A Concrete Problem Solved

The sudden collapse of certain types of pre-stressed concrete structures under continued heavy load has been explained by a Monash civil engineering research team. The type of failure involved was probably responsible for the unexpected collapse of a number of high-rise buildings, with consequent loss of life, during the Alaskan earthquake of 1964.

Following their discovery that a sudden drop in load capacity occurs in these structures at the so-called flexural cracking stage if insufficient force is used in pre-stressing, Dr. G. I. N. Rozvany, Professor N. W. Murray, and Ph.D. student D. W. S. Ho began a study of the relation of pre-stressing force to the subsequent deflection behaviour of beams of various shapes. Their results allow the minimum pre-stressing forces required to stabilize the deflection behaviour of such concrete structures under loads approaching the yield point to be calculated.

Testing experimental pre-stressed concrete beams. Load and deflection values were measured electronically and fed to an automatic plotter.

If the average pre-stressing force is smaller than the tensile strength of a particular beam, then a large increase in deflection occurs if the load is maintained after the first crack appears. This behaviour is undesirable and does not comply with international recommendations, which require stable “continuous” deflection up to the point of ultimate capacity, in order to cope with possible earthquake loads.

The Monash research revealed a relation between the pre-stressed loading of unbonded concrete structures and their

The failure of unbonded pre-stressed concrete beams was probably responsible for the unexpected collapse of this multi-story building during the 1964 Alaskan earthquake.
deflection under progressive loading. If only a small pre-stressing force was used, the deflection increased sharply when flexural cracking began. At intermediate levels the sudden increase in deflection was less. When the pre-stressing force was above a critical level, deflection rose continuously (but at a declining rate) as the loading on the experimental beam was increased.

In the case of non-rectangular sections, the critical pre-stress force is often as high as twice the tensile strength of the beam. There is some loss of pre-stress as the concrete contracts during setting and later creeps under load; this must be allowed for in calculating the critical pre-setting force required.

Mr. Ho developed computer programmes for evaluating the critical pre-stress values for variously shaped beams; the results are presented in graphical form in the Monash University Civil Engineering Report No. 5/1970 “Flexural Instability of Unbonded Pre-stressed Structures”.

An important conclusion was that ways and means should be found to use non-professionals, particularly local people, at the operational welfare level, not only in that particular town but in any community similarly stratified in class structure. The researchers comment that social workers are currently most alert to divergences due to ethnic and religious groupings, and that differences in outlook and aspirations between social and economic classes are less commonly taken into account in welfare planning.

Scale and Productivity

Economic analysts may have overlooked the contribution to productivity made by a steadily increasing scale of production in the Australian manufacturing industry.

The results of a recent study by Mr. Tran Van Hoa of the Monash Department of Economics suggest that the economies of scale were just as likely to have been responsible for the increases in productivity observed over the years as were the more commonly accepted factors, such as advances in technology, increasing managerial skills, or beneficial changes in capital and labour inputs.

Unfortunately, the data concerning rising productivity are limited and several different interpretations of the historical record are possible. Some economists have concluded that improved technology was an important factor during the post-war years, while others have attributed the changes in productivity to varying inputs of labour and capital, with technical progress playing only a minor role.

Most previous analyses have been based on assumptions that the scale of manufacture has, on the average, had no effect on the productivity of labour and capital. But Mr. Tran Van Hoa decided to see what happens when the rules of the game are changed. He produced a model that allowed for the possibility that scale of production alone would account for the increases in productivity.

The various factors involved in labour productivity then changed their effect quite dramatically. It seemed that over a 52-year period (1908-1960) manufacturers had benefited from markets that were not completely competitive. Furthermore, there was evidence of increasing returns with an increasing scale of production, particularly during the first quarter of the century.

These results throw doubt on some previous theories, and suggest that conclusions concerning the sources of change in labour productivity are unrealistic when based on assumptions that the markets confronting Australian manufacturing industry provide pure competition and are unaffected by scale.

Identification of the source or sources of such changes is important, not only for future investment planning but also for wage fixation and income distribution. Unfortunately, it is not yet possible to make definitive statements about them. Much more quantitative research is required if we are to pass from evaluation of alternative hypotheses to firm conclusions.

Current statistics collected by official agencies are not sufficiently detailed for the analyses required. Unfortunately, Australian industry has not yet backed substantial effort required to obtain the necessary figures at the company level.

Sociologists Study a Suburb

Conflicts between the aims of some professional welfare workers and the social values and the needs expressed by certain sections of the community became evident during a study by Monash sociologists of a new working-class suburb on the fringe of Melbourne.

The 15-year-old town is about 8 miles from the university. It now has a population of about 15,000 people, about half of whom are of migrant origin; two-thirds (10,000) of them are under 20 years of age.

Mrs. Lois Bryson and Mrs. Faith Thompson, of the Department of Anthropology and Sociology, based their investigation of the primarily working class community on four interlocking projects. These were a household survey, a group study, a welfare study, and a study of leadership.

The substantial efforts of welfare workers, teachers, ministers of religion, and other professional groups in the community to improve the lot of their less-privileged neighbours had met with only qualified success. The Monash sociologists concluded that this was due in part to conflicts between the aspirations of the majority of the people and those ascribed to them by middle class professional welfare workers.

The students’ choice of optional questions in an examination can make a difference of up to 10% in the total marks they obtain, according to an analysis of more than 20,000 examination papers made in the Monash Faculty of Education by Mr. L. D. Mackay.

The results of one first-year university examination and of five Victorian senior school examinations containing option questions were studied in considerable detail. The freedom of choice ranged from 3 out of 13 to 3 out of 5 questions. The differences between the average marks calculated for the least difficult and those for the most difficult combinations of questions, for candidates of equal ability, ranged from 3.3% to 10.2% of possible marks for the six examinations.

The analysis revealed that superior students tended to pick the easier and more rewarding questions, presumably because of a better knowledge of their subjects. The total marks for optional questions could be adjusted for the resulting bias. This was done by weighting them according to the relative capacities of the candidates, as revealed by their marks for compulsory questions on the same paper.

Mr. Mackay also found that the examiners did not mark the optional questions consistently to a common standard. He demonstrated this effect by studying
the marks allotted in three of the examinations by the many examiners involved, each of whom marked a proportion of the answers to every question. The maximum differences due to this bias observed between the marks of candidates of “equal ability” were considerable. The analysis revealed differences both between standards of assessment of different optional questions by an individual marker and between markers in their evaluation of answers to the same question. The maximum cumulative biases due to these two effects were 13.0%, 14.1% and 29.9% of possible marks in the three examinations analysed.

Thus, in the papers studied by Mr. Mackay, students of equal ability who answered different questions and had their answers marked by different examiners could have obtained average marks differing by as much as 30% of the possible total marks for optional questions. The results indicate several difficulties associated with that type of examination paper, which together may well outweigh the advantage of greater freedom of teaching and expression within specified course curricula claimed for the optional method.

Educational researchers at Monash are investigating many aspects of present examination methods, including their efficiency as a measure of likely university performance. Although some educators are seeking better alternatives, such as assessment by teachers or the substitution of tests that measure scholastic aptitude, others consider that the existing examination could be improved in efficiency to a stage where, possibly in combination with other types of information, it would provide a reliable and effective measure of achievement and potential success.

In addition to probing examination methods and marking of papers Mr. Mackay is also studying the consistency of examination results with predictions made by teachers, based on classroom performance. In a study of one Victorian matriculation subject he found that many, but not all, teachers were able to predict the ranking order of their students in the matriculation examination with greater consistency than different examiners could mark the same examination papers. When marks allotted by two examiners to the same examination paper were averaged, then the student rankings were similar to teacher assessments based on all-year class performance.

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Ecology For Technologists

A series of seminars on conservation and ecology designed specially for science and engineering students will be given in the Monash Department of Zoology next year. The subject will cover all aspects of the natural environment is despoiled as the exploding human population struggles for its share of the Earth's resources.
the environment, including management techniques for the prevention of degradation and pollution.

It will give technologists a working knowledge of environmental factors, serve as a guide to permissible standards of pollution, and provide background for decision-making and for the design of facilities and equipment. When graduates ultimately enter their chosen field of specialization in industry or government, they should be aware of the relevance of their activities to the total environment, and will know where to turn for advice.

The subject will take the form of a series of about 130 seminars and group projects. Students will be free to choose whichever sections they consider most relevant to their interests. The method of examination proposed is by thesis, with freedom to treat a given topic from individual viewpoints. An economist may consider economic aspects of his subject, while engineers and biologists would tackle it from their respective backgrounds.

Some 40 lecturers with specialist knowledge—from various departments of Monash, Melbourne and La Trobe universities, government bodies, and a range of industries—will give the seminars. The 14 main topics they will cover range from general subjects such as the atmosphere and the fresh-water environment to specific problems such as pesticides and the fresh-water environment to specific problems such as pesticides and poisons, public health, noise, and legal and economic aspects of pollution control and resource management.

A shorter, undergraduate course on conservation and applied ecology has been given to zoology students since 1967. In 1970, they were joined by 35 fourth-year civil engineering students. At its conclusion several expressed the view that such a subject is an essential element in the training of engineers for the modern, environment-conscious world.

Other Monash Departments are concerned with specialized aspects of the total environmental problem. For example, the Department of Mechanical Engineering is studying noise abatement and the movement of industrial effluents discharged into Westernport Bay, and the Department of Chemical Engineering has developed a process for treating one type of industrial effluent more efficiently.

Many undergraduates are concerned at the increasing threat to our environment. A group of Monash students recently organized a "Forum on Pollution", which was attended by more than 1,000 people. The students also organized an information centre to cope with the flood of queries from schools and other sections of the community on aspects of pollution.

Law And Credit
In Asia

Legal problems affecting the supply of development finance in a number of Asian and Pacific countries are the subject of an extensive international research project involving Australia, Ceylon, Indonesia, Japan, Korea, Malaysia, the Philippines, Singapore, Thailand, and the Republic of China. In each country, distinguished lawyers familiar with the problems of development finance are studying and reporting on the national situation.

An Australian committee, comprising Professor David E. Allan of the Monash Faculty of Law, Miss Mary Hiscock of the University of Melbourne, and Professor Derek Roebuck of the University of Tasmania, is charged with co-ordinating the project and with editing the ten independent national reports. These are expected to be published as separate volumes about the middle of 1971.

The legal system in each country will be described as it affects development projects and financing. Existing laws relating to the supply and securiing of credit will then be discussed and evaluated. Finally, each report will describe four or five typical development projects and show how financial and associated legal difficulties were overcome.

The 11th and final volume in the series is being written by the Australian committee. It will review on a comparative basis the problems of credit and security for development in the region, and will set out the conclusions that can be drawn from the national studies. Finally, it will make recommendations aimed at improving both the law and its practice. The work should help people involved in development finance, whether as lenders or borrowers, in the participating countries, and should be useful to governments and their legal advisers.

Although the immediate, practical objective of the project is to identify legal constraints on the supply of credit, it is hoped that the project will give deeper insight into problems of development financing and provide a basis for law reform.

The editors believe that the solutions must grow out of experience and be related to the culture and economy of each country. They hope to present a sample of typical solutions that may assist the process of law reform in individual countries, as they are unable to recommend model solutions applicable to the variety of national circumstances.

Nevertheless, the editors believe that law reform is not the complete answer. Legislation may improve the law, but no system can be better than the people charged with its operation. Thus law reform must be accompanied by education and training programmes.

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