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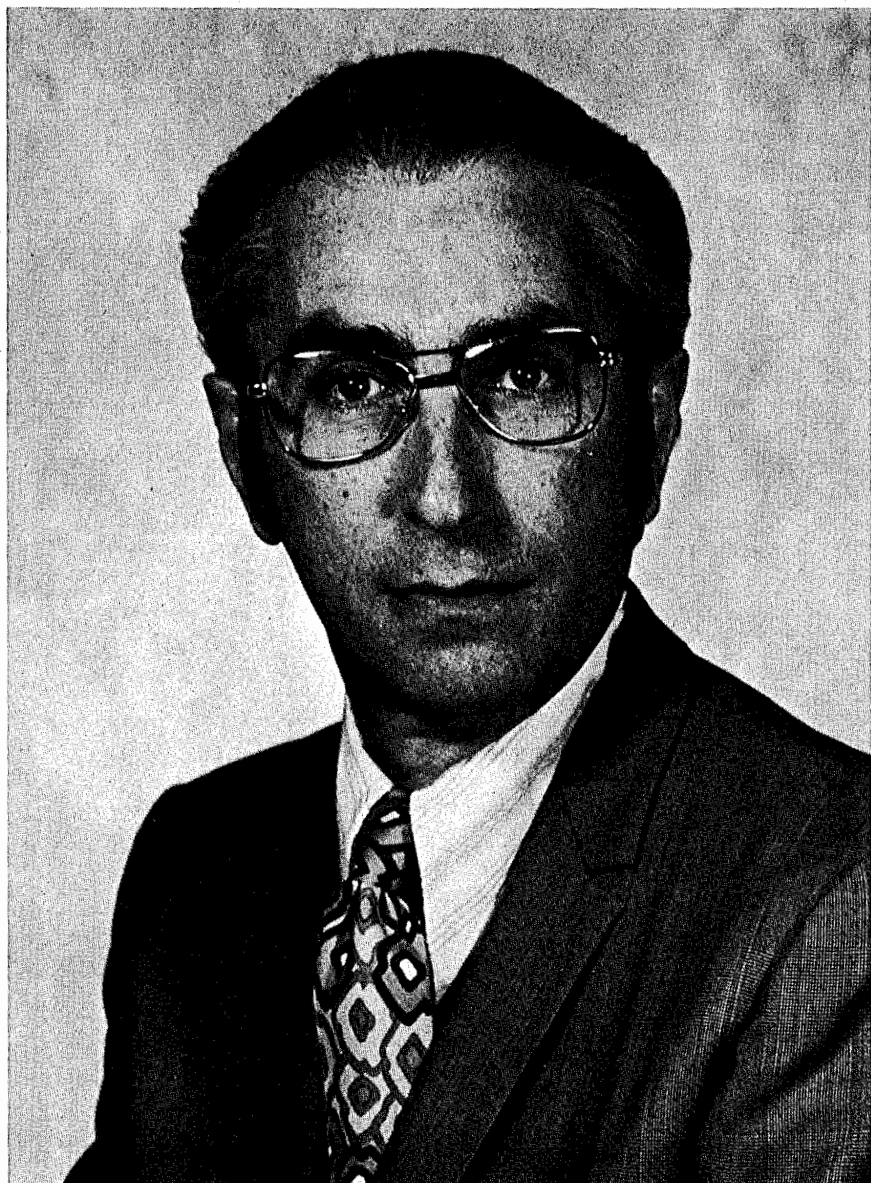
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THE CHALLENGE OF CHANGE

Presidential Address of James P. Archibald

(Presented before the Annual Meeting of the Boston Society of Civil Engineers,
March 21, 1973)

Introduction

It has been customary every few years for the President's Address to dwell on the affairs of the Society, the last such message being that of Past President Harry L. Kinsel, in 1968.

It is appropriate therefore in 1973 to review with you the present state of the union of your society. I do this not just because of the time lapse since 1968, but more importantly because the society is facing perhaps the greatest challenge in its history — and that is the challenge of change.

When I speak of the challenge of change I speak of the proposed merging of the Boston Society of Civil Engineers and the Massachusetts Section of the American Society of Civil Engineers.

To thoroughly explore this subject with you I would like to review the circumstances leading to the present proposal for merging, weigh with you some of the pros and cons of such a merger and finally explain what has been done by both societies up to the present moment and what is planned in the coming months.

First let us talk about the circumstances leading to the present proposal. In order to place these circumstances in their proper perspective it might be well to review some of the history of the two societies as well as their relationships.

Background

BSCE-ASCE relationships go back to the very first days of both societies. In fact, when ASCE was founded in New York City in 1852, one of the twelve men present at the first meeting was James Laurie, who had been active in founding BSCE. At this meeting, James Laurie presented a draft of a constitution he had prepared. This constitution, which was used for many years by ASCE, was very similar to the original constitution of BSCE — so it is interesting that the government of both societies had a similar base at a very early age.

It also may come as a surprise to some that the history of BSCE was in limbo

for a period of over ten years. The original society suspended its activities in 1861, donated its library to the Boston Athenaeum, and appointed Messrs. Asburner and Higginson to take over the property of the Society.

In 1871, however, a group of twenty-six people (people because we cannot formally call them engineers as we define engineers today) sought to form an engineering organization which was originally to be called the Boston Society of Engineers. At its second meeting, Desmond FitzGerald, a name familiar to us all, made a motion that the name be changed to Boston Society of Civil Engineers. Thus we owe a lot to Mr. FitzGerald for preserving the historical link to 1848 which makes our society the oldest engineering society in the United States. Desmond FitzGerald incidentally was the first President of the rejuvenated organization.

Two years later in June 1873 the executive committee of the society, as it was then called, sought to incorporate the society so that it could legally hold property and have exclusive rights to its name. But to the dismay of the executive committee, it learned that a society bearing the same name had been incorporated in 1851 and still had a corporate existence even though it was not active. However, where there is a will there is a way, and this was the strategy used. Steps were taken immediately to merge these two organizations thus preserving the name BSCE. The entire membership of the newly formed BSCE, historically referred to as the Jr. BSCE, was elected to membership in the older defunct, but incorporated, society. This was accomplished by the issuing of a warrant by Justice of the Peace George Morrill authorizing five of the original members to call a legal meeting of the corporation at which time the election of the Jr. BSCE members to membership in the older society was held and thus the continuity of our legal existence was preserved. These early historical notes might give us some insight in evaluating present day circumstances. I might also note that a more detailed documentation of the early days of our society can be found in the presidential address of John B. Babcock in 1936 entitled "The Boston Society of Civil Engineers and Its Founder Members" which perhaps should be required reading for all society members.

Moving on to a more contemporary time we find in 1921 the formation of the Northeastern Section of the ASCE, later to become the Massachusetts Section. At a meeting called for the purpose of considering its organization, a committee was appointed to see if the proposed section might be affiliated with the Boston Society of Civil Engineers. This committee consisted of three members of ASCE only and three members who were also members of BSCE. The committee after careful study issued a report entitled "A Report of the Affiliation of the proposed Northeastern Section of ASCE with the BSCE". The report unanimously recommended affiliation and gave detailed recommendations for the accomplishment of the affiliation. This was approved by the Northeastern Section. On November 16, 1921 on the motion of Mr. Metcalf, the BSCE voted that the establishment of the Northeastern Section of ASCE as an affiliated section of BSCE be approved and that the preparation of suitable

working arrangements, having due regard for the interests of the Boston Society of Civil Engineers, be referred to a committee of the Board of Government. Thus the affiliation was an accomplished fact. The "due regard for the interest of BSCE" is a noteworthy phrase — one which again might give us insight.

In 1922, however, came the birth of the Affiliated Technical Societies of New England, later to be called Engineering Societies of New England or ESNE. The existence of this group made the relationship between the Northeastern Section of ASCE and BSCE seemingly unnecessary and by mutual consent the affiliation was terminated.

Since that time various attempts have been made for closer co-operation between the two societies. In 1957 at a joint meeting there was a panel discussion "Why Two Civil Engineering Societies for Boston?". In 1961 a committee report was made to the Board of Government recommending that a careful study of the matter of consolidation be made to include the comparative value of consolidation vs friendly competition and co-operation, necessary changes in the by-laws of both societies, continuation of the Boston Society as a separate entity, annual dues, disposition of the permanent funds of the BSCE, membership requirements and legal complications, if any. As we shall see, these same areas of study have surfaced again in the present deliberations.

Study

Let us review the recent history of inter-relationships. In 1968 Harry L. Kinsel in his presidential address noted his concern over the consideration being given to the institution of technical divisions within the Massachusetts Section of ASCE and over conflicts in meeting schedules. He recommended closer co-operation in these areas and suggested more joint committees for the two organizations, including the program committees. His successor, incoming President Harl Aldrich, appointed a committee on BSCE-ASCE Relations with a similar committee appointed by Mass. Section President Saul Namyet. In 1970 these committees acting jointly made a report giving recommendations for a short range program for greater co-operation and a long range program. The short range program for greater co-operation and a long range program. The the long range. These short range recommendations included joint meetings, a joint newsletter and joint quarters. The long range recommendations were for studies to be made for ultimate consolidation of the societies. Interestingly, this report also noted that 21 of the 35 BSCE Technical Section officers were also members of ASCE.

These relationships committees then continued their studies of the long range program. In early 1971, again acting jointly, they issued a report entitled "A Proposal for a Final Resolution of ASCE-BSCE Relationships". In this report specific step by step recommendations were made towards the consolidation of the societies. Included was the canvassing of the membership of both societies to gain an expression of feeling of the memberships in regard to consolidation. The

governing bodies of both organizations voted to accept the plan for consolidation in principle and to canvass its memberships to confirm the intent to make this change. This report was published and a poll taken in the June-August issue of the FORUM. The results of the poll showed that the membership of both societies favored consolidation by significant ratios, the combined ratio being approximately nine to one.

Following the poll the joint committees on BSCE-ASCE relationships made a final report in which it recommended dissolution of the two committees and the establishment of one merger committee to carry out the planning for consolidation. This report was voted favorably upon by both societies.

Since 1971 the merger committee has been in almost continuous session with meetings every month to resolve the many situations facing both societies should a merger be consummated.

Resolution of Problems

Let us take a look at some of these situations or should I say problems, and at how they are being resolved. There are many of course, but let us consider those having significance to the Boston Society of Civil Engineers. They are the membership requirements of BSCE vs ASCE, necessary changes in the constitution and by-laws, the heritage of BSCE, the permanent funds of BSCE, legal complications, and dues for BSCE members.

What about the heritage of BSCE? This is extremely sensitive to many of our members and understandably so. Having looked back at the infancy of BSCE we know that it was a predominate issue even then. However, as before, where there is a will there is a way. The proposed merger in my opinion in no way jeopardizes our historical significance. The Boston Society of Civil Engineers would *not* become extinct. Its corporate status would remain the same. The only change is the name from Boston Society of Civil Engineers to Boston Society of Civil Engineers Section of ASCE. This can be done almost by just notifying the Commonwealth of Massachusetts of the name change — a familiar scene in today's corporate world. In essence BSCE remains a legal entity.

Next let us consider changes in the constitution and by-laws. This is necessary and without going into detail let me just say that the proposed new constitution and by-laws is patterned after our present documents and is in no manner jeopardizing any pre-existing role or function of the Society. If the plans for merging progress, each member of both societies will receive a copy of the proposed constitution and by-laws for his individual study.

What about the funds of the society? Various funds have been vested in BSCE for specific purposes and specific methods have been recorded for achieving these purposes. These include the Freeman Fund, the Turner Fund, the Desmond FitzGerald Fund and so on. These funds and their functioning would remain as originally intended. Just as BSCE retains its legal entity under the laws of the Commonwealth, so do the funds retain their original integrity.

The membership requirements for both societies presented a major obstacle for the possibility of merging. National ASCE has rather rigid and tight rules and classifications for membership, while BSCE membership requirements were related to classification of people interested in Civil Engineering rather than their documented backgrounds and qualifications.

What was to happen to these people who perhaps did not meet the requirements of ASCE — perhaps a technical rather than a professional person? What about the present BSCE members who did not want to be a member of National ASCE? What about a person who under present circumstances would be eligible for membership in BSCE but not ASCE?

It was here that the spirit of compromise and co-operation prevailed. After careful consideration and deliberation National ASCE stated the following:

1. Any present member of BSCE can remain a member of the BSCE Section of ASCE without becoming a member of National ASCE.
2. The proposed BSCE Section of ASCE can continue to elect members to its section as affiliates who would not ordinarily meet the requirements of National ASCE.

These negotiated stipulations, I believe, overcame the major stumbling block towards consolidation and were a major concession on the part of National ASCE.

Finally, we come to the costs of running a combined society and their effect on the finances and dues structure of each organization. One train of thinking allows that with the merger of the two societies the combined membership could be increased by some 30 percent. It is proposed that enrollment fees remain the same, that is, a ten dollar fee for a new member and a five dollar fee for associates and juniors. Incidentally, the enrollment fee back in 1848 was twenty dollars for a new member — so your society has been in phase III of our economic system for a long time. The new proposed dues structure calls for a fifteen dollar annual dues for a member who is also a member of National ASCE, which is a reduction from the present twenty dollars, and fee of ten dollars for a non-resident. For a non-National ASCE member the dues would remain the same at twenty dollars a year. The reason for the discrimination between ASCE National and non-ASCE National members is that National ASCE supports its local sections by a contribution of three dollars per National member who belongs to a local section. Thus we see that for those of us in BSCE who are not related to ASCE and do not want to become so, there would be no change in our dues. For those of us who belong to both societies there would be a savings in dues from the combined cost of twenty-five dollars to fifteen, but of course we would continue to pay National dues.

What about legal complications? As stated earlier, these have been reduced to a minimum by the retention of the corporate entity of BSCE. Only the name is changed, and a very small change at that. Legal counsel, retained and financed by both societies has given a positive report on this aspect.

Merger

Now one may say all this is very interesting but so what? Who needs it? We have gotten along in one way or another for the past 125 years. Why change now?

To answer this let me refer again to the title of my talk — the challenge of change. Dare we try to change? Dare we try to make our society better? What if we are wrong?

Let me answer that last question with another question. What if we are right? What effects will this merger have on our society? We have examined some of the problems but what of the positive aspects.

In reading past presidents' addresses I find the current problems facing BSCE are really chronic problems. A few references to previous state of the union messages might serve to illustrate.

In 1910 the membership of the society was seven hundred twenty-three and first reached the one thousand mark in 1928. Even so then President Frank H. Marston in 1928 stated "It cannot be said that the society is reaching all of the engineers in the metropolitan area that it should". Today in 1973 our membership is not much larger than it was forty-five years ago in 1928. If past President Marston were present here today he might well ask what have we done in these past forty five years. Our membership has been static regardless of the increase in the number of engineers and everything else in this country of ours.

Leonard Metcalf, President in 1920 questioned: "Often when a handful of men were present to hear a paper prepared with care and labor by some fellow member I have asked myself what is responsible for the failure of the men to turn out in larger numbers? Where are the younger men?" One of his answers and as he states the most important of all — and again I quote "the multiplicity of demands on our available time." This in 1920. In 1955 President Miles Clair stated "There now exists intense competition not only for membership but for the attention of engineers."

Harrison P. Eddy, Jr. in 1950 stated the rather startling fact that the society was in an era of deficit spending for 37 years, since 1913, in which our operating expenses exceeded our income in every year except 1916.

These quotations reveal some of the problems that still face the society today, that is costs, meeting attendance, membership and involvement of the younger engineer. Like many chronic illnesses, these problems have been treated periodically with doses of aspirin such as membership drives, dues increases and public relations efforts. However, as with a dose of aspirin, the discomfort is temporarily relieved, but the illness remains.

Can the merging of the two societies help solve these problems? Let us speculate that:

1. Through the merging of the two groups there would be a significant increase in the united membership. This would hopefully alleviate costs and increase meeting attendance.

2. It is estimated that there are approximately four hundred joint BSCE-ASCE members and, as noted, many of the key positions in both societies are held by people having dual memberships. Forming one organization will enable these key people to do a better job with less demand on their valuable time and less dilution and duplication of their effort.

3. An additional consideration is the greater need for involvement of the engineer in the community, civic and political world — a long recognized failing of the average engineer. Would not a single civil engineering organization do a better job in the civic arena?

4. The younger engineer, economically hindered, would not have to make a choice. This choice is usually to the detriment of BSCE because this younger engineer is on the move and knows there is no local section of BSCE in Cleveland, Ohio where he might soon relocate. The Associate Member Forum program of ASCE would also be very helpful in attracting these younger members into one unified society.

5. By tacit agreement, the technical aspects of engineering have been the property of BSCE while the professional aspects that of ASCE. Should not an engineer have access to and benefit from the activities in both these areas without having to join two organizations or choose between them? Certainly the competition for meeting attendance would be eliminated.

Present Plans

Now where are we today? — Today is the moment of truth.

As I stated earlier the Merger Committee has been meeting almost continuously since its formation in 1971. This committee with talented representation from both societies was given authority by the governing bodies of BSCE and the Massachusetts Section of ASCE to carry out the necessary planning and procedures for consolidation. From the activity of this committee there has emerged a new constitution and by-laws for the merged society. After many deliberations and revisions, these documents have been approved by both governing bodies and have also been accepted by National ASCE with final approval by National ASCE anticipated next month. Patterned after the present BSCE constitution and by-laws it includes the membership provisions for the BSCE membership that were discussed earlier, as well as the dues structure. The Merger Committee has also obtained legal counsel that has guided the committee on a steady course in regard to the corporate name of BSCE as well as the funds of our society.

On May one of this year the FORUM will publish a special issue devoted to the merger, giving all the facts as well as the pros and cons. Incidentally, the deadline for any material is April 1. Anyone interested in contributing a viewpoint on this subject should contact Bert Berger, Editor, of Fay, Spofford & Thorndike before the April 1st deadline.

On May 10 a joint meeting for both memberships will be held so that all

aspects of the proposed merger can be presented in order that the membership can have an opportunity for questions and discussion. Concurrently in May a vote will be taken of the membership of both societies to approve an agreement to merge as well as to approve the proposed constitution and by-laws of the merged society. If approval is received from the membership of both societies it is planned that the merger will take place one year from now in April 1974. During this coming year the governing bodies of both organizations, while still acting independently concerning the affairs of each society, would meet jointly in the interests of a smooth transition period until the merger is accomplished.

I have tried to present in a limited time a synopsis of the background leading to the present status of BSCE-ASCE relationships. As you can see there has been much discussion and activity concerning the inter-relationships of the two societies for a long period of time. Now for the first time in the history of both organizations the members, each acting independently, will make a decision on the question of merging or not merging. Each member with his vote will have the opportunity to be part of that decision.

The title of my talk today is "THE CHALLENGE OF CHANGE".

Gentlemen, the challenge is yours.

HYDRO-ELECTRIC PUMPED STORAGE SOME ASPECTS OF THE WESTERN EUROPEAN SCENE

by
H. Headland*

(The Eighth John R. Freeman Memorial Lecture of the Boston Society of Civil Engineers presented April 25, 1973)

1. Introduction

An invitation to a European to deliver a "John R. Freeman Memorial Lecture" is not only an unusual honor, but also a tribute to the influence of an eminent American beyond the borders of this Continent, his visions of inter-disciplinary technology and the place of "The Engineer in Society" as they face all nations today. Previous "Memorial Lectures" by six distinguished American engineers and one Swiss concentrated on hydrological modelling (1), sediment transport (2), jet diffusion and cavitation (3), hydraulic mixing (4), coastal dispersal phenomena (5), hydraulic transients (6) and thermodynamic testing of turbines and pumps (7), topics which are woven into the fabric of many "Pumped Storage" projects.

Any attempt to deal with this subject, even within Western European boundaries must be approached with trepidation, and even given the time and competence, it would be pretentious to bring before this "Society" another statement of the problems and benefits allied with "Pumped Storage" in a region where the "Northfield Mountain" and "Bear Swamp" schemes testify to their recognition; moreover, parallels and contrasts between American and European geography, climatic and social conditions would add few new design and construction ideas to well documented descriptions of existing and future pumped storage developments. In addition, the economic and other aspects of the "Eastern European" scene differ so markedly from those of the "West" that they too must be excluded.

Freeman was strongly oriented towards hydraulic engineering, as witnessed by his activities on the Hetch Hetchy, Catskills and other major projects, and it seems remarkable that it is the impact of this field, coupled with other factors which will determine whether "Pumped Storage" will survive in Western Europe, and indeed on this side of the Atlantic.

It is perhaps appropriate to acknowledge here the U.S. contribution under "Marshall Aid" to post-war rehabilitation of power supply undertakings in Western Europe, a concept which would have appealed to Freeman's liberal philosophy. Today, however, other crises are looming which may be as profound in their effects on "Pumped Storage" as others were on conventional hydro-electric schemes.

*Consultant, Kennedy and Donkin, Consulting Engineers, London, England.

The personal views presented here, do not reflect official attitudes but, having wider implications, are framed to co-relate prevailing outlooks on pumped storage with a future where only rigorous evaluations will be decisive; the verdict may be that such ideas are unwarranted "variations on a theme", but nevertheless suggest that they might be apposite to Freeman's impressions of the "changing world about us".

2. Pumped Storage Generally

The material for this lecture was founded on Freeman's interests in professional engineering education, training, experience and responsibility as well as his concern for public and engineering safety, the impacts of which are among the prevailing problems of modern times and have particular relevance to pumped storage on the scale envisaged in Western Europe. This appraisal was extended to blend with unconventional layouts such as coastal pumped storage schemes, underground lower and upper reservoirs, multi-purpose developments, run-of-river cascades and the association of pumped storage with tidal power, as well as "power block" and "power group" concepts. It is in such contexts that creative multi-disciplinary synthetic rather than analytical design becomes vital.

Logically this led into considerations of the Western European network, changing system load patterns, hydraulic and electrical machine developments and their influence on pumped storage operational criteria where experience has demonstrated reliability and flexibility in predictable as well as abnormal situations such as thermal station load trimming during an industrial dispute in the U.K. and incipient system collapses in Europe. Its role in system load-frequency control is also becoming important but although computers are widely used in design and system planning there have been few attempts, within a hydro-electric/pumped storage framework, to adapt them to on-line station operations. Here there is a need for a systematic technical/economic approach to reconcile disparate views.

3. Pumped Storage Alternatives

There is no denying that gas turbines are becoming active competitors, and with development plus experience now being accumulated they will prove greater threats although proper allowances for fuel consumption, capital/operating costs, availability and environmental factors should be evident in unbiased economic analyses. The fact remains, however, that they now have an acknowledged place in power system development as shown by the mathematical models for operation simulation of pumped storage/gas turbine mixes from which economic conclusions emerge between capital-intensive pumped storage and cheap gas turbine installations with high running costs.(9)

In this context two sets of numerical data are worth noting:

- (i) *C.E.G.B.* The existing gas turbine installations and forward applications for consents totalling 23 GW for the C.E.G.B. system are summarised in Tables I and II respectively.
- (ii) For the *E d F* system, with substantial conventional hydro-electric storage, the figures for a demand of 100 GW and 500 Twh in 1988/89 are given in Table III.

In reality, however, gas turbines once installed, are operated differently from the occasional low probability needs of say 12 hours/day perhaps once in 10 years, and current experience shows that they are used extensively for operational reasons in situations where fuel costs are secondary to system reliability and integrity. Moreover, many marginal and intangible benefits hitherto attributed to pumped storage are now appreciated by gas turbine designers, and developments are making them possible as supplements to other advantages where comparisons might otherwise favour pumped storage. Despite their dependence on liquid fuels, gas turbines seem inherently more acceptable to those unfamiliar with hydro-electric plants generally but for which there is no longer an undisputed economic mandate.

4. Pumped Storage Forecasts

Technical questions can now be resolved within the constraints of modern pumped storage technology, but on the scale now contemplated in Europe (Tables IV and V) with a growth rate of 15 percent p.a. bringing it to 26,000 MW by 1980/82 other issues are becoming dominant. Despite its apparent magnitude, the 10-15 percent proportion relative to system load foreshadowed by some authorities is unlikely to be attained. The 1980/82 figure stands at 3.8 percent and globally pumped storage seems destined to a minor role relative to other forms of generation.

5. Environmental Considerations

Western European opposition to pumped storage is unimpressed by system operational benefits but is often predicated on earlier hydro-electric construction disturbances thus overlooking that it is a non-consumptive water user and a marginal fuel saver. It also seems to have escaped allegations of forced social migration, silt flow restriction causing downstream erosion, coastal fishery damage, river-borne disease transmission, land salination, weed growth, increased transpiration and raised ground water levels. However, with future projects it would be prudent to disarm such contentions, for while pumped storage may have, so far, eluded public accountability after commissioning, it is not axiomatic that stations now contemplated will be equally fortunate.

It is perhaps tempting to consider 3.8 percent of pumped storage as marginal until it is realised that 2-3000 MW installations can raise significant local issues in an influential and affluent society which cannot be overruled by vested interests.

TABLE I.

EXISTING C E G B GAS TURBINE INSTALLATIONS (8)

Aircraft Engine Types	Number			Installed MW	MW Capability/Unit	
	Stations	Sets	Engines		Lower	Upper
Avon	12	36	88	1060	17.5	56.0
Olympus	13	41	56	980	17.5	70.0
Totals	25	77	144	2040	-	-
Pumped Storage	1	4	-	360	-	90

TABLE II.

C E G B FORWARD PLANNING FIGURES (11)

Generation Form	Consent Status				Totals	
	Granted	%	Applications	%	GW	%
Nuclear	3.94	25.8	0.65	8.4	4.59	20.0
Coal Fired	3.96	26.0	2.00	25.8	5.96	26.0
Oil Fired	6.00	39.4	2.20	28.3	8.20	35.7
Totals	13.90	91.2	4.85	62.5	18.75	81.7
Gas Turbines	1.35	8.8	1.50	19.5	2.85	12.2
Pumped Storage	-	-	1.40	18.0	1.40	6.1
Grand Totals	15.25	100.0	7.75	100.0	23.00	100.0

TABLE III
ELECTRICITY DE FRANCE
FORECAST POWER DATA FOR 1988/1989 (9)

Form of Generation	Power GW	Energy	
		Twh	%
Maximum Demand	100	500	--
Hydro-Electric Installations			
Lakes	11	11	2.13
Storage Reservoirs	6	15	2.89
Pumped Storage	7	15	2.89
Run-of-River	6	33	6.38
	30	74	14.29
Thermal Plant			
Gas Turbines	8	4	0.77
Mixed Cycles	9	30	5.79
Conventional (125-600 MW Units)	7	35	6.75
(700 MW Units)	13	95	18.35
Self Producers	3	20	3.86
	40	184	35.52
Nuclear Stations	30	260	50.19
Total Generation	100	518	100.00

TABLE IV
FORECAST EUROPEAN NETWORK GROWTH (10)
(EXCLUDING U.S.S.R.)

Year.	1968			1980/82		
	Capacities in GW					
	Total Installed	Pumped Storage	Max. Demand	Total Installed	Pumped Storage	Max. Demand
European Community	192.1	3.1	146.8	431.3	15.3	338.6
Rest of Europe						
Western Region	59.6	0.8	37.4	141.3	5.4	96.6
Eastern Region	43.4	1.0	35.3	123.5	5.9	161.6
Total	295.1	4.9	219.5	696.4	26.6	536.8
Increase %/annum	-	-	-	7.4	15.3	7.7
% Total Generation Capacity	-	1.6	-	-	3.8	-

TABLE V
ALLOCATION OF GENERATING CAPACITY (10)
(EXCLUDING U.S.S.R.)

Form of Generation	% Total Generating Capability			
	EEC	Total	EEC	Total
Region				
Conventional Generation				
Thermal	71.8	66.3	70.2	66.0
Nuclear	3.6	2.4	13.1	11.9
Hydro-electric	23.0	29.7	13.2	18.3
Pumped Storage	1.6	1.6	3.5	3.8
Peaking Capacity				
Excluding Conventional Hydro	3.3	3.2	7.7	7.7

The aesthetic objections to transmission lines, switchgear and transformers are common to all power projects and, inter alia, tested land-use projections do not eliminate expensive demands for undergrounding or enclosed buildings despite the disturbances during construction and subsequent maintenance.

There is scant information from existing pumped storage operations to guide environmental and ecological thinking in terms of conservation, pollution and degradation prevention. This suggests research into biological/hydrological factors and allied matters within the climatic range, terrain and other characteristics in Europe which not infrequently pose specialised challenges which must be countered by constructive proposals rather than arguments against sound objections since public concern is not wholly unrealistic in demanding optimum use of resources for the common good.

The energy element is equally minute. For example, the E d F 1988/89 forecast of 7 GW out of 100 GW is allied with 15 Twh (Table III) or 3 percent out of 500 Twh. When coupled with long construction times, inherent civil engineering risks, escalating costs and suggestions that environmental equilibrium restoration may take one or two decades, pumped storage seems unlikely to sustain public support, particularly if the initial effects are severe, against the view that the energy contribution does not warrant the dislocations involved. On the other hand, consumers have, broadly, still to realise their dependence on secure electricity supply systems some of which are already showing symptoms of impending stress because of failure to steer public opinion away from so-called "protection groups" and to streamline statutory processes between concept and commissioning. Such contentions are, and can be, fruitful grounds for advocates of compact power and energy concentration in gas turbine plants. It seems, therefore, that there are needs for presenting environmental matters not only as functions of pumped storage forms but also relative to:

- (i) *Scale of Construction* as damage or enhancement on a MW basis.
- (ii) *Temporary Damage* during construction with restoration.
- (iii) *Intermittent Bi-directional Operation* on an energy input/output basis.

It is well to realise, however, that the apparently low utilisation of pumped storage takes on greater significance than for high load factor plants and reports have been criticised, sometimes fatally, because of:

- (a) Biased evaluation and lay incomprehensibility.
- (b) Lax assessment of underlying assumptions and alternative solutions.
- (c) Lack of appreciation of land, social and environmental values.

These can no longer be disregarded since public judgments are based on aesthetic and ethical rather than economic standards.

The environmental/ecological aspects of pumped storage cover a broad spectrum, differ from and are more widespread than those encountered with high load factor fossil/nuclear fuelled stations and long term studies are more difficult to justify. The time needed to accumulate and interpret data with recommendations (say 2 years) plus the uncertain outcome and cost may, in hardening financial climates, make utilities unwilling to invest in isolated facilities, unless significant gains, other than power, become dominant.

Engineers often seem poorly briefed against challenges of adverse environmental and ecological impacts mainly because they need definition in terms of daily/weekly/seasonal water level fluctuations and reservoir internal flow distribution for pure pumped storage cycles and multi-purpose uses. They cannot, therefore, afford to dismiss such questions as:

- (i) *Disturbance* of large segments of the natural environment and river regimes; freedom from surface, ocean and groundwater, land and atmospheric changes and pollution, must be assured.
- (ii) *Potential Reactions* to consequences of raised shore lines, exposed reservoir banks and daily water level fluctuations on:
 - (a) *Aquatic Biology*, fish damage, lake eutrophication and terrestrial habitat changes.
 - (b) *Land uses* and social aspects.
- (iii) *Induced Diurnal* stream flow variations.
- (iv) *Ground Water Alterations* and regional effects on aquifers and well systems.

Engineers are, perhaps, not entirely blameless in failing to maintain a meaningful dialogue with their ecological and environmental colleagues who do not appreciate the information which can now be derived from hydraulic studies and model tests and therefore tend to vague approaches stemming from inability to present their data in forms suitable for interface discussions. As a personal view, the remedy rests with the engineer to develop an understanding of biological, and other criteria since, with all forms of pumped storage, such impacts fall on civil engineering works with contributory effects due to hydraulic machinery operations. The devising of convincing solutions can be decisive even where the capital and operating costs are otherwise compatible with system economics.

Pumped storage within a fossil or nuclear fuelled station "power block" can be beneficial but this has yet to be validated unequivocally. It will not, however,

necessarily supplant gas turbines as auxiliary power sources for they are already in common use and in fact may be incorporated in compressed air storage schemes (12), or in combined cycles for overall thermal efficiency improvement but it may be that pumped storage can gain from inclusion in a larger environmental sphere.

It may be appropriate to note here the U.S. experimental and mathematical model approaches (13) and "Environmental Evaluation" schemes (14) which, while seemingly cumbersome, highlight inter-disciplinary areas. Whether similar procedures with jurisdictional, political, social and other overtones will emerge within E.E.C. is perhaps conjectural and even more so for pumped storage; currently such questions are in the hands of constituent governments and there is, as yet, no comprehensive legislation corresponding to the U.S. "Water Resources Planning Act" (15), but directives will surely follow either as a part of the E.E.C., "Environmental", "Energy" or "Regional" policies, for it is now recognised that technology carries commitments against mis-use, and concern for "Society" and the "Environment" has penetrated, possibly via the "Club of Rome" warnings, the highest levels of "European Councils".

6. Economics

Global Economics. Pure pumped storage seems so sensitive to economic changes that there are already reflections within E.E.C. of political considerations, investment strategies, fuel policy, social opposition and base and peak load characteristics which, cumulatively, could be decisive before the end of the century; these matters are not peculiar to the "European Scene" but govern electrical system developments and, with other factors, introduce variables into project reports which make up-dating unavoidable with margins for error at each amendment. For example:

- (i) *Monetary Policy.* Recent international financial disturbances, seem likely to accelerate monetary unification within E.E.C.
- (ii) *Inflationary Trends.* Attempts to stem inflation do not bring stable construction costs, or insure against escalating land prices when projects seem imminent or against labour turnover and scarcity of men, money and materials.

Although depreciating money values may have been a key-note in timing earlier hydro-electric schemes, pumped storage is exposed to inflationary trends both in construction of 5-10 percent p.a. 7.5 - 12.5 percent on fuel and 3.5* 5.0 percent of operating costs.

Impending legislation envisaged by the far-reaching "Treaty of Rome" must also influence corporate structure, inter-trading vis à vis the construction industry,

price and dividend limitations, legal and financial/taxation policies as well as established national and international engineering contract law.

The re-structuring of the heavy electrical industry into multi-national organisations capable of competing abroad and with potential foreign penetration has been surveyed in terms of manufacturing capability, and the demands for steady rather than the prevailing irregular ordering patterns and specifications (16) (17). Pumped storage seems unlikely to materially influence this situation but forecasts of turbo-generators of 1500 MW in stations up to 6000 MW imply larger pumped storage plants of perhaps 2500-3000 MW, greater storage capacity and machines in the 500-600 MW class, and point up the needs for:

- (a) Reduced capital costs and favourable economic terms.
- (b) Site availability and possibly unorthodox layouts with high heads and short waterways.

It would be prudent to anticipate that uncertainties in the next two decades will increase pumped storage costs, but are mentioned merely to stress that no matter how elegant a scheme may be, the engineer cannot neglect external economic forces. It may be that E.E.C. "Fuel and Energy Policy" and "Environmental Recommendations" shortly to come before the "Council of Ministers" will have even greater implications.

Multi-Purpose Developments. In Western Europe some conventional hydro-electric schemes have been modified after or even during construction to accommodate pumped storage with credits for:

- (i) Exploitation which would otherwise be uneconomic,
- (ii) Increased firm capacity,

but care is needed in cascaded systems for the benefits may be marginal or even negative.

Within the framework of 3.8 percent in pumped storage by 1980/82 (26 GW), the 10-15 percent of system capacity forecast by some authorities seems insupportable for acceptability to "Society", and is not dependent on solutions to civil/mechanical/electrical system problems or operational benefits, which may or may not be valid beyond the next two decades. It is, therefore, difficult to escape the conclusion that pumped storage invites some substantial elements of multi-purpose utilisation, but cost-allocations, in the absence of goodwill, will be as vexed, if not more so, as with conventional hydro-electric schemes. Of all multi-purpose uses, only domestic/industrial/irrigation water supplies, and perhaps navigation, seem likely to yield commercial returns. Benefits from

drought alleviation, flood control and cooling water facilities are less easily identified and assignable.

There are indications that weekly rather than daily storage cycles and capability of coping with major fossil or nuclear fueled station outages of relatively long duration will become dominant. Seasonal storage has been and is being adopted where topography, hydrology and other circumstances permit but other more helpful principles are:

- (a) "*Power Groups*". In Switzerland (18) a central pumped storage scheme of 1200 MW is proposed not only for peaking but also as a standby for a group of 5 nuclear stations totalling 3350 MW.
- (b) "*Power Blocks*". In Finland (19) layouts integrating pumped storage into an underground nuclear station are under consideration.

Both proposals apparently warrant higher "economic ceilings" but it seems necessary to ensure that pumped storage, if justified in its own right, is not abandoned if the overall package proves unattractive. The "Block" concept, in particular, necessitates multi-disciplinary investigations to cover, inter alia, increased thermal station capacity.

Survival may therefore depend on recognising that:

- (i) Non-use of water resources is as much a loss as destructive over-use and exclusive appropriation is abuse.
- (ii) Integrated multiple-use, including aid to system and thermal power station operation, may enhance living standards by balanced provision of both essentials, i.e. water and electricity.
- (iii) Potential environmental and ecological damage must be minimised.
- (iv) It no longer suffices to summate marginal benefits without monetary evaluation. This demands improved methods of validating cost allocations and national economic/social benefits for financial and political scrutiny, and needs better reciprocal appreciation than seems to exist at present.

Pumped Storage Economics. In isolation pumped storage assessment on an "equivalent alternative production" basis is relatively straightforward, but nevertheless E.E.C. resources and procedures are unlikely to simplify power and system planning. Network dependent pumped storage will become no easier since other questions already appear to override technical considerations and trends which cannot be dismissed include:

- (i) *Interest Rates* which are steadily rising with repayment terms becoming more onerous.
- (ii) *Depreciation and Amortisation* practices are being questioned and in some quarters the long life and sustained efficiency of hydro-electric plant is being challenged by possibilities of obsolescence. Residual values and thermal plant retirement policies are not excluded.
- (iii) *Taxation* at local, regional, national and "Community" levels can and could be disproportionately heavy on pumped storage relative to base load stations.

Multi-purpose objectives, now slowly being realised in Europe, including association with fossil or nuclear fueled plants add to the complexities of reconciliation analyses when complicated by political and other judgements apart from those reflected by the national economy, industry and market forces on electrical systems.

Claims that, once built, pumped storage is free from inflation are not wholly valid, for operating costs depend on fuel prices and energy availability is becoming precarious. Other factors requiring scrutiny are:

- (a) Proportion of pump storage vis à vis system conditions.
- (b) Assessment of differential energy costs.
- (c) Critical times for introducing pumped storage relative to changing system needs and load patterns.
- (d) Effects of design changes and construction delays.
- (e) Availability, efficiency, flexibility and reliability evaluation.
- (f) Sensitivity of:
 - (i) Fixed annual charges to rapid and unexpected changes in system growth.
 - (ii) Operating and maintenance costs, which except for pumping energy are relatively small.

Techniques for anticipating such changes and their effects are needed to furnish answers to questions which may be posed at financial levels.

At least one major pumped storage scheme in Western Europe is currently known to be uneconomic pending intensive nuclear additions to the system. Financial losses are attributed to:

- (i) *Construction Costs* up by 50 percent on estimates with 18-20 percent due to price increases.
- (ii) *Base Load Energy* availability insufficient to cover night demands especially in winter.

Such experience, perhaps not an isolated one, is no doubt at the root of critical planning and cash flow scrutiny particularly for staged projects. There are needs for restraining investments by improved design and construction techniques to counter rising costs in climates of potential monetary instability where uncertain incentives to long-term profitability are subordinated to cheaper installations.

New systems of civil engineering costing by "method related" bills of quantities including "escalation" clauses for labour and materials are now gaining acceptance and, while needing no justification, will take "tailor-made" pumped storage costs above the older estimating methods. Moreover forecasts are now expected to embrace "investment ceilings". Abnormal land acquisition costs and engineering risks previously deemed in the "unforeseen" category, must be assessed in terms of delays and consequential costs, to substantiate "contingencies" items. Organisation internal accounting, financial standing and participation are not immune from bank scrutiny.

Critical Variables.

(i) *Changing Load Patterns.* Long-term predictions have proved unreliable in two sectors where pumped storage is constrained by energy:

- (a) *Peak Loads.* Currently both energy and load patterns are flattening peaks. Electrical system and thermal plant load duration curves seldom match, and consequently more energy comes from a low merit plant than might be expected.
- (b) *Base Loads.* Off-peak load encouragement has brought shallower and narrower troughs, shorter pumping periods and occasionally pumping energy shortages.

On networks with phased fossil and nuclear station programmes, changing merit order makes peak energy values difficult to assess and pumping costs may be dependent not only on surplus base load energy availability but also on more remunerative utilization bearing in mind that some 25 percent is sacrificed over the pumping/generating cycle. Dramatic overall efficiency improvements seem remote.

(ii) *Energy Costs.*

A. *U.K. Energy Costs.* The energy deviations from the 1968 forecasts highlight the need for a flexible policy to cope with changing circumstances. Between 1968 and 1972 electrical energy costs to industry rose from 0.65 p/kWh to 9.85 p/kWh or 30.8 percent. While partially reflecting inflation via "fuel clauses" excluded the delayed effects of price restraints, the current prediction is a doubling of prices by 1985 perhaps foreshadowing:

(a) Higher prices for non-interruptible supplies.

(b) Changed tariff structures.

The 1972 production costs, perhaps more relevant to pumped storage, are summarised in Table VI.

TABLE VI

C.E.G.B. PRODUCTIONS COSTS (20)

<u>Plant Type</u>	<u>Costs New Pence/ kWh</u>
Nuclear (Magnox)	0.10
Fossil Fuel	
Old Steam Plant (1930-39)	1.10
Coal (Mine Area based)	0.27
Heavy Oil (500 MW Units)	0.20
Installed Generating Capacity	56 GW
Maximum System Demand (January 1973)	40 GW
System Reliability	99.98%

B. *Nuclear Energy.* E.E.C. confidence in nuclear energy is not unbounded and while 15-30 percent power may come from this source, there are signs that such programmes, already under pressure, may give rise to acute problems if fuel supplies, station reliability and safety do not come up to expectations and plants become threatened by shortened life, derating, decommissioning and other considerations:

I. Little seems to be known about world uranium reserves but pointers to impending shortages are:

- (i) Pressure by some RWE shareholders (21) to allocate part of the 1971-72 dividend to new fuel research and to insurance against failure of a prospecting subsidiary.
- (ii) U.N. Resources Committee (22) predictions of an energy crisis if 1.5 million tons of uranium ores are not discovered within 10-15 years.

II. Exposure to inflationary trends, as with imported oil, exceeding the recent 2.5 percent, now seems inevitable. The Western European market for enriched uranium by 1980 is forecast at 20,000 tons/annum, and anticipated price rises are now forcing staged investment of some £1500 million (23).

III. Concern for nuclear reactor costs and safety, spent fuel disposal aside, also comes from some RWE shareholders (21) wanting to allocate from profits:

- (i) DM. 30 million for improving existing nuclear station safety.
- (ii) DM. 30 million against uninsured claims.
- (iii) An unspecified sum for investigating steam turbine blade failures.

IV. An RWE (21) warning that nuclear station construction times may double and, with delayed consents for sites, may jeopardise electricity supplies within 10 years.

(iii) *Fossil Fuels.*

A. *U.K. Situation.* In retrospect the Severn Barrage Tidal Power Scheme, with pumped storage for firming up capacity, would now be viable, although only marginally so when proposed in:

1935 and rejected because of opposition from the then privately owned coal industry.

1944 as a coal saver for reputedly dwindling resources.

Because oil companies have had to assign major shares of their Middle East concessions to host nations, there is now substantial support for the indigenous coal industry on technical, regional and social grounds with forecasts of adequate supplies. While coal therefore seems likely to remain dominant, the delivery, processing and anti-pollution costs, ash content and calorific value will not necessarily improve.

The energy contributed by oil is expected to fall by the end of the century and North Sea gas and oil estimates are uncertain as to extent, location and delivered costs. There are also ideas, without meaningful costs but partly sustained by the "Delphi" findings, that new utilisation frontiers are imminent.

High labour costs and other factors leave coal and oil prone to inflation and exploitation risks so that pumping energy costs may rise to 0.40 - 0.50 p/kWh. It is tempting to conclude, albeit cautiously, that with the present family of thermal stations moving into two-shift operation, the prevailing ratios of peak energy values to base load energy costs will continue. Thermal station efficiencies may improve marginally but, apart from being expensive and unreliable for peaking, perhaps the status-quo will remain undisturbed for pumped storage and may be enhanced by more effective evaluation of its intangible benefits for system operation. It must, however, be demonstrated that, on balance, fuel is saved and preferably without worsening the situation in the early years.

B. *Western European Situation.* This can be couched in slightly different terms. Oil imports:

- (a) Between 1961-71 from the Middle East and North Africa grew from 205 to 815 million tonnes with 80 percent of 40,000 million reserves in these politically unstable regions;
- (b) Are expected to rise to 1040 million tonnes by 1985 to produce 60 percent of E.E.C. energy.

Against backgrounds of concern for:

- (i) Effective use and the environment,
- (ii) Diminished dependence on oil imports by building up indigenous resources,

(iii) North Sea oil constituting only 16-17 percent of requirements around 1980-85, the need for an E.E.C. "Fuel and Energy" policy becomes evident. There are already references to insurance against mounting oil prices by:

- (a) Sharing local discoveries of oil and natural gas.
- (b) Support for the coal industries requiring long lead times and massive investments.
- (c) Nuclear energy which it should be noted can only be used electrically.

Whether an E.E.C. "Energy Commission" can, inter alia, maintain an equitable fuel policy and reconcile conflicting national interests seems problematical for experience shows that internal and external events can unpredictably modify availability and/or price.

Other Aspects.

(i) *Marginal and Intangible Operating Benefits.* Neglect of spinning reserve, load-frequency control, flexibility, reliability and other operational benefits can give false impressions of high costs/kWh but are the least satisfactorily defined elements in system-based financial terms. Some of these advantages are, however, becoming less valid than hitherto as gas turbine competition becomes aware of them and develops appropriate matching techniques. Although these pumped storage benefits may be amenable to economic assessment, there is need for published data coupled with production system characteristics preferably substantiated by post-commissioning evaluations confirming:

- (a) In-service reliability and peak power availability.
- (b) Rapid start up/loading, block load acceptance/shedding and quick change-over to pumping with large scale consumer disconnections.
- (c) Participation in network reactive power, voltage and load-frequency control.
- (d) Spinning reserve utilisation.
- (e) Rapid load variation and high power gradient response and peak load following ability.

Currently fossil fueled stations are displaced upwards in merit order with acknowledged operational and economic consequences of two-shift or partial

load working already causing anxiety. There are few coherent ideas for nuclear stations if and when they constitute a predominant fraction of the infrastructure. Parity is expected by 1990.

(ii) *Engineering Standards.* The so-called harmonising legislation within E.E.C. may have stimulating influences on the uncoordinated European design and construction standards and, inter alia, codes of practice and labour laws. It is thought that codification will take 10-15 years but nevertheless it is already impinging on pumped storage by embracing civil engineering and plant contracts. It may also become influential in respect of capital and other costs and the activities of such bodies as the International Standards Organisation (ISO) and the International Electro-technical Commission (IEC).

(iii) *Research and Development.* Freeman's long association with major civil engineering works no doubt gave him more than passing interest in research and development and indeed it might be said that M.I.T.'s international reputation had its origins in his anticipation of the future, but today there are needs to generate new ideas applicable to pumped storage over the next 10-15 years, rather than in the longer term. Freeman probably encountered and satisfied similar problems to the standards of his times but he could hardly have visualised the magnitude of the vexatious questions in modern power system development of which pumped storage is and will be a small and perhaps disproportionately troublesome fragment.

Broadly, Western European engineering research seems adequately orientated without major overlapping. Whether this is fortuitous or results from co-ordinated academic and commercial interests is difficult to establish. In any case pumped storage is only incidental to wider national aspirations. This is perhaps fortunate since, apart from spin-off and environmental/ecological investigations about which there is little information, pumped storage research on its own seems unlikely to attract much financial support relative to that being allocated to support Western European network investments and to counter future challenges.

Economic Conclusions. While the current outlooks for pure pumped storage in Europe (15 percent annual growth) are encouraging, most of the parameters influencing power supply economics generally make it prudent to conclude that it will play a minor part in Western European network operation and even this may not pass unchallenged when exposed to major policy questions. This has always been so, but changes are now so rapid that valid conclusions today may be invalid in the future and sometimes before construction is complete. Technical, political and social demands now seem to be indicating closer association with the other essential needs of intensely populated regions, and to remain viable pumped storage should:

- (i) Endeavour to ally itself more positively than hitherto with benefits which might accrue from incorporation in and contribution to multi-purpose schemes,
- (ii) Counter the environmental and ecological challenges which now face it,
- (iii) Couple better evaluations of its uses and system operational advantages with convincing consumers that the costs of maintaining reliable electricity supplies must be met.

It must also be recognised that unless all aspects are expressed in monetary terms and generated benefits logically presented without minimising the drawbacks particularly for new concepts and designs, pumped storage will not elude objections which may nullify even the small contribution now assigned to it. At present there seem to be needs for compatibility between comparisons and, where differences are within limits of estimating errors, financial conclusions require backing by sensitivity tests.

The questions which seem to arise from this survey are whether for pure pumped storage, in Western Europe:

- (a) Too long a view is being taken of the operational benefits.
- (b) In a growth climate, increasing population and potential opposition, land demands/competition, regulatory body activities, approval procedures and site feasibility proving, coupled with mounting construction costs and interest rates, are making investments questionable relative to cheaper alternatives.
- (c) Compact, quickly constructed gas turbine plants located within the boundaries of thermal stations for other purposes are or will become adaptable to the advantages of pumped storage where claims of deferred construction of other forms of generation are now valid only in the short term, if at all. Improved operational flexibility, reliability, and fuel consumption may combine with social/environmental objections to pumped storage to give gas turbines wider acceptance than hitherto.
- (d) Survival does not depend on under-pinning with other uses from which more tangible social benefits accrue.
- (e) Civil engineering procedures can reduce or maintain cost parity against inflationary and other trends.
- (f) Cost-effective techniques and marginal benefits, carry sufficient conviction to bridge the lay credibility gap.

- (g) Economic stability in those regions where local labour, materials and finance possibly with indigenous fuel and hydro-electric resources might benefit from pumped storage.
- (h) More than 3.8 percent could be accommodated economically within the topographical limitations in the face of growing environmental objections.

7. The Future

Opposition to land-based power plants is fostering ideas on off-shore installations in association with submarine oil and gas fields following the discovery of reserves which encouraged the belief in independence of imported fuels. Reality is less optimistic in terms of extent and life of such resources, exploitation costs and environmental impacts both on and off-shore. With the recollections that land-based situations had their origins in similar philosophies, fossil and nuclear sea-based power concentrations may be unwelcome in Western Europe on grounds of:

- (i) Atmospheric and ocean environmental damage,
- (ii) Coastal urban development, maritime facilities and population growth.

There will no doubt be attempts to match such developments, where adopted, to shore-based or coastal surface or sub-surface pumped storage, but the outcome seems likely to depend on successful commercial utilisation of advanced research. There are exciting long-term prospects for intensive energy production including coal gasification and liquefaction, fast breeder and high temperature gas reactors, thermo-nuclear fusion, magneto-hydrodynamics and perhaps for tidal, geo-thermal, aeolian and solar energy which, in helping to ease the energy crisis, may have to be allied with some form of electrical energy storage. The sea as an energy source seems more speculative.

While the "Delphi" long-range predictions (24) of 2000 MW turbo-generators, and 6000 MW power stations coupled with those of stable world population and decreased energy consumption/capita by 1990 are not beyond conjecture, it remains to be seen whether, within Western Europe, such stations together with superconducting generators, cables and transformers, will influence the need or otherwise for correspondingly large pumped storage plants.

Superficially, at least, there are no technical barriers to expansion and while the U.K. costs for two oil-fired stations totalling 6000 MW are estimated to cost around £93/kW (25) compared with the £45 - 50/kW for the projected Dinorwic Pumped Storage Scheme (1400-1700 MW) (25A), as typical of Western Europe, is hopeful, cautious economic optimism must be coloured by the potential impact of:

(i) The future outlook on environmental questions.

(ii) Developments emanating from current research.

For example, there are now claims that fuel cells will become practicable within 10-15 years (24) and that they will be:

(i) Inconspicuous and less space demanding than conventional plant thus easing site selection.

(ii) Non-polluting and require no cooling water.

(iii) Inherently more efficient than thermal plant.

(iv) Suitable for base, peak and load following duties.

(v) Less demanding in construction time.

"Delphi" also forecasts efficient electrical energy storage by 1990-2000 presumably envisaging metal fluorides where research suggests that:

(a) Eutetic mixtures have high stored energy capacity for driving Stirling cycle heat engines.

(b) Such heat stores in power stations could:

(i) Help meet peak loads and absorb off-peak energy.

(ii) Supply night loads and back-up solar plants.

If such claims are genuine they do not encourage long-term investment in pumped storage. They are, however, neither firmly coupled to prospective development, capital and operating costs, nor to dependence on indigenous and/or imported materials. Recent ambitious innovations are attracting increasing public scepticism in costs of and benefits from new developments but if the gloomy prognostications of the "Club of Rome" are credible, new energy sources seem vital.

In retrospect, and recalling nuclear energy as an example of large scale exploitation, it seems that even the upper quartile segment of the "Delphi" predictions will be realised only if technical considerations predominate over all others. If so, it seems equally evident that much intensive development must become the responsibility of the present generation of science and technology based engineers; and that Freeman's philosophies of continuing education, training and responsibility plus inter-disciplinary experience for, and participation in, national affairs and concern for public and engineering safety will be

inescapable, for the "Delphi" conclusions on international environmental co-operation and energy production are less than hopeful. While this might improve the prospects for pumped storage, it does appear, as a personal and pessimistic opinion, that alone the probabilities of its expansion or even survival beyond the end of this century are remote.

8. Conclusions

In Western Europe there seem to be needs for "Society" to recognise that professional engineers' contributions are not subservient to finance, conservation, administration and legal organisations with limited responsibility for the imminent water and energy dilemmas. Effective participation is vital in achieving multi-disciplinary objectives but engineers must learn, and learn quickly, to communicate constructively with the other professions and indeed the public at large. Even when isolated from its electrical system operational functions, pumped storage in its various forms is an almost classical example of such needs. All the professions are today more closely allied than seems to be realised but some fail to offer constructive guidance in time or terms for alternative proposals or response to difficulties or objections, and too frequently delays result or decisions go by default. The days of professional detachment and commitment to the future consequences are approaching an end for electricity and water supply projects are already vulnerable to delays in:

- (i) *Consents* due to absence of speedy procedures.
- (ii) *Plant Investment* allocations.
- (iii) *Exploitation of Indigenous Fuels* and more effective utilisation.

In Western Europe there are "clouds" and even "storm warnings" of impending power and water crises of which pumped storage is only one element. There are, nevertheless, no shortages of hydraulically orientated problems awaiting solution by those with research, mathematical, engineering design and construction inclinations but inter-disciplinary interface experience is needed not only to identify them but also to justify investigation on cost-effective bases. To quote Omar Khyam:

"The moving finger writes and having writ moves on".

The question now is whether science, technology and the allied professions can intervene in time to counter the remaining:

"and neither piety nor wit can change one word of it".

Assuredly we can and must if man is to remain "master of his destiny". This brings us back in no uncertain terms to Freeman's emphasis on youthful enterprise in the broadest senses; for new forms of power generation and perhaps transmission may bring social, political, environmental and technical problems just as nuclear power has done and is still doing. Unless these are resolved, the charter aims of your kindred U.K. Society, the "Institution of Civil Engineers" of:

"Harnessing the forces of nature for the convenience and service of man"

will not be fulfilled. It is later than we think and it is time to make a closer analysis of existing and future forms of power generation, their prospects and limitations and the future needs for energy and water coupled with pumped storage in association with multi-purpose utilisation to confirm or otherwise that such facilities can make more use than the 3.8 percent contribution in power which is attached to it in current predictions.

This "address" was stimulated not only by Freeman's engineering activities but also by his humanity and liberal concern for his colleagues and, as presented in the narrower but cogent framework of "Hydro-Electric Pumped Storage in Western Europe", it is with the hope that it may help rekindle the waning interest of younger engineers in heavy civil, mechanical and electrical undertakings; and to stir the need for imaginative, creative and synthetic as distinct from analytical approaches despite their importance in reaching the ultimate objectives. Finally, if it has, in a limited way, contributed something, at least for discussion, it may also have served to strengthen European and American professional ties which was perhaps implicit in your sponsors' invitation to present this the "Eighth John R. Freeman Memorial Lecture".

BIBLIOGRAPHY

1. *Ven Te Chow* Hydraulic Modelling. Boston Society of Civil Engineers Journal, January 1972, Vol. 59, pp. 1-27.
2. *Ippen, A. T.* New Look At Sediment Transport in Turbulent Streams. Boston Society of Civil Engineers Journal, July 1971, Vol. 58 pp. 131-163.
3. *Rouse, H.* Jet Diffusion and Cavitation. Boston Society of Civil Engineers Journal, July 1966, Vol. 53, pp. 255-271.
4. *Camp, T. R.* Hydraulics of Mixing Tanks. Boston Society of Civil Engineers Journal, January 1969, Vol. 56, pp. 1-28.
5. *Cederwall, Klass*, Dispersal Phenomena in Coastal Environments. Boston Society of Civil Engineers Journal, January 1970, Vol. 57, pp. 34-70.
6. *Parmakian, J.* Unusual Aspects of Hydraulic Transients in Pumping Plants. Boston Society of Civil Engineers Journal, April 1968, Vol. 55, pp. 30-47.
7. *Gerber, H.* European Experience with the Thermodynamic Method. Boston Society of Civil Engineers Journal, April 1968, Vol. 55, pp. 1-29.
8. *Smith, D. I.* Large Gas Turbines; Future on British Supply System. Electrical Times, 15th February 1973, p. 11.
9. *Gerard, P., et al.* Advantages of Transferring Energy from Off to On-Peak Hours by Pumping - On the French System Using a Mathematical Simulation Model. Economic Commission for Europe; Committee on Electric Power. Symposium on Hydro-Electric Pumped Storage (Athens, Greece) November 1972, Paper B.5.

10. *Dilloway, A. J.* Regional Prospects for Pure Pumped Storage Schemes in Europe. Economic Commission for Europe; Committee on Electric Power. Symposium on Hydro-Electric Pumped Storage (Athens, Greece) November 1972, Paper A.7.
11. *Anon.*, C.E.G.B. Forward Planning Figures. Electrical Times, 15th February 1973.
12. *Keskin-en, R. et al.* Sub-surface Power Plants – A Study of Pumped Storage and Gas Turbine Plants (Finland). Economic Commission for Europe; Committee on Electric Power. Symposium on Hydro-Electric Pumped Storage (Athens, Greece) November 1972, Paper B.7.
13. *Baren, C. F. & Howlett, H. A.* Delaware River Basin Commission – Pumped Storage Operation and Fish Spawning. Proceedings of University of Wisconsin – Milwaukee International Conference on “Pumped Storage Developments and Their Environmental Effects”, 1971, pp. 532-41.
14. *Seaman, E. A.* Environmental Impact Evaluation Systems. Proceedings of University of Wisconsin – Milwaukee International Conference on “Pumped Storage Developments and Their Environmental Effects”, 1971, pp. 447-54.
16. *Anon.* Recent Advances in Heavy Electrical Plant. Royal Society's Conference, Electrical Review 23rd February 1973, p. 268.
17. “Electrical Power in Europe”. U. K. National Economic Development Office Report (1972).
18. *Fray, P. F. et al.* Nuclear Plant Standby. Proceedings of University of Wisconsin – Milwaukee International Conference on “Pumped Storage Developments and Their Environmental Effects”, 1971, pp. 394-404.
19. *Kipelainen, J. E.* Nuclear Plant Thermal Pollution Avoidance. Proceedings of University of Wisconsin – Milwaukee International Conference on “Pumped Storage Developments and Their Environmental Effects”, 1971, pp. 511-23.
20. *Anon* U.K. Energy Production Costs. Electrical Times, 15th February 1973.
21. *Anon* R.W.E. Shareholders Pleas at Annual General Meeting. Electrical Review, 16th February 1973, p.234.
22. *Fischer, D. A. V.* U.N. Resources Committee Delhi Conference (1973). Electrical Review, 9th February 1973.
23. *Anon* Staged Investments for Enriched Uranium. Engineer, 8th March 1973. Electrical Times, 1st March 1973.
24. *Anon* “Delphi” Long Range Predictions. Electrical Review, 23rd February 1973, pp. 286-7.
25. *Anon* New U.K. Oil Fired Stations. Electrical Review, 23rd March 1973, p. 417.
- 25A. *Anon* Dinorwic Pumped Storage Station. Electrical Review, 23rd March 1973, p. 418.

HARRY POOLE BURDEN

1890 - 1972

Harry Poole Burden, noted educator and President of the Boston Society of Civil Engineers in 1944, passed away on October 29, 1972.

Dr. Burden was born in Lynn in 1890, was educated in the Lynn public schools, and was graduated from the University of Maine in 1912. After working for a year he came to Tufts College in 1913 as an instructor in Civil Engineering, and thus started a career of almost sixty years at Tufts. He progressed through the positions of Assistant Professor, Associate Professor, and full Professor in 1930, finally in 1936 being appointed Dean of the School of Engineering.

As Dean, he directed the affairs of the College of Engineering with great skill until his retirement in 1957 when he became Dean Emeritus. His talents and contributions as an educator were rewarded in 1953 when Tufts College conferred on him the Honorary Degree of Doctor of Engineering. The Alumni Association recognized his contributions by awarding him the Distinguished Service Award. His students honored him when the 1957 Year Book of the Tufts Senior Class was dedicated to him. The dedication read: "He has demonstrated his ability to understand the human, as well as the mechanical, side of his engineering students. His aim has always been to avoid letting his students graduate understanding their science but not themselves."

To some men it is given to make their influence felt far beyond the ordinary bounds of their lives. Dean Burden, with his charming wife, Lunetta, made a lasting impression on Tufts College all the years of their tenure. As a Dean he liked to feel that he was closer to his students and to the members of the faculty than he was to research and publication. Although he was an extremely busy and hard working man, no one of his students who had a problem was denied a sympathetic hearing. Faculty members also found him available when they wished to discuss academic problems or personal affairs. The Burden home was always open to students, whether it was for a meal or a night's lodging, and faculty members remember well the hospitality they found here. At the time of the famed Valentine's day storm in 1940 one faculty member found a home for three nights.

The last eleven years of Dean Burden's life were very lonely due to the fact that Mrs. Burden died in July 1961. He lived alone on Latin Way until 1968 when he moved to his last home on Curtis Street. He recovered rather well from a stroke which he suffered in May 1967. Through it all he maintained his interest in everything pertaining to Tufts, and looked forward to visits, not only from his friends, but especially from his former students. He made his last appearance at a Tufts event in May 1971, at the Alumni Dinner of the Civil Engineering Department.

The fine qualities of Dean Burden were admirably set forth by his good friend and colleague, Dr. Alvin H. Howell, in his remarks at the Memorial Service held in Goddard Chapel on November 8, 1972: "The living and lasting monument to Dean Burden is the Engineering College that he handed over to his successor

after twenty-one years as its head, and the alumni who received their education during these years. Harry Poole Burden was a prince of a man. He was kind and modest, completely unselfish, totally honest, and absolutely honorable, one who never did anything improper. His quick wit, sly sense of humor and happy smile revealed the Harry Burden that people admired so much, and loved.”

FRANK M. GUNBY

1882 - 1973

Colonel Frank M. Gunby, a Past President of the Boston Society of Civil Engineers, and one of the incorporators of Chas. T. Main, Inc., Engineers, died April 10, 1973, at the age of 90.

Born in Charleston, South Carolina, June 27, 1882, Colonel Gunby received his Bachelor of Science Degree in Electrical Engineering and an honorary degree of Doctor of Industries from Clemson College. He was a member of the honorary engineering fraternity, Tau Beta Pi.

After three years with the Eagle & Phoenix Mills, Columbus, Georgia, Colonel Gunby came to Boston to join Charles T. Main in 1905. In these early years of his career the Textile Industry was flourishing in New England. Many new mills were erected during this time, most being operated by water power or steam engines using rope or belt drives. Public utilities were in their infancy with electric power produced primarily for lighting and street railways. The general use of electricity in industry was challenged by many, and the economics of a changeover were difficult to establish. Colonel Gunby became a pioneer in this field and was one of the first advocates of individual overdrives in the Textile Industry.

During World War I, Mr. Gunby earned the rank of Colonel while in charge of engineering for the construction division of the Army and retained the title for the rest of his career. In the depression years, Colonel Gunby was active in organizing and operating the Emergency Planning and Research Bureau which helped obtain employment for engineers and architects in private industry and on public work programs.

In 1942, the United States Department of War initiated a crash program for large scale production of a new super-explosive, "RDX". Chas. T. Main, Inc. was selected as Architect-Engineers for the project to be constructed at Kingsport, Tennessee. Colonel Gunby was in charge of the project, later known as the Holston Ordnance Works, where he directed a staff of over 600 men. Ultimately, over two hundred and forty permanent buildings, sixty miles of road, and thirty miles of railroad with two major railroad bridges across the Holston River were constructed. At the peak of this high-priority assignment, over sixteen thousand construction men were employed on the program.

In 1958 in referring to Chas. T. Main, Inc., he stated, "We have no rules that start with don't." Colonel Gunby carried this philosophy into his personal life and gave wholeheartedly to those organizations in which he believed. He was an active member of the Boston Society of Civil Engineers, and from 1923 to 1924 served as President. Subsequently, he continued to participate in discussions and to give talks before the Society. In 1948 he was made a life member and in 1950 was given honorary membership.

He was a life member of the American Institute of Electrical Engineers, American Society of Civil Engineers, American Society of Mechanical Engineers,

(past Vice President), a member of the American Institute of Consulting Engineers, and the Massachusetts Society of Professional Engineers.

He was active in the Veteran Association of The First Corps of Cadets and served for a time as Vice President. After his retirement, he served his community as a member of the Board of Directors of the Winchester Hospital; was Chairman of the Hospital Building Committee during its last expansion; was on the finance committee of the Town of Winchester and served as Chairman of the Building Committee of the First Congregational Church of Winchester.

To all he undertook he brought tireless energy, patience and a great understanding of people.

Colonel Gunby's wife, Ruth Marceaux Gunby died on November 26, 1965. He is survived by a son, Frank M. Gunby, Jr., of Winchester, Massachusetts and a daughter, Mrs. Rollie G. DeMeritt of Dickenson, Texas, and six grandchildren.

PROCEEDINGS OF THE SOCIETY

Minutes of Meeting

BOSTON SOCIETY OF CIVIL ENGINEERS

December 6, 1972 - A meeting of the Society was held jointly with the Environmental Section. Following dinner at the Union Oyster House, the meeting was called to order at about 7 P.M. by Mr. Paul Guertin, acting Chairman for the evening. Mr. Guertin turned the chair over to President Archibald for a brief business meeting. Pres. Archibald stated that the reading of the minutes of the September 27 and November 1 meetings would be waived if there was no objection. No objection was heard.

The President then called upon the Secretary for announcements. The Secretary announced that the following had been elected to membership on October 25, 1972:

Member: Harold K. Melkonian;

Juniors: Steven C. Davis, Laurence Storch, John P. Sullivan, James H. Wazlaw.

Applications for membership have been received from:

John Delehanty, David Campbell, Michael Carpenter, Joseph E. McKeever, James O'Day, Arthur N. Olive, Jr., John D. Stelling, Zane Spiegel.

There being no further business, the President turned the chair over to Mr. Guertin who introduced the speakers of the evening, Mr. Russell Culp, who presented a description of the Lake Tahoe Plant and Mr. Donald Schwinn, who described the Blue Plains (D.C.) Plant. More details of the presentations and discussion may be found in the minutes of the Environmental Section.

The meeting was adjourned at 9:30 P.M. Approximately 70 members and guests attended,

Joseph F. Willard
Secretary

January 24, 1973 - A joint meeting of the Boston Society of Civil Engineers with the Mass. Section of the American Society of Civil Engineers and the Society of Women Engineers was held at noon in the Branding Iron Restaurant.

A.S.C.E. Section President Brian Hogan conducted a brief business meeting, and then introduced President Archibald of B.S.C.E. who gave notice of forthcoming meetings and asked for a vote on the motion "authorizing the Board of Government to transfer a sum of not more than \$9,000.00 from the Principal of the Permanent Fund to the Current Fund to meet Current Expenditures". The motion was VOTED with no objection. The second VOTE will be taken at the February 28, 1973 meeting.

The Secretary of B.S.C.E. then announced the election to membership on December 27, 1972 of Stanley D. Elkerton, Joseph E. McKeever and John D. Stelling. The Secretary also announced the deaths of Irving Finberg and John Pierce, and the resignation of Robert Restall.

Mr. Chan Rogers then introduced Mr. Edward Fucik President, Harza Engineering, Chicago. Mr. Fucik spoke on "Salary Guidelines, Ethics and Action", with slides illustrating his lecture. A brief question and answer period followed.

The meeting was adjourned at about 2:15 P.M.

About 90 members and guests attended the meeting.

Joseph F. Willard
Secretary

February 28, 1973 - A joint meeting of the Boston Society of Civil Engineers was held on Wednesday, February 28, 1973 with the Transportation Section of the Society and the Mass. Section of the American Society of Civil Engineers in the Harvard Room of Purcell's Restaurant.

Following a social hour and dinner, the meeting was called to order by Vice-Chairman Richard Guzowski of the Trans-

portation Section in the absence of Chairman Tierney. Following introduction of the head table, Mr. Guzowski turned the meeting over to President Archibald for a short business session. The second of two VOTES was taken "authorizing the Board of Government of the Boston Society of Civil Engineers to transfer a sum of not more than \$9,000.00 from the Principal of the Permanent Fund to the Current Fund to meet Current Expenditures". The Secretary then announced the names of those elected to membership by the Board of Government on February 14, 1973 after which the meeting was turned back to Mr. Guzowski.

This being the Annual Meeting of the Transportation Section, the next order of business was nomination and election of officers for the Section for the coming year. Following this, the acting Chairman turned the meeting over to Mr. Russell Barnes who introduced the guest speaker, Dr. Charles H. W. Foster, Secretary of the State's Department of Environmental Affairs.

Secretary Foster spoke on the "State Reorganization Program", outlining the general nature of the new form for the Executive Branch, and then speaking in detail about his Department and how it intended to function in environmental matters. A short question and answer period followed.

Forty members and guests attended the meeting, which was adjourned at 8:45 P.M.

Joseph F. Willard
Secretary

March 21, 1973 - The 125th Annual Meeting of the Boston Society of Civil Engineers was held in the Science Museum, Science Park, Boston, Mass. and was called to order at 4:15 P.M. by President James Archibald.

President Archibald announced that the minutes of the January and February meetings would be published in the Journal, as had been done for previous meetings during the year.

The President then called upon the Secretary for announcements. The Secretary announced that at the Board of Government meeting held March 19, 1973 the following had been elected to membership:

Grade of member: James N. Jackson,

Richard L. Laramie and Albert S. Lucks.

The Secretary also announced that applications for membership had been received from the following:

Grade of member: Nils A. Anderson, Reidar Bjorhovde, Kenneth F. Briggs 3rd, John Delehanty, Peter Dunlop, Francis X. Hall, Howard L. Keller, Jr., Alfred J. Lattanzi, Edward J. McNamara, Charles J. Owen, Dominic M. Palmer, Jr., John D. Pettinelli, James A. Ryan, Robert L. Simone, Henry B. Tom and Erik H. Vanmarcke.

Student member: Rene de Simone.

The Secretary then announced that Professor Arthur T. Ippen and Dr. George R. Rich had been elected Honorary Members by the Board of Government, and that Leslie Hooper, William Raphael and Julian White had become eligible for Life Membership.

The annual reports of the Board of Government, Treasurer, Secretary and Auditors were presented. Reports were also made by the following committees: Publication, Hospitality, Library, John R. Freeman Fund, Ralph W. Horne Fund, Membership, Advertising, Joint Legislative Affairs, and Quarters.

It was VOTED "that these reports be accepted and placed on file".

The annual reports of the sections were read and it was VOTED "that the annual reports of the sections be accepted and placed on file".

The President stated that the reports of the committees and sections will be published in the April 1973 Journal.

The Tellers of Election, Samuel E. Rice 3rd. and Bruce N. MacIver made their report on the results of the ballots, and, in accordance therewith, the President declared that the following had been elected officers for the ensuing year:

President	Max D. Sorota
Vice-President	Charles A. Parthum
Secretary	Joseph F. Willard
Treasurer	Robert T. Colburn
Directors	Arthur R. Barnes, Jr. Stephen E. Dore, Jr.
Nominating Committee	Morse H. Klubock Edmund G. Johnson Robert T. Tierney

President Archibald made a few announcements concerning the evening meeting.

Following a five-minute recess, President Archibald delivered the Presidential Address, entitled "*The Challenge of Change*".

The meeting was adjourned at 5:40 P.M. to reconvene following the social hour and dinner.

President Archibald called the adjourned meeting to order again at about 8:10 P.M. Following general remarks and announcements, the President introduced the guests and officers at the head table and then turned the affairs of the meeting to the awarding of prizes.

The Secretary stated that Professor Arthur T. Ippen had been elected to Honorary Membership by the Board of Government, and President Archibald presented the certificate, reading as follows:

Boston Society of Civil Engineers
 "As a Distinguished teacher, perceptive researcher, prolific author and dedicated scholar whose disciples, friends and interests are legion and world-wide

Arthur T. Ippen
 has been duly elected an
 Honorary Member
 by direction of the
 Board of Government
 March 21, 1973"

The Secretary also stated that Dr. George R. Rich had been elected Honorary Member, whereupon President Archibald presented the following certificate:

Boston Society of Civil Engineers
 "For his outstanding career as a dedicated engineer, dynamic lecturer and author and inspiring leader in the Engineering Field

George R. Rich
 has been duly elected an
 Honorary Member
 by direction of the
 Board of Government
 March 21, 1973"

The Secretary stated that the Ralph W. Horne Fund was established in 1964 by a gift from the Directors of Fay, Spofford & Thorndike, Inc. the income of which would be devoted to a prize or certificate to be awarded annually to a member designated by the Board of Government as having been

outstanding in unpaid public service in municipal, state or federal elective or appointive posts; or in philanthropic activity in the public interest. The Secretary announced that the recipient of the award this year is Mr. Francis S. Harvey and asked him to step forward. President Archibald presented Mr. Harvey the certificate reading as follows:

"Ralph W. Horne Award
 Presented by the
 Boston Society of Civil Engineers
 to

Francis S. Harvey
 Dedicated Civil Engineer, for his efforts, over many years, to better the community by service on various boards, committees of State and Local governments, Hospital and Youth Organizations, the
 Board of Government
 of the

Boston Society of Civil Engineers
 has selected him to be the
 EIGHTH RECIPIENT
 of the

Ralph W. Horne Award
 and this certificate is presented proudly to him, March 21, 1973."

The Secretary announced the recent retirement of the former office secretary, Mrs. Virginia Boudia and action by the Board of Government to award her an engraved Revere bowl with a sum of money as a token of appreciation for her years of service to the Society. The award, presented by President Archibald, was accepted on Mrs. Boudia's behalf by Dr. Robert Culver.

The Secretary stated the endowment conditions for prizes and asked each of the recipients to step forward to receive the prize awards as follows:

<i>Award</i>	<i>Recipient</i>	<i>Paper</i>
Desmond FitzGerald Medal	Prof. Arthur T. Ippen	"A New Look at Sedimentation in Turbulent Streams"
Clemens Herschel	L. A. Wolfskill C. Soydemir	"Soil Instrumentation for I-95 MIT-MDPW Test Embankment"

<i>Award</i>	<i>Recipient</i>	<i>Paper</i>
Geotechnical Section Award	T. W. Lambe D. D'Appolonia K. Karlsrud R. Kirby	"The Performance of the Foundation Under a High Embankment"
William P. Morse Scholarship	Robert Ducibella	
Desmond Fitzgerald Scholarship	Wayne Reeves	

President Archibald then introduced the speaker for the evening, Mr. Carl de Suze, who gave an excellent, well-illustrated talk on "African Wild Life, the Vanishing Wonder". Following the guest speaker's presentation, President Archibald turned the meeting over to President-elect Max Sorota who presented the retiring President with a certificate of appreciation for services to the Society.

The meeting was adjourned at 10:00 P.M.

One hundred and sixty-three members and guests attended the dinner and meeting.

Joseph F. Willard
Secretary

Meeting of the Hydraulics Section

January 31, 1973 - The Hydraulics Section of the Boston Society of Civil Engineers held its annual meeting at the Playboy Club in Boston. The meeting was called to order at 7:15 p.m. by the Chairman, Mr. Jerry Degen.

The Chairman presented the nominating committee's report which recommended the following slate of officers for the coming year:

Frank Perkins	Chairman
Saul Cooper	Vice-Chairman
Thomas Baron	Clerk
Lee Wolman	Executive Committee
Oscar Donati	Executive Committee
Jerry Degen	Executive Committee

The above slate was elected unanimously by voice vote.

An appeal was made for new members and applications were handed out to several nonmembers attending the meeting.

Mr. Degen introduced the guest speaker, Mr. Bill Eichert, Director of the Hydrologic Engineering Center at Davis, California. The speaker discussed the activities of the Hydrologic Engineering Center in the field of water resources. The Center performs four principal functions: research, training, special studies and methods systemization. Mr. Eichert explained the types of studies currently underway for each function. He then explained the general computer programs prepared by the Center for Corps-wide use. These programs can be made available to any public or private organization.

A question and answer period followed the talk.

The meeting adjourned at 8:30 p.m. Forty-one persons attended.

Saul Cooper
Clerk

Meeting of Construction Section

February 14, 1973 - A joint meeting was held with the Mass. Section of ASCE at Nick's Restaurant. The meeting was a luncheon meeting starting at 12:30 a.m. and adjourned at 2:20 p.m. Attendance was 68.

The guest speaker, Mr. George B. Stryker, Resident District Manager of the District of Columbia Blue Plains Treatment Plant, spoke on the construction of additional facilities at the treatment plant.

The following were nominated and elected to the Executive Committee of the Construction Section for the year 1973-74:

Joseph B. Kerrissey, Jr.	Chairman
Samuel E. Rice	Vice-Chairman
Laimonis Rieksts	Clerk
Frank J. Killilea, Jr.	Executive Committee
Morse H. Klubock	Executive Committee
John T. Quinn, Jr.	Executive Committee

Respectfully submitted,
Samuel E. Rice
Clerk

Meeting of the Structural Section

March 14, 1973 – A joint meeting with the Geotechnical Section was called to order at 7:35 P.M. at the 57 Restaurant by Jurgis Gimbutas, Chairman of the Structural Section. 130 were in attendance.

Mr. Gimbutas introduced Mr. Archibald, President of the BSCE, who reminded the audience of the Annual BSCE Meeting, March 21.

Mr. Johnson of the Geotechnical Section announced cancellation of a scheduled M.I.T. lecture on March 20, and reminded those in attendance of the next Geotechnical Meeting, March 28.

The following were nominated and elected to the Executive Committee of the Structural Section:

Chairman: Mr. Rubin M. Zallen
 Vice-Chairman: Mr. Harold V. McKittrick
 Clerk: Dr. Kenneth Leet
 Members: Dr. Frank Heger
 Mr. William Hagen
 Mr. Edwin C. Joiner

Professor Kenneth Leet introduced the speakers, R. Whitman, A. Cornell, E. Vanmarke, all of M.I.T. and J. Brennan of Le Messurier Assoc. The topic was "The Boston Earthquake Zone – Lateral Loads and Design Provisions". "Topic II – Building Response and Damage".

Professor Whitman outlined the general scope of the talk which covered *seismic design provisions* for new 5 to 20 story frame buildings built in Boston in firm ground.

Mr. Brennan described the configuration, size and nature of buildings studied, and the applicable forces and codes for which they were designed.

Forces from five seismic zones were considered: (1) Zones 0, 1, 2 and 3 from the Uniform Building Code, and (2) a new Zone 4 (forces twice that of U.B.C. Zone 3).

Professors Whitman, Vanmarke and Cornell discussed damage probabilities for various types of buildings designed for varying seismic forces and subjected to various earthquake intensities, the potential repair costs and incident costs.

The study is still in its very early stages and limited, but its purpose has been to select earthquake design criteria, striking an optimum balance between initial construction cost and anticipated future losses.

The final selection of such criteria will depend to a large degree upon feedback from members of the profession presented with present and future data from this study.

Respectfully submitted,
 Harold V. McKittrick
 Clerk, Structural Section

Meeting of the Computer Section

April 4, 1973 – The Computer Section met at the Playboy Club, Boston, on April 4, 1973. Thirty-two people attended. The meeting was called to order at 7:30 p.m. by Computer Section Chairman David Hellstrom. There being no Section business, Professor John Christian introduced the speakers for the meeting: Dr. Anwar E. Z. Wissa, Research Assistant, Department of Civil Engineering, M.I.T.; and Mr. Robert Mirick, Reservoir Control Center, U.S. Army Corps of Engineers, Waltham, Mass. Dr. Wissa spoke about field instrumentation used to obtain data for subsequent computer analysis. Mr. Mirick discussed telemetry of data from remote flood control stations for direct input to a computer for analysis, including computer graphics. A discussion period followed the presentations. The meeting was adjourned at 9:30 p.m.

David I. Hellstrom
 Chairman

ANNUAL REPORTS
REPORT OF THE BOARD OF GOVERNMENT
1972-1973

To the Boston Society of Civil Engineers:

Pursuant to the requirements of the By-Laws the Board of Government presents its report for the year ending March 21, 1973.

The following is a statement of the status of membership in the Society:

Honorary	10
Members	1067
Associates	4
Juniors	47
Students	4
<hr/>	
Total	1132
Applications pending March 21, 1973	16
Student Chapters	2
<i>Summary of Additions</i>	
New Members	28
New Juniors	7
New Students	1
New Associates	1
<i>Summary of Transfers</i>	
Juniors to Members	4
<i>Summary of Loss of Members</i>	
Deaths	14
Resignations	15
<i>Life Memberships</i>	
Life Members	132
Members becoming eligible today for Life Membership	3

Honorary Membership is as follows:

John B. Babcock 3rd.	elected	January 2, 1969
Charles O. Baird, Jr.	elected	January 2, 1969
Arthur Casagrande	elected	February 1, 1965
Frank M. Gunby	elected	February 15, 1950
Ralph W. Horne	elected	February 1, 1965
Arthur T. Ippen	elected	March 19, 1973
Karl R. Kennison	elected	February 7, 1951
George R. Rich	elected	March 19, 1973
Howard M. Turner	elected	February 18, 1952
Frederic N. Weaver	elected	February 1, 1965
John A. Volpe	elected	January 29, 1968

The following members have been lost through death:

Gerald F. Blake	1972
George W. Bowers	1972
Harry P. Burden	1972
Robert G. Field	December 30, 1972
Irving W. Finberg	October 30, 1971
Andrew D. Fuller	July 26, 1972
William L. Harris	October 2, 1972
Harold D. Kilgore	1972
Paul D. Killam	July 29, 1972
Horace W. Oxnard	1972
Clemens Petrelis	August 19, 1972
John F. Pierce	October 1972
Albert B. Rich	1972
Manuel H. Sylvia	date as yet undetermined

MEETINGS OF THE SOCIETY

March 22, 1972	Address of Retiring President, Ernest A. Herzog, "Transportation - The Design of Minimal Design Functions".
April 26, 1972	Joint meeting with Transportation and Geotechnical Sections. Presentation on "The Proposed Third Harbor Crossing", by Messrs. Walt Hansen, William Wachter, Stiles Stevens and Morse Klubock.
May 31, 1972	Joint Outing with Sanitary Section. Tour of Braintree Incinerator and Presentation by Mr. Frank L. Heaney of Camp Dresser & McKee, Inc.
September 27, 1972	Joint meeting with Geotechnical Section. Dr. J. J. Harrington, Harvard University; "Environmental Impact Statement Analysis".
November 1, 1972	Annual Student Night, joint meeting with Mass. Section of American Society of Civil Engineers. Professor Robert L. Meserve of Northeastern University spoke on "Beyond the Code of Professional Ethics".
December 6, 1972	Joint meeting with Environmental Section; "Design and Operation of Advanced Wastewater Treatment Systems", by Russell Culp and Donald Schwinn.
January 24, 1973	Joint meeting with Mass. Section, A.S.C.E. "Salary Guidelines", by Edward Fucik, President of Harza Engineering.
February 28, 1973	Joint meeting with Transportation Section. Dr. Charles Foster, Secretary of Environmental Affairs, spoke on the "State Reorganization Program".

ATTENDANCE AT MEETINGS

Date	Place	Dinner	Meeting
March 22, 1972	Science Museum	134	134
April 26, 1972	Red Coach Grill, Boston	46	52
May 31, 1972	Valle's, Braintree	37	70
September 27, 1972	Harvard University	60	60
November 1, 1972	Northeastern University	75	75
December 6, 1972	Union Oyster House	60	70
January 24, 1973	Branding Iron	90	90
February 28, 1973	Purcell's Restaurant	37	40

The sections of the Society also held a number of meetings during the year covering a variety of subjects of interest. The name of the Sanitary Section was changed to Environmental Section during the year. Reports of the various sections will be presented at the Annual Meeting of the Society and will be published in the Journal.

FUNDS OF THE SOCIETY*

PERMANENT FUND. The Permanent Fund of the Society has a book value of \$71,265.83. The Board of Government authorized the use of as much as necessary for the current Income of this fund in payment of current expenses. By vote of the Society, as prescribed by the By-Laws, at the January 24, 1973 and February 28, 1973 meetings, the Board of Government was authorized to transfer an amount not to exceed \$9,000 from the Principal of the Permanent Fund for current expenditures. The amount transferred was \$8,074.36.

JOHN R. FREEMAN FUND. In 1925 the late John R. Freeman, a Past President and Honorary Member of the Society, made a gift to the Society of securities which was established as the 'John R. Freeman Fund'. The income from this fund is to be particularly devoted to the encouragement of young engineers. Mr. Freeman suggested several uses, such as the payment of expenses for experiments and compilations to be reported before the Society; for underwriting meritorious books or publications pertaining to the hydraulic science or art; or a portion to be devoted to a yearly prize for the most useful paper relating to hydraulics contributed to the Society; or establishing a traveling scholarship every third year open to members of the Society for visiting engineering works, a report of which would be presented to the Society. The expenditures from this fund during the year were \$608.60.

EDMUND K. TURNER FUND. In 1916 the Society received a bequest of \$1,000 from Edmund K. Turner, a former member of the Society, the income of which is to be used for Library purposes. The Board voted that \$130 be transferred for this purpose.

ALEXIS H. FRENCH FUND. The Alexis H. French Fund, a bequest of \$1,000 was received in 1931 from the late Alexis H. French, a Past President of the Society. The income of this fund is 'to be devoted to the Library of the Society'. The Board voted that \$130 be transferred for this purpose.

CLEMENS HERSCHEL FUND. This Fund was established in 1931 by a bequest of \$1,000 from the late Clemens Herschel, a Past President and Honorary Member of the Society. The income from this fund is "to be used for presentation of prizes for papers which have been particularly useful and commendable and worthy of grateful acknowledgement." The expenditures from this fund during the year was \$85.53.

DESMOND FITZGERALD FUND. The Desmond FitzGerald Fund, established in 1910 by a bequest of \$2,000 from the late Desmond FitzGerald, a Past President and Honorary Member of the Society provided that the income from this fund shall "be used for charitable and educational purposes". The Board voted on April 13, 1964 'to use the income of this Fund to establish a Boston Society of Civil Engineer's Scholarship in Memory of Desmond FitzGerald, and that it be given to a student in Civil Engineering at Northeastern University'. It was voted 'to accept the recommendation of the Committee at Northeastern University, namely, that the scholarship of \$200 be given to Wayne Reeves'. Presentation to be made at the Annual Meeting of the Society on March 21, 1973.

*Details regarding the value and income of these funds are given in the Treasurer's Report.

EDWARD W. HOWE FUND. This fund, a bequest of \$1,000, was received in 1933 from the late Edward W. Howe, a Past President of the Society. No restrictions were placed on the use of this bequest, but the recommendations of the Board of Government was "that the fund be kept intact, and that the income be used for the benefit of the Society or its members". The Board voted that \$169.17 be transferred to Current Fund.

WILLIAM P. MORSE FUND. This Fund, a bequest of \$2,000, was received in 1949 from the late William P. Morse, a former member of the Society. No restrictions were placed on the use of this bequest, but the recommendation of the Board of Government was "that the Fund be kept intact and that the income be used for the benefit of the Society or its members". Upon recommendation of the committee appointed by the President, the Board voted on April 5, 1954 'to appropriate from the income of this Fund a Scholarship to be known as the Boston Society of Civil Engineers' Scholarship in Memory of William P. Morse, and that it be given to a Civil Engineering student at Tufts University'. It was voted "to accept the recommendation of the Committee at Tufts University, namely, that the Scholarship of \$200 be given to Robert Ducibella". Presentation to be made at the Annual Meeting of the Society on March 21, 1973. Also, \$118.38 be transferred to the Current Fund.

FRANK B. WALKER FUND. This Fund, a bequest of \$1,000, was received in 1961 from Mary H. Walker, wife of Frank B. Walker, a Past President of the Society. No restrictions were placed on the use of this bequest, but the recommendation of the Board of Government was "that this fund be kept intact and that the income be used for the benefit of the Society or its members". The Board voted that \$76.31 be transferred to the Current Fund.

RALPH W. HORNE FUND. This Fund, a bequest of \$3,000, was received June 29, 1964 from the Directors of Fay, Spofford & Thorndike, Inc., the income from which shall be devoted to a prize or certificate to be awarded annually to a member designated by the Board of Government as having been outstanding in unpaid public service in municipal, state or federal elective or appointive posts; or in philanthropic activity in the public interest. Members of B.S.C.E. only are eligible for the Award. The Board voted unanimously "to accept the recommendation of the Ralph W. Horne Fund Award Committee, namely, that Francis S. Harvey be the recipient to receive the Ralph W. Horne Fund Award for the year 1972-1973. Also, \$99.19 was transferred to the Current Fund.

THOMAS R. CAMP FUND. This Fund, a bequest of \$10,000, was received January 15, 1971 from the Directors of Camp Dresser & McKee, Inc., to establish the 'Thomas R. Camp Fund', the income to be used to support an annual Thomas R. Camp lecture or lectures on outstanding recent developments or proposed or completed research in the sanitary engineering field. The income from the fund, over and above that needed to support the annual lecture should be added to the fund, but could be used otherwise at the discretion of the Board of Government of the Boston Society of Civil Engineers.

PRIZES

A number of prizes and awards were recommended for presentation at the Annual Meeting. For the list of awards and recipients, refer to the minutes of the Annual Meeting.

COMMITTEES

The usual special committees dealing with the activities and conduct of the Society were appointed. The membership of these committees is published in the Journal and the reports

of the Committees will be presented at the Annual Meeting March 21, 1973.

Your Board in conclusion wishes to express its appreciation of the excellent work done by the officers of the sections and by the committees of the Society.

James P. Archibald
President

REPORT OF THE SECRETARY

Boston, Mass. March 21, 1973

The following is a statement of cash received by the Secretary and of the expenditures approved by the President in accordance with the budget adopted by the Board of Government.

FOR THE YEAR ENDING FEBRUARY 28, 1973

OFFICE ACCOUNT	EXPENDITURES	RECEIPTS
Rent and Services	\$ 5,054.96	
Gross Salaries	12,996.66	
Social Security	1,215.94	
Stationery and Postage	1,701.30	
Committee Expenses	---	
Miscellaneous	853.68	\$ 138.45
Capital Costs	40.20	
MEETINGS ACCOUNT		
Hospitality Committee (incl. 1972 Annual Mtg.)	2,036.90	1,240.25
Hall Rentals, Speakers	---	
Sections	1,612.80	1,302.71
JOURNAL AND PUBLICATIONS ACCOUNT		
Journal, printing and postage	7,748.39	
Forum	1,310.56	
E.S.N.E.	1,044.75	
Reprints	1,150.45	1,395.00
Miscellaneous	59.95	
Soil Mechanics		568.00
Ads in Journal		2,022.50
Sale of Journals		2,810.25
MISCELLANEOUS		
Dues		18,160.50
Moving Costs	614.59	
Furniture	1,115.33	564.75
Transfer Income Permanent Fund		4,156.64
Transfer Principal Permanent Fund		8,074.36
Transfer Income Turner & French Funds		260.00
Transfer Income Howe, Walker, Horne, Morse Funds		463.05
	<u>\$38,556.46</u>	<u>\$41,156.46</u>
Estimated Bills Payable 1972	2,600.00	
	<u>\$41,156.46</u>	<u>\$41,156.46</u>

Entrance Fees to Permanent Fund: \$320.00
28 New Members; 1 New Associate; 7 New Juniors

The above receipts have been paid to the Treasurer whose receipt the Secretary holds. The Secretary holds cash amounting to \$30.00 to be used as a fixed fund for cash on hand.

Respectfully submitted,
Joseph F. Willard
Secretary

REPORT OF THE TREASURER

March 21, 1973

for

Fiscal Year March 1, 1972 to February 28, 1973

FINANCIAL STANDING

The financial standing of the Society is summarized in the following four tables which accompany this report. The tables represent conditions as they existed at the close of business on February 28, 1973.

TABLE I	Condensed Statement of Condition (Assets, Liabilities and Funds)
TABLE II	Condensed Statement of Income and Expenditures, Distribution of Funds
TABLE III	Portfolio of Investments
TABLE IV	Income and Yield from Investments

SOCIETY INVESTMENTS

The Boston Safe Deposit and Trust Company continues to provide us with investment management and custodian services for the portfolio of securities owned by the Society, and has furnished us with a certified audit of the Income and Principal Accounts relating to our investments.

The Investment Division of the Boston Safe Deposit and Trust Company has reviewed our portfolio of securities and as a result has made no recommendations for changes.

The general policy which dictates the handling of the portfolio continues to be the maintenance of reasonable income consistent with reasonable growth rate as a hedge against inflation.

The following changes were made in the portfolio this fiscal year.

<i>Matured Securities (Received)</i>	\$3,000.00
Ontario Deb. 3¼%	
<i>Established Thrift Savings Account (Deposited)</i>	\$3,000.00
National Shawmut Bank	

The percentage of common stocks in the portfolio based on current market value is now 75%. The yield from all securities in the portfolio is approximately 4.3%. The increase in market value of all securities during the fiscal year period was \$1830.00, which is 0.8%.

AUDIT

The Auditing Committee has reviewed the Treasurer's account book, the bills paid by the Treasurer, the receipts from the Secretary, the savings bank passbook, the checkbook, and the certified audit of the income and principal accounts of the Society investments. The information contained in this report has been verified.

INVESTMENT FUNDS INCOME ACCOUNT (Boston Safe Deposit & Trust Co. Custodian)

	Debit	Credit	Balance
Balance March 1, 1972			\$985.03
Custodian Service Charge	\$ 1,343.82		
Transfer to B.S.C.E.	9,000.00		
Dividends from Stock		\$ 7,364.26	
Interest from Bonds & Thrift Sav. Acct.		2,796.93	
TOTAL	\$10,343.82	\$10,161.19	
Balance in account Feb. 28, 1973			\$802.40

INVESTMENT FUNDS PRINCIPAL ACCOUNT
(Boston Safe Deposit & Trust Co. Custodian)

	<i>Debit</i>	<i>Credit</i>	<i>Balance</i>
Balance March 1, 1972			\$ 46.89
Established a Thrift Savings Acct.	\$ 3,000.00		
Received from Matured Bond		\$ 3,000.00	
TOTAL	\$ 3,000.00	\$ 3,000.00	
Balance in account Feb. 28, 1973			\$ 46.89

SAVINGS ACCOUNT
(First Fed. Sav. & Loan Assoc. of Boston)

This savings account is used as a temporary investment for cash available for investment and for excess balance in the checking account, thus providing additional income while being available as cash for operating purposes.

	<i>Debit</i>	<i>Credit</i>	<i>Balance</i>
Balance March 1, 1972			\$3,321.40
Transfer from Custodian Acct.		\$ 2,500.00	
Transfer from Checking Acct.		4,000.00	
Interest Received		266.17	
Withdrawn—Transfer to Checking Acct.	\$ 9,700.00		
TOTAL	\$ 9,700.00	\$ 6,766.17	
Balance in account Feb. 28, 1973			\$ 387.57

CURRENT FUND ACCOUNT

This is the operating account of the Society. The account is provided with a balance of \$3,000.00 on March 1 of each year, to insure that operations can be carried on until regular income is received.

	<i>Debit</i>	<i>Credit</i>	<i>Balance</i>
Balance March 1, 1972			\$3,000.00
Office Expense including Salaries	\$21,862.74*		
Meetings Expense including Annual Mt.	3,649.70*		
Journal & Publications Expense	11,314.10*		
Moving Expense, Furniture Purchase	1,729.92*		
Received from Secretary		\$28,202.41*	
Transfer from Permanent Fund Income		4,156.64	
Transfer from Permanent Fund Principal		8,074.36	
Transfer from Turner & French Fds, Income		260.00	
Transfer from Howe, Walker, Horne, Morse Fd. Inc.		463.05	
Reserve for 1972 Bills Payable	2,600.00		
TOTAL	\$41,156.46	\$41,156.46	
Balance Feb. 28, 1973			\$3,000.00
Reserve for Bills Payable Feb. 28, 1973			\$2,600.00
Deficit in Fiscal Year 1972-73 = \$8,074.36			

*The membership and other interested persons are referred to the report of the Secretary published elsewhere in the Journal for a detailed breakdown of the income and expense of the Current Fund.

By vote of Board of Government \$4,156.64 was transferred from the income of the Permanent Fund to the Current Fund.

By vote of the Board of Government and two votes taken at regular monthly meetings of the Society \$8,074.36 was transferred from the principal of the Permanent Fund to the Current Fund.

By vote of the Board of Government a total of \$260.00 was transferred from the income of the Turner and French Funds to the current fund to be used to underwrite the operating cost of the Society's Library.

By vote of the Board of Government a total of \$463.05 was transferred from the income of Howe, Walker, Horne, and Morse Funds to the Current Fund.

PERMANENT FUND

The Permanent Fund receives income from its prorated portion of interest and dividends from investments, and pays its portion of service charges of the Custodian Bank.

Receipts from entrance fees are credited to the principal of this fund.

	<i>Debit</i>	<i>Credit</i>	<i>Book Value</i>
Book Value March 1, 1973			\$78,990.98
Custodian Bank Service Charge	\$ 615.70		
Interest and Dividends		\$ 4,772.34	
Entrance Fees		320.00	
Profit from Matured Bond		29.21	
Income transferred to Current Fund	4,156.64		
Principal transferred to Current Fund	8,074.36		
TOTAL	\$12,846.70	\$ 5,121.55	
Book Value Feb. 28, 1973			\$71,265.83

This year the Permanent Fund received approximately 46% of the income from Interest and Dividends as it's prorated share. Next year, due to the \$8,074.36 reduction in principal it will receive only 42% as it's prorated share.

BORING DATA FUND

No expenditures were made from this fund this year, as no work was done on sorting and collating the boring data information into publishable form.

Balance March 1, 1972	\$1,528.11
Received from sale of books	20.50
Balance Feb. 28, 1973	\$1,548.61

KARL R. KENNISON FUND

On March 16, 1973 Mr. Kay of the Massachusetts Company reported to the Treasurer of the Society the status of the irrevocable trusts established on behalf of the Society by Karl R. Kennison. As of Feb, 28, 1973 the two trusts involving shares in the Massachusetts Fund were as follows

	<i>No. Shares</i>	<i>Market Value</i>
Trust No. 4315	356,650	\$ 4,386.80
Trust No. 4444	480,899	6,038.06
TOTAL	837,549	\$10,424.86

A year ago there were 837,538 shares which had a market value of \$10,343.60

OTHER FUNDS

The membership and other interested persons are referred to the Report of the Board of Government published elsewhere in this issue of the Journal for information concerning the remaining funds, and reasons for existence.

Table II gives a summary of Income, Receipts, and Expeditures of all the Funds.

Respectfully submitted
Robert T. Colburn
Treasurer

TABLE I
CONDENSED STATEMENT OF CONDITION
ASSETS LIABILITIES AND FUNDS
February 28, 1973

ASSETS	BOOK VALUE		MARKET VALUE	
	2-28-73	2-29-72	2-28-73	2-29-72
First Nat. Bank Boston (Checking Acct)	\$ 704.79	\$ 1,619.17	\$ 705	\$ 1,619
Boston Safe Dep. & Trust Co. (Custodian Acct.)				
Bonds	52,692.59	55,628.84	42,684	44,674
Stocks	118,675.93	118,675.93	192,970	192,150
Thrift Savings Acct.	3,000.00	-	3,000	-
Balance in Custodian Acct.	849.29	1,031.92	849	1,032
First Fed. Savs. & Loan Assoc. Boston	387.57	3,321.40	387	3,321
Cash	30.00	30.00	30	30
TOTAL ASSETS	\$176,340.17	\$180,307.26	\$240,625	\$242,826
LIABILITIES AND FUNDS				
Permanent Fund	\$ 71,265.83	\$ 78,990.98	\$ 98,500	\$107,490
John R. Freeman Fund	54,835.40	52,280.79	75,500	71,220
Edmund K. Turner Fund	2,912.77	2,889.88	4,018	3,921
Desmond FitzGerald Fund	5,573.21	5,441.26	7,680	7,385
Alexis H. French Fund	2,882.24	2,860.92	3,990	3,890
Clemens Herschel Fund	1,927.51	1,901.01	2,680	2,590
Edward W. Howe Fund	3,220.34	3,219.15	4,450	4,221
William P. Morse Fund	5,222.22	5,220.35	7,200	7,100
Frank B. Walker Fund	1,453.78	1,453.24	2,020	1,970
Ralph W. Horne Fund	4,455.29	4,453.69	6,150	6,074
Lectures Fund	3,852.40	3,658.87	5,318	4,990
Thomas R. Camp Fund	11,500.20	10,922.26	15,880	14,960
SUBTOTAL	\$169,101.19	\$173,292.40	\$233,386	\$235,811
Boring Data Fund	\$ 1,548.61	\$ 1,528.11	\$ 1,549	\$ 1,528
Current Fund	3,000.00	3,000.00	3,000	3,000
Secretary's Change Fund	30.00	30.00	30	30
Taxes Withheld	60.37	56.75	60	57
Reserve for 1972 Bills Payable	2,600.00	2,400.00	2,600	2,400
TOTAL LIABILITIES AND FUNDS	\$176,340.17	\$180,307.26	\$240,625	\$242,826

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CONDENSED STATEMENT OF INCOME AND EXPENDITURES - DISTRIBUTION OF FUNDS

Fiscal Year March 1, 1972 through February 28, 1973

FUND	Book Value 3-1-72	Income Interest and Dividends	Gain from Matured Securities	Receipts Transfers to Funds	Expenditures Transfers from Funds	Book Value 2-28-73
Permanent Fund	\$ 78,990.98	\$ 4,772.34	\$29.21	\$ 320.00	\$ 615.70	\$ 71,265.83
Trans. Income to Current Fund					4,156.64	
Trans. Principal to Current Fund					8,074.36	
John R. Freeman Fund	52,280.79	3,144.01	19.20		608.60	54,835.40
Edmund K. Turner Fund	2,889.88	174.31	1.07		22.49	2,912.77
Trans. Income to Current Fund					130.00	
Desmond FitzGerald Fund	5,441.26	321.18	1.95		191.18	5,573.21
Alexis H. French Fund	2,860.92	172.51	1.06		22.25	2,882.24
Trans. Income to Current Fund					130.00	
Clemens Herschel Fund	1,901.01	111.35	.68		85.53	1,927.51
Edward W. Howe Fund	3,219.15	194.22	1.19		25.05	3,220.34
Trans. Income to Current Fund					169.17	
William P. Morse Fund	5,220.35	307.84	1.87		189.46	5,222.22
Trans. Income to Current Fund					118.38	
Frank B. Walker Fund	1,453.24	87.60	.54		11.29	1,453.78
Trans. Income to Current Fund					76.31	
Ralph W. Horne Fund	4,453.69	262.49	1.60		163.30	4,455.29
Trans. Income to Current Fund					99.19	
Lectures Fund	3,658.87	220.63	1.35		28.45	3,852.40
Thomas R. Camp Fund	10,922.26	658.88	4.03		84.97	11,500.20
SUBTOTAL Investment Funds	\$173,292.40	\$10,427.36	\$63.75	\$ 320.00	\$15,002.32	\$169,101.19
Boring Data Fund	1,528.11			20.50		1,548.61
Current Fund	3,000.00			28,202.41	38,556.46	3,000.00
Trans. Income From Permanent Fund				4,156.64		
Trans. Principal from Permanent Fund				8,074.36		
Trans. Income from Other Funds				723.05		
Reserve for Bills Payable	2,400.00			*	2,400.00	2,600.00
Secretary's Change Fund	30.00					30.00
Taxes Withheld	56.75			60.37	56.75	60.37
TOTAL	\$180,307.26	\$10,427.36	\$63.75	\$41,557.33	\$56,015.53	\$176,340.17

* \$2,600 included in transfer from Boring Data Fund

TABLE III
PORTFOLIO OF INVESTMENTS

BONDS AND THRIFT SAVINGS	BOOK VALUE		MARKET VALUE	
	2-28-73	3-1-72	2-28-73	3-1-72
ACCT. - 19%				
Assoc. Invest. Co. 5-1/8-79, Deb.	\$ 6,000	\$ 6,000	\$ 5,220	\$ 5,085
Flintkote Co. 4-5/8-81, Deb.	10,450	10,450	8,350	7,750
Florida Power Corp. 3-1/8-84, 1st. Mort.	1,018	1,018	664	661
Florida Power Corp. 3-7/8-86, 1st. Mort.	5,038	5,038	3,419	3,475
Georgia Power Corp. 3-3/8-77, 1st. Mort.	5,162	5,162	4,231	4,250
Marine Midland Corp. 4-1/2-89, Deb.	5,000	5,000	3,600	3,575
Montreal Quebec Imp. 6%-87, Deb.	10,075	10,075	8,625	8,375
Orange and Rockland 6½-97, 1st. Mort.	9,950	9,950	8,575	8,563
Ontario, 3½-72, Deb.	-	2,936	-	2,940
Nat. Shawmut Bank Thrift Savings	3,000	-	3,000	-
TOTAL	\$ 55,693	\$ 55,629	\$ 45,684	\$ 44,674
PREFERRED STOCK - 5%				
International Tel. & Tel.	\$ 1,534	\$ 1,534	\$ 13,134	\$ 17,093
COMMON STOCKS - 75%				
Amer. Tel. & Tel.	\$ 4,332	\$ 4,332	\$ 12,438	\$ 10,875
Clark Equipment Co.	12,287	12,287	19,250	20,000
General Motors Corp.	9,131	9,131	12,495	13,451
Boise Cascade	9,802	9,802	1,697	3,089
Illinois Power Co.	11,591	11,591	7,562	8,937
Inter. Business Machines	11,648	11,648	21,575	18,425
McGraw Edison Co.	14,211	14,211	14,500	15,100
B. F. Saul Real Estate Inv. Trust	10,500	10,500	10,000	12,656
New England Electric System	7,505	7,505	9,084	8,682
Newmont Mining Corp.	12,549	12,549	14,125	15,938
Exxon	1,977	1,977	17,875	15,100
Texaco	1,516	1,516	17,936	15,812
Warner Lambert Pharm. Co.	9,937	9,937	21,200	16,875
W. R. Grace & Co.	156	156	99	117
TOTAL	\$117,142	\$117,142	\$179,836	\$175,057
SAVINGS BANK ACCOUNT - .3%				
First Fed. Sav. & Loan Assoc.	\$ 387	\$ 3,321	\$ 387	\$ 3,321
CASH ACCOUNTS - .7%				
First Nat. Bank Bos. (checking)	\$ 705	\$ 1,619	\$ 705	\$ 1,619
Bos. Safe Dep. & Trust Co. (Custodian)	849	1,032	849	1,032
Secretary's Change Fund	30	30	30	30
TOTAL	\$ 1,584	\$ 2,681	\$ 1,584	\$ 2,681
GRAND TOTAL	\$176,340	\$180,307	\$240,625	\$242,826

TABLE IV
INCOME AND YIELD FROM INVESTMENTS

	<i>Estimated Income</i>	<i>Yield on Current Market Value</i>
BONDS		
Assoc. Invest. Co. 5-1/8-79 Deb.	\$ 307.50	6.0%
Flintkote Co. 4-5/8-81 Deb.	462.50	5.9
Florida Power Corp. 3-1/8-84 1st Mort.	31.25	4.7
Florida Power Corp. 3-7/8-86 1st Mort.	193.75	5.6
Georgia Power Corp. 3-3/8-77 1st Mort.	168.75	4.0
Marine Midland Corp. 4-1/2-89 Deb.	225.00	6.3
Montreal Quebec Imp. 6%-87 Deb.	600.00	7.1
Orange & Rockland 6-1/2%-97 1st Mort.	650.00	7.6
Ontario 3-1/2-72, Deb.	97.50	3.3
TOTAL	\$2,736.25	6.1%
PREFERRED STOCK		
International Tel. & Tel. Co.	\$ 481.50	2.8%
COMMON STOCKS		
Amer. Tel. & Tel. Co.	\$ 650.00	6.0%
Clark Equip. Co.	560.00	2.8
General Motors Corp.	578.00	4.3
Boise Cascade	43.50	1.5
Illinois Power Co.	550.00	6.2
Inter. Business Machines	270.00	1.5
McGraw Edison Co.	560.00	3.7
B. F. Saul Real Estate Invest. Trust	680.00	5.4
New England Electric System	558.48	6.4
Newmont Mining Corp.	520.00	3.3
Exxon	780.00	5.2
Texaco	783.52	4.9
Warner Lambert Pharm. Co.	260.00	1.5
W. R. Grace & Co.	6.00	5.1
	\$6,779.50	3.9%
SAVINGS ACCOUNT		
First Fed. Savings and Loan Assoc.		5.25%
TOTAL YIELD FROM INVESTMENTS		4.3%

REPORT OF THE AUDITING COMMITTEE**March 21, 1973**

To the Boston Society of Civil Engineers:

We have reviewed the records and accounts of the Secretary and Treasurer of the Boston Society of Civil Engineers, and we have compared the bank statement of securities held by the Boston Safe Deposit and Trust Company with the enumeration submitted by the Treasurer.

We found them to be in order and to account accurately for the Society's Funds.
We make the following recommendations:

1. The Secretary, in addition to the Treasurer, should have access to the Savings Account;
2. individualized expense items should be attached to the invoice;
3. the Treasurer should develop a standard form for Sections to use to request payments for their expenses.

Respectfully submitted,
Lawrence C. Neale
Charles C. Ladd

REPORT OF JOURNAL EDITOR**Boston, Mass., March 19, 1973**

To the Board of Government, Boston Society of Civil Engineers:

During the last fiscal year, Volume 59 was published, consisting of issues for January, April, July and October 1972; the October issue now being at the printer. It contained nine technical papers, plus Society reports, in 206 pages of text.

The new composition procedure inaugurated in 1971 has resulted in some production cost saving. This has produced some net saving to the Society. It is felt that the cost of the Journal should and can be reduced further if a real effort is made to obtain more advertising and professional card insertions. An intensive effort to keep down production costs should continue.

While the quality of papers published was good, a scarcity of acceptable papers continues to be a problem. Sections must make a greater effort to have their speakers present papers, and new potential sources of good professional papers explored.

The continuing purpose of the Journal is to provide the Society members and our subscribers with a publication of high standards as a medium for top quality technical papers, high grade professional advertising, and Society reports.

Respectfully submitted,
H. H. Holly, Editor

REPORT OF PUBLICATION COMMITTEE**Boston, Mass. March 21, 1973***To the Boston Society of Civil Engineers*

Following is the Annual Report of the Publication Committee for the year just completed.

Papers received:	14
Papers rejected:	4
Papers accepted, published or in press	9
Papers under review	1

Maintenance of Journal quality continues to depend upon the receipt of high quality manuscripts. Considering the number of Section meetings with speakers the yield of papers for publication is very low. It is up to the Section Chairmen to insist upon a written version of the talks when arranging for speakers.

Respectfully submitted,
Peter S. Eagleson, Chairman

REPORT OF HOSPITALITY COMMITTEE**Boston, Mass. March 21, 1973***To the Boston Society of Civil Engineers:*

The Hospitality Committee submits the following report for the year 1972-73:

A total of eight meetings of the Society were held during the past year. This was three more than the previous year.

Included in this total were the 124th Annual Meeting, two joint meetings with the American Society of Civil Engineers, and five regular meetings of the Society.

Dinners or luncheons were served prior to all meetings.

The average attendance for members and guests for the eight meetings was 74.

Respectfully submitted,
Peter K. Taylor, Chairman

ANNUAL REPORT OF MEMBERSHIP COMMITTEE 1972 - 1973*To the Boston Society of Civil Engineers*

A recruiting campaign was undertaken by the Membership Committee this year. The program involved four areas of activity including contact with colleges and universities; letters and promotional material to contact men of engineering firms, letters to the chairmen of technical sections and a general mailing to all society members enclosing promotional data on BSCE and membership information.

Membership statistics are as follows:

New Members	28
Applications Pending	16
New Junior Members	7
New Student Members	1
New Associates	1

Total society membership as of March 1, 1973 is 1132.

Respectfully submitted,
William S. Zoino, Chairman

ANNUAL REPORT OF THE JOINT LEGISLATIVE COMMITTEE
Boston, Massachusetts March 21, 1973

To the Boston Society of Civil Engineers

Nine Legislative Acts of General interest to BSCE Members were enacted by the Massachusetts General Court in 1972, and are as follows:

Chapter 242

AN ACT GRANTING IMMUNITY FROM DAMAGES TO CERTAIN PROFESSIONAL SOCIETIES AND COMMITTEES FOR OFFICIAL ACTIONS TAKEN ON BEHALF OF SUCH SOCIETIES OR COMMITTEES

Covers registered engineers and architects who act in good faith

Chapter 632

AN ACT FURTHER REGULATING THE AWARD OF CONTRACTS TO THE LOWEST RESPONSIBLE AND ELIGIBLE BIDDER BY THE MASSACHUSETTS TURNPIKE AUTHORITY

Applies to contracts of the Authority to the same extent as the Commonwealth. Also covers bidding on the sale of real property.

Chapter 636

AN ACT PROVIDING FOR THE ALLEVIATION OF FINANCIAL BURDENS IMPOSED ON CITIES AND TOWNS AS A RESULT OF THAWS, RAINS, FLOODS OR CERTAIN OTHER DISASTERS

Provides for issuing bonds by the Commonwealth not exceeding \$5 million dollars.

Chapter 648

AN ACT INCREASING THE AMOUNT OF MONEY WHICH THE METROPOLITAN DISTRICT COMMISSION MAY EXPEND FOR THE CONSTRUCTION OF CERTAIN FLOOD CONTROL FACILITIES IN THE CITIES OF MELROSE, MALDEN, EVERETT AND REVERE AND THE TOWNS OF SAUGUS, STONEHAM AND WAKEFIELD
May issue bonds not exceeding \$1,750,000.

Chapter 678

AN ACT AUTHORIZING THE DIVISION OF WATER POLLUTION CONTROL TO ENTER INTO CONTRACTS FOR THE DEVELOPMENT OF COMPREHENSIVE RIVER BASIN, WATER QUALITY MANAGEMENT OR WASTE TREATMENT MANAGEMENT PLANS

Needed to comply with Federal requirements

Chapter 774

AN ACT EXPEDITING PAYMENTS TO GENERAL CONTRACTORS AND TO SUBCONTRACTORS AND IMPROVING THE FLOW IN THE CONSTRUCTION INDUSTRY

Lengthy Act amends Section 39F of Chapter 30 of the General Laws and adds a new Section 39N.

Chapter 781

AN ACT ESTABLISHING A DIVISION OF ENVIRONMENTAL PROTECTION WITHIN THE DEPARTMENT OF THE ATTORNEY GENERAL, AND DIRECTING THE PREPARATION OF ENVIRONMENTAL IMPACT REPORTS

Defines "damage to the environment", provides for public hearings and reviews by various agencies.

Chapter 782

AN ACT FURTHER PROTECTING THE INLAND WETLANDS AND FLOOD PLAINS OF THE COMMONWEALTH

Protects inland wetlands, revises Section 40A of Chapter 131 of the General Laws.

Chapter 784

AN ACT RELATIVE TO THE PROTECTION OF WETLANDS

Protects all wetlands including coastal wetlands, revises Section 40 of Chapter 131 of the General Laws.

Bills Filed in 1973

Among the many bills filed in 1973, the following will be of interest to members of the BSCE:

Senate No. 1485 Interim Report of the Special Commission on Salt Contamination of water supplies and related matters.

House No. 6065 To provide for methods of payment on public consulting services performed by architects and engineers.

House No. 1309 To provide a limitation of three years for the bringing of actions of tort for malpractice, error mistake against architects, engineers and land surveyors.

House No. 2486 Providing for the voluntary registration of Professional Planners

House No. 5609 To authorize engineers to organize professional corporations

General Comment

There were undoubtedly many other pieces of Legislation passed in 1972 or submitted for consideration in 1972 which would be of interest to special disciplines in the general field of civil engineering. No effort was made to present them here.

Engineers should not hesitate to contact and cooperate with the Committee throughout the year should bills be introduced which require clarification of intent or which warrant concerted action either pro or con.

Respectfully submitted,
Charles A. Parthum, Chairman

REPORT OF B.S.C.E. QUARTERS COMMITTEE

March 21, 1973

To the Boston Society of Civil Engineers:

In late May 1972, the Society library was transferred to Northeastern University and made a part of the University's library. As a condition of the gift, Society members have been granted the use of the Northeastern University library.

On June 6, 1972, the Society quarters were moved to Room 714 (Bradbury Building), 230 Boylston Street. In addition to the space at Room 714, the Society shares a conference room with the Consulting Engineers Council of New England which occupies the adjoining office. As a result of moving to these new quarters, the Society has reduced the total rental space to an amount that is more in keeping with its overall requirements and has, thereby, significantly reduced the annual rental cost.

In conjunction with the move, arrangements were made for the replacement of a portion of the office furniture. The total expense of the move and the items purchased were as follows:

Moving and disposal of office items	\$ 200.00
Refinishing of metal furniture	305.00
Purchase of new furniture equipment and other office items	1,131.34
Installation of equipment and other items	178.97
Miscellaneous	54.25
TOTAL EXPENDITURES	\$1,869.56
Receipt from sale of furniture and other items	\$ 564.75
NET EXPENSES	\$1,304.81

Respectfully submitted,
Max D. Sorota, Chairman

REPORT OF THE JOHN R. FREEMAN FUND COMMITTEE

March 21, 1973

To the Boston Society of Civil Engineers:

The eighth Freeman lecture has been scheduled for April 25, 1973. It will be presented by Mr. H. Headland of London, England and his subject will be *Hydroelectric Pumped Storage - Some Aspects of the Western European Scene*.

This event follows the annual meeting of the Society so that it falls outside the Society year. There has, therefore, been no activity to report for the past year.

Respectfully for the Committee,
Leslie J. Hooper, Chairman

ANNUAL REPORT OF THE RALPH W. HORNE FUND COMMITTEE

March 21, 1973

To the Boston Society of Civil Engineers:

This is the Seventh Annual Report of the Ralph W. Horne Fund Committee, which was formed in 1964, when the Society received from Fay, Spofford & Thorndike, Inc., a grant of \$3,000 to finance recognition of unpaid public service on the part of Society members.

At the 1972 Annual Meeting, the Society, acting upon the recommendation of the Committee named Earle F. Littleton as the recipient of the Ralph W. Horne Award and presented him a scroll in recognition of the unpaid public service which he has rendered throughout his professional career.

Prior recipients of the Award were:

Wilfred McGregor Hall in 1970
 Edward Wright in 1969
 Dr. Carl Stephen Ell in 1968
 Llewellyn T. Schofield in 1967
 Miles N. Clair in 1966
 Charles O. Baird, Jr. in 1965

William L. Hyland, Chairman

NEWSLETTER COMMITTEE REPORT (1972-1973)

March 19, 1973

To the Board of Government, Boston Society of Civil Engineers

During the past year the newsletter was published four times. Meetings were held approximately every three weeks to collect, assemble and review material received from members, engineering firms, universities and others.

The newsletter has continued to be recognized as a source for interesting articles, news of members and calendar events. The size of the newsletter has varied between ten and twelve pages with considerable material being rejected to avoid increasing the number of pages.

The cost of the newsletter has continued to increase and staff members became quite concerned, resulting in the committee asking the Societies to approve the inclusion of ads by manufacturers and suppliers. This new program has just begun and the March edition contained the first series of listings.

During this last year we have included interviews with Governor Francis Sargent; Edward J. King, Executive Director, Massport; Dr. Frank Perkins, Professor, M.I.T.; Major Kevin White of Boston. A feature editorial and article was included in our August 1972, issue which received considerable exposure. The feature editorial was discussed in the Boston Globe Newspaper, August 27, 1972, which is attached. Additional recognition was received from Consulting Engineers' Magazine of May 1972, where they complimented our exchange of views with the Governor. Also, National ASCE recognized our efforts and a letter was received from Mr. William P. Layton, Assistant to Manager, Field Services.

The newsletter this year was distributed to approximately 3,300, composed of the following:

BSCE and ASCE Subscribers
 Local Colleges and Universities - Student Chapters
 National ASCE Officers and State Chapters
 Periodicals, Journals, Newspapers, etc.

The cost for the year's four publications was approximately \$2,700, and it was divided equally between both BSCE and ASCE. The cost per copy was approximately \$0.20.

The organization framework of the newsletter is as follows:

Bertram Berger	Chairman and Editor-in-Chief
Gary Irish	Production and Graphic Design
Peter Riordan)
Prof. Roderic W. Sommers) Contributing
David H. Treadwell, Jr.) Editors
Leonard J. Barberi)
John Carey	Circulation Manager

The Committee appreciates the support received from the Society and looks forward to another successful year in publishing the Forum.

Respectfully submitted,
 Bertram Berger, P.E.
 Chairman

Boston Sunday Globe, August 27, 1972

But there's no agreement

Land Sewage Disposal
is one man's answer

By Evelyn Keene
Globe Correspondent

For years engineers have been designing sewage treatment plants in an effort to minimize pollution of rivers and oceans. But the sludge and effluent from these facilities have continued to pollute the waters of the country.

The leader of a Ralph Nader study group on water pollution, David Zwick of Washington, apparently touched off a scientific controversy recently when he said that sewage treatment plants are a "mistake, at best only a shot-term, half-baked solution."

Zwick proposed that the country restructure its thinking and consider land spray irrigation of sewage, either directly into the soil, or from sewage treatment plants.

Zwick's findings have been published in a paper-back called "Water Wastelands."

Among those who find Zwick's ideas distasteful is Dr. Clifford Smith, Jr., deputy regional administrator in Boston of the Federal Environmental Protection Agency.

At the least, think of the hungry of malnourished children in this country and around the world, Mr. Austin, and of the pipeline of nutrition which you can extend to them.

Smith says the idea of land disposal of sewage is as old as the hills. It is still being done in parts of China, Indonesia and Thailand, but it causes many problems, including the danger of disease.

He feels modern sewage treatment facilities are necessary, not only because of public health, aesthetic and odor problems, but because sewage must be conditioned before it can be absorbed.

In urban areas, with growing population, there is a little river or land capacity which could handle the sewage being produced, he said. Sludge perhaps could be spread on land, but "there must be the right kind of land in term of climate and soil condition before it could even be considered, Smith said.

Smith holds a doctorate from Johns Hopkins University and has taught civil and sanitary engineering at three different universities.

He pooh-poohs Zwick's credentials. A leader of a Nader-supervised research group, Zwick is a graduate of the US Coast Guard Academy and Harvard Law School.

But Zwick has become one of the country's leading advocates of land disposal and there are others who are beginning to adopt his view.

The Assn. for the Preservation of Vineyard Sound at Cape Cod is fighting for adoption of a proposal which would dispose of sludge and effluent from the Otis Air Force Base sewage treatment plant to a tract of land adjacent to the base and a nearby parcel of land in Falmouth.

The group, headed by Glenn MacNary, has received approval of \$65,000 at the Falmouth Town meeting for a preliminary study of land spray irrigation. Its plan is opposed to another proposal to dispose of Cape Cod sewage in the ocean.

MacNary's group believes its plan would prevent depletion of the Cape Cod water supply. Salt intrusion would occur if sewage is disposed of in the ocean.

The Cape Cod group has found an ally in state Sen. William Bulger (D-South Boston), chairman of the legislation commission studying Boston Harbor pollution.

Zwick and MacNary both have testified at Bulger's committee hearings.

Bulger is like a lone cry in the wilderness, demanding that the professional engineering fraternity as well as public officials begin a reappraisal of the vast sums of money already expended on sewage treatment plants.

As result of Bulger's protests, the state of Massachusetts last month signed an agreement

with the Environmental Protection Agency committing the state to building a minimum of secondary treatment plants at Deer and Nut Islands.

But at the same time the statement of intent by Massachusetts says that alternatives such as land disposal will have to be considered in planned engineering studies.

The new agreement also includes a provision that the state will abandon plans to construct secondary treatment plants at Deer and Nut Islands in the Boston Harbor if better alternatives have been found by 1976, or if the Legislature fails to act.

Federal and state funds also would have to be made available if construction of secondary treatment plants at these key points is undertaken.

But the opposition to land disposal continues and comes from various quarters.

Engineers, said Sen. Bulger, are "terribly biased" against any idea that threatens the continued construction of traditional sewage treatment plants. Bulger's aim is zero pollution of Boston harbor, and he insists that land disposal is the answer.

A newsletter, the "Forum" which is distributed to the American Society of Civil Engineers in Massachusetts and the Boston Society of Civil Engineers, editorializes in its August issue against the Zwick proposals.

Bertram Berger, the editor, contends Zwick is hardly qualified to speak as an expert on sewage disposal after only two or three years of investigation. Berger says Zwick's statements are irresponsible and could sway public opinion in the wrong direction. When conditions are not ripe, he adds, severe pollution of ground and surface water can result from using the land as a filter to purify the water.

Land disposal is being done in other parts of the country. A pilot project has been started in Muskegon County, Michigan, where waste from 17 communities will be spread on land after going through an outmoded sewage treatment plant.

Similar projects have been tried at Pennsylvania State University. Sewage has been sprayed to fertilize a farm in Anondale, Pa.

The Army Corps of Engineers has undertaken a study to investigate whether land disposal of sewage can be achieved in the Boston area.

The answers to these questions may revolutionize the engineering profession, and land disposal, if found to be practical, may not only save taxpayers millions of dollars, it could prove to be the solution to the water pollution problems.

ANNUAL REPORT FOR 1972-73 – STRUCTURAL SECTION

March 21, 1973

The Executive Committee this year consisted of the following members:

Chairman:	Dr. Jurgis Gimbutas of Fay, Spofford & Thorndike
Vice-Chairman:	Rubin M. Zallen of Rubin M. Zallen Associates
Clerk:	Harold V. McKittrick of the Perini Corporation
Member:	Dr. Kenneth Leet of Northeastern University
Member:	Edwin Joiner of the M.B.T.A.
Member:	Lawrence Ogden of Sepp Firnkas Engineering Co.

The Structural Section held five meetings during the past year, described as follows:

May 10, 1972

A joint meeting was held with the Computer Section at Purcell's Restaurant in Boston. The title of the two-part program was "Practical Problems Using Computers In Structural Design".

Paul Goldberg of Albert Goldberg & Associates spoke on time sharing and described many small design problems, as well as a moderately sized three dimensional problem.

Chan Lin and Tom Collins, both of Sepp Firnkas Engineering Co., spoke on batch

processing and described the design of a large project in Greece which was designed for earthquake loading.

Attendance at the meeting was 50.

November 8, 1972

Mr. Fred L. Elsasser, Structural Engineer with Weiskopf and Pickworth of New York City was the feature speaker at this section meeting at the 57 Restaurant in Boston.

The subject of Mr. Elsasser's talk was "The Design And Construction Of The One Beacon Street Building".

Mr. Elsasser first described the more unusual design features of the superstructure such as the wind bracing system, floor construction and columns, and finally discussed some of the features of the foundation design, including the use of earth tie backs during the construction phase.

Attendance at the meeting was 41.

January 10, 1973

The next meeting of the Structural Section was held at the Tech Square House in Cambridge. Forty people heard Mr. Abraham Wolff of Abraham Wolff & Associates describe the design features of the Colonnade Hotel. Of particular interest was a discussion of the curved ramps to the parking area.

February 21, 1973

The first of two joint meetings with the Geotechnical Section on "The Boston Earthquake Zone - Lateral Loads And Design Provisions" was held at the 57 Restaurant.

Topic I, "Seismicity and Foundation Effects", was the subject of the meeting.

The report of this meeting in detail is covered in the Annual Report of the Geotechnical Section.

March 14, 1973

The second of two joint meetings of the Geotechnical Section and the annual meeting of the Structural Section was held at the 57 Restaurant in Boston.

130 people were in attendance as Topic II, "Building Response and Damage" of "The Boston Earthquake Zone - Lateral Loads And Design Provisions" was presented.

Professors Whiteman, Cornell and Vanmarke of M.I.T. and Mr. Brennan of LeMessurier Associates were the feature speakers.

Professor Whitman outlined the scope of the talk which described an M.I.T. study whose purpose has been to select earthquake design criteria, striking an optimum balance between initial construction cost and anticipated future losses.

The study is still in its future stages and very limited and final recommendations will depend greatly upon feedback from members of the engineering profession.

The particular phase of the study dealing with 5 to 20 story frame buildings built on firm ground was the emphasis of this particular talk.

The other speakers described the nature of the buildings studied, the potential repair and incident costs for buildings designed for varying seismic forces and subjected to various earthquake intensities.

At the beginning of the meeting, nominations and election of officers for the 1973-74 year were held. Elected were:

Chairman:	Rubin M. Zallen of Rubin M. Zallen Associates
Vice-Chairman:	Harold V. McKittrick of the Perini Corporation
Clerk:	Dr. Kenneth Leet of Northeastern University
Members of the	Edwin S. Joiner of the M.B.T.A.
Executive Committee:	Dr. Frank Heger of Simpson, Gumpertz & Heger William Hagen of LeMessurier Associates

In addition to the aforementioned activities, a special Committee of the Structural Section, consisting of Dr. Jurgis Gimbutas, Rubin Zallen, Harold McKittrick and Dr. Kenneth Leet was formed to formulate a reply to a letter received from the City of Boston Corporation Counsel. That gentleman, Mr. Herbert P. Gleason, requested the Boston Society of Civil Engineers to examine existing procedures used to evaluate new, renovated and existing buildings and what new procedures might be recommended.

A response to Mr. Gleason is in the process of being drafted and will be issued sometime in April of 1973.

Respectfully submitted,
Harold V. McKittrick
Clerk

ANNUAL REPORT FOR THE YEAR 1972 - 1973 TRANSPORTATION SECTION March 21, 1973

The Executive Committee of the Transportation Section for the year 1972-1973 included the following:

Robert T. Tierney	Chairman
Richard K. Guzowski	Vice Chairman
R. Lawrence Whipple	Clerk
A. Russell Barnes	Past Chairman
Rodney P. Plourde	Member
Maurice Freedman	Member

The Transportation Section held three meetings during the past year, as follows:

October 18, 1972 - Joint Meeting with ASCE and I.T.E.

Dr. James A. Fay, Chairman of the Massachusetts Port Authority spoke on "The Future of Logan Airport". He addressed much of his talk to proposals from the Governor and Secretary of Transportation with regard to Massport operations. There were many questions from the audience concerning access to the airport, the third harbor tunnel, satellite parking areas, etc.

Attendance:	Approximately 100
Location:	Branding Iron Restaurant, Blossom Court, Boston
Time:	12:00 noon

November 15, 1972 - Joint Meeting with ASCE

Mr. John G. Wofford, Assistant Commissioner of the Massachusetts Department of Public Works and Director of the Boston Transportation Planning Review and Mr. William F. Chouinard, Director of Community Development for the Greater Boston Chamber of Commerce presented two opposing and enlightening points of view on "Boston Economic Survival and the Transportation Planning Review". Mr. Chouinard noted the reality of auto transportation versus anticipated transit; over-emphasis of the environmental aspects and de-emphasis of the economic aspects; and, the impact of a negative decision on future projects. Mr. Wofford explained the Governor's goals to provide a balanced transportation system primarily through improved transit facilities; government management of all transportation facilities; and more consideration of the environment. A lengthy question and answer period followed the two presentations with responses from both participants.

Attendance:	40
Location:	Purcell's Restaurant, School Street, Boston
Time:	5:45 p.m.

February 28, 1973 - Joint Meeting with the Main Society and ASCE

Dr. Charles H. W. Foster, Secretary of the Massachusetts Department of Environmental Affairs gave a detailed outline of the "State Reorganization Program" as it relates to his Department. The discussion began with a brief history of the establishment of ten cabinet positions to oversee the operations of approximately three hundred state agencies. The Department of Environmental Affairs will pool the efforts of approximately fifty agencies dealing with environmental problems. Dr. Foster noted the establishment of an Engineering and Construction Task Force to work in the areas of sewage, water treatment, parks and recreation, solid waste disposal, highways and bridges. Land acquisition and engineering services will be pooled and major efforts will be made in the area of master planning. Following his presentation, Dr. Foster answered questions from the audience.

This meeting was the Annual Meeting of the Section and the following members were nominated and elected to the Executive Committee of the Transportation Section for the year 1973-1974.

Richard K. Guzowski	Chairman
R. Lawrence Whipple	Vice Chairman
Rodney P. Plourde	Clerk
Maurice Freedman	Member
Robert T. Tierney	Member
Marvin W. Miller	Member

Attendance: 37
 Location: Purcell's Restaurant, School Street, Boston
 Time: 5:30 p.m.

The Committee also had four meetings throughout the year to discuss programs and nominate new members. They were on: March 27, 1972; July 6, 1972; January 11, 1973 and February 28, 1973.

A letter to Governor Sargent concerning transportation policy and the BTPR Reports was drafted by Maurice Freedman as a joint effort with the Transportation Policy Sub-committee of the ASCE Action Program Committee (copy attached). Governor Sargent's reply commended the efforts of both societies and encouraged their continued participation in the planning process (copy attached).

Respectfully submitted,
 R. Lawrence Whipple, Jr.
 Clerk

MASSACHUSETTS SECTION
 AMERICAN SOCIETY OF CIVIL ENGINEERS

November 6, 1972

The Honorable Francis W. Sargent
 Governor of Massachusetts
 Boston, Massachusetts

Dear Governor Sargent:

We have reviewed the Phase II Reports of the Boston Transportation Planning Review (BTPR) and while we commend the study effort for its noteworthy attempt to include the broadest possible public participation in the planning process, we have to admit to certain disappointment in the fractured nature of these ponderous reports. The lack of recommendations should make them even more difficult for the average reader to comprehend and assimilate.

While this massive documentation and the short time available for comment must present all reviewing agencies and parties with a great problem, we recognize the even greater pressures on you to reach a final decision, and do sympathize with the necessity for establishing and keeping to a firm schedule for decision-making.

Although we obviously lack the vast resources, time, or skills, possessed by the BTPR staff in preparing the various studies and reports, we would nevertheless like to submit the following comments and recommendations for your consideration:

1. Planning Continuity

In order to assure the continuation of the planning process started by the BTPR, we heartily support the formation of the Joint Regional Transportation Committee for the Boston Region and are gratified that one of our members (A. Russell Barnes) has been appointed to this important committee. We hope that this continuing involvement of the Civil Engineering Societies will be an asset in the formation of new transportation policies.

2. Automobile Restrictions

We are concerned that the strength of the regional core may be jeopardized by the excessive restriction of the private automobile at a time when the lack of downtown connectivity and the functional obsolescence of the present archaic downtown transit "system" is discouraging increased transit ridership. We therefore believe that while some additional controls on vehicles traveling in the peak hours may be necessary, these should be applied with great restraint.

3. Transit Improvements

There are many areas of possible improvement for the existing transit and commuter rail systems. A number of these have been recognized by transit officials and the MBTA Master Plan, as well as recent transit proposals that have evolved in the BTPR study. We support the following transit improvements:

- a. roadway improvements, signing and parking so that direct links will be provided, in fringe areas, between the highway and transit systems;
- b. improvements in transit system rolling stock and roadbeds;
- c. coordinated schedules for commuter buses, trolleys and rapid transit lines;
- d. station revamping, construction of connecting links and rescheduling to assure improved "system" continuity for transit transfers in the downtown area;
- e. upgrade the commuter rail systems and coordinate with the transit system where possible;
- f. a greatly intensified program to inform the public of transit system improvements and improved scheduling as these occur.

4. Highway Improvements

In a free-economy nation, it is not possible to force the traveling public to shift from the mode the majority has selected (auto) to the one the planner chooses (transit) by legislation or fiat since the public has the alternative of *not going* if they so choose. This is particularly true in a period of increasing affluence when demands for comfort and convenience are accompanied by locational alternatives to the Boston core area, and a shift to service industries which are very sensitive to employee demands. In the long run the strength of the regional core will be dependent upon the decisions of leaders of these service industries to locate or stay downtown.

Most important, to remain vital the downtown must attract new residents who will be, for the most part, auto oriented.

For the above reasons, and to provide corridors for bus and goods movement, we recognize the need for the construction of new, but limited, radial highways to the core area as well as the Third Harbor Tunnel crossing.

5. Long Range Viewpoint

In the long range, if an improved urban environment is to be provided in the downtown core, an alternative to the use of the private automobile must be found. However, (and this is the key issue) before the auto can be supplanted, an attractive, efficient, comfortable and safe transit system alternative must be available in the downtown area.

In order to attract people, such future transit systems should be designed to operate within the same general parameters as the private auto (i.e., speed, comfort, security, flexibility, etc.).

Further serious attention must be directed towards the development and demonstration of a system such as personal rapid transit (small automated vehicle on fixed guideways) which may be able to achieve this.

In summary, we hope that in making your present transportation decisions based on the BTPR study, you will consider their short-term nature. While recognizing the need for bus and truck travel, we suggest that you do not preclude the private auto options until it can be proven that the general public will accept an alternative.

Very truly yours,

Maurice Freedman, P.E., Chairman

A. Russell Barnes, P.E.

Charles H. Flavin, P.E.

Transportation Policy Subcommittee (Action Program Committee)
American Society of Civil Engineers (Massachusetts Section) and
The Transportation Section - Boston Society of Civil Engineers

cc: Secretary Alan Altshuler
Messrs. Jack Wofford, BTPR
Walter Hanson, BTPR
BTPR Working Committee
ASCE Forum

For response—please contact the writer c/o Sasaki, Dawson, DeMay Associates, Inc.
23 Main Street, Watertown, Mass. 02172

THE COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE DEPARTMENT
STATE HOUSE, BOSTON 02133

January 25, 1973

Mr. Maurice Freedman, P.E.
Sasaki, Dawson, DeMay Associates, Inc.
23 Main Street
Watertown, Massachusetts 02172

Dear Mr. Freedman:

I want to take this opportunity to commend the Massachusetts section of the American Society of Civil Engineers and the Transportation section of the Boston Society of Civil Engineers for its vigorous and articulate participation in the Boston Transportation Planning Review (BTPR).

I am very appreciative of the long hours and dedicated efforts that your committee has contributed to the BTPR and am gratified that one of your members, A. Russell Barnes, P.E., has been appointed to the Joint Regional Transportation Committee.

The decisions that I have made concerning the transportation programs for the metropolitan Boston area have not been easy ones. As I indicated in my speech of November 30th, these decisions will affect all of us. I have sought to make decisions that I feel to be in the best interest of our citizens.

Now, we move from decision making to implementation. In this undertaking, the engineering profession has a vital role to play. Throughout the history of transportation in America, the engineer has always been in the forefront of developing new ways to serve the public interest.

It is my hope that your distinguished profession will again rise to the challenge of working with government in building a transportation system in Massachusetts that will not only meet the needs of our citizens but also improve our quality of life.

As we move toward our goal of a truly balanced transportation system, it is also clear that the economic health and vitality of the transportation industry in Massachusetts must be sustained. I want to assure your Committee that this continues to be a paramount objective of my administration.

It is my hope that the engineering profession will continue its enlightened efforts to change the transportation planning process not only in Massachusetts but also throughout the United States.

I was greatly heartened to note that the monthly journal of the American Society of Civil Engineers (ASCE) is now sub-titled, *Environmental Design and Engineered Construction*, and that this ASCE journal is now devoting a good deal of consideration to the social impacts of engineering works. Also, the Society's Urban Transportation Division now includes sub-committees that are concerned with environmental aspects of urban transportation systems and urban transportation goals and objectives.

This indicates a clear and positive response of your profession to the environmental challenge that now confronts us in metropolitan areas throughout America. It is my hope that we will continue to work together so that future generations will look back upon this time as a creative and unique moment in the history of American transportation.

With best wishes to you and your colleagues for a Happy New Year,

Sincerely,

Francis W. Sargent

REPORT OF THE EXECUTIVE COMMITTEE OF THE CONSTRUCTION SECTION

March 21, 1973

To the Boston Society of Civil Engineers:

The following meetings were held during the past year:

August 16, 1972 — Executive Committee Meeting to discuss the program for the upcoming year. In attendance were Chairman John T. Quinn, Jr.; Vice-Chairman Joseph B. Kerrissey, Jr.; Clerk Samuel E. Rice; Arthur H. Mosher, and Frank J. Killilea, Jr.

October 4, 1972 — A luncheon meeting was held at Nick's Restaurant. A total of forty-three persons attended. Mr. John Lukacz, Jr. of C. E. Maguire, Inc., spoke on the "New Charles River Dam Project".

February 14, 1973 – A luncheon meeting was held at Nick's Restaurant jointly with the Massachusetts Section of the ASCE. Total attendance was 68. The guest speaker, Mr. George B. Stryker, Resident District Manager of the District of Columbia Blue Plains Treatment Plant, spoke on the construction of additional facilities at the treatment plant.

Comments were invited from those in attendance on recommendations for improving procedures to ensure compliance with the City of Boston Building Code so as to prevent, as far as possible, the recurrence of calamities as exemplified by the disaster at the Vendome Hotel.

The following were nominated and elected to the Executive Committee of the Construction Section for the year 1973-1974:

Joseph B. Kerrissey, Jr.	Chairman
Samuel E. Rice	Vice-Chairman
Laimonis Rieksts	Clerk
Frank J. Killilea, Jr.	Executive Committee
Morse H. Klubock	Executive Committee
John T. Quinn, Jr.	Executive Committee

Respectfully submitted,
Samuel E. Rice
Clerk

REPORT OF THE EXECUTIVE COMMITTEE OF THE GEOTECHNICAL SECTION

Boston, Massachusetts March 21, 1973

The Geotechnical Section held the following meetings during the past year:

February 9, 1972:

Annual Meeting and Election of Officers:

E. Johnson	Chairman
S. Poulos	Vice Chairman
V. Murphy	Clerk
S. Stevens	Member
A. Wissa	Member
R. Bucknam	Member

Dr. Clifford Kaye, U. S. Geological Survey, Boston office, presented "New Information on the Geology of Boston Subsoils". This meeting was held at the Tech Square House, Cambridge, with an attendance of approximately 100 members and guests.

April 12, 1972

Dr. H. P. Aldrich spoke on "Back Bay Boston" with special emphasis on ground water levels. This meeting was held at the Red Coach Grill with 90 members and guests in attendance.

September 27, 1972

Dr. J. J. Harrington presented "Environmental Impact Statement Analysis" before 60 members and guests at the Harvard University Law School Dining Room.

December 13, 1972

A two-part presentation on large Pumped Storage Hydroelectric Projects was presented 50 75 members at the MIT Faculty Club by:

Mr. R. J. Conlon – discussed the Churchill Falls Project;

Mr. P. A. Wild – discussed the Northfield Mountain Project.

February 21, 1973

This Joint Meeting with the BSCE Structural Section and the Northeast Section of the Association of Engineering Geologists was Topic I of a two-part presentation:

“Boston Earthquake Zone; Lateral Loads and Design Provisions”.

Professors R. V. Whitman, C. A. Cornell and J. Christian presented “Seismicity and Foundation Effects” at the 57 Restaurant before 110 members and guests. This meeting was also the Annual Meeting of the Geotechnical Section with the election of the following officers for the coming year:

S. Poulos	Chairman
V. Murphy	Vice Chairman
S. Stevens	Clerk
A. Wissa	Member
R. Bucknam	Member
W. Zoino	Member

In addition to these formal meetings, the following Forum meetings also took place:

March 15, 1972

“Pile Specifications” –

Moderator: *Dr. H. P. Aldrich*

Panel: *F. Maxwell, W. Carter, D. Goldberg, D. Thompson*

This meeting was presented at the Aquarium Restaurant before 80 members and guest.

May 17, 1972

“Design and Construction Considerations to Minimize Movement Adjacent to Braced Excavations” –

Moderator: *D. T. Goldberg*

Panel: *M. Febesh, B. Gillfillan, W. Jackson, T. Liu, D. McKittrick*

This meeting was held at the Harkness Commons, Harvard University, before 90 members and guest.

November 2, 1972

“What Role Can Geotechnical Engineers Play in Preparation of Environmental Impact Statements?” –

Panelists: *J. Cortell, R. DeSanto, E. Leffel, L. MacMillan, P. Taylor*

This meeting was presented at the Engineer’s Club, Prudential Tower, before an attendance of 60 members.

January 30, 1973

“Design and Construction of Soil-Bearing Caissons” –

Moderator: *Dr. S. Poulos*

Panel: *J. Collins, P. Navarro, J. Cahill, E. Johnson*

This meeting was held at the Aquarium Restaurant before an attendance of 100 members and guest.

An informal affiliation has been established with the Northeast Section of the Association of Engineering Geologists, as approved by the Directors of the Geotechnical Section, for meetings and field trips that are of interest to the memberships of both professional groups.

Respectfully submitted,
V. J. Murphy, Clerk

ANNUAL REPORT OF THE COMPUTER SECTION – 1972-1973

March 21, 1973

During the fourth year of its organization, the Computer Section conducted four meetings described herein.

March 29, 1972 – No meeting held due to misunderstanding on date.

May 10, 1972 – Practical Problems Using Computers in Structural Design. A joint meeting chaired by the Structural Section, was held at Purcell's Restaurant with 50 people present. Paul Goldberg of Albert Goldberg and Associates spoke on time sharing, and described many small design problems solved over a terminal as well as a moderate sized three dimensional frame. Chan Lin and Tom Collins of Sepp Finkas Engineering spoke on remote batch processing and described the design of a large project in Greece which was designed for earthquake loading.

October 11, 1972 – EPA Storm Water Management Model. A meeting joint with the Hydraulics Section was held at the Playboy Club with 34 members and guests present. Mr. Jekabs Vittands of Metcalf & Eddy, Inc. spoke on the structure and application of a tool for the analysis and design of combined sewer and drainage systems.

November 29, 1972 – "Why Computerize Specifications?" A panel discussion was held at the Red Coach Grill with 44 members and guests present. The panel was moderated by Jekabs P. Vittands, who called upon G. Stephen George of Metcalf & Eddy, Inc. to discuss his firm's use of the magnetic tape typewriter in the preparation of specifications. Dr. James N. Jackson of Engineering Computer International discussed a large scale computer system developed specifically for specification editing, which Donald W. Nordbeck of Stone & Webster Engineering Corporation described his firm's experience using time sharing terminals with a general text editing system. Finally, Manning F. Chellis of Camp Dresser & McKee, Inc. related his firm's experience in implementation and use of the system described by Dr. Jackson.

January 17, 1973 – Annual Meeting – "Information Retrieval – Use Oriented Systems and Applications in Engineering". The meeting was held at Nick's Restaurant with 30 members and guests present. Gerald Woodland, Chairman of the Nominating Committee, gave his report. He stated that the Committee also consisted of Professors Logcher and Frank Perkins. The Executive Committee slate was then presented by Mr. Woodland, as follows:

Chairman	David I. Hellstrom
Vice Chairman	Prof. John T. Christian
Clerk	Jekabs P. Vittands
Member	Lewis Holzman
Member	James N. Jackson
Member	Prof. Robert D. Logcher

Professor John T. Christian, Chairman of the April 4, 1973, meeting, reported that it will be held at the Playboy Club and that the program will be on data acquisition and handling, with attention to both the hardware and software aspects.

Under the chairmanship of Charles D. Shaker, the technical meeting proceeded with three present items:

Mr. John W. Olcott, Marketing Manager of A.R.A.P. of Princeton, New Jersey, discussed the general aspects of his firm's software package entitled "Date Retrieval System (DRS)".

Mr. Robert C. Feldman, Director of Systems Development for Camp Dresser & McKee, discussed his firm's use of DRS in the area of personnel data retrieval.

Dr. Rodney P. Plourde, Senior Engineer with Fay, Spofford & Thorndike, Inc., discussed his firm's use of the system in the area of transportation planning studies and library cataloging.

Other Comments

The section, under the leadership of Professor John T. Christian, conducted a survey of members to determine their meeting preferences. Evening meetings were strongly favored over luncheon meetings and downtown Boston over more remote locations.

During the year the Executive Committee lost through relocation its former chairman, Alan E. Rimer. We regret the loss of his strong and active support and participation, but wish him well in his new ventures. Lewis Holzman of Stone & Webster Engineering Corporation was elected to fill this vacancy on the Committee.

The chairman would also like to express his appreciation to the entire Executive Committee for the thought and efforts that went into developing and producing an excellent technical program aimed at stimulating and educating BSCE members in the potential and application of computers in their professional lives. Through the diversity of the Committee, the program was able to cover almost all aspects of society interests.

Respectfully submitted,
Robert D. Logcher, Chairman



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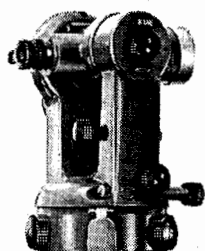
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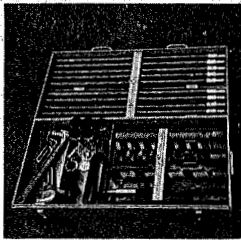
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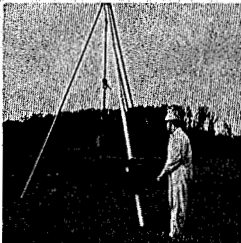
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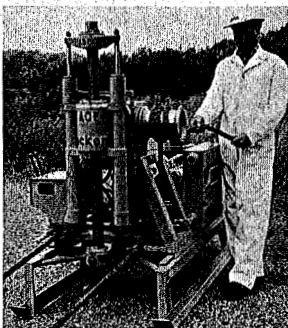
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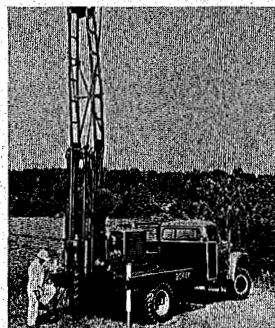
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