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General

Cover picture

Napier after the Hawke's Bay earthquake of 3 February 1931. The means of dealing with such emergencies are discussed in the paper on p. 266.

NEW ZEALAND
Engineering

THE JOURNAL OF THE N.Z. INSTITUTION OF ENGINEERS* VOL. 33, No. 12, 15 DECEMBER 1978

A *Christmas message* *from* the *President*

BEHIND the facade of commercialism which has come to surround it, Christmas is the commemoration of a simple event in the lives of very ordinary people two thousand years ago — the birth of a baby in the humblest of circumstances. Despite the apparent simplicity of the event, its consequences have been profound.

As the festival returns each year it means more to some than to others, but to all it is an opportunity for rest and relaxation, for family reunions, for renewal of old friendships in the exchange of greetings, for giving, and for reflection.

As we privately recount our personal successes and failures, in the year which has gone, so also should we spare a moment to ponder on the fortunes of the profession to which we belong, and the professional institution of which we are members. Has our profession gained in stature in the eyes of the community, and to what extent have we, as individuals, contributed to the standing of the profession and the success of the Institution?

As an Institution we have been exceedingly fortunate in the enthusiasm and dedication of those who have served it on Council and committees, branches, divisions, and technical groups, supported at all times by a loyal and conscientious secretariat. I think we can fairly claim progress in a number of directions in the year which has just passed.

By regular calls on Ministers of the Crown we have established the identity of our Institution in the highest political circles, and our views are welcomed and respected. We have shown ourselves to be forward-looking by the establishment of a committee for the future. We have addressed ourselves to the salutary task of identifying our objectives and setting priorities.

In recognition of the pace of technological change, we have taken positive steps to provide our members with opportunities to participate in structured continuing education. A long hard look is being taken at the relevance in the modern scene of our 50-year-old Registration Act.

In the field of publications, surely one of the most significant activities of a learned society, a high standard has been maintained. An important step taken recently, in the cause of better internal communication, is the inauguration of the newsletter, in which we hope to provide a regular supply of bright and topical items of interest. The success of this venture will depend very much on the willingness of members themselves to provide a continuous flow of suitable material.

The welfare activity of the Institution has, during the past year, been given greater status, with more direct access to Council.

Finally, a concerted drive has been launched to bring students or graduates into the Institution at an earlier stage in their careers, to bring in older engineers who for some reason have never joined, and to win back others who, for whatever reason, have relinquished their membership. This membership drive will rely heavily on the support of branch members who are prepared to make the necessary personal approaches to potential recruits. The higher the percentage membership we can achieve, the stronger our claim that the Institution is truly representative of the whole engineering profession in New Zealand.

I have said enough, I hope, to demonstrate beyond all doubt that the Institution is alive and well. Its continued health will depend upon the support it receives from each and every one of us.

In conclusion, the Council and staff of the Institution join me in wishing you and your loved ones a joyous Christmas, and a happy and prosperous New Year in 1979.

PHIL. BLAKELEY
President

* Unless specifically indicated, statements or opinions in *New Zealand Engineering* do not necessarily reflect the views of the Institution or the publishers. Correspondence on material published is welcomed.

Civil defence

MAJOR-GENERAL R. H. F. HOLLOWAY *
C.B., C.B.E.

In New Zealand the term civil defence is used to describe the measures necessary for public safety in the face of threats to life from natural hazards and man-made accidents where disasters from these causes require something more than the routine operations of the police, fire service and other emergency services. When it was introduced, the Civil Defence Act 1962 was seen by many authorities overseas as a novel approach to disaster management and this is still largely so today. The Act has been amended substantially on several occasions but the basic concept is unchanged. It would have to be admitted, however, that the concept has not, in the sixteen years of its existence, been proved in a major disaster. Undoubtedly, the architects of the 1962 legislation had in mind something of the dimensions of the 1931 Hawke's Bay earthquake but mercifully a disaster on that scale has not recurred.

1. INTRODUCTION

CIVIL defence emergencies are declared on average three or four times a year but usually the disasters are localised and of short duration. Regrettably, many people have come to see civil defence only at this level and decline to contemplate the consequences in terms of planning, resources and organisation needed for dealing with a major disaster.

2. THE THREAT OF MAJOR DISASTER

The potential for major disasters arising out of natural hazards of various kinds does not diminish even though New Zealand has for some time been very largely spared the destruction and loss of life that regularly stem from earthquakes and other natural causes elsewhere in the world. Probably the most difficult threat against which to provide defences is the destructive earthquake without warning. Most other causes of disaster either have some degree of warning or are relatively localised in their effects and thus are inherently more "manageable".

About 1 000 earthquakes of Richter magnitude 4 or greater occur each year in New Zealand and every decade an earthquake of magnitude 7 or greater occurs. In some circles it is argued that the possibility of a major earthquake is increasing significantly on the thesis that accumulating stress in the main seismic region of New Zealand must be released before long. Some regions are, by historical record, more prone to earthquakes than others but seismologists would not exclude any area in New Zealand as a possible site of a major earthquake.

3. THE 1931 EARTHQUAKE

In assessing civil defence today it is very necessary to have a perspective of the major disaster that could occur. The 1931 Hawke's Bay earthquake is such an illustration (see Fig. 1 and cover).

The initial shock occurred in late morning of Tuesday, 3 February 1931. The epicentre was close to Napier and Hastings but caused substantial damage and destruction from Gisborne in the north to Waipukurau in the south. Nearly one in every hundred of the 26 875 comprising the combined population of Napier and Hastings died and uncounted others were injured. Official accounts of the disaster in Napier tend to conceal the full horror of the situation, particularly in the first twenty-four hours, and the massive task faced by those trying to help with all communications disrupted and the disaster area very nearly isolated from all outside help. Many of the disaster victims were killed by the internal collapse of buildings; others when the second earthquake shock collapsed buildings, verandahs or parapets on them as they reached the street. Worse still, many that were trapped in the debris met their death in the fire which in Napier broke out within three minutes of the first earthquake shock and eventually gutted much of the centre of the town.

It was not until the following morning that some organised relief work began in Napier. An official account refers to a meeting of citizens at the police station at 7.30 a.m. on 4 February to set up an emergency committee which in turn set up subcommittees to deal with sanitation and water supply, construction, demolition and safety of buildings, food distribution, shelter, communications, hospitals, transport and traffic control. Later an accommodation and evacuation committee was established to evacuate women and children from Napier because of the risk of disease. One cannot help but be struck by the sturdy self-reliance of the people who picked themselves out of the ruins and set about dealing with the situation, or by the spontaneous and immediate help generously given by people in the surrounding districts. Nevertheless, seen in hindsight, a terrible penalty was exacted for the lack of pre-disaster planning and organisation.

If an earthquake of the same magnitude were to be centred today near a community the size of Napier and Hastings at that time, it is difficult to gauge the consequences for the people of the area. Improvements in building design and standards, together with the

Fig. 1: Napier — 3 February 1931.

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* Director of Civil Defence, Wellington.
This paper was received for publication on 1 September 1978.

powers given to local authorities to require demolition or strengthening of buildings considered to be earthquake risks, would undoubtedly mean that there would be fewer immediate casualties.

On the other hand, the 1931 earthquake occurred in the middle of a dry summer and fortuitously the crew of H.M.S. *Veronica* was immediately available for rescue work. In other seasons and places, the weather and isolation from outside assistance might have had a significant effect on the survival of casualties. People today, perhaps, are more aware of the earthquake risk and hopefully know some of the basic precautions to take when an earthquake strikes. The most significant change would be the civil defence control and co-ordination of disaster relief which could be instituted in that vital first twenty-four hour period.

4. THE CIVIL DEFENCE CONCEPT

Every local authority is required by law to maintain, or unite with neighbours in maintaining, a workable civil defence plan and an organisation of volunteers to deal with disasters in its own district. A local authority has the power to declare a state of local civil defence emergency and by doing so automatically assumes the right to exercise certain arbitrary powers to deal with the situation and to co-ordinate the operations of the police and the other normal emergency services in its district. Where a disaster is beyond local resources it is the responsibility of the Ministry of Civil Defence to co-ordinate and control external aid from government and any other available sources.

Local authority districts are grouped into one of three civil defence regions, each the responsibility of a Ministry of Civil Defence commissioner. The director and regional commissioners of civil defence exercise their responsibilities during a state of emergency from operational headquarters established in the sub-basement of the Beehive in Wellington in the case of the national headquarters and from regional headquarters in Auckland, Palmerston North and Christchurch.

Civil Defence is seen to require the expertise if not the active participation in disaster relief of twelve other government departments in planning and in operations. At national level the permanent heads of these departments form the principal advisory group to the Director and Minister of Civil Defence as the National Civil Defence Committee. Most departments are represented on the three regional civil defence committees set up to advise the commissioners on the planning, co-ordination and use of government resources in disaster relief.

Central to the New Zealand concept of civil defence are the states of civil defence emergency which may be declared by local authorities, by the director and commissioners of civil defence or by the Minister of Civil Defence. A state of national emergency may be declared only at the highest level of government and refers to a war situation. A state of civil defence emergency excludes the situation that might be brought about by an actual or imminent attack on New Zealand. Even so, the special powers and functions authorised by the Civil Defence Act 1962 may be used in either a national or civil defence emergency. (Elsewhere in the world civil defence has a primary objective of protecting civilians against acts of war and in meeting this objective is able to deal with disasters arising out of natural hazards. The distinction between the New Zealand concept and that adopted elsewhere is finely drawn. This largely accounts for civil defence in New Zealand being associated with the administration of local government within the Department of Internal Affairs. If the overseas concept had been adopted civil defence would probably have been a function of the Ministry of Defence.)

Once a state of civil defence emergency has been declared, local authorities through their controllers of civil defence (often a mayor, or councillor or town clerk), or the police, or the commissioners of civil defence may exercise arbitrary powers for requisitioning, evacuation of people, closing of access, removing vehicles and entering buildings. Local authorities during a state of emergency have wide powers to carry out disaster relief and even to take emergency measures for the disposal of the dead. Anyone carrying out in good faith civil defence duties and obligations during and emergency is protected from legal liability for anything he might do in that regard. A state of civil defence emergency may even be declared in a district not affected by a disaster in order to use special powers and functions in assisting the disaster area.

In circumstances when a disaster is so large that a local authority cannot handle disaster relief operations and the assistance needed to restore the area after the emergency is beyond the scope of normal government departmental activity, a Commissioner for Disaster Recovery may be appointed. This commissioner with his staff would be given the authority to control disaster operations whilst a state of emergency continues if no local civil defence controller is available, but primarily he would be given special powers to deal with the restoration of the disaster area and its return to normal local authority control. The principles and procedures to be adopted for this particular aspect of civil defence are contained in a national civil defence plan approved by the Cabinet Committee for Civil Defence in May 1972.

5. CIVIL DEFENCE IN PRACTICE

Given the possibility that destructive earthquakes may strike anywhere without warning, there is no practical alternative to the reliance placed on local authorities to plan and control civil defence. Only in this way can there be assurance that some disaster relief organisation will exist and some resources will be available wherever they may be needed. In any case, this reliance on local authorities in the first instance acknowledges the natural instinct for community self-help in an emergency and ensures that relief operations are wherever possible conducted by those who know the people and the district affected by the disaster.

There are at present 116 local authority civil defence plans and organisations covering the whole of New Zealand (see Appendix). One is a local government regional organisation, 68 are joint organisations (i.e., where two or more local authorities have united for civil defence purposes) and 47 serve a single local authority in each case. All these civil defence organisations representing at very least some planning and a system for disaster control ensure that some precautions against major disaster exist wherever the emergency may occur but the shortcomings are only too apparent.

The local and joint organisations differ widely in size and tasks. At one end of the scale are the densely populated urban areas with substantial local authority and governmental resources within the district. At the other end of the scale are the sparsely populated rural areas with few resources and very different problems. For example, one urban civil defence organisation serves a population of nearly 300 000 in an area of 150 km2, whilst one rural organisation, typical of several, serves a population of less than 2 000 in an area of 830 km2.

Besides the perennial difficulties in attracting sufficient volunteers and in sustaining enthusiasm in an organisation that is rarely, if ever, used, many districts have neither sufficient people nor other resources upon which to base viable civil defence organisations. Some of these districts have pooled resources and combined to form joint civil defence organisations but many have not exercised this option or cannot for reasons of geography. The setting up of regional and united councils with mandatory responsibilities for the control and co-ordination of civil defence measures in their local government regions may see some solution to this problem.

Although the Auckland regional district and the eighteen other local government regions proposed vary widely in terms of area and population, the pooling of resources at this level on the whole should lead to a substantial improvement in civil defence capabilities.

Individual civil defence volunteers may be trained to perform particular tasks by a local authority. Some attend courses conducted by the Ministry of Civil Defence and a few are trained at the Australian Counter Disaster College. In the main, however, reliance is placed on the abilities and skills acquired in other contexts. Most local civil defence organisations have no experience in dealing with disasters at any level and a significant number do not engage in training or regular practice of any sort.

Local authority civil defence plans are concerned mainly with the organisation to be set up upon the declaration of a state of emergency and the procedures to be followed for dealing with a disaster, whatever its cause. National civil defence plans as envisaged in the Civil Defence Act each deals, with a specific aspect of civil defence such as communications, welfare, transport, or supply. These plans are again largely concerned with organisation and statements of principles for the guidance of civil defence at each level. It has been said that civil defence operations require "inspired improvisation" on the grounds that there is little planning to deal with specific contingencies. The desirability of introducing contingency planning and thus more complicated plans must be weighed against the need for civil defence plans to be readily understood by the non-professional part-time volunteers that constitute the organisation at local level. Nevertheless, there is a need to bring together scientific and technical material on the effects of natural phenomena most likely to be the cause of disasters as a basis for planning at national level. For example the production of such aids as earthquake microzonation, tsunami inundation maps, volcanic risk maps, definition of coastal lowlands exposed to potential storm surge, landslide potential maps, and flood hazard mapping would permit some better anticipation of the problems to be faced. There is a need also to devote the same depth of study to the likely effects of disasters on individuals and communities that has been devoted to the effects of earthquakes on structures and property. We know considerably more today of the effect of a 1931 size earthquake on structures than its effect on people.

Perhaps the most significant change in dealing with a disaster now, compared with the problems faced in 1931, is the development of communications. Regional commissioners can communicate readily by radio with many local civil defence organisations using equipment positioned for that purpose or in an emergency using radio networks developed by other government departments. Most local civil defence organisations have some system of VHF radio communication within their districts. Most important is the ability today to communicate with people in the disaster area owing to the widespread use of battery-powered transistor radios. One eye-witness recalling the scene in Napier of 3 February 1931 said: "We thought it was the end of the world. Everwhere we looked there was destruction and there was no way of knowing that it was just the Hawke's Bay that had been so badly hit. There was no way of knowing if anybody could help us."

The ability to reassure the survivors of a disaster, to inform them of steps they should take, and even to use radio broadcasts to direct the relief workers where all normal means for passing information have been interrupted, represents a substantial advance.

6. CONCLUSIONS

There can be little doubt that civil defence provides a useful basis for the co-ordination of existing services and for the best use of existing resources in an emergency despite its "amateur" status and reliance upon improvisation. There are, however, shortcomings in organisation, planning and training which might be crucial in a major disaster of proportions not experienced since civil defence was established in 1962. The principal problem is simply public indifference. Civil defence obligations receive only grudging acceptance in many quarters. There is a marked reluctance to accept the possibility of major disaster and to prepare accordingly.

APPENDIX

Local Authority Civil Defence Organisations Grouped According to Provisional and Final Schemes for Local Government Regions

(Administering authorities for regional and joint civil defence organisations are shown in parentheses.)

NORTHLAND REGION (PROPOSED)
(Whangarei City Council)

Far North Area Joint (Kaitaia Borough Council)
Whangarei and District Joint (Whangarei City Council)
Otamatea County
Mid North Area Joint (Kaikohe Borough Council)
North Kaipara Joint (Hobson County Council)

AUCKLAND REGIONAL DISTRICT
(Auckland Regional Authority)

Rodney Area Joint (Rodney County Council)
Central Area Auckland (Auckland City Council)
South Auckland Area Joint (Manukau City Council)
North Shore Joint (Takapuna City Council)
West Auckland Area (New Lynn Borough Council)
Franklin Joint (Franklin County Council)

WAIKATO REGION (PROPOSED)
(Hamilton City Council)

Thames Valley Joint (Paeroa Borough Council)
Hamilton/Waikato (Waikato County Council)
Piako/Te Aroha/Morrinsville Combined (Piako County Council)
Matamata County Combined (Matamata County Council)
Waitomo District
Raglan/Ngaruawahia/Huntly Joint (Raglan County Council)
Cambridge
Waipa/Te Awamutu Joint (Te Awamutu Borough Council)
Otorohanga

BAY OF PLENTY REGION (PROPOSED)
(Rotorua City Council)

Tauranga Area Joint (Tauranga City Council)
Kawerau
Rotorua City and County Joint (Rotorua City Council)
Whakatane
Murupara

TONGARIRO REGION (PROPOSED)
(Taupo County Council)

Taupo Joint (Taupo Borough Council)
Taumarunui County and Ohura (Taumarunui County Council)
Taumarunui Borough and Manunui District (Taumarunui Borough Council)

EAST CAPE REGION (PROPOSED)
(Cook County Council)

Waiapu County

Waikohu County

Gisborne

Opotiki County

Cook County

HAWKE'S BAY REGION (PROPOSED)
(Napier City Council)

Wairoa County

Hawke's Bay County

Hastings Joint
(Hastings City Council)

Wairoa

Napier

Central Hawke's Bay
(Waipawa District Council)

WAIRARAPA REGION (PROPOSED)
(Masterton Borough Council)

Eketahuna County

Carterton and South Wairarapa Joint (Wairarapa South County Council)

Greytown

Martinborough

Masterton Combined
(Masterton Borough Council)

Featherston County

Featherston Borough

TARANAKI REGION (PROPOSED)
(New Plymouth City Council)

Waitara District Joint
(Waitara Borough Council)

Taranaki County

Stratford Combined
(Stratford Borough Council)

Waimate West Joint (Waimate West County Council)

Hawera Joint
(Hawera District Council)

New Plymouth

Inglewood District Joint
(Inglewood Borough Council)

Egmont County

Eltham Joint
(Eltham Borough Council)

Patea and District Joint
(Patea County Council)

WANGANUI REGION (PROPOSED)
(Wanganui City Council)

Waimarino Joint
(Waimarino County Council)

Taihape Joint
(Taihape Borough Council)

Wanganui Joint
(Wanganui City Council)

South Rangitikei Joint
(Marton Borough Council)

MANAWATU REGION (PROPOSED)
(Palmerston North City Council)

Kiwitea County

Feilding Joint (Feilding Borough Council)

Foxton

Dannevirke District Joint
(Dannevirke Borough Council)

Pahiatua Joint
(Pahiatua County Council)

Pohangina County

Manawatu County

Palmerston North Joint
(Palmerston North City Council)

Woodville Joint
(Woodville Borough Council)

WELLINGTON REGION (PROPOSED)
(Wellington Regional Council)

Horowhenua Joint
(Horowhenua County Council)

Hutt Valley Combined Joint (Lower Hutt City Council)

Tawa

Upper Hutt Valley Joint
(Upper Hutt City Council)

Porirua (Porirua City Council)

Wellington

NELSON BAYS REGION (PROPOSED)
(Nelson City Council)

Golden Bay County

Nelson Combined District
(Nelson City Council)

Motueka Combined District
(Motueka Borough Council)

MARLBOROUGH REGION (PROPOSED)
(Marlborough County Council)

Marlborough Combined District (Blenheim Borough Council)

Kaikoura County

WEST COAST REGION (PROPOSED)
(Grey County Council)

Buller Combined District
(Westport Borough Council)

Grey Combined District
(Greymouth Borough Council)

Inangahua Combined District (Inangahua County Council)

Westland Combined District (Westland County Council)

CANTERBURY REGION (PROPOSED)
(Christchurch City Council)

Amuri County

Hurunui County

Rangiora/Kaiapoi and Districts (Rangiora Borough Council)

Malvern County

Banks Peninsula Combined District (Wairewa County Council)

Cheviot County

Oxford County

Christchurch Combined District (Christchurch City Council)

Ellesmere County

AORANGI REGION (PROPOSED)
(Timaru City Council)

Ashburton Combined District
(Ashburton Borough Council)

Geraldine Borough

Timaru City

Waimate Combined District
(Waimate County Council)

Strathallan County

Temuka Borough

Mackenzie County

Waitaki Combined District
(Oamaru Borough Council)

OTAGO REGION (PROPOSED)
(Dunedin City Council)

Lakes Combined District
(Lake County Council)

Maniototo Combined District (Maniototo County Council)

Silverpeaks County

Tuapeka Combined District
(Tuapeka County Council)

Clutha County

Vincent Combined District
(Vincent County Council)

East Otago Combined District (Waihemo County Council)

Dunedin Combined District
(Dunedin City Council)

Milton/Bruce/Kaitangata Combined District
(Bruce County Council)

Balclutha Borough

SOUTHLAND REGION (PROPOSED)
(Invercargill City Council)

Wallace Combined District
(Wallace County Council)

Southland Combined District
(Southland County Council)

Eastern Southland Combined District (Gore Borough Council)

Invercargill Combined District (Invercargill City Council)

The engineer and the community

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This is a modified version (condensed and revised) of the author's Inaugural Address as Professor of Civil Engineering, presented at the University of Auckland on 8 September 1977. While intended originally for an audience of non-engineers, it has interest for the profession.

1. INTRODUCTION

NGINEERING is an essential part of civilisation. Featured on the cover of Kenneth Clark's book, *Civilisation*, is a photograph of the Firth of Forth Bridge. It is significant, perhaps, that this photograph is on the back, while pride of place is reserved for Raphael's fresco in the Vatican, "The School of Athens". Technology takes second place to Art; a case of "the carpenter encouraging the goldsmith".

Economists use the term "infrastructure" to include the roads, bridges, telephone systems, port facilities, water and power supplies — all those services that we tend to take for granted but without which civilised life as we know it could not exist. To conceive, design and construct such systems is part of the work of the engineering profession.

"Yes, but . . . ", you are thinking — "What about pollution? What about the plundering of the landscape; the fatal road accidents; the dehumanising effects of urban existence? Are not these also the product of the engineer?"

While engineers have undoubtedly had a hand in these, I do not believe thay are primarily to blame. How, then, has this "environmental crisis" come about? Let us first look at the period which preceded it.

2. THE GOLDEN AGE OF ENGINEERING

The century 1850-1950 has been termed by some "the golden age". That is not to say that many notable works had not been previously constructed. The Industrial Revolution had brought about profound changes in the way of life of the majority of people in the more progressive countries. Some of the changes had been for the worse — but most were for the better.

In Britain, Brindley had been constructing canals, road transport had been vastly improved by Macadam's new pavement design, and the railway boom was at its peak. But, before this period, civil engineering design had been largely empirical, based on past experience rather than on scientific analysis. By 1850, most of the essential mathematical tools that we use today had become available.

Moreover, by that time, laboratory tests were yielding essential information on the strength of the materials then available. Portland cement (not very different from that used by the Romans) was re-invented and patented in 1824. Wrought iron was being produced, and rolled into rails and structural sections in the 1830s. But it was not until the 1880s that steel could be mass produced. In place of man- or horse-power, steam engines could be used to work cranes and pumps during construction.

During this golden age there were revolutionary changes in all forms of transport and in communications. Daring, innovative works were designed. These structures were hailed as marvels of the age. Robert Stephenson's Britannia Bridge over the Menai Straits, one of the first wrought-iron girder bridges, was completed in 1850. For the international exhibition in London in 1851, the Crystal Palace itself was a structural engineering achievement, forerunner of skyscrapers, while the exhibition, which attracted six million people, extolled the wonders and promise of technology; such exhibitions were a feature of the age.

On completion of such marvels of engineering, there was widespread rejoicing. Even as recently as 1937, at the opening of the Golden Gate Bridge in San Francisco, 200 000 people joined in the fiesta to celebrate the occasion, and pageants continued for a week.

Though these works are purposefully utilitarian, their aesthetic qualities should not be ignored. Some years ago, there was an exhibition, in the Museum of Modern Art in New York, of photographs of civil engineering structures from many countries. The art critic of the *New York Times* was moved to write:

> It is clear that in the whole range of our complex culture, with its self-conscious aesthetic kicks and esoteric pursuit of meanings, nothing comes off with quite the validity, reality, and necessity of the structural arts.
>
> Other art forms seem pretty piddling next to dams that challenge mountains, roads that leap chasms, and domes that span miles. The kicks here are for real. These structures stand in positive, creative contrast to the wilful negativism and transient novelty that have made so much painting and literature, for example, a kind of diminishing, naughty game. The evidence is incontrovertible; building is the great art of our time.

3. THE PROFESSION'S VIEW OF ITSELF

How did these engineers of the golden age see themselves and their work? They not only felt, they knew in their hearts that what they were doing was good; not just marginally beneficial — wholly and incontrovertibly good. The engineers of the Tennessee Valley Authority, for example, derived great satisfaction in changing, by irrigation, an arid dust-bowl into productive farm-land, and at the same time providing electric power to serve the community. Here in New Zealand, the engineers for the Arapuni dam — an unusually difficult undertaking, as it turned out — knew that their work would be of great benefit to the nation.

This must have given them not merely satisfaction but something akin to joy! It may come as a surprise that engineers — coldly rational beings as they must appear to some — can actually have emotional feelings. Robert Louis Stevenson, grandson of a civil engineer, wrote, "The joy of my grandfather for his career was as the love of woman".

It is clear that professional engineers of that era, filled

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This paper was first received on 22 September 1977 and in its present form on 30 August 1978.

with dreams of Utopia, saw themselves as great benefactors — saviours of mankind.

While a few intellectuals expressed warnings against this technological progress — from Samuel Butler's *Erewhon* to Aldous Huxley's *Brave New World* — the general opinion prevailing amongst the vast majority of people throughout the western world was that technological progress was real progress — for the true benefit of humanity.

4. THE ANTI-TECHNOLOGISTS

Then, about the middle of the century, a growing general disenchantment with the "technological society" set in. This manifested itself in many ways, but we can see two separable facets of this. One was the environmental crisis which resulted in a general popular indication of discontent. Its theme — to return to nature, to get away from the world of technology — was very effectively transmitted through the medium of the "pop" songs of that period.

The other, more insidious, aspect was the appearance of the "anti-technology movement" — the doctrine that technology is the basic cause of all the problems of society. Samuel Florman, in his fascinating book, *The Existential Pleasures of Engineering,* traces the immediate origin of this movement to a French theological philosopher, Jacques Ellul. In his book, *The Technological Society,* which came out in 1954, he claimed that "technique" was no longer under man's control — that it was now dominating man. By "technique" he meant not only technology as we know it, but all forms of organisation aimed at efficiency.

Surprisingly, Lewis Mumford joined the movement in his series entitled *The Myth of the Machine.* This is surprising because he had been, earlier, so well known as a historian of technology. Yet, in one of his recent books he states that technology is claiming priority in human affairs and that technological progress has become a blind, overriding and sometimes self-defeating aim.

According to Florman, three other authors were leaders in the anti-technology movement: Rene Dubos, whose *So Human an Animal* appeared in 1968; Charles Reich, who wrote *The Greening of America* two years later; and Theodore Rozak with his *Where the Wasteland Ends* (1972).

Dubos' book has achieved wide aclaim, and won a Pulitzer prize. As a biologist, he traces our evolutionary development. Man is not, Dubos suggests, well suited to this "post-industrial" society which he is creating for himself. Less extreme than some of the anti-technologists, he pleads that we "avoid the technological takeover and make technology once more the servant of man instead of his master".

Reich's book was an immediate success, being in harmony with the prevailing mood of the counter-culture. He personalises technology as an "unthinking monster" which will "dictate to man" and claims that affection, music, dance, etc., "have been ravished by an expanding technology".

Rozak speaks of the "treachery of technology" which, he says, "threatens to murder the flora and fauna of whole oceans".

To summarise their arguments, the anti-technologists assert that technology has become an uncontrollable force for evil; that within a technocratic power structure man's daily work has been made tedious and degrading; and that he is cut off from the natural world in which he evolved.

This is a dangerous philosophy — one that should be utterly refuted. Man and his technology are not separable entities. Man is a technological animal. His technology is the result of his own inventiveness. To personalise technology as a demon is to deny man's responsibility for his own creativity.

The anti-technologists delight in describing the lot of the average man in bygone ages as idyllic — living a peaceful, rustic existence in harmony with nature. Kenneth Clark is more honest: "Throughout the great ages of human achievement which I have been discussing," he says, "the mass of voiceless people have had a hard time. Poverty, hunger, plagues, disease: they were the background of history right up to the end of the 19th century, and most people regarded them as inevitable — like bad weather."

The present-day drift to the cities, while regrettable perhaps, shows that most people prefer the hazards of urban life to the peace of the countryside. And the majority find some satisfaction in their work.

There can be no doubt that the lot of the average man — and woman — throughout the western world has been made infinitely more agreeable by the application of technology. People live longer and in greater physical comfort than before — but this does not necessarily mean that they are happier or more content.

5. ENGINEERS AND THE ENVIRONMENT

After their euphoria, earlier in this century, when they saw themselves bringing a better life for everyone, engineers were as shaken as any by the environmental crisis. Motivated as they had been by such good intentions, could all these new troubles of society really have been caused by them? Many people — some engineers included — seemed to think so. The profession had qualms of conscience. "If only we had been more aware of the social consequences of our endeavours." Or even: "If only we had been more moral!"

I cannot do better, in refutation of this reproach, than to quote Florman:

> What an ironic turn of events! For if ever there was a group dedicated to — obsessed with — morality, conscience, and social responsibility, it has been the engineering profession.
>
> Practically every description of the practice of engineering has stressed the concept of service to humanity. Thomas Tredgold's classic definition dates from 1828: "Engineering is the art of directing the great sources of power in nature for the use and convenience of man." The definitions have been pouring forth ever since, most of them saying the same thing with just a few words changed here and there.

6. PUBLIC PARTICIPATION

Nowadays, things are very different. When, for example, a hydro-power development is mooted, every available conservationist, environmental and local interest group is mobilised. And this is highly desirable if the result is a balanced decision on what really is most beneficial for the common good.

This is one facet of "public participation" in the decision-making process for proposed works. There has always been some public participation, of course, in that practically all major works are undertaken as a result of public pressures; not for a dam, perhaps, but for the water or power it will produce. This is an area where civil engineers could do more — in encouraging constructive public participation in the early conceptual stages.

It works best where the people who will benefit from the scheme, and those whose interests are jeopardised, are both in the same area — as with a motorway passing through a city. By calling public meetings, by describing the advantages and disadvantages of alternative proposals — and asking the public themselves to submit further alternatives for consideration — engineers can seek a solution which will be acceptable to the majority as the best that could be conceived. Particularly in the

United States, this process is being used more and more widely.

The process is more difficult if the people likely to be adversely affected are a small group in one area, while the benefits are widespread. An example is the Clutha Valley hydro-power development. Here, the Ministry of Works and Development has made an endeavour to involve the local people in the decision-making process. While the outcome can never be expected to keep everyone happy, an attempt has been made to achieve a result acceptable to most.

7. TECHNOLOGY ASSESSMENT

Now, to gauge more accurately the full consequences of a particular course of action, environmental impact reports are called for when any major scheme is seriously considered. This is one part of "technology assessment" in which multi-disciplined studies are made into every aspect of a proposed scheme in terms of its effects on the physical environment, on flora and fauna and in terms of its social effects. Such studies are undoubtedly most desirable, but we must not delude ourselves into thinking that they will resolve our problems. Even if such studies did provide accurate predictions (which they do not) we should still be left to make value judgments, based on the results.

It is perhaps necessary, here, to point out that civil engineers, employed as they are on power stations, irrigation, harbour works, roading, water supply, etc. — even if they are private consultants — are normally working, directly or indirectly, for central or local government; that is, they are in the "public sector". As such, they have received somewhat less opprobrium than other branches of the profession with regard to environmental concerns. Though motorways may be criticised for their unsightliness and for cutting across integrated communities, and hydro dams condemned for ruining the natural beauty of the countryside, civil engineers have escaped relatively lightly compared with, say, mechanical and chemical engineers, who tend to be employed in private industry.

In the United States, over 70% of professional engineers are in this "private sector". (The corresponding figure in New Zealand is 20%.) The products of industry must be competitive in the market-place. If the man in the street prefers a frivolously styled car to one with built-in safety features and low emission exhaust, can the engineer, employed in industry, be blamed for giving him what he wants? When people, in larger and more responsible groups, decide that certain built-in safety features and pollution limits are desirable for the common good, then regulations can set guidelines within which engineers will be happy to work. The difficulty lies not with technology — it lies in deciding what is desirable for the common good.

I was working in London in 1952, the year of the "Great Smog" which caused 4 000 deaths from respiratory troubles. An investigating committee was set up, chaired by Sir Hugh Beaver. But this was not the first committee. Discussion on air pollution in Britain can be traced back 700 years, with complaints being made, committees set up and reports filed, but the actions taken had not been fully effective. The Beaver Committee's report was acted upon, not because it was exceptional, but because the public was, at last, receptive. And the results were completely successful. According to Sir Hugh, the lesson to be learned is: "on public opinion, and on it alone, finally rests the issue".

Let us return to the question of deciding what is desirable for the common good. It used to be simpler than it is now. When, for example, the Auckland-Wellington railway was commenced in the late 1880s, it was universally recognised as a worthwhile project for the benefit of the country as a whole. There would have been very few, then, who bemoaned the destruction of native bush in order to provide this vital communications link.

The Aswan High Dam project, in Egypt, has received the full force of the environmentalists' vilifications. I do not claim that the environmentalists' allegations are unfounded, but, by discounting the benefits that the scheme brought, they have presented to the world a totally distorted picture.

When it comes to sociological effects, consequences are even less clear. In the field of public transportation, some estimate must be made of how many people will use the proposed system. If the Bay Area Rapid Transit system is typical, it shows that the best estimates of this number, on which economic viability depends, can be most unreliable. Human reactions (whether of individuals or of people en masse) are notoriously difficult to predict. When the first motorways were built, they were regarded as a solution to the problem of congestion on the streets. Who would have imagined that, in an affluent society, some cities would become tangles of spaghetti-like super-highways just as congested as the streets they replaced, and that citizens would be signing petitions to stop further construction?

Man's success, as the outstanding species among the world's fauna — biological success is gauged in terms of population increase; surely our success is mighty — stems from his intelligence and his adaptability. One form in which this adaptability is manifest is in his ability to learn from his own mistakes. The process has not stopped. We are certainly still making mistakes, but we are still learning from them. Thinking people, world-wide, now recognise that there are limits to growth; that the world's resources are finite. Recognition of these facts is the first essential step in changing the course of our progress to ensure survival.

Similarly, on a much smaller scale, we now realise the importance of assessing in advance, as best we may, the effects of our works on the physical and social environment. This means that, before embarking on a work of civil engineering, the planning must involve not only civil engineers, but also botanists, zoologists, chemists, social and physical scientists — an endless list of experts. The engineer himself cannot be expected to be expert in all these fields. He should, however, be aware of what his fellow technologists have to offer and be capable of organising their activities.

8. THE ORGANISATION OF PUBLIC WORKS ENGINEERING IN NEW ZEALAND

The way in which professional engineers relate to the community they serve is strongly dependent on the organisational framework within which they operate. Civil engineering in New Zealand is largely dominated by the Ministry of Works and Development (MWD). From those who have grown up with the system, the questions are asked, "How else could it be? What alternatives are there?" The present Ministry-dominated organisation is an inheritance from our not-too-distant colonial past. It may have been the best organisational framework in earlier days, but that does not mean it is necessarily the best for the present day.

The MWD is an organisational colossus. When any organisation becomes too large, it tends to become a law unto itself. It is involved in power design, public buildings, roading, town and country planning and public health engineering. Right now it is rapidly growing in the water and soil conservation direction. Privately, many engineers disapprove of the existing structure. Why do they not speak out against this? Because they are either in it, or beholden to it! The private consultant hopes that the Ministry may channel some work in his direction. Practically every engineer who is not employed by the MWD must have his works approved by the MWD. He dare not raise his voice. Some of the, very few, civil engineers not beholden to the Ministry are those on the staff of the universities. Here, too, an increasing proportion of our research funding comes from or through the Ministry, putting our independence in jeopardy.

The MWD acts as "consultant" to the National Roads Board which was initially set up as a supposedly independent body. In 1976-7 the MWD increased its "consulting fee" by 50% — from 5 to 7 1/2% of the cost of the works involved. This transferred $4.3 million from expenditure on roading to the Ministry. What private consultant could get away with this — particularly during a period in which professional fees were "frozen"?

The present system is self-perpetuating — the ear of government hears little other than the MWD viewpoint — and the professional institution, the N.Z.I.E. which might be expected to take a lead, also seems loath to raise its voice in criticism.

There has been, in the past decade, a praiseworthy move to put more design work in the hands of private consultants. These have been comparatively small projects, however. For any major works, the Ministry's claim is that no private consultant has adequate experience, or staff resources. This, too, is self-perpetuating — unless the consultants are given such work they will not gain the experience or acquire the staff resources.

On the construction side, the Ministry is reluctant to admit that the majority of works can be done more efficiently by contract than by direct labour.

Somewhat frustrated within this country, the consultants have been seeking outlets for their services overseas. Enex of New Zealand (short for Engineering Export) has in the past year been responsible for the design of works costing over $100 million, and the review of a $1 500 million roading project, all in South-east Asia. For major works, several local consultants co-operate as a consortium, and in this way deal successfully with works of considerably greater magnitude than they have had the opportunity of doing in New Zealand. Some consultants are also operating successfully overseas, outside the Enex framework.

Do not mistake the direction of my criticism. It is not aimed at the people within the MWD or at the standard of the works they accomplish. Standards of civil engineering in this country are remarkably high. It is the organisational framework which I criticise.

What is the alternative? I am not suggesting that the Ministry should be completely dismantled. I do suggest, however, that it would better serve the people if it were a much smaller organisation, charged with basic top-level planning and regulatory functions.

9. PRESENT-DAY ATTITUDES

And how does the general public regard its professional engineers? For the most part it disregards them, and takes their works for granted. There are exceptions. A medical practitioner, in conversation recently, stated, without any prompting from me, that civil engineers contribute more to public health than the medical profession. But such enlightenment is rare.

One way of looking at it is that in taking these things for granted the public shows great faith in our profession. Indeed, in some ways this faith seems unbounded. At one time when natural disasters such as flood, storm or earthquake wrecked engineering works, these events were termed "acts of God". Nowadays they are more likely to be ascribed to the engineer's negligence. Attempts are made, of course, to assess the nature and magnitude of such hazards, and to make provision for them. But such calculations can only be made in terms of probability — not certainty.

In a presidential address to the New Zealand Institution of Engineers Mr Ingram complained that, when the government set up a Commission for the Future, it included no engineers among its members. Similarly, the committee appointed by the Minister of Works and Development to review the Public Works Act included no engineers. The Royal Commission on Nuclear Power Generation comprised a judge, a microbiologist, an accountant, a physicist and a member of the Committee on Women — but again no engineer.

Mr Ingram answered his own complaint: "We have not projected ourselves adequately as people who have a contribution to make; we have not been sufficiently forceful in putting our views across."

With this I would agree. The reason, I suspect, is that engineers are so concerned with their own technology, that they seldom take the time or make the effort to involve themselves in the political arena where the important decisions are made. Yet the education and training of an engineer make him a better decision-maker than most. Unfortunately, in politics, decisions tend to be made by people who see problems in black and white. The man who can see both sides of a question and seeks a compromise solution is seldom listened to.

We do, of course, have some engineers in prominent positions. They include the Vice-Chancellor of the University of Auckland, Dr Maiden, who is also chairman of the N.Z. Energy Research and Development Committee; Mr George Beca, member of the University Council and, until recently, Pro-Chancellor; and members of the Auckland Regional Authority, the City Council and the Electric Power Board. The chairman of the Environmental Council, David Thom, is a civil engineer.

So it appears that, while there are engineers making valuable contributions in a variety of ways, it is particularly in the non-elected committees and commissions, whose members are directly appointed by central government, that the profession is being ignored, even in areas where the specialist knowledge of engineers would clearly be of value.

Today, the names of leading engineers seldom become household words. This is largely because it is no longer possible for one man to conceive, to basically design, to supervise the construction of, and to take full responsibility for a major project. The technology has become so complex that a team of engineers must co-operate on various aspects of works of any real size.

But there are some who should not be forgotten — one such is the late Arthur Mead, in whose department of the Auckland City Council I obtained my initial experience. He then had planned the development of the city's water supply for the next half century, and the basic ideas are still being followed.

He was a shy and self-effacing man, but in addition to his professional work he steadfastly pursued his goal of conserving for the people of Auckland large areas of bush in the Hunua and Waitakere ranges. He did this long before "ecology" and "environment" had become the catchwords they now are. The Centennial Memorial Park, a recreation area for Aucklanders to enjoy, exists largely because of his efforts.

10. CONCLUSION

In this article an attempt has been made, not merely to describe the sort of work engineers do, but to give some insight into their thoughts and feelings concerning their profession. To do that I referred to the mathematical and scientific bases of engineering which led to the golden age, when not only engineers but the majority of people had, as it now appears, an excessive faith in technology and abused it. The popular disenchantment and the intellectual forecasts of doom were, to my mind, excessive reactions; but perhaps this was a necessary prelude to the more balanced outlook which is now emerging. Books are being written, such as Schumacher's *Small is Beautiful* and Gabor's *The Mature Society*, in which technology, while still recognised as an essential part of civilisation, is neither personified as an uncontrollable force for evil, nor regarded as the solution of all men's problems.

Engineers, bereft of their Utopian dream, still aim at making the world a better place for people to live in; but they are not alone in thinking that man's problems are now more in the realm of sociology than of technology.

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Ornamental rocks . . .
an environmental danger

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There can be few fields of engineering where safety is of more concern than in traffic engineering. Traffic engineers must face the fact that every year about 20 000 people are killed or injured on New Zealand roads. It is not just well-designed roadways that are required from the traffic engineer but also a safe roadside environment to prevent minor traffic incidents from becoming serious accidents.

1. INTRODUCTION

THE roadside environment has been made safer TH providing wide shoulders and medians which allow accident-involved vehicles room to recover or stop safely. Frangible street lighting columns have been developed which will shear off at the base when struck by a car so avoiding the injuries incurred when solid poles are struck.

Where irremovable roadside hazards exist, energy-absorbing guard rails are used to redirect errant motorists on to a safer trajectory. All of these measures have made a positive contribution to road safety by reducing the likelihood of injury when a traffic incident occurs.

Unfortunately there has recently been a trend in some of the main cities for parks and reserves officers to beautify the roadside environment by placing ornamental rocks on roundabouts, traffic islands or medians. The decision to beautify the environment is to be praised. The decision to do so with solid, impactable objects close to the roadway is to be condemned.

The effect that ornamental rocks can have on safety is illustrated by a case study in Wellington.

2. COBHAM DRIVE, WELLINGTON

Cobham Drive is a relatively high speed (L.S.Z. and 70 km/h speed limits) arterial connecting the airport to the city. A 4 to 5 m wide median extends along its entire length with roundabouts controlling the intersections with Troy Street and Calabar Road (Fig. 1).

In 1973 some 400 large rocks at a cost of several thousand dollars were placed adjacent to the carriageway on the two roundabouts and along the median for about a kilometre of its length. This was done against the advice of the council's professional engineering staff and with opposition from the Automobile Association and the Ministry of Transport. The rocks were installed to provide climatic protection for plants and as an aid to the beautification of the area. Beautiful or not, the rocks have had an adverse effect on road safety in the area.

In the four years (1969-1972 inclusive) before the rocks were installed on Cobham Drive, there were six injury accidents where a vehicle crossed or in some way encroached on the central islands. Only two of these accidents resulted in serious or fatal injuries.

In the four years (1974-1977 inclusive) after the rocks were installed, there were 11 injury accidents from vehicles encroaching on the central island and seven of these resulted in serious or fatal injuries. This represents a virtual doubling of the previous accident rate and a tripling of the number of accidents involving serious or fatal injuries. However, with such small numbers of accidents on Cobham Drive, statistically this evidence is more indicative than significant.

Of the 11 accidents occurring since the ornamental rocks were in place

- — 1 involved a vehicle in collision with a power pole; the driver was seriously injured.
- — 2 involved vehicles running on to the islands without hitting any rocks or poles; 3 minor injuries were caused.
- — 8 involved vehicles colliding with ornamental rocks; 2 fatalities, 10 serious injuries and 4 minor injuries resulted.

The above pattern -of accidents implicates the ornamental rocks as being responsible for both the high number of "after" accidents on Cobham Drive and the tendency towards more serious accidents.

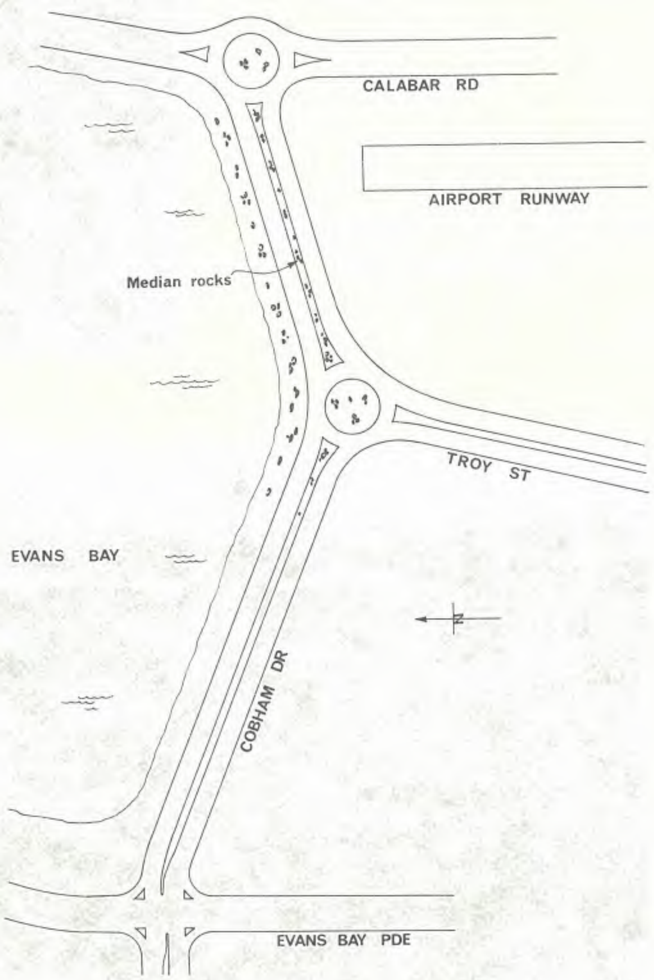

Fig. 1: Plan (not to scale) of Cobham Drive.

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Fig. 2: A car was extensively damaged on these rocks.

Fig. 3: Two people were seriously injured on impact with this rock.

Fig. 4: Two people were killed after colliding with this rock.

Fig. 5: This rock has been struck on two occasions, causing five people to be seriously injured. Note how the rock was shifted by the last impact.

The need to keep traffic islands completely clear of all solid obstructions is borne out by the injuries in the above accidents. Where no obstructions were encountered only minor injuries resulted. When a pole or an ornamental rock was encountered, the injuries were predominantly serious or fatal.

2.1 Accident history

Details of the 8 accidents on Cobham Drive where an ornamental rock was struck are given below:

1. January 1974: A car heading west from the Troy Street roundabout changed from the left lane clipping a car already in that lane. The resultant swerve took him on to the median and into an ornamental rock. All four occupants were seriously injured — head injuries, facial injuries, side, back and leg injuries. Had the ornamental rock not been there it is possible the driver could have recovered control without an accident occurring.
2. April 1975: In the early hours of the morning a car heading west from the Troy Street roundabout moved on to the central island and struck an ornamental rock. The driver suffered minor injuries. He was apparently feeling rather sleepy before the accident and may have briefly dozed off.
3. July 1975: A car heading east from the Troy Street roundabout in the early hours of a wet morning drifted on to the central island and struck an ornamental rock. The driver received cuts to the head and his car was extensively damaged.
4. March 1976: A car heading towards the city from Calabar Road hit another car, lost control and ran on to the median hitting an ornamental rock. The driver was seriously injured — facial cuts, contusions — and his two passenger received minor and serious injuries, respectively.
5. July 1976: A driver thought to have fallen asleep driving from Calabar Road into Cobham Drive collided with an ornamental rock on the median, shifting it 4 m. The driver received serious facial lacerations, jaw and knee injuries, and his passenger minor teeth and jaw injuries.
6. September 1977: A car heading west from the Troy Street roundabout collided with an ornamental rock, seriously injuring both driver and passenger and extensively damaging their car. The driver suffered a fractured nose, jaw and internal injuries, and his female passenger suffered concussion and abrasions.
7. November 1977: A car heading west from the Troy Street roundabout ran on to the median, hit a large ornamental rock, flipped into the air and landed back on the road on its roof. The driver received severe head injuries. The car was beyond repair.
8. December 1977: A car heading east struck a large ornamental rock on the Troy Street roundabout killing both of its two elderly female occupants.

Ignoring suffering, the total community cost of these accidents would be in the order of $100 000.

Two facts emerge from the accidents:

1. The injuries were caused when the vehicle struck an ornamental rock. The ornamental rock usually brought the vehicle to a very abrupt halt and threw the occupants against the inside of the vehicle. Head and facial injuries were common.
2. In many cases, but not all, it appears no injury accident would have occurred had the vehicle been able to miss the rocks. In one case there is evidence that the driver was already in the process of recovering from his excursion on to the median when he struck a rock and injured himself. In some cases, however, it is likely that an accident would still have occurred even if no rocks were present, although the injuries would probably have been less severe. Cross median, head-on accidents have not featured in Cobham Drive's accident records in the past so it is unlikely the ornamental rocks are preventing this type of accident now.

3. CONCLUSION

Although the above case study relates to a situation in Wellington, there have been recent fatal accidents in other centres, namely, Christchurch and Whangarei, when vehicles have struck ornamental rocks placed on traffic islands. These accidents all serve to illustrate the danger of compromise on what is a basic traffic engineering principle to leave areas adjacent to the carriageway free from solid, impactable objects. There is value in reiterating some of the recommendations of the AASHO traffic safety committee concerning safe highway design.

1. A continuous obstacle-free area for at least 10 m from the pavement edge should be provided.
2. Trees or posts with diameters over 140 mm must be regarded as obstacles.
3. Only when hazardous obstacles cannot be removed should protection be provided by an appropriately flared and anchored guard rail.
4. Frangible poles should be used for lighting and sign supports.

There is a need for those responsible for roadside beautification to be sensitive to traffic needs as well as aesthetic values. To ignore basic traffic engineering requirements in beautification projects can result in unnecessary economic wastage and human suffering.

Footnote: A few of the rocks on Cobham Drive have now been removed.

Call *for confederation* to protect professional *interests**

The professions should be more united and self-conscious of their separate interests in putting forward their distinctive point of view, emphasised Lord Hailsham of St Marylebone, P.C., C.H., when he delivered the Fourth Rivers Lecture to the Institute of Chartered Secretaries and Administrators in London. Saying that the professions were unrepresented at the highest levels Lord Hailsham asked: "If there can be a Confederation of British Industry why can there not be a Confederation of British Professional Associations, however loosely associated, to identify the problems which affect us all?"

I SPEAK to you as a group of professional men and women. I speak to you therefore as one of yourselves. I am a professional man, formerly a lawyer, now a retired member of the judiciary, still, I am happy to say, called on for part-time professional services. I am the son of a professional man and the father of a professional man and a professional woman. I am thus deeply embedded on both sides of my family in the professional middle class.

A speech by one professional to others should normally be unemotional, objective, and if possible, full of learning, but I speak to you in some anger. I believe our services are undervalued in modern society and in particular in modern Britain. I believe our rewards are insufficient. I believe our earnings are taken away by excessive taxation — in this country vastly excessive as compared with others on either side of the Iron Curtain. I believe our savings are being destroyed by inflation even when they are not being deliberately confiscated by unjust fiscal measures.

I believe that our most valuable possession, which is our integrity and our independence of judgment, is under threat. In the meantime we have suffered a catastrophic fall in our standard of life and the current negotiations between the Government and the TUC (neither of whom represents our interest) are predicated upon the proposition that this situation shall not merely continue, but that the fall should be accelerated. I believe that all this is happening not as a mere matter of chance, still less the result of irresistible changes or impersonal forces. It is happening partly as the result of deliberate policy and partly by our own failure to present a united front and proclaim in a coherent manner our philosophy of life and the individual contribution which professional men and women make to society at large.

Of course, my plea would not be valid unless I were able to establish that professional men and women were a valuable component in society, and unless I were able to establish in addition that their continued existence as a separate component was the essential condition of this contribution being made. But that, of course, is precisely my contention and it is around this contention that this lecture is being built.

I must begin with a disclaimer. By saying that our contribution is unique and individual, I do not mean that it is better than that of others. This would be foreign to the whole outlook on society of professional men and women. I only mean that it is different, and that its continuance is essential to a free and civilised society. The professional man has no class antagonisms. He is not hostile to manual labour, organised or not organised. He is neither hostile nor subservient to management in industry, to the agriculturalist, to the landlord, to the tenant, or to any other class. On the contrary, he provides services to them all. But the view of society to which he subscribes and which alone is congenial and conducive to his interest is that it should not be uniform. The mark of a free and civilised nation is not its rule by majority vote, but the treatment it accords to minorities, and, where they exist as a majority; also to what are called ungrammatically "under-privileged groups". Uniformity — and for that matter equality whether of income, property or esteem — can be bought, if at all, which is doubtful, only at the price of repression. Uniformity is the enemy of freedom; imposed equality is inconsistent with justice, social or individual.

DEFINING A PROFESSION

Clearly the first thing is to discuss what is meant by a profession. Definition is a boring subject, but some discussion of what is meant is quite essential to this matter, particularly because a strict definition is impossible: there are a number of parameters not all of which are ever present at the same time, and the resultant answer is a matter of degree and opinion and not a matter of kind. This need not depress us at all. There is no greater fallacy than to suppose that only that which can be defined or measured can exist and the existence of grey areas in any subject is no argument against the existence of black or white.

In the age of Trollope's novels, the professions *par excellence* were, of course, the Church, the Law, Medicine and the Officer grades in the armed services. But this is not merely wrong today, even if it were ever right; it is in fact positively misleading. The growth in the number of professions shows it to be false; an attempt at definition simply by enumeration of the individual members of a class is bound to be misleading. Professions today are more numerous than they have ever been in the past, and their services more than ever essential to the public weal.

The first, and obvious, feature of a professional is that, even when a lawyer would define him as being under a contract of service, which is true of an increasing number of professionals today, he is in fact the provider of skilled services for which both an academic and a vocational qualification are required. These require previous training and years of delay before earning capacity is achieved. Ali professional men and women therefore begin their lives with a sacrifice of leisure and income during the period for which training is required. There are, of course, some professions like the administrative civil service and the foreign service recruited by competitive examination, where vocational training is mainly post-entry. But most professions

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required pre-entry training and most characteristically set the required standards themselves.

This last characteristic is of great importance. That a profession should set its own standards of qualification is part of its general claim to autonomy of self-government as a separate group within the community. Obviously if a profession were to set its standards much too low, with the result that insufficiently qualified persons were able to practise, or impossibly high so that an insufficient number of adequately competent persons could not be reached, that would be a matter of legitimate public concern. No profession or group of professions can set itself up as a state within a state, claiming to be immune from public criticism or public legislation. But autonomy is essential to professional status and it is essential as a safeguard to the public which requires in such matters to be protected against shoddy standards and political interference.

RULES OF CONDUCT

This autonomy does not limit itself to qualification for entry. It is essential that a profession should be in control of its own special disciplines and professional ethics. Each profession has rules of conduct which are binding on its members. It is of course important that these, too, should not conflict with the generally accepted ethical code to which all are expected to conform, and that the codes involved should be aimed at the public advantage and not merely the advantage of the profession itself. But the idea that a profession can exist without a special code of conduct binding upon its members is not, I think, acceptable. The rule that chartered accountants, barristers, solicitors and doctors in private practice should not advertise, and the various regulations which are made from time to time varying, relaxing, or extending this general prohibition are aimed as much at the protection of the public against the quack as the protection of the practitioner against unfair competition. The rule that the barrister or the medical consultant does not accept instructions direct from members of the public is to protect the specialised character of the service he provides, and not simply to provide jobs for solicitors or G.P.s.

If a profession is to be autonomous in respect of its ethical rules, it must equally be autonomous as to its means of enforcement. This is not to say that I necessarily criticise the co-option of lay members on to the Solicitors Disciplinary Committee, or the particular, and publicly promulgated, constitution of that or the General Medical Council. It is important that members of the public should have confidence in the tribunal and that both the profession and the public should be protected. But the general rule should be that the profession itself should declare and police its own rules subject only to overriding considerations of public interest and public policy. In this respect the professions differ from the requirements of industry and commerce where quality control of the product is best assured by competition and advertising and the danger of the quack and the charlatan is in general less acute, and where present, should be the subject of legislation.

A third, but essential, ingredient in the continued existence of a profession as such is that the professional should remain independent in his judgment and in the integrity of his advice whether he remains in private practice as a free-lance, or whether he operates under a contract of service as part of an industrial or public concern. I imagine that the overwhelming number of chartered secretaries and administrators are so employed. So is an increasing number of solicitors and barristers and so are the doctors employed in hospitals or by the N.H.S. Chartered engineers and chartered accountants are not characteristically one or the other. Nor are architects. But no employer has the right to ask a salaried professional to prostitute his professional judgment, and his professional association ought always to be prepared to fight for his interest if it is threatened in this respect.

Having said all this, it is manifestly a matter of degree when a professional becomes part of management. I have no doubt whatever that there are hundreds of barristers, solicitors, secretaries, administrators, accountants, surveyors, architects, engineers who have moved upwards, downwards or sideways, out of purely professional practice and into purely directorial, managerial or financial posts. Moreover, there are certain business activities, like that of a banker or bank manager, which partake of many of the characteristics of a profession. On the other side of the scale there are professions which grade imperceptibly into the ranks of skilled labour, and vice versa.

EVER-CHANGING SOCIETY

Society is not a caste system, nor a class system with fixed boundaries. It is more like a constantly shifting biological group. There are journalists who regard themselves primarily as professionals. There are others who prefer to think of themselves primarily as skilled operatives. There are school teachers who think of teaching primarily as a profession. There are others who seem to behave as if it were only another skilled occupation. There are engineers who think of themselves as technical assistants; others regard themselves as professionals. Who is to say who is right and who is wrong? We are not talking about watertight compartments. A man is very often exactly what he thinks himself to be.

Having thus discussed rather than attempted exactly to define our terms of reference, I now come to discuss the place of the professional in society. In the first place I would point out that by nature the professional desires to have and by preference chooses to play no part whatever in class warfare. He is neither, in any big way, a have or a have not. No doubt the professions contain by achievement or the lack of it many who are one rather than the other, or vice versa. But characteristically a professional is a member of the middle class, hoping in his best years to earn more than the average wage as the result of the years he has spent in acquiring his qualification, trying to save, attempting to found a family which will do him credit, and conform to his own standards of ethics and social acceptability.

Characteristically he will wish to retire on something more than the state pension and leave property to his widow and family, at least sufficient to achieve comfort. Characteristically he will be a patron of literature and the arts at least to the extent of acquiring a modest general library, going to the theatre and concerts, and perhaps collecting objects of beauty and value. I do not mean to say that no one else does this. I only mean to say that I know of few professionals who do not do at least some of these things, that they do so because the nature of their education and training inclines them to do so, and they do so characteristically, as much as or more than any other segment of society.

I have said enough, I hope, to show that the professional adds a sophisticated, educated, critical, independent minded note essential to the continuance of a free society. He is not, characteristically, and perhaps happily, a member of any particular political party. A number of us belong to one or the other of these, and we hope to bring with us when we do the characteristics which belong to our chosen way of life. When we do not play a part in controversial politics, as is true, perhaps, of a majority amongst us, we find our services much in demand on the committees and in the organisation of a vast number of charitable, social and cultural organisations, whose very variety precludes description, but who form the glory and provide the substance of a free and civilised nation.

DIMINISHING STANDARDS OF LIFE

I began these remarks with words of some bitterness. But at this stage, I feel sure an unfriendly critic would be inclined to ask why it is, if all this be true, and if we are really the high minded, cultivated, public spirited, talented group that I have claimed us to be, do we find ourselves to be persecuted, do we suffer a deliberate denigration of our ideals, and a continuous, progressive and increasingly rapid diminution in our standards of life.

I would reply, first, that the nature of the services we provide has been almost continuously undervalued. It is easy of course to praise the operatives who make an object of use or beauty, which is manufactured and perhaps exported. On the other side we occasionally — more seldom nowadays, but still sometimes — read words in praise of the entrepreneur, the man with enterprise, the bicycle repairer turned motor manufacturer, or even the man to discern the economic possibilities of a building site and the drive and capacity to realise and achieve its potential. But, as I believe, to our great disadvantage, we do not often hear of the design engineer who first conceived the product, and drew it on the board.

We do not hear much of the men or women who first laid out the factory or the production line, who learned the skills or the languages necessary to sell the product overseas, or who provide the necessary accountancy, secretarial or administrative skills to let the whole business work smoothly, to keep it solvent, or the legal skills to draft its contracts, to fight its battles (few, one hopes) in the Courts, or the medical skills to keep either its managerial or industrial staff in health and at work. This is because you cannot easily measure the value of brains, nor the advantage of technical training. In my own sphere, if you win a case for a client, it is justice which has prevailed, if you lose it, it is the incompetence of the advocate; and since advocacy, and medicine, and accountancy, and administrative capacity largely depend on imponderables and can often be frustrated by ill-luck, you seldom hear of the virtues of their practitioners. On the contrary, it is when things go wrong that they are most heard of, and then, alas, it is almost always by way of criticism and complaint.

But the mere fact that brains are undervalued in this country is not the only reason why the professional becomes unpopular. He is the constant proponent of advice, and advice is seldom popular except when it is palatable, and when it is palatable it is almost always unnecessary. The lawyer is always advising that a scheme which at first sight looked so attractive is, unfortunately, illegal. The physician proscribes as well as prescribes, and what he proscribes are normally the nicest things to eat and drink, or the darling habits which lead to obesity and heart disease. The accountant is always telling his client or his employer that he cannot afford it, and the administrator that you must not or cannot do what you want. We are therefore the eternal whipping-boys of management, and the obvious targets of organised labour. We are considered to be the lackeys of capitalism, when all we are doing is to remind others of the facts of life when it is least to their taste to remember them. If we are to be respected we have always first to fight for our integrity with tooth and claw.

I would now wish to list some of the dangers to which we are exposed. There is the danger from government. There is the danger from corporations, private and public. There is the danger from organised labour. Each and all of these influences is gradually encroaching on the integrity and independence of the professions.

TIP OF THE ICEBERG

This is a gloomy forecast, but anyone with an eye to realities can see that it is true. The recent battle between the doctors and the Health Service is an example of the first. For years now the Health Service has battened upon the devotion and enthusiasm of the junior doctors, driving them to inordinately long hours of duty at impossibly low salaries. Political influence is seeking to destroy the independence of consultants. There is a continual battle between public authorities, and even private industry, and the administrators they employ. Only the worst cases, like Clay Cross, become public. But the worst cases are only the tip of a far larger iceberg. The fiscal policies of successive governments might have been expressly designed to diminish the standard of life of professionals and middle management, and in some cases have undoubtedly been so designed.

The danger from trade unions has only just begun to be seen. But it is quite clear that a trade union affiliated to the TUC does not and cannot adequately represent the interests of a chartered accountant or engineer or administrator, or doctor, or a barrister whether he be salaried or in private practice. This is not because one is better than the other. It is that they are different kinds of entity. A professional needs a professional association to represent him, and although professional associations, such as your own, or the Bar Council, or the various engineering institutes, or the Law Society have many of the characteristics of trade unions, they are by no means the same, and they do not or at least have not until recently felt themselves as free to apply industrial pressures in support of their members as do unions of the other kind.

But, increasingly, of recent years, and especially since last year's Trade Union and Labour Relations Act, pressure has been brought by trade unions to force genuine professionals to leave their own professional associations which understand their needs and requirements and compel them to join with non-professionals in unions of the usual kind on the top salaried fringe of the trade union movement. Whatever may be said of a closed shop for workers of the same grade, an attempt, in the interests of a closed shop, to force members of the professions into unnatural membership with those who have not the same interest is something which ought to be resisted by all who have the interest of the professions at heart.

What then is the answer to these problems? I suggest two. The first is that the professions should be aroused to their dangers and should be more united and self-conscious of their separate interest in putting forward their distinctive point of view. This does not mean that professional associations should take sides in party politics. For many years I have thought that the organic relationship between the TUC and the Labour Party has been a corrupt and corrupting influence on our public life, and is indeed a significant contributory cause of our national decline.

I would not wish professional associations to take a similar line. But to say that they should not take sides as between political parties is not the same thing as to say that they should not associate with one another. If there can be a Confederation of British Industry why can there not be a Confederation of British Professional

Associations, however loosely associated, to identify the problems which affect us all, to pressurise politicians, to proclaim our distinctive points of view, to defend our interests, and to advertise the importance to society of a strong, independent, incorrupt, public spirited professional class not identified with management or organised labour, nor with the private or public sector of industry as a whole, but permeating society by reason of the services provided for each sector of the whole?

It is as well to remember that the professional is not without natural allies in his struggle to survive. Although essentially middle class in outlook he is not the whole of the middle class. Although often self-employed, he does not represent the whole of the self-employed. He naturally finds himself in the same plight, and therefore in the same lobby as middle management, as the small shopkeeper or business proprietor, as the farmer, as the skilled technician or workman. The only trouble is that he has not yet learned to organise and fight the political battle either in the field of party politics or outside it. It is time that we came to look at one another and recognise in one another persons who are suffering from the same pressures, and who all need allies not simply to secure personal survivial but to ensure the continuance of standards in society without which independent and honourable professions cannot continue to exist.

Preparing a technical paper for publication

The following are some of the requirements for the presentation of technical papers submitted for publication. They are extracted from the "Guide to Authors" which is available from the Institution. Three copies of the complete text and illustrations should be submitted.

1. The Typescript

Each page should be typed on one side only, using double spacing. Both margins should be generous (say 30 mm) to allow adequate space for the editorial staff to provide instructions to printers. In papers containing mathematical expressions, additional space should be left below and above formulae.

It is usual to divide a paper into sections and subsections according to a logical plan. Each division should carry a brief, appropriate heading.

Mathematical expressions and formulae should be kept as simple as possible and the use of symbols should be consistent in all equations. Unless presented carefully, equations are a prime source of confusion to editors and typesetters.

2. Illustrations and Tables

A suitable ratio is one illustration per thousand words of text.

Wherever possible, drawings should be to NZS 5901 parts 1, 2 and 3, *Engineering Drawing Practice,* or to "The specification for the preparation of drawings by N.Z. Government Offices for 35 mm micro-filming". Lettering should be to ISO 3098/1, *Technical Drawings — Lettering.*

All dimensioning must be in SI units.

Each illustration should carry a descriptive caption.

New Zealand Engineering rarely prints illustrations in colour.

2.1 *Line illustrations*

Illustrations other than photographs should be drawn with black ink on tracing paper, linen, smooth white paper or cardboard. Most illustrations when printed will be reduced to a width of about 83 mm and the widest possible width is about 177 mm. In some cases they may be smaller. Size of lettering is more important than thickness of lines but the latter should be sufficiently heavy and thick to be legible after reduction. Lettering should not be less than 1.5 mm high when reduced.

Highly detailed maps, plans or working drawings are generally unreadable when reduced to a suitable size for reproduction. These should be re-drawn as diagrammatic sketches, showing only significant elements and their relationships. Frequently this can be done easily by tracing the essential elements, omitting all extraneous detail.

Graphs should be drawn to show only axes, curves, plotted points and essential co-ordinate lines (if any); fine background reference lines, particularly exponential scales, reproduce very poorly.

2.2 *Photographs*

Photographs should be chosen so that the point they are intended to illustrate is conspicuous. They should be glossy black and white prints of good quality, sharply in focus with good light and shade contrast. Negatives or colour transparencies are not acceptable.

2.3 *Tables*

Complicated tables, those of great length, and those containing unessential data are rarely studied by readers. In such cases the table is best replaced by a simple bar chart or series of curves emphasising the main trends of the original tabulation.

2.4 *Numbering illustrations, tables and appendices*

Illustrations should be numbered consecutively, using Arabic figures. Tables and appendices should be numbered consecutively in Roman figures. The numbering of illustrations and tables in appendices should be continuous with those of the text proper.

2.5 *Referring to illustrations and tables in text*

To assist both readers and the editorial staff, each line illustration, photograph and table should be referred to in text by number, for example, "as in Fig. 1".

3. References

References must be referred to in the text and should be indicated in the text by superior numbers, e.g.'. They should be listed in the order of their appearance in the text.

4. Cover Pictures for "New Zealand Engineering"

Good photographs which are appropriate to the subject of the paper but are not included in the illustrations associated with the text should also be sent with the paper. They may be useful as cover pictures and will be returned after use upon request.

N.Z.I.E. NEWS

MONITORED TRAINING AND THE SUPERVISING ENGINEER

The following statement has been prepared by the examinations committee to clarify the way in which the monitored training programme will affect graduates and their supervising engineers. Copies of the statement are available from the Institution headquarters, P.O. Box 12241, Wellington.

Most graduates heading towards Professional Interview have obtained guidance and training from those with whom they work. Although this has been the practice for some years, the Institution has now found it necessary to introduce more formalised arrangements for the guidance of graduates during their training in preparation for Professional Interview. The training regulations of the Institution indicate the requirement for a graduate to have obtained not less than 12 months of suitable experience in each of the areas of design, practice and responsibility. The average candidate is taking a little over four calendar years to reach a standard appropriate for Interview.

Under the current arrangements for monitored training a graduate outlines in a record book his experience to date and likely future activity, and forwards copies of this to the Institution for comment by a training review panel.

An additional requirement is that each graduate must nominate a corporate member of this Institution, or a registered engineer, to act as a supervisor and mentor. A supervising engineer should:

(a) Assist the trainee to prepare a training programme to meet the training requirements of the Institution with the intention of bringing him to a standard appropriate for Professional Interview.
(b) Monitor the trainee's progress, provide guidance to the trainee and ensure that he forwards the training record to the Institution at intervals no greater than 12 months.
(c) Report progress to the Institution in a form of comments noted on the training record.
(d) Ensure that the trainee has reached a suitable standard before applying to attend Professional Interview.

The foregoing responsibility would seem to require personal contact at least every four weeks. If the trainee has to look outside his own organisation for a supervising engineer, the person selected should be sufficiently senior to be able to discuss training with the trainee's employers. If, after a supervisory arrangement has been initiated, the circumstances change in a way which precludes a continuance of supervision, the trainee will need to make a fresh arrangement for a new supervising engineer.

It is desirable (but not essential) that the supervising engineer be experienced in the same discipline as the trainee. The central question at most Professional Interviews is to determine whether the candidate has reached a professional standard in matters of experience, engineering judgment, and maturity. The standard applied by interviewers is that which they would deem appropriate in their own area of engineering and which they would expect of staff working with them, or working for them. Although much of the technology on which engineering is based is continually developing, the personal performance factors which interviewing engineers look for have not changed over the years.

A supervising engineer, in addition to watching the technical development of a trainee, should have equal concern for the development of a professional outlook, of maturity of judgment and of other characteristics which should be found in a professional. The standards expected by interviewers, which are always discussed at the full meeting of the interview panel, reflect the general standards of those taking part and these reasonably reflect the standards of the profession as a whole.

GOVERNMENT SERVICE DIVISION

A SPRINKLER TYPE SELF-CONTAINED FIRE SUPPRESSION SYSTEM

THE system described here was developed by the Ministry of Works and Development for use at Scott Base, Antarctica, and is now in use there and also in New Zealand.

All fires should be brought under control as quickly as possible, and this is even more important at Scott Base, because the loss of a building there can result in much greater hardship than is normally experienced in other locations. The undoubted advantages of automatic fire sprinklers have not been realised on this site owing to the very limited water supply, in the liquid form at least, and the difficulty of keeping large quantities of water and pipework from freezing in unheated or poorly heated places. The solution devised was to use a self-contained system independent of external water and power sources. Provided that the limitations of this system are understood, it could be used in other locations where a reliable water supply is difficult to obtain and where some form of automatic fire suppression at modest cost is judged to be beneficial.

The general arrangement is shown in Fig. 1. It consists of a pressure tank of approximately 450 litre capacity, similar to that used on pressure sets for small domestic water supplies. In cases where a greater supply is required, a number of such tanks are coupled together. Water in the tank passes up through a sparge pipe into the sprinkler system which is installed in accordance with the rules for extra light hazard occupancy. The water pressure and flow are maintained by the use of a cylinder containing compressed nitrogen or other suitable gas using a conventional regulator and fittings. This arrangement avoids the need for an external source of power for operation and ensures that there is at least minimal water available for fire fighting.

The installation has all the instruments and fittings necessary for monitoring and checking, including pressure gauges on the gas cylinder and pressure tank. Over-pressure protection of the storage tank is preferably provided by a bursting disc which is simple, leakproof and not subject to malfunction if not required to operate for several years.

A sight glass at full water level gives visual indication that the tank is full. A float switch to actuate a fire alarm and/or give remote indication of a fall in the water level can be installed. A pressure switch coupled in parallel with the float switch can be used as a low system pressure alarm. A water filling connection, non-return type isolating valve, and a non-return valve on a hose inlet complete the installation.

Because of the limited supply of water, it is essential that it be distributed by the sprinkler as efficiently as possible. Tests' on "extra light hazard" installations have shown that a single 10 mm sprinkler head centrally disposed in a 4.5 m square room supplied with water at

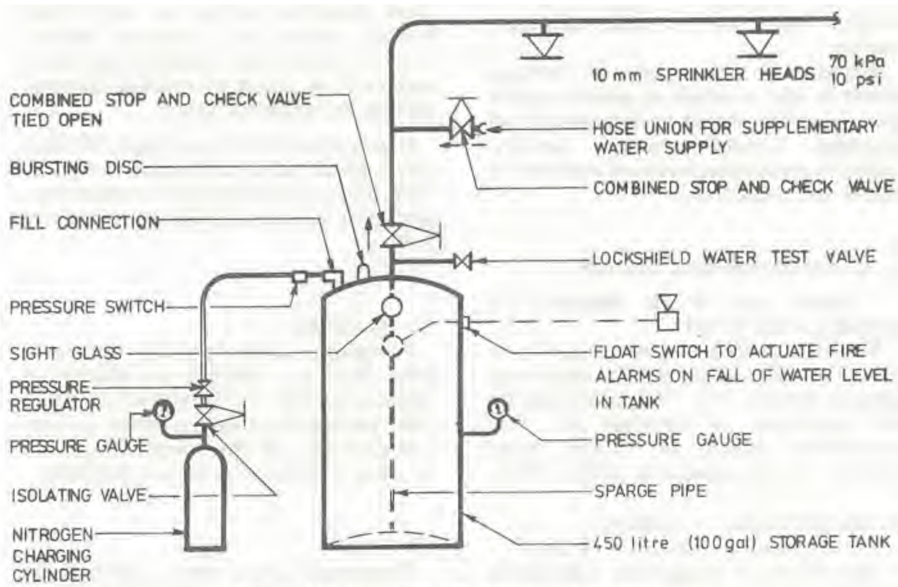

Fig. 1: Self-contained fire suppression system.

70 k Pa to give an average density of 2.25 mm/min over the floor area will adequately cope with any fire likely to occur, reducing the fire to very small proportions within about five minutes. Using this information as a basis, it was decided to carry out some simple tests to check the performance and suitability for the type of application envisaged which by now included some possible installations in New Zealand.

With the co-operation of the N.Z. Fire Service in Christchurch, a simple system using a single head was installed in a derelict house. The room used for the test was 2.7 m x 3.0 m x 2.9 m high, with the sprinkler head located close to the ceiling and in the centre. The room had a bare wooden floor and walls lined with lath and plaster. The fire loading was simulated using timber, wood shavings and paper doused with kerosene. Sprinkler heads from two different manufacturers were used with a rated operating temperature of 68°C (the normal temperature). A thermocouple was located in the room air adjacent to the sprinkler to determine the temperature throughout the ignition period.

The tests showed that, with a discharge of 0.4 litres/s (3 mm/min over the floor area), a fierce fire can be quickly brought under control with minimal water, i.e., in 2 to 4 min. Much of the water was in fact used to control parts of the fire out of the line of the water spray, particularly that directly under the sprinkler head. It is interesting to note that the fire did not generate sufficient heat to crack the windows of the room.

Details of the test results may be obtained by writing to the Commissioner of Works, Ministry of Works and Development, P.O. Box 12041, Wellington North; Attention — Chief Engineer, Building Services.

This system is well suited to installations where property damage can be greatly reduced by early suppression, particularly where the availability of water may limit the ability to control a more established fire. The limited water supply may restrict the ability of the system to extinguish or suppress all fires and it is preferable to couple it to an alarm to summon assistance as soon as possible.

Reference

[1] Manchester, Mather and Platt Ltd (1967): Extra light hazard fire test conducted on behalf of FOC 23 November 1966, *Rep. No. F1056.*

U.S.-U.K. COMBINATION

Richardson McCabe & Co. Ltd, representative in New Zealand of Fisher Controls Company and principal distributor in New Zealand of GEC-Elliott Control Valves Ltd, announce that Monsanto Company of St Louis has reached a preliminary understanding to combine its control valve and process control businesses, principally Fisher Controls Company, with similar businesses of the General Electric Company Limited (GEC) of the United Kingdom.

BUILDING SERVICES GROUP

SOME TRENDS IN FIRE PROTECTION — AN INSURER'S VIEW

Summary and notes of a talk given to the Building Services Group, Auckland, by R. J. Estall, Grad.I.Fire E., acting chief technical officer, Insurance Council of New Zealand.

Introduction

THE Insurance Council is an industry organisation whose technical department advises insurers on factors affecting risk (i.e., probable loss) and examines and assesses fixed and portable fire-fighting systems. The aim is to apply risk management principles to minimise losses and create a stable system in which they can be insured against.

This talk is confined to a few of the trends in fire protection with which we have been involved recently, and is intended only to draw attention to these trends, not to discuss them in any depth.

For most forms of fire protection the department has set up rules which if complied with normally lead to premium reductions: for example, a 2'/2% premium reduction for first-aid fire-fighting equipment (i.e., extinguishers), and 50% for dual independent supply automatic sprinkler systems.

The department maintains technical officers in the four main centres, and at its head office and laboratory in Wellington.

Fire protection and loss control

It is important to distinguish between these two concepts. Complete loss prevention may be uneconomic. In many cases it is possible to tolerate a certain level of loss. Building owners and designers are more receptive to the idea of keeping loss within acceptable limits. We encourage building owners and designers to first identify a tolerable level of loss. For an average building the loss of one room in 100 years might be acceptable. If it was the records room or the motor control centre, it might not. The aim is to limit loss within the area of loss the insured can stand. A study of businesses that had suffered major fires revealed that 71% of them failed within three years of the fire, i.e., the loss was greater than they could economically tolerate.

Similarly, if we are dealing with our own or national standards, it is important to start by defining our objective. The first time I attended a meeting of the Standards Association of New Zealand committee on fire protection bylaws, I asked the question, "How many people are you prepared to lose in a major fire?" It caused some consternation, but it is important to be realistic. Now the concept is coming to be recognised in these circles. In a major fire, disabled people on the top floor of an unsprinklered building may not get out or they may have to be carried out.

Fire growth curves

When a fire develops in a room the critical moment occurs when the room surfaces reach about 300°C and there is a sudden dramatic increase in the size of the fire known as "flashover". The occurrence of flashover usually marks the difference between a small loss and a major loss. In a fast fire this point can be reached in as little as 21/2 minutes, and in a slow growth fire 10 to 20 minutes.

To relate loss control schemes and fire growth, we wanted to know, for example, which buildings it was feasible to protect by an automatic fire alarm system which relies on fire brigade response for extinction. When a detector is triggered the fire keeps going, so the important parameter with a detector system is not so much the operating time of a detector head, but the total growth time before the loss is controlled. This includes the time for the brigade to arrive and effectively control the fire.

Thermal detectors take about 11/2 minutes to operate from the time that open flame combustion first occurs in a fast fire, 21/2 minutes in a slow one. Smoke detectors take about *1/2* and 1 minute in the same circumstances. Two factors account for this time lag. First, the heat has to reach the detector head (or there has to be sufficient temperature gradient for ionised smoke particles to be carried to the smoke detector); this means that open flame combustion is generally needed before a low-level fire will set off ceiling level heads. Second, in heat detectors, the thermal inertia of the head itself must be overcome. Typically, in a fast fire a head set to function at 68°C might not operate until the air temperature has reached 230°C. This is not bad design, but simply the thermal lag of the metal head.

So far as brigade turn-out times are concerned, on an average city callout it will take at least 8 minutes before the brigade starts to apply water. In high-rise downtown areas, it may be 20 minutes. The control room log may show 3 minutes for the appliance to reach the fire. However, this is registered to the nearest minute on a digital clock, and the appliance may radio that it has reached the fire when it is still half a block away. On reaching the building, the crew still have to locate the fire (if they can already see it, it is probably already out of control). They then have to couple hoses to the nearest hydrant before the water carried on the appliance (about a minute's fire-fighting supply) is exhausted. A fast growing fire may reach 1 000°C before the brigade is ready to fight it. Sometimes it may even be better not to put such a fire out. A complete burn-out costs less to demolish.

Thus early detection is not necessarily synonymous with early loss control. Loss control depends on *stopping* (not just detecting) the fire while it is small.

Some fires smoulder for a long while before growing to a detectable size. In old match-lined washhouses, for instance, wood may carbonise over a period of years. The growth rate after open flame combustion is established is the significant factor. In a slow fire, the average small office or even low hazard factory with a detector system may have quite a reasonable chance of a save if the brigade and mains water are reasonably close. A fire does not matter too much if it is not growing. The important factor in fire control is the *rate of growth.*

This philosophy has led to a review of premium reductions for the detector system/brigade combination. We have case histories such as a flour mill in Christchurch, where, within 14 minutes of detection, the brigade was applying 225 litre/s (3 000 gal/min). It was a total loss. In Dunedin last November, a detector system in a three-storey brick building sounded the alarm. The headquarters station of the brigade was less than a mile away, but the whole top floor was taken out. This floor had storage on shelving. Shelving and racking, dust, cardboard, plastic, and paper can all lead to fantastically rapid fire growth.

In Christchurch, a proposal for detector protection of an automatic warehouse was refused. We arranged a dry run of an actual brigade arrival. It took 15 to 17 minutes before the brigade could arrive, locate, and attack with sufficient water to control a moderate sized fire. Unfortunately, the high piled stacking, cardboard cartoning, and pallets meant that, in this time, the place would have been a total loss. We suggested that the company should not spend money on a detector system, but select fire protection on a better assessment of risks and savings with other systems.

Q. *Does the same philosophy apply if the building is one of a row of buildings, i.e., would not the alarm/brigade combination at least prevent spread?*

A. No, this is a different problem that is dealt with by the design of the buildings not by the provision of equipment. The New Zealand standard model building bylaw (NZS1900) deals with this in Chapter 5 which calls for intrinsic non-transmission of fire. New Zealand has always had good separation, and insurers have always insisted on party wall separation too.

Q. *Would an alarm system be suitable in a large single building such as a wool store, where it would at least allow a partial save?*

A. Big fires are the exception which brigades are not really geared to fight. The energy required to fight the fire cubes as the size of the fire doubles. Such a fire requires a large number of appliances, which take time to arrive. They must get their water from progressively further away, and the fire develops faster than they can control it. Hence the pattern is — either the brigade achieves a good save, i.e., small loss, or there is a total loss.

Q. *So far we have been talking of material loss, and not life. Surely alarms have another function, to alert danger and save life.*

A. This is a fair point. Detector systems can save life irrespective of brigade attendance, but there are still limitations. You have to choose your building and your occupants. In practice, there are very few buildings where the detector/brigade combination is unsuitable for property protection but suitable for life protection. If, for example, fire growth is such that there is less than a minute between detection and flashover, then the distinction between life and property is largely unreal. Egress codes do not anticipate escape times as short as 1 minute. It is also important to consider the "escapees". In a hospital, for example, no matter how long you give him, a patient in traction cannot escape. In most cases, however, if a detector can assure the safety, it can probably, in combination with the brigade, achieve property loss control. There are exceptions, such as a remote hotel where the alarm will alert people and get them out, but there is no prospect of summoning a nearby brigade to save the property.

Electrical equipment

Water is now generally accepted as a means of fighting fire in electrical equipment and this is regarded as nothing very special. The only unusual thing about such a fire is that energy comes from the current. For the rest, it is usually ordinary combustibles, e.g., plastics burning. Water puts these out well. There have been some very good saves from sprinklers over electrical equipment. It is important, however, to dry the equipment out immediately after the fire. This should be part of the loss control plan. You want to get the equipment back into service as soon as possible. This needs early salvage, cleaning and corrosion control. For example, within 48 hours after a fire in a university physics department, where fortunately one of the people in charge was aware of problems of corrosion, with hydrochloric acid gas as a product of PVC combustion, some 90 items of advanced physics equipment underwent a corrosion cleaning programme, using clean water and some meths, every item being washed and dried.

One very large Scandinavian reinsurance company has formed corrosion control squads. Instances have been quoted, one of a $US12 million fire claim which would have been $US2 million if prompt steps had been taken to clean up. Even for computer suites, we prefer a basic coverage of sprinkler protection backed up by operators trained in loss control and an automatic Halon system. Add corrosion control equipment in relatively basic form: squeegees, hair driers (one firm had an audit query on these), mops, buckets, and sausage-like cushions to form dams. This equipment is well worth while to control loss in the immediate post-fire period. By and large, the idea of sprinkler protection for electrical equipment has been accepted. The consequential loss in toilets and similar areas is nothing compared with the loss in a switchboard fire and yet we have to argue very hard sometimes to get a sprinkler into a switchboard cupboard. Generally, New Zealand underwriters do not accept inert gas systems as an alternative in a sprinklered building. Water systems are robust, simple, and reliable. Sophistication and complication are often the worst enemies of fire protection. Simplest is best.

Q. *What about motor control centres, especially Class III?*

A. We make no exceptions. We are quite happy to have water there. We think the loss is less. Remember, we are talking about the alternative to uncontrolled fire damage. Some owners are adamant so in the past we have sometimes accepted separation by concrete walls, etc. However, we have not found contra-indications to our policy and I see the "separation" option disappearing. The BCNZ use sprinklers in their remote transmitters, and this does not seem to justify a different rule.

Q. *Is it better to use totally enclosed metal clad or open cabinets?*

A. Totally enclosed cabinets are better to prevent fire break-out, but slow the sprinkler operation. If the room is sprinkler protected, boards may be better unenclosed.

Q. *What is your attitude to a BCF bottle with a head attached as an alternative to sprinklers?*

A. The problem is that you do not know it has operated, and the condition causing the fire may persist. I must refute the idea that, so far as extinguishing is concerned, Halon systems are better for electrical cabinets than water. Water cools off plastic much better than Halon. If there has been a fire in a cabinet it can re-ignite through after-glow. Water will quench an arc, too, if that is the source of the heat. A transistor radio has been shown to operate satisfactorily after dunking in a bucket of water, provided the loudspeaker is wrapped in plastic.

High pile storage

This is one of the worst fire hazards. The higher the storage, the faster the fire growth. Timber, plywood, and veneer stacks have plenty of airspace. Rolled newsprint defoliates, especially when stacked vertically, and burning particles then convect around to start fresh fires. A cold store is a potential hangi. If the underside of the roof is of exposed sprayed polyurethane, people probably cannot run fast enough to escape it if it catches fire. The most common storage fire problem is cardboard, which can be as bad as flammable liquid.

In automated high bay warehouses, racking may be 30 m high. Unless controlled, fire will readily reach the top (from a small ignition source) in less than 3 minutes. Work in Britain on high rack storage has led to the development of a multi-head zone sprinkler system with line detection. A conventional multi-head system without high-speed detection has the problem that the fire can outrun the response time of the sprinkler heads. The British high-speed zone system uses a frangible disc in the main supply (set off by a detonator) and open heads. The detector line is constructed so that melting anywhere along its length closes an electric circuit to fire the detonator, which may be arranged in parallel with a standard quartzoid bulb for back-up. Single sprinkler heads can also be fired by a detonator device.

Comparative test figures show the amount of water to put a fire out using various systems. American tests using various ceiling detector systems used between 394 000 and 83 000 U.S. gallons (worst and best case). Conventional wet-pipe systems with detector heads at different levels in the racks used 10 500 U.S. gallons (best case). By contrast, the British high-speed system used 90 U.S. gallons (best case). Commercial hardware for this system is available.

Work in the Standards Association of N.Z.

NZS1900, Chapter 5, is currently being revised. The committee is trying for a more flexible approach to compartment size: what goes on in the compartment is intended to be more precisely assessed in determining maximum dimensions. The question of egress is also being re-examined. The egress requirement is being looked at in more dynamic ways. A partial draft could be available for comment early in 1979.

However, flexible code requirements will mean that more time will be needed to design and to check the design. By adding complexity, margins for error increase. Applications take longer to check and differences of interpretation can lead to more argument. However, so far, designers seem happy with the general direction.

The intentions of the code are the safety of occupants and the safety of the property with respect to neighbours. The country cannot afford to have large buildings gutted, so the code also limits unsprinklered compartment size. Furthermore, it should protect firemen from structural collapse during fire fighting. Should it also provide egress from terrorist raids or gas escape? Handicapped people have said that they are not looking for special consideration in egress, though they expect good access as a normal requirement.

Meat works

A draft has been made available for comment as DZ4216. The aim is to provide a supplement, and in part an alternative, to NZS1900, Chapter 5. The freezing industry claims that it has a different set of circumstances from those contemplated by Chapter 5, that the meat is too cold to catch fire; that works are on island sites with good water supplies, good management control, works fire brigades, etc. These arguments are good on paper. However, some Of these aspects are more apparent than real. For example, if huge water supplies became significant, has not the fire already been lost?

A major point at issue is the frequency of ignition. Chapter 5 at present assumes that if there can be ignition then there must be protection. There was a substantial debate over this question. The freezing industry seems keen to keep sprinklers out of cold stores, but there is wealth locked up in a cold store. My own interpretation of tests carried out by the Building Research Association of New Zealand is that these revealed little difference between the development of fire in fresh or in frozen meat, although both are difficult to ignite with a small source of ignition, e.g., a welding bead. But once the fat starts dripping, a pool of molten fat forms. Even after the fat flashes, the burning carcass is still frozen at a depth of 10 mm. Of course, the result of even a small fire may result in condemning a whole store full of meat.

Obvious sources of large-scale ignition are an accident to a fork-lift truck or arson. There was concern that sparks from welding could be a problem, but sparks were found to burn the muslin off but not ignite the carcass. Of course, in stores of boned-out meat cuts, the exposed faces of cardboard cartons burn well. There is conflicting evidence on cigarette ends in some recent shipboard fires in frozen meat.

ENERGY IN TRANSPORT

The *Energy in Transport Report: Volume 1 — Data* presents the data collected and used for one of the most important research contracts let by the N.Z. Energy Research and Development Committee to date. The research was performed by Beca, Carter, Hollings and Ferner and considers a number of short- and medium-term policies that would reduce the volume of domestic transport and fuel used in New Zealand.

It must be emphasised that the policies considered in the report are short- and medium-term in nature and that there are additional longer-term policies, such as land use/transport planning and more extensive use of public transport that could show large savings in fuel use. Such long-term policies are currently under investigation in further N.Z.E.R.D.C. contracts and will be reported on in the future.

CORRESPONDENCE

UNIVERSITY TEACHING

Sir,

I should like to raise and question the continued use of an "honours degree" being the minimum requirement for a teaching position in a university engineering department. At a time when the university engineering departments appear to be wandering further than ever from practical education, they seem to be cutting off access to a wide body of potential engineering experience by retaining the "honours" criterion.

The granting of honours is after all a value judgment and we appear to be limiting the development of the profession through adherence to a form of judgment which may be directly affected by a person's variation in application in one year of their lives — the final university year.

Surely an investigation of the post-university years would be a better judgment, or are the universities determined to keep the majestic air of obscure research rather than seek to provide a relevantly practical engineering education?

At a time of employment difficulties, the students emerging from the technical institutes are becoming better and better employment prospects and I am sure that the university engineering students would welcome a practical note to their education which might restore their employment demand with that of the technical institutes. I think dropping of the "honours" requirement would offer a wider selection of possible teachers and probable benefit to the profession at large.

W. BROWN
Auckland

Sir,

I welcome the opportunity to reply to Mr Brown's letter, both because it contains a number of assertions which are frequently made and which I believe to be unjustified, and because it provides the opportunity for me to put forward some views of my own which I hope will lead to a more productive interaction between the university, practising members of the profession and the engineering industries.

I shall begin by replying to the points made in Mr Brown's letter and shall interpolate the points I wish to make as I go. Mr Brown's first point concerns the matter of an honours degree being the minimum requirement for a teaching post in a university engineering department. Though the advertisements for most posts do include a statement of the type "Applicants should have a higher degree or good honours degree," there is in fact nothing to prevent an applicant without such a degree from applying, and I am sure that, if such an applicant turned out to be the most appropriate person, then he would be offered the post. It is, however, a fact that people with good honours degrees and higher degrees tend to be good at their subject. I seriously doubt the implication of Mr Brown's letter that those who possess honours degrees are necessarily "less practical" than those who do not.

Mr Brown goes on to assert that the awarding of honours is a "value" judgment. As I understand the term "value" judgment, it applies to judgments which cannot be put on an objective basis. The award of honours in the engineering degrees at this university is most certainly not a "value" judgment in these terms. It is made on the basis of a well-established objective method.

Mr Brown further asserts that the award of honours depends only on the performance of a candidate in his final university year. This again is incorrect. The award of honours in engineering at Canterbury is based on the candidate's performance during his whole time in the engineering school, i.e., over the final three years of his four-year course.

The next statement in Mr Brown's letter asserts that "engineering schools appear to be wandering further than ever from practical education." This statement implies that engineering schools have always been a long way from practical education and that the situation has worsened recently. Both of these assertions are serious matters which relate to the whole purpose of the university education of engineers.

Practical content can appear in the undergraduate course in engineering in three ways, through the practical orientation of the lecture and classroom material, through the laboratory work and through the outside work requirements of the degree course. Professor P. V. Dankwerts in his inaugural address in 1957 at the Imperial College of Science and Technology said, "Engineering in practice is compounded of science, experience and judgment. Of these only the first can be learned at University and in fact, if it is not learned there, it is unlikely to be learned later." Now, as then, the desire to include as much "practical" orientation as possible in the undergraduate course must be tempered by the recognition that the science neglected at this level may be lost to the student forever.

Despite the growing amount of science with which it is necessary to equip the engineering graduate, the syllabuses of the engineering degrees at Canterbury include the same amount of compulsory practical work now, both in laboratories during term time and in industrial experience, as they always have. As Mr Brown must know, this includes a course at the technical institute during the first year and three periods of industrial experience of 60 days each which occupy the whole of three summer recesses. It would be difficult to arrange for undergraduates to spend any more time gaining practical experience during three years at the engineering school.

I might add at this stage that, while some employers take a keen interest in this aspect of the training of undergraduates and go to considerable lengths to ensure that the practical periods in industry provide maximum benefit to the students, it is a cause for continuing concern and considerable disappointment that there are many engineering firms which are reluctant to play their part in this aspect of undergraduate training. As a result of this, some students have difficulty in obtaining the work to fulfil this requirement for their degrees. Others are given jobs but no attempt is made by their employers to ensure that they gain worthwhile experience in these jobs.

If, as I believe and as the profession at large loudly proclaims whenever the subject is raised, the practical work is an essential part of an undergraduate's training, then it is up to the members of the profession and the engineering industries to provide appropriate and properly supervised experience in these periods. This experience can only be obtained outside the confines of the university and it is high time that the profession at large recognised and accepted its responsibility in this respect and stopped looking for others to blame for the deficiencies in the practical experience of new graduates.

It could well be that the impression that Mr Brown has that the universities are wandering further than ever from practical education is a result of developments which have taken place in engineering and which are now reflected in engineering education since Mr Brown's own undergraduate days. Engineering is a rapidly moving field in all its branches and there are certainly many topics dealt with in engineering courses today which were not there 20 to 30 years ago. It is notable that, for many years past, the universities, and more recently the Institution, have sponsored post-graduation courses and have provided means for graduates to keep up with developments in the subject which have taken place since their graduation.

The post-university years are indeed taken into account when appointments are made to the staff of the engineering school, and many of the staff of this school have significant periods of post-graduation "i ndus trial" experience. Indeed in the department to which I belong, with a staff of 12, nine have spent extended periods earning their living in the practice of their profession outside the university.

The universities are charged by the Acts of Parliament under which they were set up with "the advancement of knowledge and the maintenance and dissemination thereof by teaching and research". The responsibility, laid on the university by the Act, to conduct both teaching and research means that, in selecting staff, we look for evidence of aptitude in both these areas. The honours or higher degree is not infrequently contributory evidence of research ability. It should, however, be noted that a strong teaching or research record is often placed alongside recent industrial experience as a requirement in the advertisements.

It is in the universities that one *expects* to find the speculative studies which are aimed at producing the new knowledge which, while perhaps regarded as esoteric now, will become the commonplace of tomorrow. It is in the universities that one expects to find people working to find answers to the questions that others have found "too hard". If this is what Mr Brown calls a "majestic air of obscure research," then long may it remain so. It certainly does not detract from the relevantly practical education which we have always sought to provide for our undergraduates. (Indeed it has been my own experience with research that "relevance" is mostly hindsight.) Nor does it detract from the relevantly practical *association* of academic staff members with the profession and with the engineering industries as advisers and consultants.

A check among the departments at Canterbury revealed that over 80% of the staff are involved in some way or other with "non-academic" engineering activities. This includes consulting to both the private sector and to government departments, and membership of advisory bodies. As if to emphasise this point, my own first attempt to answer Mr Brown's letter was interrupted by a phone call from an eminent engineer (and former President of the Institution) requesting advice from academics on a very practical problem which needed immediate action!

On the matter of the employment difficulties of engineering graduates, I can only say that Mr Brown's experience differs from my own. To quote again from my own department (chemical engineering), last year we could have placed three times as many graduates as we produced; on a recent weekend, there were advertised in a single issue of the local newspaper enough jobs to take two-thirds of this year's graduating class; last week we had an enquiry from a well-known firm of consultants for another graduate "like the last one we got from you" (he incidentally had graduated with a Ph.D.). And so it goes on!

Mr Brown says that technical institute students are becoming better and better employment prospects. I am sure that this is true. There are places in the structure of the profession for the graduates of both the technical institutes and the universities. I agree that most university engineering students welcome the practical content of their education and, as I have already mentioned, I think that one of the most immediate requirements in this respect is for employers to take a more positive and constructive interest in the existing undergraduate practical work requirements.

Another requirement is for employers to take an equal interest in the post-graduation training of their engineering employees. The Institution recognises this need and is attempting to provide new graduates with a better guided path to registration with which it is to be hoped employers will co-operate.

One must recognise that the university cannot in four years produce the "Compleat Engineer." As I see it, our main task is to provide the proper academic base with, of course, as much practical orientation as can be included. The final polishing of the raw graduate is of necessity largely the task of the profession and is a responsibility which, if accepted, takes time and effort which I believe has in the past been left to too few of the practising profession.

I do not believe that "dropping the honours requirement" would provide a wider selection of possible teachers and offer a benefit to the profession at large. Over the past five years, in excess of 40% of all students graduating from Canterbury in engineering have done so with honours. There is, therefore, a very much bigger number of honour graduates available than are employed in, or indeed apply for, posts in the universities. It is also a fact that the students who graduate with honours often do better in their subsequent careers than those who do not and there is certainly no general indication that non-honours graduates in practice are any more practical or in any way better than honours graduates.

I agree with Mr Brown's desire to generate more direct contact between university staff, undergraduates and the practising profession. One recent suggestion aimed at achieving this has been for an arrangement whereby undergraduates have "professional" tutors as well as "academic" tutors.

Another has been to arrange exchanges between university and industry and short-term appointments in the universities to bring in lecturers from professional practice. Some moves have already been made in this direction and they have been quite successful. However, I believe that in this the initiatives have come from the universities and a few interested parties in practice and it will take a much greater degree of positive action from the profession to bring schemes of this kind to full effectiveness.

In conclusion, may I record here my conviction that overall the members of the academic staff of the schools of engineering are far more aware of what goes on in the engineering profession and in practice than are practising engineers of what goes on in the university.

A. G. WILLIAMSON,
Professor of Chemical Engineering,
University of Canterbury

Sir,

Mr Brown's letter contains a number of points that I shall attempt to comment on briefly.

First, although few people these days would be appointed who do not have an honours degree — in fact, most would have a higher degree as well — the conditions of appointment at Auckland seldom state this as a requirement. An example of the conditions of appointment for a position in mechanical engineering — my own department — will illustrate the kind of things we are usually looking for.

> "Applicants should have a strong academic background in engineering, preferably with education at the post-graduate level. Although research, industrial and teaching experience are regarded as important, it is not essential that applicants should have experience in all three."

We make no apology for seeking to appoint people who are well qualified academically, for it is our experience that it is from this group that we get the strongest teachers, the strongest researchers and the people best able to adjust to the changes in technology that are likely to occur during the working lifetime of the average academic. Where it has been necessary to appoint people with particular practical experience such as in design, surveying and one or two other fields, the New Zealand schools of engineering have not been slow to do so even though the people so appointed have sometimes had quite modest academic qualifications. In the matter of practical experience we shall, of course, be looking for performance at a high level.

To be pedantic for a moment, it is worth recording that the B.E. degrees at both schools of engineering in New Zealand are "honours degrees" although not all students gain honours. At Auckland the percentage of B.E. graduates gaining honours has in recent years exceeded 33%.

As to the award of honours in the B.E. degree at Auckland, this is based on the grades obtained in the four years of the course and is no more a value judgment than the award of a grade in any subject or, for that matter, a pass or fail; the ingredients are the same.

In his third paragraph Mr Brown suggests that, in making appointments, the schools of engineering are not concerned about the experience of applicants post-graduation. I hope I have indicated that the reverse is true. As Dean of Engineering and as a long-time member of the appointments committee of this university, I would like to emphasise that we should, in most cases, like to appoint people who have a strong academic background and experience at a high level in their profession. On the matter of the kind of research that the schools of engineering conduct, it has been my experience as one who has spent less than half of his professional life in a university that very little of it is obscure, although this in itself may not be a fault. Most research is of a highly practical nature and much of it relates specifically to New Zealand problems. Increasingly, research in engineering is being funded by outside agencies who are interested in solutions to their problems.

Far from divorcing the academic engineer from his profession, research often provides him with expertise that is sought after by consulting engineers, government departments and by industry and serves very much to keep him in touch. In my experience it is the talented researcher who often has the most to offer the engineering community and whose services in consulting and in solving difficult problems are often in greatest demand.

Mr Brown suggests that the educations offered by the schools of engineering are impractical. Having reviewed the courses at many universities, I do not believe that this is so, although I would stress that the fresh graduate is not a professional engineer and that he needs a period of practical training in the chosen branch of his profession before he becomes a fully fledged professional. This is recognised by the New Zealand Institution of Engineers and the Institutions in other countries with a British tradition. Unfortunately, the responsibility to provide necessary training to supplement the fresh graduate's education is not one that all employers fully recognise. Practical training means on-the-job training, properly structured, properly supervised, and in which an appropriate level of responsibility is reached.

Another suggestion of Mr Brown's is that B.E. graduates and N.Z.C.E. graduates are in competition for jobs. There are cases in industry where this is so and many of these involve jobs which are of a kind more suitable to holders of the N.Z.C.E. qualification. It should be remembered that the number of people qualifying with an N.Z.C.E. has only recently passed the number graduating B.E. and that traditionally a percentage of B.E. graduates had been under-employed in both government service and in industry. This is not to denigrate the N.Z.C.E. qualification for which I have a very high regard and which I believe to be serving New Zealand industry particularly well. The evidence is that we need many more people with this qualification, but, generally speaking, the certificate holder and the B.E. graduate should be filling different but complementary roles.

The C.E.I. examination, for which preparation is offered in a decreasing number of subjects at the Auckland Technical Institute, is hardly any longer of significance in New Zealand. The number of engineers qualifying by this examination in the next three years will be of the order of 1% of those graduating B.E.

As for the demand for B.E. graduates, the Auckland experience last year was that (i) the demand for chemical and material engineers and mechanical engineers was considerably in excess of the supply, (ii) the demand for electrical engineers was strong, and (iii) only the civil engineering graduates had difficulty finding employment although most, in the end, were able to do so. The pattern this year appears much the same with employment in civil engineering perhaps being more difficult.

R. F. MEYER,
Professor of Mechanical Engineering,
University of Auckland

TOXICITY OF METHANOL/GASOLINE

Sir,

In the article "Methanol/gasoline blends as a motor fuel for New Zealand" (E. E. Graham and B. T. Judd, August 1978 issue), toxicity values were given which are well out of date. The current New Zealand values (1977) taken from "Threshold Limit Values" published annually by the Department of Health are shown in the table alongside the values quoted by Graham and Judd.

Compound	*TLV (ppm) — Time Weighted Average*	
	Graham and Judd	*Dept. of Health*
Methanol	200	200
Benzene	100	10
Toluene	200	100
Xylene	200	100
Heptanes	300	400
Octanes	200-300	300
Gasoline	250-700	Approx. 25

The values published by the Department of Health are taken from those adopted by ACGIH. Recently OSHA, one of the members of ACGIH, have issued a new standard for benzene of 1 ppm (*Chemical Engineer,* Vol. 85, 1978, p. 54), hence it is likely that this will be the new figure adopted by ACGIH and therefore eventually in New Zealand. The value of 25 ppm for gasoline is based on the lead and benzene levels in New Zealand petrol and would reduce to about 20 ppm with a benzene level of 1 ppm.

These revised figures therefore further strengthen the basic tenet of Graham and Judd that the addition of methanol to gasoline will lead to no increase in toxic inhalation hazards. Methanol/gasoline blends may, of course, be more toxic than ordinary gasoline, depending on the lead level, if *ingested.*

A. A. EVANS
P. F. HEVELDT
Wellington

The authors reply:

We thank your correspondents for drawing our attention to the proposed new TLV for benzene, a change that we had only become aware of after submission of the paper for publication. We agree that, if this new value is accepted, then dilution of the benzene concentration by addition of methanol should lead to a reduction in TLV for the blended fuel. Other factors require consideration, however, particularly the effect of methanol on the vapour pressure of the fuel and also the effect of methanol on the dispersion characteristics of the fuel vapour.

To obtain hard data, concentrations of the various fuel components around a typical fuel bowser are being measured. Comparative data when dispensing both premium gasoline and a methanol blend are being obtained. These measurements are being made by the Department of Health and will, no doubt, be reported in due course.

Noteworthy

FIRE DOORS A SUCCESS

UNDER tests by the Building Research Association of New Zealand, A.W.L. steel-framed, glass-panelled doors have had to withstand temperatures averaging close to 700°C for a period of 30 min. The tests were to ensure that the doors would contain heat and smoke while maintaining their self-closing characteristic.

The test at the BRANZ laboratories was the first of its type. It involved building the double-wired glazed doors and steel frame into the wall of the BRANZ furnace. Although the test was regarded as a 30 min one, the doors were actually exposed to intense heat (peaking at well over 800°C) for 35 min. Architectural Windows' experience in building similar doors extends back to the 1930s, but the new door was specially modified to meet the requirements of the 30 min test and insurance underwriting demands. Built with flush mild steel frames, the doors are manufactured to a standard size, 2 100 mm by 1 425 mm wide.

Circle 51 for more information

DIVING COMPANY WINS OVERSEAS CONTRACT

A team of commercial divers from Auckland flew to Ecuador in September for a second major offshore diving contract for one of the world's largest oil companies, Texaco Petroleum Inc. The work involved the changing out and installation of a single-point mooring terminal plus the survey and repair to the 75 cm undersea pipeline at the Balao Terminal, Esmeraldas, Ecuador.

Earlier this year the divers, from Diver Services N.Z. Ltd, were successful in installing another s.p.m. single-point mooring buoy in Ecuador for Texaco. The value of the two contracts is more than $100 000.

Circle 52 for more information

PROGRAMMABLE CALCULATOR LOGS CRITICAL WATER SUPPLY

A forward step in utilising the benefits of a desktop calculator has been achieved in an installation commissioned by the Wellington Regional Water Board.

The installation replaces manual monitoring of the critical parameters related to maintaining the flow of daily water for domestic and industrial consumers in Wellington and Lower Hutt cities.

Centre of the new installation is a standard Hewlett-Packard 9815 programmable desktop calculator-controller. Digital inputs of the levels in two artesian wells and the levels of the sea tide and Hutt River are interfaced with the calculator through a standard interface bus. A digital/analogue converter, real-time clock, and strip chart recorder complete the hardware.

The system plots the three inputs every minute and records and tests level every 15 min. At noon every day the calculator prints the average levels of the wells over the past 24 hours and the difference between the tidal level and artesian level at each well.

The calculator continuously checks for primary and secondary alarm conditions and initiates taped telephone messages to duty operators should these conditions arise. The printout also emphasises every alarm condition and shows time, date and the levels that initiated the alarm.

The system is designed for continuous unattended performance and will automatically restart in the event of a power failure/recovery. Through the keyboard, engineers can interrogate the system, change the alarm parameters and enable/disable the alarms.

Circle 53 for more information

NEW WELDING PRODUCTS

New Zealand Industrial Gases have introduced a new pack of tip cleaners. These contain a range of cleaners suited to New Zealand welding tip and cutting nozzle sizes, rather than being a standard set manufactured for some other country.

Each cleaner has a 9 mm lead in and champered end preventing bell-mouthing of the nozzle orifice.

The cleaners are attractively packaged in a full opening metal case.

Also being released this month is a new Piezzo lighter. Being of all metal construction, the lighter is designed to take the rigours of workshop use. The lighters work by crushing a small crystal to produce a high voltage electric spark. These are very effective lighters and particularly suitable for use with I.p.g. and often difficult-to-light gas.

Circle 54 for more information

NEW GLOVE CUTS RISK OF INJURY

A new concept in industrial safety gloves, currently being introduced to the New Zealand market, should play a major role in dramatically reducing the incidence of injuries to hands, which is the biggest single contributing factor to lost time accidents in industry in this country. Last year lacerations to the hand and forearm accounted for nearly 40% of all accidents in New Zealand industry with this figure being nearer the 70% mark in the meat industry.

Made in U.S.A., the new Whizard gloves are fabricated from strands of stainless steel and a du Pont "miracle" fibre, Kelvar, which has a tremendously high cut resistance yet retains complete flexibility. This provides the user with better feel and dexterity and gives a greater sense of protection. Each strand of stainless steel and Kelvar is encased in nylon to give the gloves longer life under tough working conditions and to enhance greatly their cleanability. They are easily hand or machine washable in a mild detergent. Whizard gloves are available through the marketing division of Mauri Brothers and Thomson (N.Z.) Ltd.

Circle 55 for more information

CATERPILLAR ENGINE SELECTION GUIDE

A new I2-page selection guide for industrial and mobile equipment engines, which gives specifications for the 300, 3 400 and 3 300 series and 3 208 diesel engines, has been released by Gough, Gough & Hamer Ltd, the New Zealand dealers for Caterpillar equipment.

Circle 56 for more information

PIPE JOINTING LUBRICANT ELIMINATES BACTERIAL GROWTH

WRC Medlube a bactericidal lubricant based entirely on synthetic constituents, and used in pipe jointing of water mains, which is claimed to have advantages over soap and castor-oil-based lubricants used by most water supply organisations, is now available in New Zealand, through Sel Wither Ltd of Balmoral, Auckland.

Developed by the British Water Research Centre and made under licence by Isaac Bently, of Liverpool, England, Medlube represents a breakthrough in pipe jointing of water mains. It has been accepted for use on mains water supply pipes by the Canadian Bureau of Chemical Hazards, the British Department of the Environment, and the U.K. National Water Council and KIWA Limited, The Netherlands Watermarks Testing and Research Institute, whose standards are recognised throughout Europe.

Medlube has the advantage that it can be used on iron, cement or plastic water pipes to assist the positioning of the rubber "0" sealing ring and achieve efficient insertion. In addition, it is toxicologically acceptable, produces no taste or odour, and, being water-soluble, is readily washed off hands and clothing.

Circle 57 for more details)

BIG SEWAGE-TREATMENT ORDER

The largest single order ever placed in New Zealand for submersible pumps and level controls has been successfully commissioned by Tolley Industries for Hamilton City Council's new sewage treatment scheme.

Totalling $250 000, at present-day cost, the 120 pump sets were chosen from the latest Flygt range. AD pumps are of the submersible type having advantages in minimising installation costs and allowing easy withdrawal for maintenance.

Correct levels of sewage are maintained at each station automatically by means of Flygt level regulators which are manufactured by Tolley Industries in New Zealand and sold on home and export markets.

(Circle 58 for more details)

AN ENGINEER'S BOOKSHELF

INTEGRATED CIRCUITS **GUIDEBOOK, by.** K. Tracton, 195 pp., illus. (TAB Books, 1975, $US5.95.)

This book is intended as an initial introduction to the use and characteristics of, mainly, linear integrated circuits, although there is one chapter on digital I.C.s. The operational amplifier is given a reasonable treatment for a book at this level. After a chapter on hybrids and interface circuits, various applications in the audio field and wave-form generation are discussed. Applications in power supply design are also given. The level has been kept at that appropriate to the electronic hobbyist.

— J. G. S. W.

TOWN PLANNING, by D. F. G. Sheppard and J. P. McVeagh, 122 pp. (Brooker and Friend Publishing Ltd, 1978, $39.85, including remainder of current subscription.)

The authors of this loose-leaf volume updated quarterly have produced an essential and invaluable aid for all involved in land-use planning and development.

The publication sets out the recently enacted Town and Country Planning Act 1977, and the Town and Country Planning Regulations 1978 with notes indicating changes from the 1953 Act and its amendments, and listing relevant planning decisions. Also included are a table of relevant cases and a general index to the Act and the Regulations.

No other document providing this assistance and analysis of the comprehensively revised Act and Regulations exists.

Of particular value is the cross-referencing between the Act and the Regulations. The document is clear and concise and should enable its users to gain a wider and better working knowledge of' this key legislation.

Launched in June 1978, it is intended that the volume be kept constantly up to date at least each 90 days, or more frequently if warranted, with loose-leaf replaceable pages. It is available on a subscription basis and is available from the publishers, 44 Upland Road (P.O. Box 43), Wellington.

—D. N. S.

AVIATION ELECTRONICS HANDBOOK, by Edward L. Safford, 404 pp., illus. (TAB Books. 1975, $US8.95.)

Although this book deals mainly with the electronic/electrical aspects of aircraft, the basic idea of the overall system is also given in the case of navigational aids and traffic control, to make this a useful reference book for ground technicians.

Considerable emphasis is laid on describing various commercial equipments in a general way. As this equipment is all of U.S.A. origin, it becomes really relevant only if encountered in local aircraft. Even so, the general principles discussed must help in the assessment of equipment by other manufacturers.

The book has ten chapters, covering the aircraft environment and its control, aircraft power systems, communication equipment, autopilots, aircraft instruments, directional and doppler navigational aids, inertial navigation and radio altimetry, and related systems airborne radar, and air-traffic control. There are glossaries of avionics and aeronautical terms.

There is a liberal supply of photographs and diagrams to illustrate the text.

— J. G. S. W.

MISCELLANEOUS ADVERTISEMENTS