which could substantially aid the industrial development of Manitoba. The result was a $2.1 million Industrial Development Grant to the Faculty, spread over a period of three years ending in 1983. The benefit of this grant can be realized when comparison is made to the operating budget of the Faculty, which for the fiscal year 1980-1981 amounted to $3,106,492. The grant has given an opportunity for internal re-direction of funds to take place in the University Budget portion of the Faculty's income. The success in obtaining the grant has renewed confidence that similar funds can be obtained after 1983.

CONCLUSIONS

The accreditation process has helped at the University of Manitoba, by making Geological Engineering academically acceptable for Professional registration across Canada. Most helpful has been the independent appraisal by an agency outside the University having national recognition. The studied opinion, including criticisms and recommendations of such a body as the CAB carries much weight in the eyes of the public, University Administration and Governments. A public-airing of underfunding of programs at a state University is a painful experience. However, it can with well-documented arguments, lead to additional support from Government.

The up-dating and improvement of an engineering program is much helped by first defining what is expected of an engineer in any particular field. This is particularly true in less familiar fields such as Geological Engineering.

The future for Geological Engineering in Canada looks bright indeed. In a recent Geological Surveys of Canada report by Neale, E.R.W. and Armstrong, J.E., (1981), increased demand has been predicted for graduates in key sectors of the economy, particularly in those fields related to petroleum, mining and resource development. There are now more employment opportunities than there are graduates. Enrolment has climbed. Student numbers for the 1981-1982 academic year have reached 27, 22 and 18, respectively in second, third and fourth years of Geological Engineering at the University of Manitoba. Accreditation has "paid off".

REFERENCES

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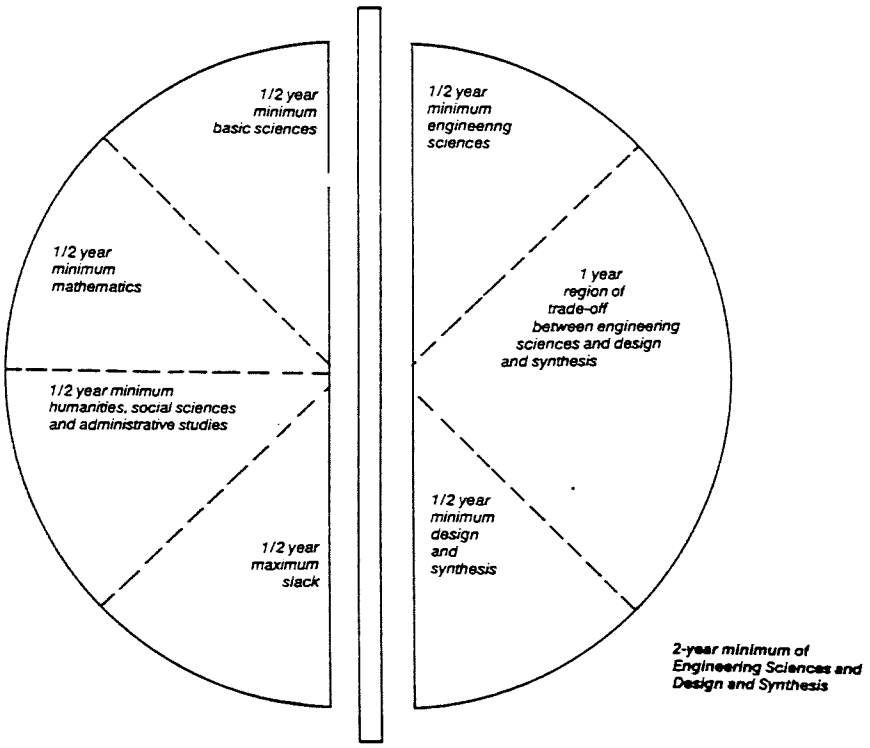

FIGURE 1 INTERPRETATION OF CAB CRITERIA
(From CAB Annual Report June 3, 1980)