THE INSTITUTION OF CIVIL ENGINEERS

GLASGOW AND WEST OF SCOTLAND ASSOCIATION

SESSION 1991-92

# Chairman's Address

ROBERT McGOWAN
BSc FICE FIStructE FIHT FCIArb MConsE

*Robert McGowan, BSc, FICE, FIStrucE, FIHT, FCIArb, MConsE*
*Chairman: Session 1991–92*

# CHAIRMAN'S ADDRESS

by

ROBERT McGOWAN
BSc, FICE, FIStructE, FIHT, FCIArb, MConsE

**Delivered to the Association in the Mitchell Library, Glasgow on 10th October 1991**

**and to the Highlands and Islands Branch in the Mercury Hotel, Inverness on 13th November 1991**

## Biographical note

Bob McGowan graduated from the University of Strathclyde in 1960 and after five years experience in contracting in the United Kingdom and Zambia he worked in London and Canada on designs for hydroelectric and thermal power stations.

From 1967 to 1969 he was engaged on bridge design in the Glasgow Office of Scott Wilson Kirkpatrick & Partners and was later Resident Engineer (Bridges) on a section of the Glasgow motorway.

Following further bridge design in SWK's Nairobi office he returned to Glasgow in 1971 and in 1973 was made responsible for bridge and structural work undertaken by SWK in Scotland.

He was appointed Associate in 1979 and Partner in 1981.

# CHAIRMAN'S ADDRESS

## Introduction

This is the second occasion in my life when the 10th October has been a significant date. The other one was no less daunting but for different reasons. I shall return to that shortly. Every Vice-Chairman has to ask himself the question "What shall I say for the Chairman's address?". I see one or two people tonight who are already thinking about this question. For many the subject is obvious. They have devoted their career to one single branch or aspect of our profession.

I am sure Ritchie M. Campbell in 1956 did not have to think long and hard about his topic. He had been for many years consultant to the Clyde Lighthouse Trust, whose official bi-centenary celebrations occurred a few days prior to his address. That, plus the fact that the official Institution of Civil Engineers Crest embodies a lighthouse, presented him with a subject choice of such singularity as to have been the envy of many subsequent chairmen, certainly this one!

On the other hand the obvious does not always prevail. Twenty years later in 1976 Professor David McKinlay must have surprised not a few when, after declaring his speciality to be soil mechanics and geotechnical engineering — a fact already well known to all his audience — he pronounced that it was not his intention to use his Chairman's address to give yet another lecture on soil mechanics!

I think there is a general feeling amongst those of us not involved in lecturing or teaching that the prospect of delivering an address must surely be much less harrowing for our colleagues in universities and colleges who give lectures daily as part of their routine duties.

I was not present in 1969 when Professor Marshall delivered his address but the postscript at the end of the published paper notes that his talk was tape-recorded and then transcribed by his Secretary, to whom due acknowledgement is given. The impression one gets is that Professor Marshall's address was based on few written notes and might have been to some extent extempore.

One can also detect by reading the honest introduction of other past Chairmen's addresses that there were many others more like the present new incumbent, for whom the address meant much thought and difficult decisions.

Now in thinking about a theme for my address I realised that whatever it was to be, whether a direct account of some engineering works at one extreme, or my philosophy on the future of mankind at the other, it would inevitably be the product of, and be influenced by my education, career and surrounding environment.

If this were the case and moving one step backwards in the thought process, what were the determining factors, I asked myself, which had influenced the way my career has unfolded? My first thoughts were that certainly in my early career, what might be called the nomadic period, the twin influences of money and geography seemed to dominate.

But further and deeper reflection revealed that perhaps the Institution of Civil Engineers was the greatest influence of all.

I applied to join as a Student Member of ICE whilst still in my first year of study at The Royal College of Science and Technology, I think that was relatively early for a full-time student, but this early enthusiasm has to be judged in the circumstances at the time. It seemed to me that it opened the door to some easy money. This spur to my joining came from a notice posted on the engineering notice board of the college to the effect that a bursary was available from the ICE, more or less it appeared to me, for instant collection — provided you were a Glasgow born, full time student of civil engineering and a student member of the Institution. I applied immediately for student membership and then for the bursary.

Many, many months later, it might even have been over a year, I was awarded a small but very welcome sum of money from the C.C. Lindsay Bequest. This was my first connection with any past Chairman of this Association, C.C. Lindsay was Chairman in 1901.

The next career decision was easy. I joined a contractor as soon as I graduated, spurning offers from some prestigious Glasgow consultants. The opportunity for instant travel and the startling 50% or so salary package differential in 1960 could not be resisted.

Now we come to the 10th of October, 1962. Twenty-nine years ago tonight I took off from Gatwick airport for my first ever air flight to begin my first ever overseas job, in Lusaka, Northern Rhodesia. I recall with some shock that on receiving the ticket a few days before departing I discovered I was classed as an emigrant. I did not wish to be an emigrant, but my employer at the time, a contractor, had taken full advantage of a British Government Scheme which offered subsidised air fares for those taking up residence in some of our dwindling number of colonies. I was told I was on an eighteen month tour. I was issued with a one way emigrant ticket. Have contractors changed? But as a Graduate of only two years maturity

the opportunity to work abroad was too good to miss. Regrettably, there are even fewer of these opportunities for our young graduates today.

Perhaps the most profound influence of the Institution came when, like so many others, I decided it was time to be a corporate member. It was the pressing requirements of design experience demanded by the Institution which drove me out of the contracting side of our industry and into a design office, as I remember at some financial disadvantage. After five years as a contractor it was a painful decision in many ways but, on this occasion, financial reward was the secondary influence.

Suddenly a major career goal was achieved, corporate membership of the Institution of Civil Engineers was conferred. I have no doubt that this is a time of great introspection for all professional civil engineers. It is a watershed, a time for serious thought. What next? In my case the twin influences of money and geography prevailed once again. Carrying out the same sort of work in a better climate for a better standard of living seemed an attractive, even seductive, prospect and I indulged in such pursuits for a year or two.

1968 marked the end of my nomadic period. Following some eight years of very varied experience in Africa, Canada, London and elsewhere in England circumstances conspired to bring me home to Glasgow. This was contrary to my two previous objectives of financial reward and geographical location. I was not paid any more money and I was not overly enthusiastic about working in Glasgow, the city of my birth and education. I fully realise that this is not the sort of thing you wish to hear from the new Chairman of the Glasgow and West of Scotland Association

> "But facts are chiels that winna ding
> and downa be disputed"

to quote our national bard, Robert Burns.

These were the facts at that time and cannot be denied. How things change! It was after all (I reasoned) only planned to be a temporary position and I did manage to break away for another two years in the sunshine but for this last twenty years of my professional life I am delighted to say I have been based in Glasgow.

In making major career decisions, there are usually many influencing factors. It is interesting to think back and ask oneself — why did I allow one factor to dominate over another? Did I make the right decision? It seems to me that in most occasions the actual chosen course of action was less important than the subsequent application of effort to ensure that it was the right choice. There is no harm in a little post decision justification.

In his Chairman's address in 1960 James Robertson quoted the decision-making methods attributed to Napoleon. It is said that when faced with recommendations for appointment to the highest command in his army he invariably asked the question "Is he lucky?". I am attracted to this view. Good decisions can turn out badly and bad decisions can turn out well. The outcome is much affected by lots of application and some luck.

I find it fascinating to consider that in February 1960 whilst I was sitting in a lecture in The Royal College of Science and Technology in George Street preparing for my final examinations, not 200 yards away in the City Chambers a meeting was taking place which was to have a profound effect on my later career. During this meeting Scott Wilson Kirkpatrick & Partners were invited by the Corporation of Glasgow to undertake a highway plan for the city.

I was later to spend over a third of my working life on the final design and implementation of some of the proposals which arose as an outcome of that meeting. Most of this time was devoted to structures design and contract administration and that effectively set the course for the rest of my career and my subject choices for this address. There have been three main threads running through my professional life over the last twenty years.

They are, in chronological order of my first awareness:

(1) Structures on the Glasgow motorway system
(2) Contract dispute resolution
(3) Managing the business of a consulting engineering practice

## Managing the business of a consulting engineering practice

Rather than choose one I will address all three, in reverse order and will only say a little about the last item, but it cannot be ignored as without a financially viable business operation there is no opportunity in private practice to undertake any engineering at all. I would also venture the view that this particular aspect was probably of much less concern to previous consulting engineering Chairmen of the association who were in office perhaps ten years ago or more. Even in this relatively short time interval, which coincides with my period as a principal in my firm, the business of a consulting engineer has undergone dramatic changes. I will not catalogue all the changes and I will also say that I believe some to be of benefit to the pursuit of good engineering design, whilst others, including the uncertainty in the ever changing law of liability as it affects the professional person, have been to its detriment.

There is one development however which concerns me to such an

extent that I must mention it even if I provoke cries that I am guilty of blatant self interest. In childhood one's favourite fairy tales always began with the words "one upon a time". That seems a good place to start.

Once upon a time consulting engineers were commissioned by clients on the basis of acknowledged expertise and a reliable service. These worthy attributes are still important of course but for commissions from Government and many local authorities the highest expertise and reliability merely gives the consulting engineer the opportunity to participate in the real competition which is to see who will work for the lowest fee. The lowest is best value, apparently. In the long term this is of course nonsense as most of us instinctively know and as has been known for a long, long time. The precept that cheapest is best has a fairy-tale ring to it.

I cannot say it any better than has already been said by the 19th century philosopher, John Ruskin. I quote his words

> "It is unwise to pay too much, but its worse to pay too little. When you pay too much you lose a little money that is all. When you pay too little you sometimes lose everything because the thing you bought was incapable of doing what it was bought to do. The common law of business balance prohibits paying a little and getting a lot. It cannot be done. If you deal with the lowest bidder it is well to add something for the risk you run, and if you do that you will have enough for something better."

Despite all this good sense I admit there will be occasional "catch bargains' to be had by shrewd clients, especially when the construction market is generally depressed. In this circumstances it is other side effects we should be concerned about. Cut-backs in training and research, stifled innovation, all these will occur. But the question must be asked, is this really a sensible long term policy for any responsible government who wishes to be taken seriously in the matter of providing and maintaining the infrastructure of the nation? I don't think so, I have never thought so and I am pleased that there are now signs, here and there, that this misguided policy is being questioned by other responsible bodies.

Firstly on the question of value for money. Think of it in terms of the life cycle cost of the project. Several years ago an American admiral, one D.C. Iselin, who was at that time commander of the US Navy's facilities engineering command said:

> "In a typical project we find that outfitting, operating, maintenance and repair costs represent 56% of the life cycle cost. Construction costs represent 42% and design costs represent approximately 2%. The relatively modest design

cost has a critical influence on both the 42% construction and especially the 56% for operation, maintenance and repair. In my professional opinion any proposal which seeks to reap near term saving by reduction in design costs but which increases the risk of diminished technical quality of the design effort, is short sighted in the extreme. We will live with the cost impact of that diminished technical quality for the full economic life of the facility."

Projects vary of course as do percentages of life cycle costs and the figures can be crafted one way or the other but the clear fact is that for any project with a high content of civil engineering design the cost savings to be achieved by fee competition in relation to the life cycle costs are absurdly trivial.

Secondly, on the matter of safety and risk taking. On 23rd April, 1988 the car park roof of a new shopping development in Burnaby, a suburb of Vancouver, British Columbia, Canada collapsed on opening day. An official inquiry was commissioned to investigate the cause of the collapse and make recommendations. The report was published on 26th August, 1988 and the passages which follow are taken from the section headed "Chapter 14 — Professional Fees". The report lists the engineering services which should have been associated with the construction of the collapsed building. It then examined the actual fees paid and the number of man hours budgeted by the structural engineering firms who competed for the work. They varied from 260 to 640 manhours. The report then says:

"the conclusion is inescapable that all companies did not intend to provide the services listed above with the same degree of diligence. Indeed the causes of the collapse show that failure to carry out some of the steps with unhurried precision led to this event."

Finally, the Inquiry Commissioner says

"I have concluded that an enforceable fee schedule for engineers who offer their services to the public could assist in maintaining acceptable professional standards. Therefore I recommend that 'The Engineers' Act' should be amended to permit the Association of Professional Engineers of British Columbia to establish and enforce a schedule of minimum fees to be approved by the Lieutenant Governor in Counsel."

In this country we do not have an Engineers' Act or its equivalent in the registering and licencing of engineers but this is not relevant. The Commission to the inquiry is using this as a suggested method of enforcing minimum design fees to safeguard the public. It is

surely a subject for further debate. What is the duty owed to the public by elected members and officials who knowingly encourage and promote the cheapest possible designs? Where would they stand in the public eye if a Burnaby-type disaster occurred here and excessively low fees were judged to be contributory?

Thirdly, and most recently, and more close to home. On the subject of quality of design I will quote an extract from a letter of 22nd November, 1990, sent by the Royal Fine Arts Commission in Scotland, to the Secretary, The Scottish Development Department on the subject of modern beam bridges and post and beam bridges in Scotland.

> "The commission is now seriously worried however that only routine solutions are being offered. It is concerned that pressure to reduce professional fees means that off the shelf designs predominate and are even chosen where they are evidently ill proportioned and spoiling sensitive sites. Ease of design and construction, and the demand for minimum cost, are stifling innovation."

I believe there is something in what they say.

The most disappointing aspect of all of this from the point of view of a consulting engineer is that this is exactly what we predicted would happen when this foolish policy was embarked upon some seven or eight years ago.

I am reminded at this point of some introductory remarks made by past Chairman, William Linn, in 1949 when he confessed to completely abandoning his first ideas and script for his Chairman's address as they emerged as a strongly worded political diatribe. I think at this juncture I will take counsel from his wise words and abandon any thoughts I might have had of saying more on this subject.

Curiously enough it was William Linn who contributed in part to the second of my major career threads — dispute resolution.

## Contract dispute resolution

I attended an evening lecture of this Association in, I think, 1968 at which William Linn talked about arbitration and presided over a "mock arbitration". I still have those mock arbitration papers. This meeting stimulated my interest in the subject and was my first formal lecture on arbitration. Many, many have followed since.

The reasons for my interest then, as now, are very straightforward. My experience has been that it is impossible to be involved in the design, execution or supervision of civil engineering contracts and

avoid argument or dispute. I first realised this in my early contracting days when a somewhat cynical senior contracts manager advised me that the surest way to be a successful contractor was to know the conditions of contract more thoroughly than the resident engineer.

Given therefore that some argument or dispute seemed inevitable it appeared logical to me that I should be aware of the ultimate process of resolving that dispute and what was more important, I should know what the rules were so that I could appreciate the value of not pursuing lost causes or perhaps lose a good argument because I had issued the wrong letter at the wrong time. In following this interest it would have been apposite to say I had been inspired by, and had taken the advice of, the Chairman's address of another one of our most illustrious past Chairman, Donald Matheson, who said in his 1905 address:

> "The young engineers might, with advantage, be given lessons in and learn something of the law"

and also

> "I think the young civil engineer should get some knowledge of the law of contract so far as pertaining to civil engineering and contracting work, and he should be made familiar with the practice in arbitration."

However, I cannot say that I was inspired by Donald Matheson as I only read his Chairman's address a few weeks ago, but I found it interesting and concur wholeheartedly with his sentiments. Equally, I would readily admit that not all engineers should become qualified arbiters.

The very word "arbiter" usually raises a question, even to the most casual reader of the ICE Conditions of Contract, especially those from south of the border. We all know that Clause 67 is headed "Application to Scotland" and that the first sub-clause simply instructs that the contract shall be in all respects construed, operated and interpreted in accordance with Scots Law. Hence the first part of Clause 67 is not too surprising, but in the second sub-clause there is another specific instruction to say that in the application of Clause 66 which is the arbitration clause, the word "arbiter" shall be substituted for the word "arbitrator". Now, does that really matter? Seems a fair question. Are we Scots just being awkward and pedantic?

The reasons for the difference between the two words "arbiter" and "arbitrator" are I believe interesting, and instructive in giving some insight into why the arbitration process is different in important basic fundamentals in Scotland from that in England, but before

exploring this aspect of arbitration I should, as I was surely trained to do, begin with a definition — what is arbitration?

The most concise definition can be found in D.M. Walker's excellent book on arbitration:

> 'The adjudication of a dispute or controversy on fact or law or both, outside the ordinary civil courts by one or more persons to whom the parties who are at issue refer the matter for decision."

The four essentials of arbitration are contained in this definition by Walker. It is for handling disputes, it deals with fact and law, it is outside the ordinary civil courts, it is voluntary by the parties concerned.

Arbitration of some form or another has been around in Scotland for a very long time. The Celtic and Nordic peoples accorded respect to certain individuals who were consulted on the settlement of disputes between neighbours.

It is said, that the root of the differences between Scots and English arbitration lies in the preference of the Scottish monarchs in the 13th and 14th centures to permit and encourage submission to arbitration (rather than the courts) of often complex disputes which came to their notice.

Many possible reasons for the adoption of this less legalistic policy have been advanced. One of the interesting ones which I am sure must give all Scots some quiet satisfaction is that unlike their English counterparts the Scottish monarchs did not derive their original authority from conquest and hence there was no need to use Courts of Law as a means of consolidating foreign rule over a native population, as the Normans had to do in England.

What is important is that during the period of late medieval law development three forms of extra curial (that is to say outside the formal courts) dispute settlement became established.

Persons were appointed to act as arbiter, arbitrator and amicable compositor. The first two functions of arbiter and arbitrator refer respectively to legalistic arbitration and equitable arbitration. The third of amicable compositor to some form of mediation.

So what we have here is a distinction in medieval times between the words 'arbiter' and 'arbitrator" as used in Scots Dispute Resolution Practice. The arbiter performed legalistic arbitration and was expected to handle proceedings in a relatively formal manner, adhering strictly to positive law. This has had a very strong influence in Scotland on the modern system of ordinary arbitration.

The arbitrator on the other hand was permitted to handle

proceedings more informally and could make decisions in an equitable manner. Also he dealt with different types of dispute, such as quarrels between feuding families or valuation and price fixing.

The common style in which third parties were appointed — as "arbiters, arbitrators and amicable compositors" — meant they could act in any one of the three capacities as they thought fit. Disputes between named families were often complex with each side raking up all the grievances they could think of. In such cases it was frequently convenient for the appointed person to act more as an equitable arbitrator or even amicable compositor, thereby avoiding the strictly legalistic approach which might have resulted in him having to reject claims altogether upon which one powerful party or the other laid great store. Given the general weakness of law enforcement at the time his decision might then have been rendered ineffective. So arbitration by an arbitrator became a common form of resolving disputes.

These traditional forms of equitable arbitration dispute settlements between and among members of kin groups began to decline from about the end of the 16th century and by the middle of the 17th century had virtually collapsed. This led to an enormous increase in the case load of the ordinary courts. Litigants weary of waiting for the court to determine their cases resorted once again to arbitration. The historical distinctions between arbiter, arbitrator and amicable compositor were now hardly recognised and those appointed issued decisions according to their view of what the situation demanded.

Arbitration law was in disorder. The authorities adopted two ways of dealing with the situation. Court procedure was reformed and at the same time decrees arbitral (that is to say the arbitration decisions) were protected from reversal by a higher court. This latter provision was enforced by means of what was called the 25th Article of Regulation in 1695 which says:

> "That for the cutting off of groundless and expensive pleas and processes in time coming, the Lords of Session sustain no reduction of any decree arbitral that shall be pronounced hereafter on a subscribed submission at the instance of either of the parties submitters upon any cause or reason whatsoever unless that of corruption, bribery or falsehood to be alleged against the judges arbitrators, who prounced the same."

This is still in force today and the Scottish Courts have always shown great unwillingness to set aside decrees arbitral properly framed by arbiters. By the latter half of the 18th century the concept of the arbiter had expanded to include much of what was previously within the concept of the arbitrator. By the turn of that century, 1800, the distinction between the two words had all but

disappeared but the important fact is that it was the equitable decisions of the arbitrator which gave way to the legally based decisions of the arbiter.

English arbitration law and practice is quite different to Scots, but I will leave the detailed examination of the development of English arbitration law and why it should be different from Scots law to others. I am content to have a reasonably clear understanding of how our law and practice has developed and some knowledge of the main points of difference between the two systems — and that includes why we say "Arbiter" and not "Arbitrator".

One of the main tasks of the Arbiter is to study all the detailed documentation submitted by the Claimant in substantiation of his case and this can be fairly tedious. A few years ago I unearthed in the firm's archives some of the original claim documents prepared for an arbitration in 1919. The dispute was over payment for the construction of Rosyth Dockyard on the Forth Estuary. The contract had begun in 1909 but as war loomed closer and closer the contract was extended again and again and construction continued until about 1916. The Admiralty and the Contractor could not agree on the cost of the work and duly embarked on Arbitration, choosing as arbiter Sir Cyril Kirkpatrick who later became one of the founding partners of my firm and also a President of the Institution in 1931.

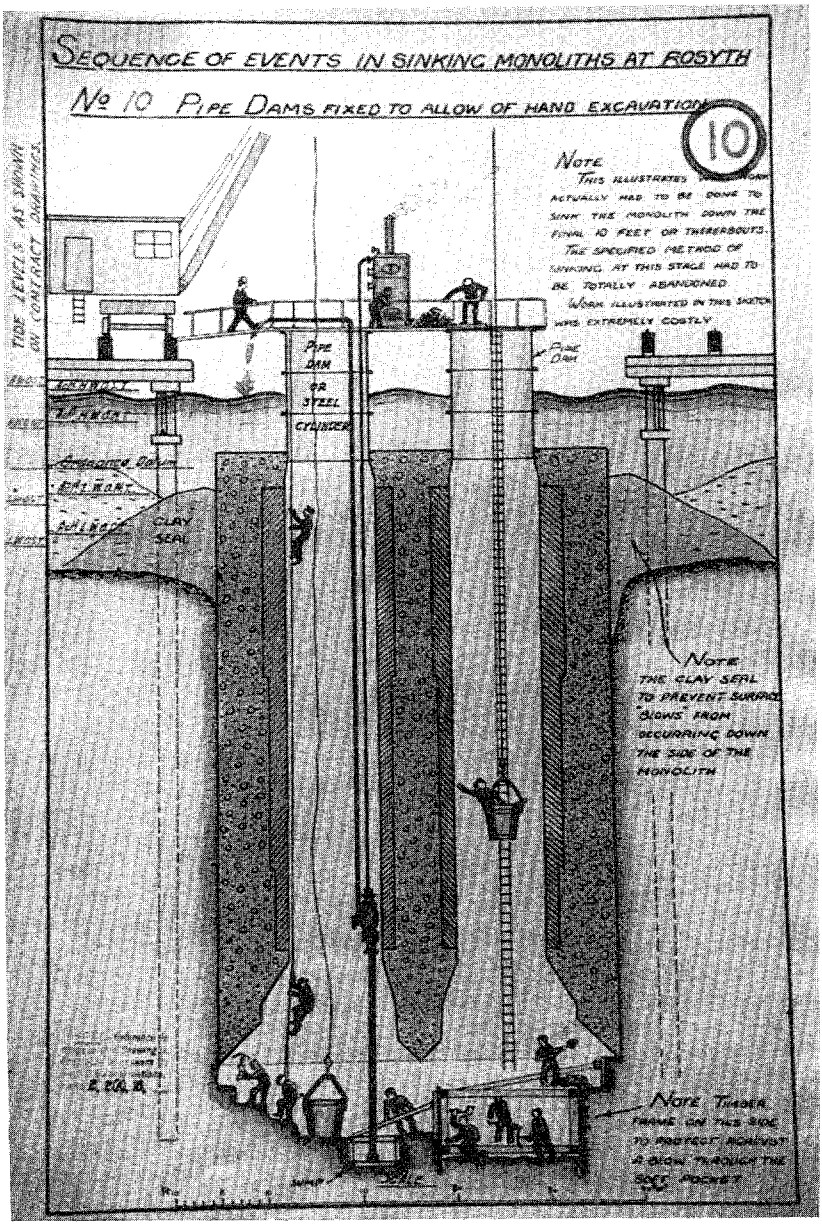
The documentation includes a book of drawings in cartoon style which must have been more of a pleasure for Sir Cyril to digest than some of the drawings we have to wade through in today's arbitrations. Here is a selection of them to show you the style (example overleaf). Perhaps contractors working up a claim submission could take note!

Now I cannot leave arbitration as a topic without bringing matters right up to date on the latest developments and differences within the United Kingdom. I must refer to UNCITRAL, which is the abbreviation for the United Nations Commission on International Trade Law. In my resume so far I have dealt with some aspects of the development of domestic arbitration in Scotland.

The development of international arbitration is yet another fascinating subject, albeit one which to date has not impinged much on Scots law or indeed Scots law on international arbitration.

The market for such arbitrations is large, prestigious and I am led to believe, lucrative. The major trading nations compete to have their law and arbitration rules written into contracts. In Europe alone there are international arbitration centres established in London, Paris, Geneva, Stockholm, Vienna and elsewhere.

The rules of the International Chamber of Commerce (ICC) dominate international arbitration in western Europe and although




*Illustrated drawing submitted in Rosyth Dockyard Arbitration — 1919*

many other centres and legal regimes are receptive to arbitration conducted under these rules, ICC has its headquarters in Paris and has therefore a distinctly French flavour. Paris is the venue for the largest numbers of arbitrations carried out under ICC rules, with Geneva in second place.

London is nevertheless the venue of more international arbitrations in total carried out under ICC, English Law and other rules, especially if defined to include maritime, commodity and trade disputes. This has arisen from mercantile and financial traditions and the historical position of English law in the colonies and later the commonwealth countries. Scotland and Scots Law has played no part in this.

On 21st June, 1985, the United Nations Commission on International Trade Law adopted a Model law for international commercial arbitrations. This historic point was reached at the end of a three weeks session, the 18th such session in the six year series on the subject. Seventy delegations were represented including 32 UNCITRAL member states and 30 observer states.

The model law applies if the place of arbitration is in the territory of an adopting state, hence the next step in the enforcement of the use of this model law is for states to formally and legally adopt it. In the United Kingdom a committee was set up in 1982 to study the early drafts of the UNCITRAL model law. Later the Secretary of State for Trade and Industry called into existence another committee to advise on what steps the UK Government should take regarding the enactment of the new UNCITRAL model law.

The committee was widely based and included representatives from what is called "The Three Law Districts" of the United Kingdom, that is to say England and Wales, Scotland and Northern Ireland. It was evident from early on that factors affecting enactment might well be different in Scotland from the other two districts. A separate advisory committee was set up by the Lord Advocate to concentrate on the implications of the model law for Scotland.

The United Kingdom committee reported in 1989 to The Secretary of State and recommended that as regards England and Wales and Northern Ireland the model law should not be enacted. The Scottish Committee took a different view and recommended that the model law should be put into effect in Scotland. The Secretary of State accepted the advice of both Committees.

The UNCITRAL model law on international commercial arbitration came into effect in Scotland on 1st January, 1991 by means of the Law Reform (Miscellaneous Provision) (Scotland) Act 1990.

The reasons why the two learned committees came to different

views are interesting but not for this address. Suffice to say that in general terms the Lord Advocate's committee decided the new provisions were conceptually and philosophically consistent with the law and practice of arbitration in Scotland.

As a citizen of the United Kingdom, I find this situation quite remarkable. I would find it difficult to explain the constitutional situation to a foreign visitor, especially a non-lawyer. Here we have a United Nations member state (the United Kingdom) which has chosen to enact a United Nations Model Law over part of its territory and to reject it over the remainder.

For an explanation of this paradoxical situation I can only turn to the words of a great Scottish legal mind, Lord Cooper of Culross who said

> "We are habituated in these islands to constitutional usages which defy logical justification but which nevertheless work."

But will the UNCITRAL model law work in Scotland? Will it even be used? It will be mandatory for all international commercial arbitration in Scotland, but will there be any? Will Scotland become a popular venue for international arbitrations? I cannot say but I can see no reason now why it should not. However, parties will also be able to adopt the model law by contract where the arbitration would not be an international commercial arbitration. For example by parties who have places of business in different parts of the United Kingdom or even by parties from within Scotland.

Perhaps we shall see the situation where a foreign, or even English, developer wishing to build in Scotland might be persuaded to adopt the UNCITRAL model law for arbitration in the Conditions of Contract in preference to any other, including Scots and English Law. A most interesting development is it not?

Finally I will now address the topic which has occupied me longer than any others, bridge design.

## Structures on the Glasgow motorway system

I cannot, in what is after all only a part of a Chairman's address, deal with the subject in the comprehensive manner which it deserves, or indeed in which I would like. What I will do is concentrate my remarks on some aspects of bridge design which have intrigued and interested me over the years, and to give some focus to these comments I will relate them particularly and by illustration to structures designed by Scott Wilson Kirkpatrick & Partners (Scotland) on the Glasgow motorway system.

Bridge design can either be a highly emotive subject, for some, or

one of supreme indifference to others. The bigger the bridge the wider the interest and the more it will evoke comment. Bridges over rivers generally invite inspection, praise or criticism but are seldom unnoticed.

Almost everyone knows of, and has a view on, the very large bridges. They are much photographed and appear regularly in the media, on post cards and on calendars. When engineers design bridges over rivers, ravines or estuaries they are well aware that what is required in addition to the engineering solution is a "statement structure". A dramatic visual effect which will hopefully enhance the landscape and act as a feature in its own right.

For the vast majority of motorway bridges the foregoing remarks do not apply. Public awareness of the bridges on our motorway system is low and comment extremely limited. The problem does not touch the heart of the average man, who in all probability does not even notice them. It does however concern generations of bridge designers, architects, landscape architects, planners and those generally connected with the visual environment.

It is worth remembering the well known point that if an artist or sculptor produces a mediocre result it can be easily cast aside or destroyed until a great work comes along. We can all then be spared the pain, including the perpetrator, of having to live with mediocrity. Not so with badly designed bridges. We have to live with them for a very long time, it was once thought perhaps several hundred years although this may now seem optimistic for a variety of reasons.

The process of "design" needs to be further explained. I know what I mean and I am sure that Prince Charles or even The Royal Fine Arts Commission are clear what they mean. I doubt if we are all talking about the same thing. Will Howie in a recent article in *New Civil Engineer* explained the difficulty very clearly. There is confusion between the roles of designer and stylist throughout the media, the public and British culture in general.

For the complete avoidance of confusion let me explain that when I refer to bridge design I mean the total process, from concept to detailed drawing. In my view it is not possible to describe oneself as a bridge designer unless you have carried out all the steps in the total process at some time or another, preferably on the same bridge although that opportunity occurs but rarely and often at an early stage in one's career. On a personal basis I can only recall one such occasion.

Bridge design is first, foremost and always an engineering problem which requires an engineering solution. Bridges cannot be designed by those who do not have the knowledge and understanding of the

structural principles, the analytical techniques and an in depth understanding of the materials to be used. Conceptual designs undertaken by stylists without a background of engineering training are likely to require serious alteration and amendment.

However, even those with the correct engineering background, training and experience require something more if they are to produce consistently satisfactory bridge designs. They require an understanding and appreciation of a whole new vocabulary which is alien to the formal training of engineers and which contains unquantifiable expressions such as "elegant", "proportion", "harmony", "texture", "form", "rhythm", "scale", "shadow", "shade", "visual mass", "duality" and many others. Attempts have been made to define these at one time or another, but they are unsuited to definition by the written word. The successful bridge designer must therefore study examples, discuss the merits of good and bad design and generally take advice from those who have studied visual aesthetics as a single subject.

After all, having mastered the difficult parts of the bridge design, the mathematics, the structural analysis and the complex detailing it seems little enough further effort to be acquainted with the principles and practice of aesthetics. He should than apply these principles to his designs. But of course, even then, there will be no universally agreed "correct" solution. Aesthetics is subjective. Beauty is most adequately defined by Aquinas as:

"That, which being seen, pleases."

Whatever you design you may be sure it will not please everyone, but the designer should be sure and confident of the principles that he, at the very least, is trying to follow and satisfy those.

Some of the most sensible and down to earth advice on the subject is to be had from the words of Sir Alan Harris when he was speaking on bad bridge designs:

> "Where they were bad it seemed to me that somebody had put in something silly. Somehow the mind is at rest with necessity. It is something we can recognise and we accept it. When something silly is put in for which there is no reason visually, economically or otherwise — then one is asking for trouble and nearly always get it."

In my view almost all road and motorway bridges should be simple, unobtrusive and to borrow the word from Sir Alan Harris not have anything "silly" in them. I do not need to define "silly", you will know it when you see it. Exceptions to this are few, river and ravine crossings may justify a different approach, of course, as mentioned previously.

In designing a motorway overbridge, underbridge or interchange bridge the key to the form and style is to remember why the bridge is there in the first place. Not as a monument to the designer or as a landmark, but to carry a road. Roads are designed to strict geometric standards for flowing traffic. The traffic flows, the road flows and the bridge should flow also. Bridges should echo the geometry of the road they carry. Their purpose is to carry roads with least fuss and minimum obtrusion. The closer to ribbons carrying traffic we can make the bridges the better.

The grade separated interchange never looks better than in a cardboard 1 to 500 scale model. In concept that is what we should be trying to achieve. In an urban motorway the principles become even more important. The road geometry completely dominates and the bridge is subservient to it. Often with a rural motorway overbridge there is the opportunity to adjust the side road geometry to simplify a bridge (and rightly so), or to adjust spans to standardise here and there.

Very seldom does the tight road geometry in the urban situation allow any relief to the bridge engineer. Varying widths, varying curvature, bifurcations, varying crossfall, are all presented for a competent structural solution. Headroom clearance is usually at an absolute minimum and intermediate supports are a nuisance to the road geometry below. The columns can only be placed in the central reservation, the two roads which cross are never at right angles so the inevitable result is a line of skew supports giving more structural complications.

Services carried under existing city streets are as we all know numerous, diverse and always troublesome. The problems are compounded when they are carried across the motorway in a bridge. When a 36 inch diameter water main requires to be taken across a short span bridge, what then happens to elegance and proportion? The span to depth ratio is not then a matter of choice and the designer must take other steps to make the structure pleasing.

The objective of a flowing alignment effect will not be achieved by considering the bridge in isolation. Where retaining walls and abutment walls are necessary the treatment of those requires careful attention and design. Most engineers if asked to design the shape of a wing wall will produce a minimum height solution with the wall top made up of straight lines and sharp angles. This does not produce the desired effect in an urban situation. What it did produce during the design stages of our Glasgow motorway work was a lot of argument and discussion between this engineer and the consulting architects!

My views have been developed by this process of discussion and by comparing what was eventually achieved with other examples around the country where less, or no, consideration has been given to the vertical profile of the top of the walls. This vertical geometry must be designed as part of the overall visual plan and not left to emerge from strict engineering solutions to earth retaining problems.

Similarly, equal consideration must be given to the bridge cope or string course and also to the parapet or vehicle barrier. Contrary to some views I have heard I do not find the present universally used open metal vehicle parapet unacceptable in any visual respect on motorway bridges. On large structures I have heard it criticised as being out of scale — "a filigree of domestic handrail". All my main problems in bridge design as far as parapets are concerned have emanated from attempts to match the requirements of British Rail and the Highway Authority in a visually acceptable manner. I am prepared to admit to failure in some situations.

The surface treatment of all structural elements is crucial to the appearance. This is a topic without an engineering solution because it is not really an engineering problem. Engineers however have been guilty of many environmental eye-sores in the specifying of wall finishes, chosen it would appear, on no better basis than some whimsical notion that a pattern of some kind or other is better than nothing at all. Sometimes "do nothing" would produce a better long term result.

Throughout our work in Glasgow on some 45–50 bridges we only have two types of wall finish. The first final design contract was at the Townhead Interchange where sandstone was chosen for the wall cladding. Although I played no part in this decision I have always thought it to be an appropriate solution — Glasgow is after all a sandstone city and at that time there was a plentiful supply — as the sandstone city was being converted to a highrise city concurrent with the construction of the motorway. Twenty-five years on I think the sandstone has served us well.

It was decided in the late 1960s that for the next contract, along the north flank from Townhead to St Georges Cross, that a new wall treatment was required. Much thought, argument and discussion ensued once again between engineers and architects. The architects were adamant that a strong, vertical, deep feature was necessary. The engineers did not like the reinforcement detailing problems that this implied. Those holding the purse strings did not like the cost either.

The final solution was a precast concrete panel which we used as a front shutter. This satisfied the architects, kept the engineers happy and we managed to prove to the purse holders that the cost

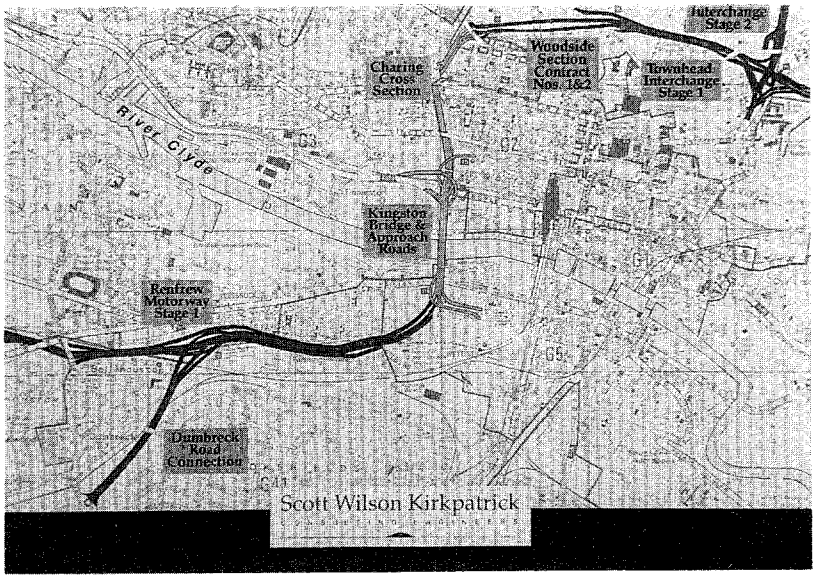
disbenefit was relatively little. This solution was so successful that it was promulgated on all our subsequent Glasgow motorway contracts. The form of the panel has been used elsewhere by other designers on the motorway although usually as a bolt-on panel rather than a front shutter. I believe it gives a reliable, consistent and durable wall finish.

I would now like to illustrate some of the points I have been making about bridge design by showing you some slides of our bridges and structures on the Glasgow Motorway Network.

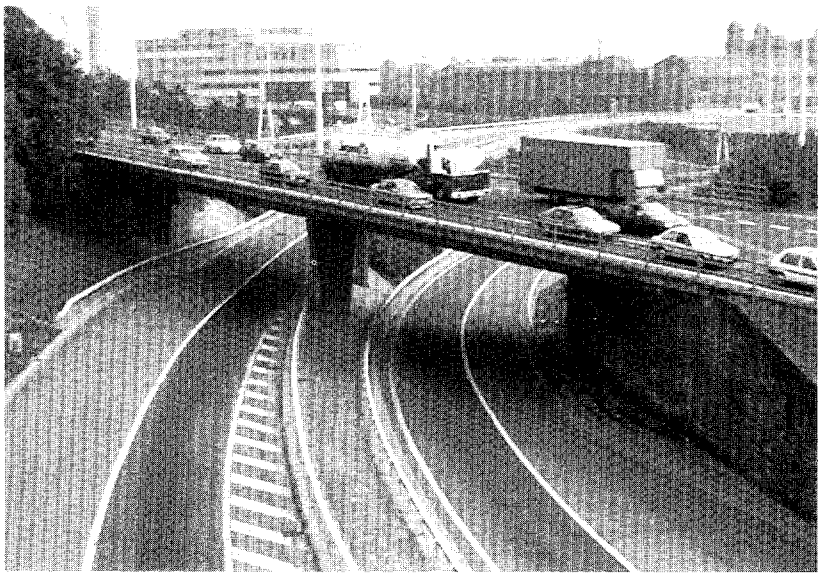
## In conclusion

Ladies and Gentlemen you have been most generous tonight in granting me your tolerance and patience and listening to my personal views on three of my favourite topics. My hope is that you might also have heard something of interest. I am looking forward to a busy and, I hope, effective year in office. Every new Chairman is conscious of the responsibility he takes on in maintaining the long tradition of excellence and contribution to Institution affairs for which this local Association is renowned. I would also like to think that one year from now my erstwhile benefactor, Charles Coxhead Lindsay, our 1901 Chairman would have felt, if he had been alive today, that his bursary bequest was well spent on the young McGowan in 1957.

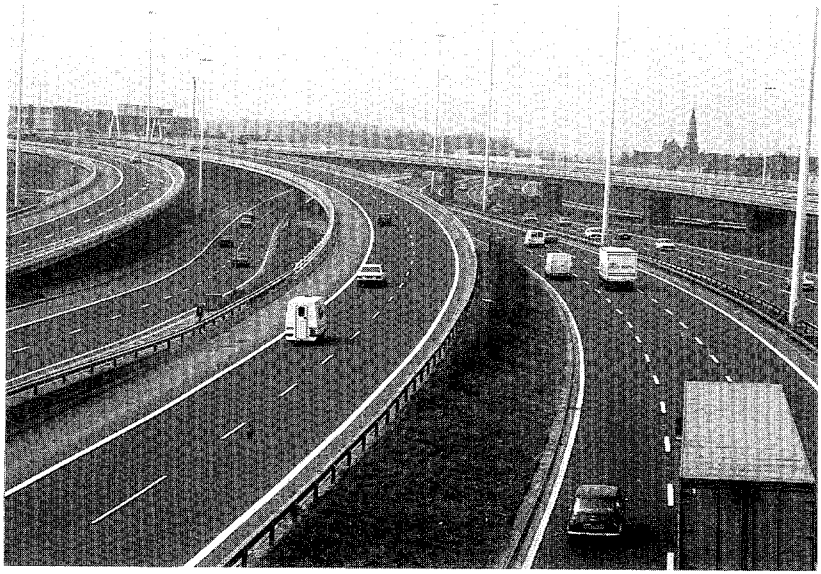
Thank you for electing me. Thank you once again for your attention and most importantly may I thank you in advance for your support throughout the year to come which I know will be there and on which I know I can rely.



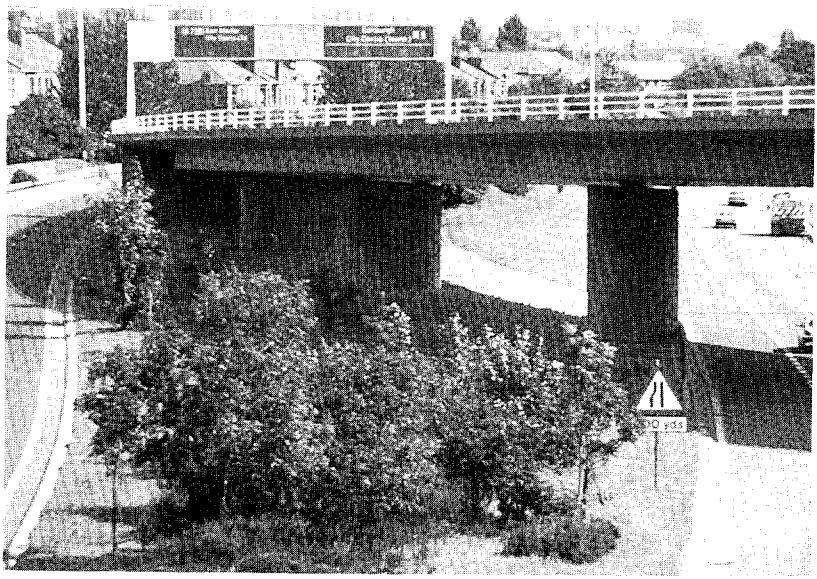

*Central Glasgow Motorway System — Final Design Projects by Scott Wilson Kirkpatrick in dark shading*



*Townhead Interchange*

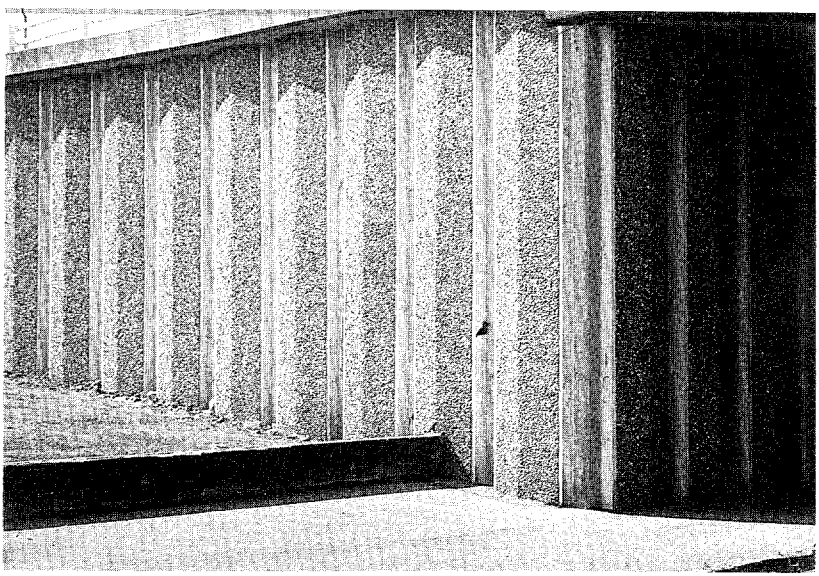


*Renfrew Motorway — Stage 1: Grade Separated Interchange*



*Renfrew Motorway — Stage 1: Ramp A Bridge*

*Renfrew Motorway — Stage 1: Dumbreck Road Bridge*



*Precast concrete wall facing as front shutter*