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CAN ENGINEERING BE AUTOMATED?

Presidential Address by
John M. Biggs

(Presented at Annual Meeting of Boston Society of Civil Engineers, March 14, 1967)

The effects of the current technological advance are profound in all fields of endeavor, and civil engineering is no exception. One of the most important manifestations of this progress is the electronic computer. In my opinion, the computer is much more than a rapid computational device, and will have a far-reaching and basic influence on the practice of civil engineering. By attempting to answer the question posed by the title of this paper, we may be able to predict the nature of this influence.

The advent and increasing use of computers over the past few years has been the cause of considerable discussion, and even debate, among engineers. Many of us tend to be rather emotional on this subject and to take one of two extreme views. On the one hand, some engineers seem to believe that a computer can do everything, and that eventually the primary requisite for a good engineer will be a knowledge of computers and computer programming. This point of view overestimates the capability of the machine and, more seriously, underestimates the intricacies of engineering and the unique contribution of the human engineer.

At the other extreme are those who believe that the computer, and particularly its human proponents, are degrading professional practice. They are afraid that mechanization will produce sterile engineering, and perhaps even dangerous design, because of a lack of human judgment. They also feel that computer-oriented engineers are too dependent on the machine and incapable of knowing when the computer results are wrong.

It must be recognized, however, that the fault in such cases, when they exist, lies not in the machine but in the individual engineer. Those who fear the computer for such reasons fail to recognize that human progress matches technological progress, and that engineers are capable of not only using but also controlling this new and powerful tool.

Both of these extreme viewpoints are of course wrong. In fact, we have advanced beyond this level of argument. Computers are now universally accepted, although with some lingering doubts, by the engineering profession. But it is still not clear how far we can go with computerized engineering, and what its impact will eventually be.

Before we can attempt to answer the question in the title, it is necessary to define our terms. Engineering, in this context, is not merely problem-solving, but rather a creative process which involves an experimentation with ideas. It includes, but is not limited to, the analytical techniques of testing and evaluation. Although the decision as to which of the available techniques should be used (or perhaps the formulation of new techniques) is engineering, the mechanics of executing these analyses is not. In other words, computation per se is not engineering. Most importantly, engineering requires the synthesis of all the factors (tangible and intangible) which contribute to the success of the total project. Basically, engineering is conceiving alternative solutions to the problem, and selecting the most appropriate on some rational basis.

Automation, as used in the title, does not merely imply computation but rather the execution, without human intervention, of the complete engineering process from the initial collection of raw data to the final specification of the project ready for construction. One frequently hears the term "automated design", but this is usually restricted to only a part of the design process, an optimization of a concept already qualitatively formed. Automated engineering, in the present context, means not only the execution of formalized analysis but the mechanical creation of alternatives and the pre-programmed capability of decision-making.

Within the ground rules established by the definition of the two terms above, it seems apparent that engineering cannot be automated. However, it is equally apparent that some parts of the process which are normally considered to be engineering,

can and have been automated. Structural analysis, to take an example, is now seldom done by hand except in rather trivial cases. This automation of analysis might have been thought impossible a few years ago, and we should therefore not jump to the conclusion that engineering, in the broad sense, cannot be automated.

If engineering is to be automated, the machine must be programmed to make the decisions now made by humans. The extent to which this can be done is the subject of studies in the field of artificial intelligence. A review of some of the current thinking in this field may give a better insight into the possibilities of engineering automation.

The beginning of the modern concept of artificial intelligence is usually associated with the introduction of the term "cybernetics" by Norbert Wiener in 1943. Since that time, numerous investigators have pursued this idea with increasing success due to the expanding capabilities of computers. The generality of this work indicates that the questions considered in this paper are not unique to engineering. Although engineers tend to look upon the group working in this area as rather far-out, abstract, and addicted to unintelligible jargon, closer reading of their work reveals that they are really interested in the same problems as are engineers. Basically, artificial intelligence means the ability of a machine to make judgments or decisions which, when made by a human, are considered to indicate intelligence. But here we encounter a problem in semantics: What is intelligence? It is this ambiguity which makes it difficult for us to understand those promoting the concept of artificial intelligence. However, such efforts are to be commended, and if such a thing exists, it is certainly applicable to engineering.

One of the first experiments in this field involved a mechanical mouse which, when placed in a maze, could always find its way out by trial and error. Furthermore, the mouse had a memory, and if placed at the same starting point, would immediately find its way out without trial and error. Is this intelligence? I think not. Whatever intelligence was involved was exercised by a human in designing the mouse. The fact that the mouse performs better than a human placed in the same circumstances is irrelevant.

Another frequently cited example is the computer which plays checkers. It is said that the computer consistently defeats the man who wrote the program. Again, this does not prove intelligence. What both of these examples do indicate, and this is important in the engineering problem, is that the computer has a much greater capacity than man for data processing, i.e., the storage, sorting, and retrieval of information.

These experiments were only the beginning. A more recent computer program displays what is called "analogical reasoning" by recognizing similarities between geometric objects. On the basis of a college admission test involving such recognition, and intended to test human intelligence, it is believed that the computer program could score at about the tenth-grade level. Although this is impressive, it must be realized that geometric recognition is the only function which the program can perform. It may also be significant that this single-minded program stretches the capacity of available computers.

It is sometimes said that a computer has the ability to "learn". The mechanical mouse certainly learned in a narrow sense. It has also been suggested that a computer could "learn" structural design. A structural engineer learns by experience, and a successful solution to some previous problem is remembered and applied to a new problem. It is argued that similarly a computer could be given a large number of successful designs to be stored in its memory (somewhat analogous to a student being taught structural design) and recalled for use when a new problem is supplied. By matching problem characteristics, it presumably could produce a reasonable design. Although this seems at least feasible, whether or not it is "learning" depends on one's definition of the word.

So, what is intelligence, and can it be created artificially? One suggested test is to place a man in one sealed room, a computer in another, and communicate with both by telephone. If, after a series of questions and answers, we could not tell which room contained the machine, then artificial intelligence is indeed possible. Although this is not as far-fetched as it may seem, my own belief is that we could always detect the man because of his wider scope of responses and ideas. However, the capability of computers is expanding rapidly and in the future they will be able to perform tasks in a manner unbelievable today. But man also improves, and the human will

always be ahead of the machine. In our context this means that the engineer will be working at progressively higher levels. This will be demanding on the talents and efforts of future engineers, but it also represents a great opportunity for better engineering.

Considering now the immediate future, and coming a little more down to earth, there are several current developments in the computer field which will affect engineering in a more basic sense than did previous use. We have passed the stage in which engineers are for the first time becoming acquainted with the computer, and have reached the point at which we are primarily concerned with improving current procedures. An evaluation of these efforts may give us some clue as to the possibility and degree of eventual automation.

Most of the current developments are in the general area of improved man-machine communication. The objective is to make it possible to integrate the computer into the engineering design process, and not merely to use it as a large calculating machine. Man and machine can be coordinated so that the shortcomings of each are compensated by the other. The potential of such a combination is much greater than the sum of its parts. The most significant of the new developments in man-machine communication are (1) improved languages, (2) time-sharing, and (3) graphical input-output.

There has been a continuous evolution of languages (i.e., the format of computer input) since the advent of computers. Originally, machine language was used. This was extremely tedious, time-consuming, and degrading to an engineer. It required, for example, an instruction to move number A from memory location X to Location Y. In effect, the user was forced down to the machine's level. A quantum step forward was made with the introduction of FORTRAN. This language permitted the use of macro statements, each one of which would cause a whole series of internal machine operations. For computation it was possible to write arithmetic expressions in much the same form that a mathematician or engineer would normally use. Although FORTRAN was a major improvement, it was not engineer-oriented and required substantial programming efforts for the solution of non-standard problems. Perhaps the most serious disadvantage was that it required the engineer to have considerable computer expertise.

The latest in this continuous evolution is the development of the Problem-Oriented Language which, as the name implies, permits the engineer to communicate with the computer in his own terminology. The individual input statements (or commands) in such languages are extremely powerful, and each causes a whole series of internal computer operations. As an example, consider the very successful STRESS (or more recently STRUDL), a computer system developed at M.I.T. for the analysis of structures. A single command like MEMBER PROPERTIES 14WF30 stores the properties of a member in a frame for whatever purpose may be subsequently required. STIFFNESS ANALYSIS causes the complete elastic analysis of a structure and stores all results for future reference. It is also possible to SELECT MEMBERS from tables of standard sections after an analysis has been made. A system like STRUDL might be considered to be automated engineering. A more correct view is that it represents an easy means for the engineer to accomplish mechanical operations. The engineer is then free to devote his efforts to the more difficult and intangible aspects of design. The machine makes no decisions unless the rules for such decisions have been pre-programmed. If these can be rigorously codified, then the making of the decision is no longer engineering.

A second significant current development is the hardware and software embodied in the concept of time-sharing. Normal computer operation (batch processing) is inefficient for engineering purposes because the engineer has no direct contact or interaction with the machine. He must prepare and submit a program, wait several hours (or even days) for someone else to run the problem, evaluate the results when they mysteriously appear, redesign and start the whole process over again. With time-sharing, many engineers may use the same computer simultaneously through remote terminals (currently teletypes). Each engineer is said to be "on-line", which means that his instructions are immediately executed by the computer and the results are quickly returned via the teletype. When the engineer has such a terminal in his own office, and when powerful problem-oriented languages are available to him in this mode, he will have achieved a major step increase in his capacity to do engineering. Time-sharing systems with engineering capabilities now exist experimentally and will in a

few years be available commercially (commercial remote-computing systems are now available but these do not have the capacity or software required to do "engineering" in the present context). The potential value of time-sharing for engineering is enormous since it will enable the engineer to use the computer at his convenience, thus permitting him to truly integrate the computer into the total design process.

Graphical input-output is a third significant development in the area of man-machine communication. Engineers naturally use graphical representations, both to crystallize their ideas and to communicate with other engineers. It is now possible to communicate with a computer in the same way. Sketches may be drawn on the face of an oscilloscope, and the geometric information contained in the sketches transmitted directly to the computer's memory for use in stored programs. Computer results may be displayed in the same way or they may be automatically plotted for permanent records. Computer-controlled drafting is now a reality, although not yet economical for most purposes. If the preparation of design drawings and other documentation is considered to be a part of engineering, then this phase of engineering certainly can and should be automated. It might also be noted in passing that the quantity of hardcopy drawings will surely decrease since such information can be stored and retrieved much more efficiently on tape or disk.

The advances in man-machine communication which I have cited above, and which in my opinion represent the most significant progress being made in the computer field, are definitely not leading us toward automated engineering. On the contrary, the whole purpose is to give the individual engineer a more important role in the design process. By using the power of the computer, he can more effectively apply his judgment to the problem, exercise his options with respect to alternatives, and more thoroughly control the progress of the whole project.

It is apparent that there are many ways in which the computer can assist the engineer in addition to mere computation. Most engineering requires a great deal of data and data manipulation, and this is an area in which the computer excells. Modern computers are essentially enormous storage and retrieval devices and they should be viewed in this light when we consider proper engineering use. Recent hardware develop-

ments in large, random-access storage devices are particularly significant for engineers. For example, the entire steel handbook, complete with tables and specifications, can be stored in less than one percent of the space available on some disk packs. Furthermore, any item of information thus stored can be efficiently retrieved either for the engineer's inspection or for use in a program.

When mention was made of the large amount of engineering data, I was not primarily thinking of collected raw data (e.g., traffic data), but rather of the temporary data which is created and used during the design process. If one analyzes the numerical work associated with design, it is surprising to find how little is actual computation. The major part of the effort is in collecting and organizing the numerical data in preparation for mathematical operations or for display and evaluation. In other words, much of what is normally called design is in reality bookkeeping. To verify this statement one has only to look through the hand computation sheets for the analysis and design of a structure. It is apparent that the data processing power of the computer can be brought to bear on this kind of manipulation without disturbing the engineer's prerogatives and without automating engineering in the true sense.

The concept of the computer as a public utility is gaining wide credence. The idea is that a network of interconnected computers could be made available to the general public in much the same way that the telephone system is now available. A commonly cited example of use is the housewife who employs the system from her kitchen for such chores as balancing the checkbook, making up shopping lists, and checking her household budget. This may not come to pass for economic reasons, and some husbands may not even find it desirable, but it is certainly feasible. Along the same vein, there is now a program in the MAC time-sharing system at M.I.T. called the MAD DOCTOR which is a reasonable facsimile of a psychiatrist. When the user asks a question through a remote terminal, the computer responds with another leading question somehow related to the first. Although this is very entertaining, and the computer seems to display some intelligence, I doubt that the psychiatrists are in serious danger. The purpose of these

somewhat facetious remarks is to emphasize that, if such things are feasible, there must be an enormous, untapped potential for the use of computers in engineering.

Whether or not the great advances being made and about to be made in the computer field constitute the automation of engineering, it is clear that so far we have only scratched the surface and engineering is entering a period of drastic evolution. I am convinced that the significant advances over the next decades will not lie in improved theories of analysis and design, but rather in the organization and management of the design process itself. The computer will play a dominant role in this development.

The change now taking place in the information processing field, including engineering, has been compared to the industrial revolution. This is not a far-fetched idea. What will be the effect on the engineering profession? Some fear that it will result in technological unemployment. I do not share this concern. It is true that better engineers will be needed because they will be operating at a higher level. They will be doing a better job of engineering in a more comprehensive manner, leaving the routine operations to the computer. This will not only benefit society but will result in a higher status for engineering - a goal which we all seek. None of this necessarily implies fewer engineers since there are many important aspects of engineering which are not now given proper attention. However, it may mean some dislocation of engineers at the lower levels, and this is a transition problem which the profession as a whole must face.

Lest we be too optimistic, it should be noted that there are certain dangers created by the computer revolution which must be recognized and met by the engineering profession if it is to continue serving its proper role. The engineer must assert himself and not allow his position to be usurped by the so-called "computer expert". This can only result in poor engineering, but could happen if engineers fail to make full use of the tools available to them. For this and other reasons, I believe that there is a threat to the engineering consulting firm as it is now constituted. If such firms are slow to accept and implement new ideas and methods, they will find themselves in a position of declining importance. It is disturbing

to hear of an Avco or a Dow Chemical receiving contracts for what is essentially civil engineering work.

Although the computer may be responsible for some of these problems, it may also provide the answer. The machine is a great equalizer. The smallest consulting firm has access to the same computer as the largest organization. If it properly uses the computer, the small firm can undertake large projects, and do them well, without overtaxing manpower resources. The difficulty in the past has been the lack of access to a large computer and the high cost of program development. However, the advances being made in computer technology, e.g., improved languages and time-sharing, and the general availability of large-scale programs for engineering purposes, will remove these obstacles to extensive computer use by small organizations. In my opinion, the automation of appropriate parts of the engineering process can be a boon to the engineering consulting firm in its traditional form, and can preserve for the public the advantages of this type of engineering organization.

In passing, I feel compelled to comment on engineering education with respect to computers. Educators have been criticized in recent years for placing too much emphasis on the machine and producing graduates who were excellent programmers but knew little about engineering. This criticism may have been valid a few years ago but I do not believe it is now appropriate. The emphasis, at least at the better schools, is on engineering in its true sense, with the computer relegated to its proper role as servant to the engineer. Little time is devoted to computer programming per se. In fact, by using the computer for routine engineering chores, the student has the time to study in depth the more profound aspects of engineering design. He is exposed to a wide variety and large number of engineering problems, and by actually obtaining solutions to these problems gains experience which would previously have taken years of post-graduate practice.

To summarize these remarks, let us return to the original question, "Can Engineering Be Automated?" In my opinion, engineering will never be automated. However, this statement is based on the recognition that the meaning of "engineering" constantly changes. Much of what we previously considered to be engineering has already been

automated. Undoubtedly, much of what we now call engineering will be automated in the future. Whenever a step in the engineering process becomes so well developed that the decisions involved can be pre-programmed, that step is no longer "engineering" and is a proper subject for automation. However, engineering in its true sense is decision-making on the basis of incomplete information. This fact, plus the ever-expanding scope of engineering, indicates that the total process will never be automated.

Current developments in computer technology, e.g., improved languages, time-sharing, and graphical input-output, are of great importance to engineers. However, these advances are all leading to computer-aided engineering rather than automated engineering. The difference is not merely semantics but is actually rather profound. The intent is not to replace the engineer, but to relieve him of the routine so that he is better able to cope with the real engineering problems.

The amazing progress being made in the computer field is in no way a threat to the engineer or the engineering profession. On the contrary, it will permit the engineer to move to a higher level of activity, thus permitting him to make a greater contribution to society and, at the same time, giving him a higher status in that society.

TIMBER DESIGN IN WATERFRONT CONSTRUCTION

by
Paul S. Crandall

(Presented at a meeting of the Structural Section, October 13, 1966)

Timber design in waterfront construction remains largely an art where knowledge of exposure conditions is important to assure durability. It is important for engineers designing with timber to master this art if they wish to be good designers. Also, since metal fastenings are required in timber construction, an understanding of the behavior of steel and iron in sea water environment is essential.

Ever since man has been able to cut timber to suit his purposes, he has used this natural material to build his shelters, bridges and vessels. Even today, timber is quite competitive with the newer materials because of its natural properties of resilience, light weight and ease of fastening and gluing. Timber in waterfront construction was quite unsatisfactory in the early days and therefore was avoided since marine borer attack would destroy untreated timber quite readily, except in a few cases, such as oak, where the bark gave protection as long as it stayed on. This resulted in the use of stone and masonry, which is quite evident in European and Mediterranean ports. On the other hand, in fresh water timber was found to be very durable and therefore pile foundations using timber are found in many large structures. Fortunately, when timber exposed to sea water is buried in mud, silt, sand or clay, the marine borers will not attack. As a result, a good many waterfront structures were founded on

untreated timber piles, backfilled and protected by the soil with a masonry structure on top.

In the field of ship construction, man was required to devise means of protecting the wooden hulls of vessels so that borers would not attack. Therefore, sailing ships were sheathed with sheets of copper, and very often a coating of tar or ship's felt was applied to the hull before the copper sheets were fastened. This resulted in an effective protection but required re-sheathing every two to three years since the copper would often be torn off by the abrasion of ice or floating debris. The art of sheathing has endured and is used for protecting the hulls of wooden fishing trawlers. In many cases, this amounts to covering the hull of the vessel with ship's felt and then putting on strips of tropical hardwood, such as greenheart, which is relatively immune to borers in temperate waters.

Tarred ship's felt is a by-product of the wool industry in Great Britain and Ireland, and to our knowledge, this felt has never been penetrated by marine borers as long as the felt was kept intact by structural boards or sheet metal.

Coal tar was used in early days as a coating to protect wood. In order to improve adhesion and obtain some penetration of the wood, the tar was dissolved in various solvents which could be absorbed by the wood fibres. However, it was not until pressure treatment was developed that large amounts of preservative could be forced into the sapwood as is now done with creosote oil and coal tar. The ability to penetrate depends a great deal on the type of wood selected. The tabulation shown in Fig. 1 gives an outline of the ability of various domestic woods to retain creosote. One problem with creosote oil is that it will eventually leach out, leaving the wood exposed to attack. This has been improved upon by using a mixture of creosote and coal tar in which the tar seals in the creosote so that the leaching is reduced. Then the use of full cell processes, in which the timber is put under vacuum to cause as many pores as possible to be filled with the preservative, has resulted in a remarkable resistance to attack.

Of all the domestic timbers, yellow pine is still by far the best to accept treatment because it has a great deal of sapwood which readily takes treatment in comparison with other types of timber which have very little sapwood. A few other timbers such as yellow birch will accept a reasonable amount of treatment.

The writer has seen many unsatisfactory installations where treatment was called for on heart wood timbers, and in

Woods with Good Retention	Uses
Yellow Pine - Sap and Summer Wood only	Piling, Shims
Loblolly Pine	Sheathing, & Bracing
Jack Pine	Bracing, Sheathing & Piling
Red Oak (with careful treatment)	Fender Piles, Shims
Red Pine	
Woods with Light Retention	
Birch	Shims
Hemlock	Cribbing
Woods with No Retention	
Fir	Flooring, Beams & Piling
White Oak	Fenders Beams & Piling
Yellow Pine-heartwood	Beams & Piling
Spruce	Piling
Woods Resistant to Marine Borers Without Creosote	
Azobe	Beams
Manbarklak	Beams
Greenhart (Temperate Regions Only)	Piling and Beams
Oak and Hemlock piling while bark stays on	
Angelique or Basra Locus	

Fig. 1 Creosote Retention of Common Structural Woods

spite of insizing, the penetration was not more than 1/32". It is futile to specify that woods be treated if the wood cannot accept treatment. However, time and again Douglas fir is seen which has been sawn square and subjected to treatment. It is pitiful to see the results. Recently, there has been considerable success in the treatment of Douglas fir plywood by pressure treatment in which the treatment has penetrated through 1" thick plywood. This material is being used for sheathing wooden hulls and appears most promising.

Tropical hardwoods, such as greenheart, azobe and manbarklak, resist very well the attack of teredo and limnoria in our North Atlantic ports, but are not as effective in warmer waters south of Norfolk, Virginia. These heavy dense woods are best used in submerged structures where twisting and distortion will not take place. The warping and splitting of these dense woods in atmospheric exposure is very severe. Their great strength and modulus of elasticity make them excellent for underwater construction.

The design of timber structures is usually dependent on metal fastenings to achieve strength and rigidity between the various timber elements. Today, great strides have been made in developing adhesives which bond timber more strongly than the strength of the basic wood. However, the durability of metal fastenings is as vital to this discussion as is the wood itself, since they cannot be avoided in waterfront construction. Generally, most fastenings are of ferrous metals, such as mild steel, wrought iron or cast iron. These may or may not be galvanized. There have been many instances where the use of galvanizing is misunderstood. In general, a galvanized fastening stands up very well when only exposed to the oxidation of the atmosphere. It is good in the splash zone, but whenever galvanizing is utilized for structures where the fastening remains under water, rapid dissolution of the zinc by electrolysis results. This has even been seen to take place in fresh water.

Cast iron, where it can be used, has proven to be very durable in sea water. It is cheap and will outlast forged or rolled steel by many years. Cast steel is substantially more durable in sea water than either forged or rolled steel.

The use of machine bolts in waterfront construction is very common, but, in the opinion of the author, it is much less costly to use ordinary drift iron in which the fastening is basically the friction between the timber and the iron bar. We do not hesitate to construct dwellings using nails so why should we change our approach when it comes to waterfront construction? The ability of timber to hold drift bolts is amazing, and the fact that the bolt is imbedded in the wood protects it against oxidation. When domestic timbers are used, drift bolts should be inserted in holes about 1/16" smaller than the drift. If tropical hardwoods are used, the interference should not be more than 1/64".

When small pieces of steel are used, they are subject to oxidation if exposed to air. However if they are imbedded in wood, oxidation is of very little consequence. Also, if small pieces are electrically separated from other large steel bodies, they do not normally suffer from electrolysis. For the above reasons, drift bolts of iron or steel are very durable. On the other hand, machine bolt heads and nuts will readily corrode away leaving only the imbedded shank. It is therefore wise to design fastenings in such a way that most stresses

pass from timber to timber with minimum reliance on the iron fastenings except where they are imbedded in the wood. Marine organisms cause corrosion where they attach themselves to iron surfaces. This is a factor in the deterioration of bolt heads and nuts.

Waterfront structures utilizing timber are usually best when composite construction is used. The timber deck of a wooden pier will suffer badly from decay due to rain water and the lack of immersion of the deck in the sea water since it is the salt in the sea water which acts as a preservative. It is therefore preferable when building piers to utilize timber piling in the sea water and reinforced concrete for the upper structure. It is already known that concrete suffers severely from freezing and thawing, which makes concrete piles in a tidal range very unsatisfactory. However, in tropical locations this is not a problem. Structural steel in sea water, although quite impressive immediately after construction, has proven to be short-lived and costly to maintain. There is a zone about 2 feet below low water in which the oxygen content appears to cause very serious attack on structural steel. This was found at the Army Base in Boston and on structural steel cradles in Halifax. As can readily be understood, cleaning and painting structural steel 2 feet below low water is for all intents and purposes impossible without enormous expenditures. Encasing the steel with concrete is not very satisfactory since the concrete will spall in this zone. It is therefore most desirable to use timber if possible in this very difficult location. The only alternative would be to use massive rock or concrete construction.

Figs. 2, 3, and 4 illustrate the effects of exposure at various levels and show suggested means of protecting against adverse effects.

When nails and spikes are driven into a piece of soft wood, the ability of the wood to compress without splitting is taken for granted and the holding capability of this nail is a function of the modulus of side grain compressibility. Very dense hardwoods cannot be spiked as readily because of their much greater compressive strength and if a nail is forced in the wood, it will split due to intense tension across the grain combined with a notch effect.

The author has been very interested in the elastic behavior of timbers in side grain compression. This is particularly important in the field of dry docking of ships where

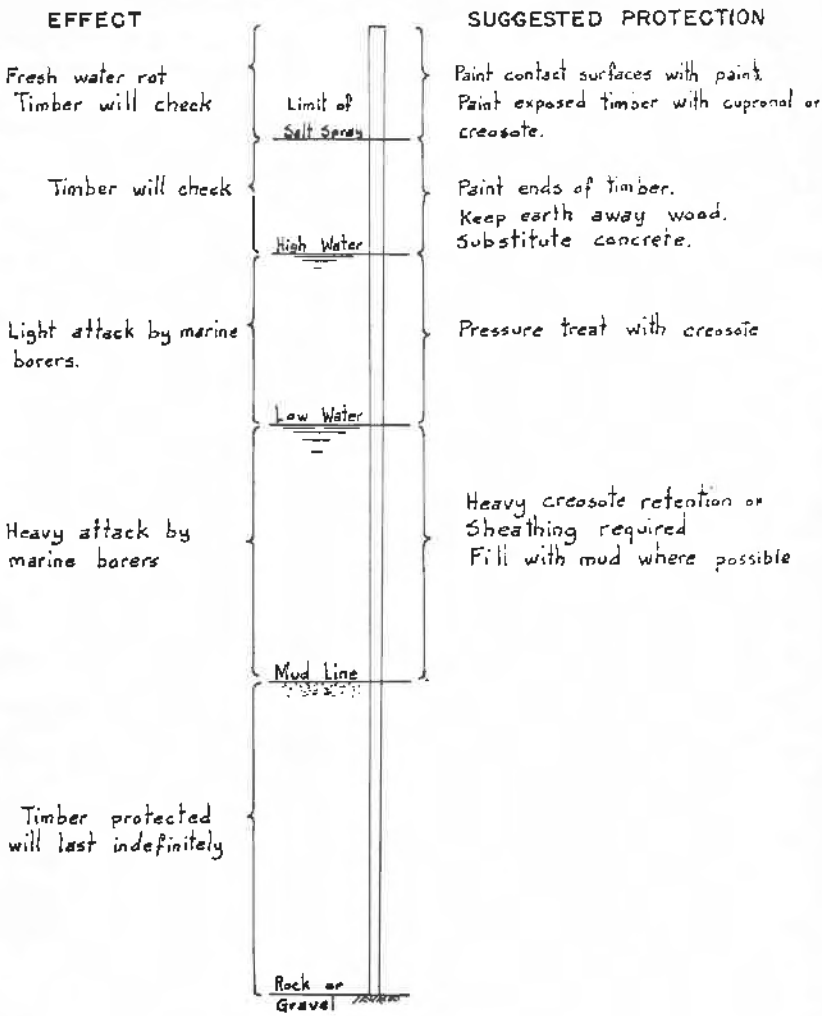

Fig. 2 Timber Exposed to Sea Water

wooden blocking is used to provide an elastic compressible support between the ship and the dry dock. To better understand the nature of timber behavior in side grain compression, tests were made on five domestic timbers, one being tested in the dry and one set in the wet. Curves of stress vs. strain are shown in Figs. 5 - 9. The amazing thing about timber in side grain compression is its ability to yield with-

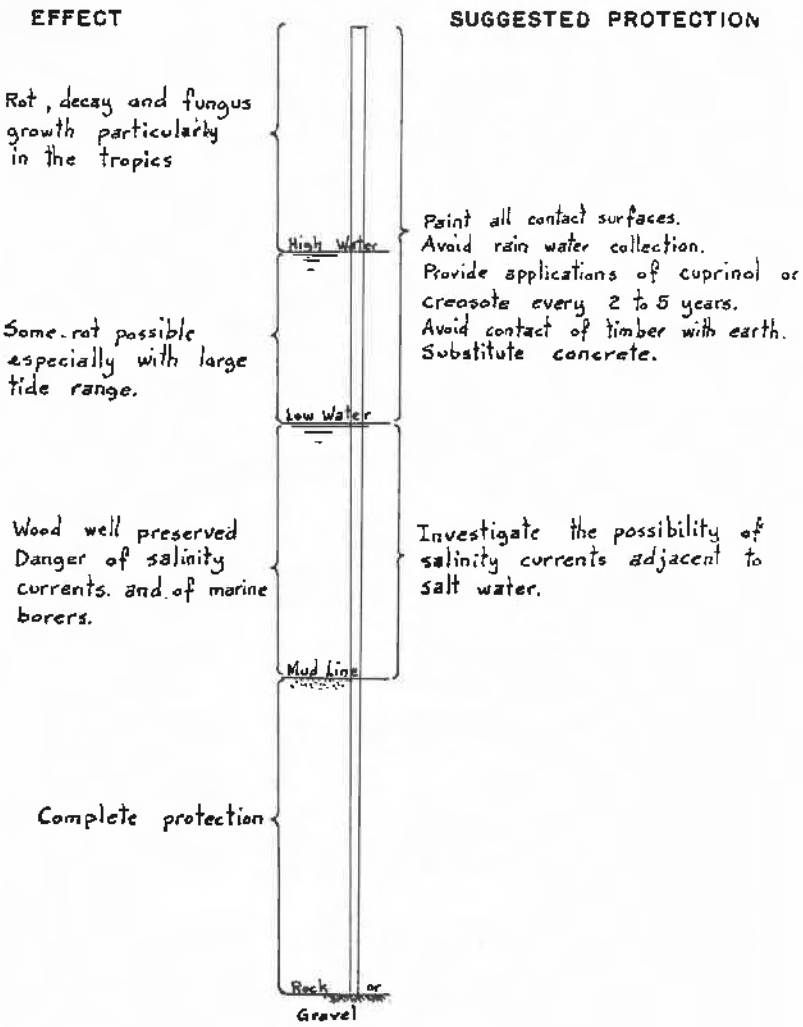

Fig. 3 Timber Exposed to Fresh Water

out failing. In general, there is a zone of elastic compression, then a zone of considerable compression in which the fibers are actually yielding and the pores of the wood are closing, and finally there is a zone of high resistance when the pores of the timber are, for all intents and purposes, closed. This behavior puts a new light on the allowable side grain compression which may be used in design. The tests were made

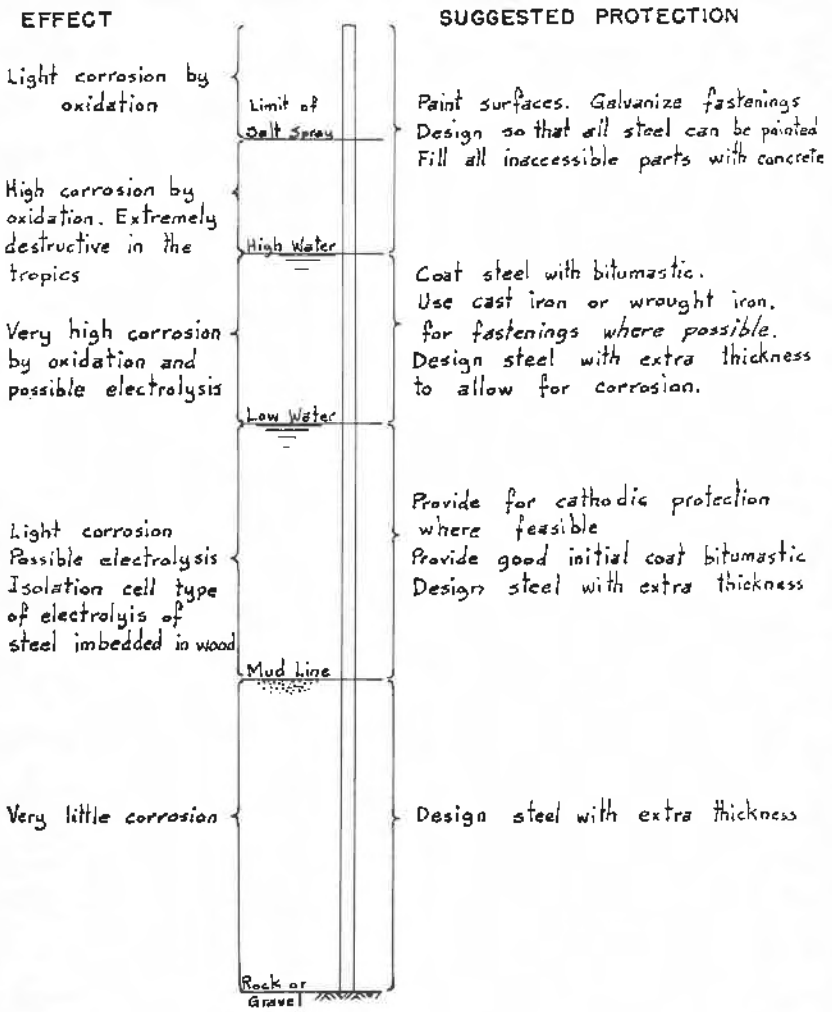

Fig. 4 Steel Exposed to Sea Water

on random samples 8" x 8" x 20" with loading applied quite slowly to permit the wood to yield. It was remarkable to see the crushed wood recovered 75% to 90% of its original thickness about 30 minutes after load was released.

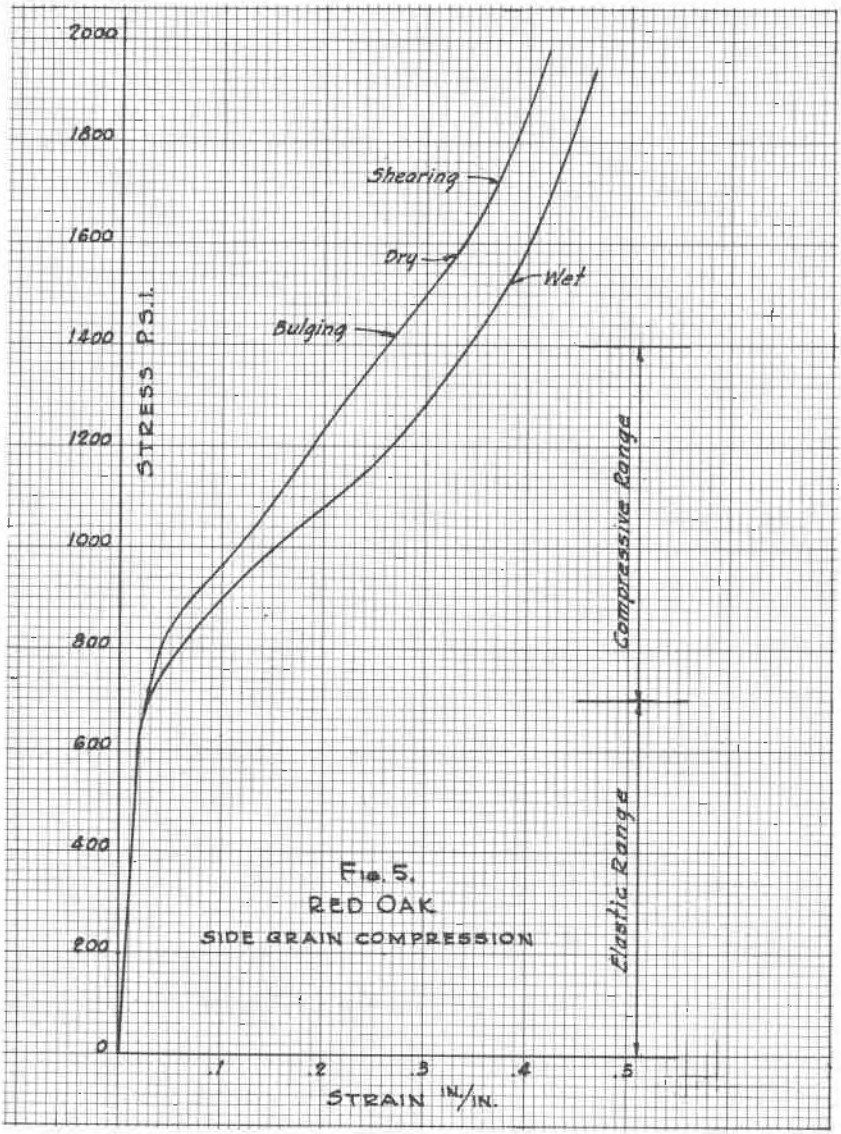
2000
1800
1600
1400
1200
1000
800
600
400
200
0
STRESS P.S.I.
Shearing
Dry
Wet
Bulging
Compressive Range
Elastic Range
.1
.2
.3
.4
.5
STRAIN IN./IN.
Fig. 5.
RED OAK
SIDE GRAIN COMPRESSION

Fig. 5

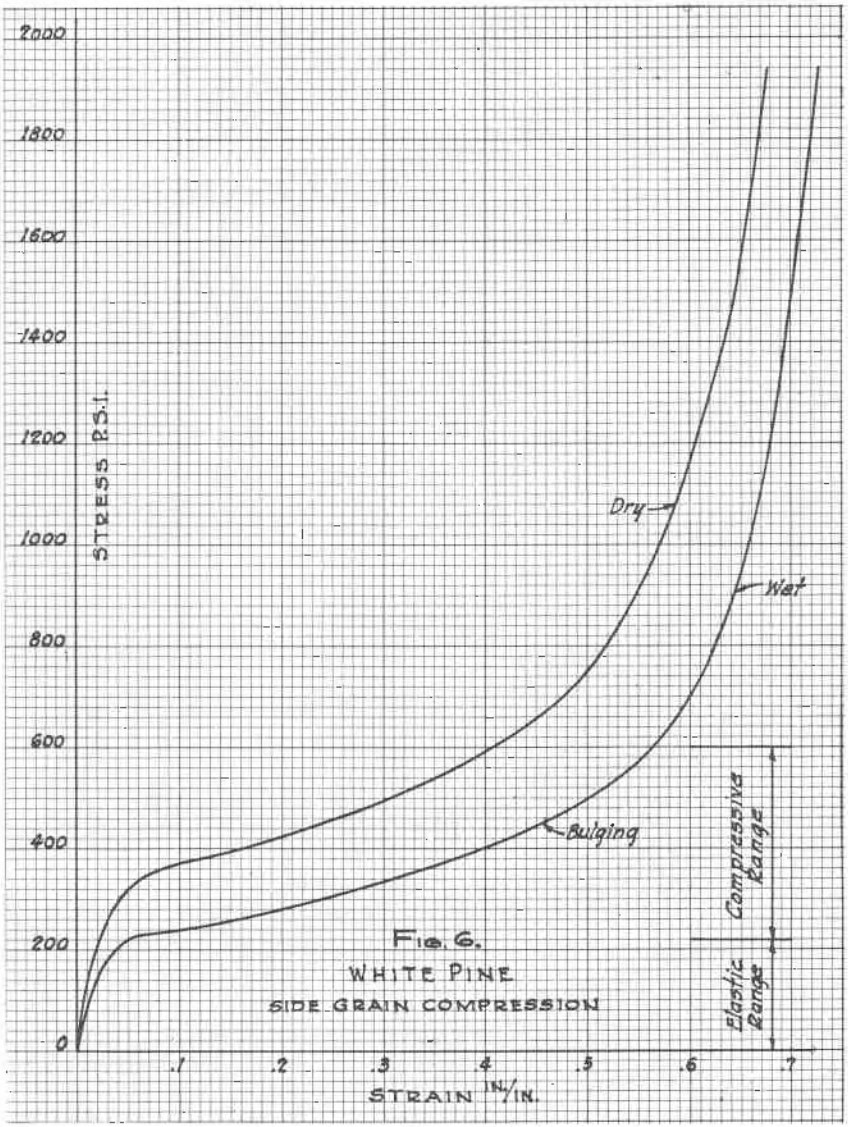
2000
1800
1600
1400
1200
1000
800
600
400
200
0
STRESS P.S.I.
.1
.2
.3
.4
.5
.6
.7
STRAIN IN./IN.
Dry
Wet
Bulging
Compressive Range
Elastic Range
Fig. 6.
WHITE PINE
SIDE GRAIN COMPRESSION

Fig. 6

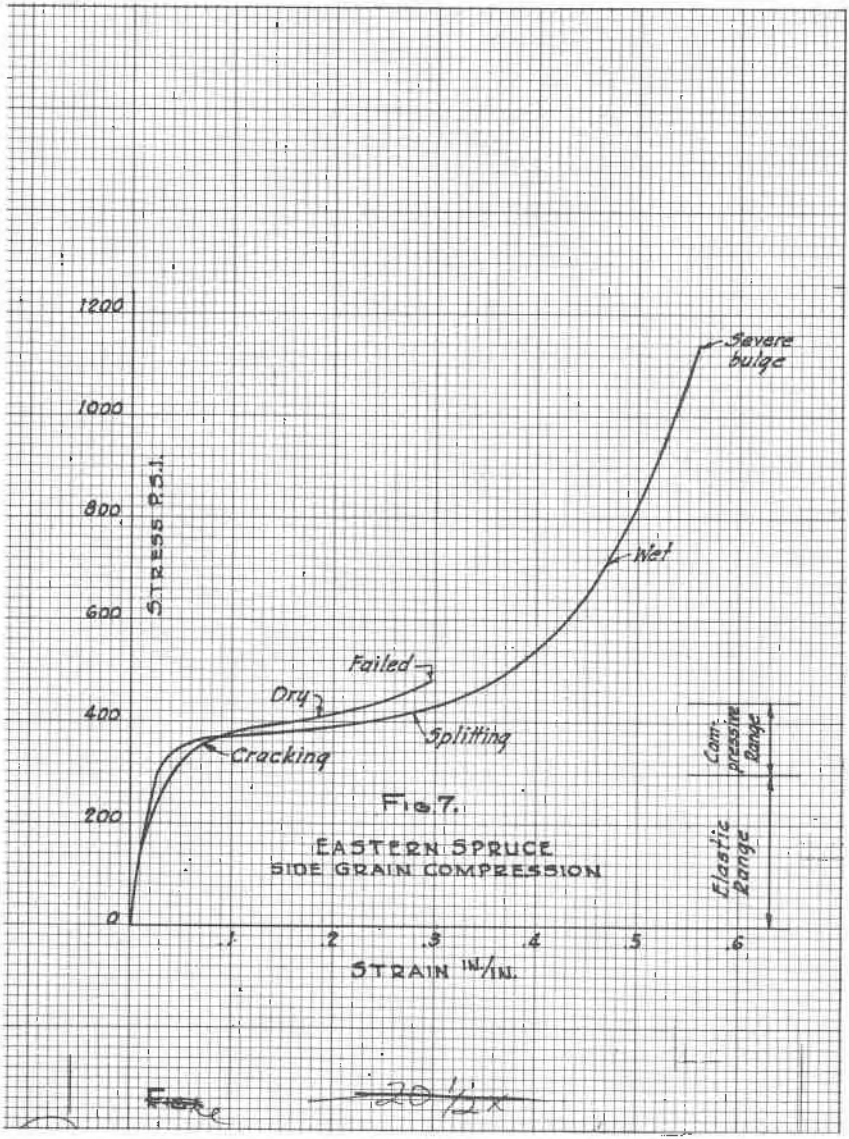
1200
1000
800
600
400
200
0
STRESS P.S.I.
Severe bulge
Wet
Failed
Dry
Splitting
Cracking
Fig. 7.
EASTERN SPRUCE
SIDE GRAIN COMPRESSION
Com. pressive Range
Elastic Range
1
2
3
4
5
6
STRAIN IN/IN.

Fig. 7

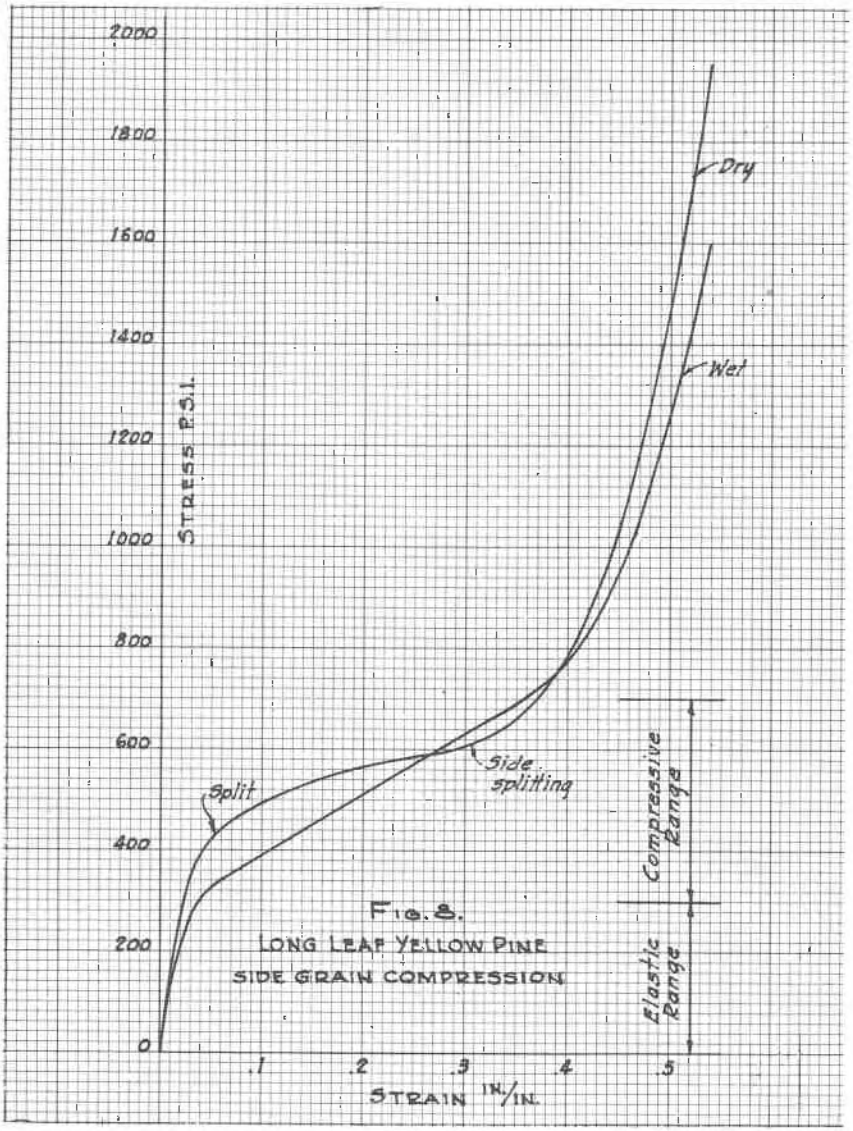
2000
1800
1600
1400
1200
1000
800
600
400
200
0
STRESS P.S.I.
Dry
Wet
Split
Side splitting
Compressive Range
Elastic Range
.1
.2
.3
.4
.5
STRAIN IN./IN.
FIG. 8.
LONG LEAF YELLOW PINE
SIDE GRAIN COMPRESSION

Fig. 8

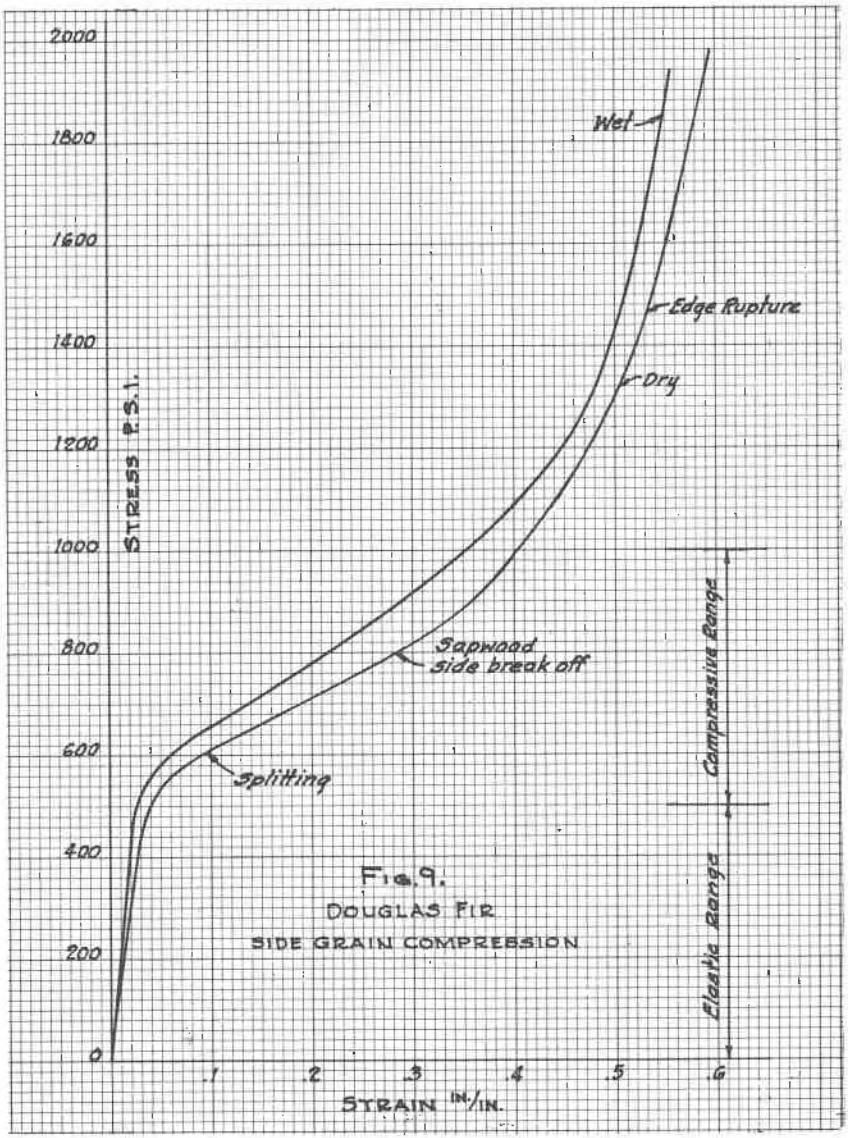
2000
1800
1600
1400
1200
1000
800
600
400
200
0
STRESS P.S.I.
Wet
Edge Rupture
Dry
Sapwood
side break off
Splitting
Compressive Range
Elastic Range
.1
.2
.3
.4
.5
.6
STRAIN IN/IN.
Fig. 9.
DOUGLAS FIR
SIDE GRAIN COMPRESSION

Fig. 9

The author feels that more testing of a greater variety of timbers in a manner similar to those reported in this paper would be worthwhile to undertake and hopes that the information already presented will be beneficial to engineers working with timber both in design and in field construction.

Kind of Timber		Elastic Range		Compressive Range	
		Stress in P.S.I.	Modulus P.S.I.	Stress in P.S.I.	Modulus P.S.I.
Red Oak	Dry	0-700	32000	700-1400	2700
" "	Wet	0-700	32000	700-1400	2200
White Pine	Dry	0-220	9000	220-600	750
" "	Wet	0-220	6250	220-600	540
Eastern Spruce	Dry	0-300	12000	300-440	400
" "	Wet	0-300	12000	300-440	330
L.L.Yellow Pine	Dry	0-300	13000	300-700	700
" " "	Wet	0-300	11000	300-700	1200
Douglas Fir	Dry	0 500	19000	500-1000	1150
" "	Wet	0 500	15000	500-1000	1350

Note - Wet timber immersed in water 48 hours. Test samples were 8" x 8" x 20"

Fig. 10 Modulus of Compressibility
Side Grain Compression - Domestic Timber

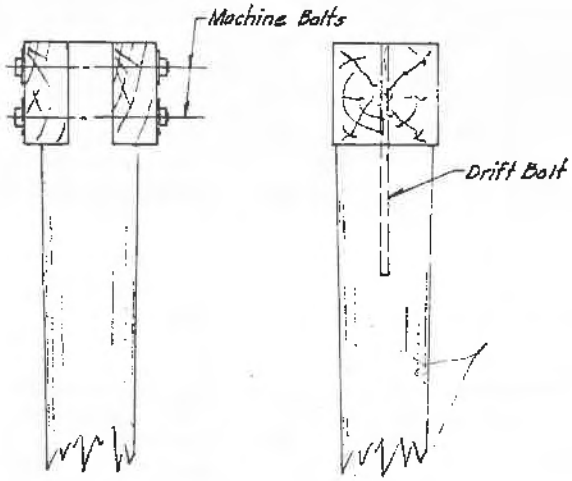

Fig. 11 Comparative Method of Capping Piles as Practiced in New England

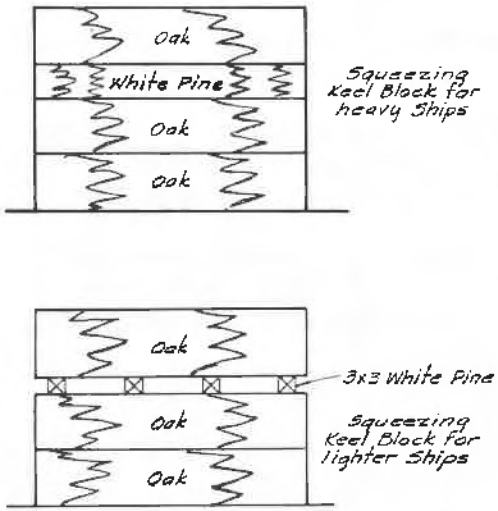

Fig. 12 Application of Highly Compressible Woods to Limit Maximum Load of Ship Keel on Blocks

Fig. 13 Spruce pile attacked by limnoria on the exterior and by teredo on the interior. The portion attacked was above the mud line. The portion of pile to full dimension was protected by mud. Here is an example where an eaten pile was salvaged by cutting away the damaged wood and installing a solid timber cap above the re-cut pile.

Fig. 14 MacMillan Wharf, Provincetown, Mass. This wharf is a good example of composite construction utilizing creosoted yellow pine piles with cast-in-place reinforced concrete caps. The longitudinal stringers were precast to minimize form work over water and to enable rapid assembly of the deck system. Forms were then placed between the stringers for pouring a 6" reinforced concrete slab to tie all of the caps and stringers together.

Fig. 15 The lowest point in the concrete is 2' above high water so that the concrete is never immersed in sea water which would otherwise cause spawling due to freezing and thawing. The timber piles are always exposed to complete wetting so that decay will not start due to the combination of creosote and salt preservation.

Fig. 16 Tanker wharf consisting of five dolphins at Bucksport, Maine, in the Penobscot River. The low-cost timber piles with the heavy concrete cap provides a stable structure for mooring tankers. The concrete cap shelters the structural piles against rain water decay and at the same time ties all of the battered piles so that they will act together. The mass of the concrete is above highest water so that maximum effective weight will exist for stability. The piles between low water and the concrete were treated with copper naphthanate solution against rotting. These piles are untreated fir since they are in the fresh water of the Penobscot River. This in another example of the advantage of composite construction using timber and concrete.

PROCEEDINGS OF THE SOCIETY

The Construction Section held two joint meetings during 1966. The first was held with the main society and the second was held with the Structural Section.

May 25, 1966 - Mr. Richard Halloran of the Perini Corporation described "Heavy Construction Estimating", using a descriptive system divided into six major categories:

1. Construction Management
2. Joint Ventures and Partners
3. General Classification of Project Costs
4. Project Accounting, Cost Accounting and Costs Feedback
5. Bidding a Project
6. Estimating Engineers' Specializations

Attendance: 89

January 11, 1967 - Mr. Phillip Maslow, Grace Construction Materials Division of W. R. Grace & Co. lectured on the "Use of Epoxy Resin in Concrete".

Attendance: 48

The newly appointed officers of the section are as follows:

Chairman	William Wiley
Vice Chairman	Arthur H. Mosher
Clerk	Charles F. Sullivan

Respectfully submitted,

Arthur H. Mosher, Clerk

November 2, 1966 - A meeting of the Hydraulics Section of the Boston Society of Civil Engineers was held in the society rooms, 47 Winter Street, Boston, Mass. The meeting was called to order by Athanasios A. Vulgaropulos, clerk of the section, substituting for the chairman of the section, Mr. Nicholas Lally.

Mr. Vulgaropulos introduced the speaker of the evening, Mr. Peter A. Larsen, Associate Professor of Civil Engineering at the Worcester Polytechnic Institute. Professor Larsen spoke on "Head Losses Caused by an Ice Cover in Open Channels" and showed slides of prototype investigations in Sweden. The speaker discussed field observations and measurements of head losses in certain river sections with and without ice cover, the roughness of the underside of ice cover where a ripple pattern is formed, and the results of the above investigations.

The meeting had an attendance of 16 and was adjourned at 9:00 P.M.

Respectfully submitted,

Athanasios A. Vulgaropulos, Clerk

November 7, 1966 - A regular meeting of the Structural Section was held on this date at the society rooms. Meeting was called to order by Chairman Robert L. Fuller at 7:10 P.M. Mr. William A. Henderson, Vice President - Universal Engineering Company spoke on "History and Development of Bridges".

After a discussion period the meeting adjourned at 8:00 P.M. 21 members and guests attended the meeting.

Respectfully submitted,

F. Hampe, Clerk

November 22, 1966 - A meeting of the Transportation Section of the Boston Society of Civil Engineers was held in the society rooms, 47 Winter Street, Boston, Mass., and was called to order at 7:00 P.M., by the chairman, Cas. J. Kray. The minutes of the previous meeting were read and accepted.

After a few brief comments relative to the future meetings, Chairman Kray introduced the guest speaker of the evening, Colonel Remi O. Renier, Division Engineer, Cape Canaveral, who gave a most interesting illustrated talk entitled "Construction for Space Age". Colonel Renier discussed the problems involved in the transportation and assembly of the component parts of missiles at Cape Canaveral.

After a brief discussion period, the meeting adjourned at 8:30 P.M.

Respectfully submitted,

Robert J. Kiley, Clerk

January 18, 1967 - A meeting of the Transportation Section of the Boston Society of Civil Engineers was held in the Society Rooms, 47 Winter Street, Boston, Mass., and was called to order at 7:00 P.M., by the chairman, Cas J. Kray. At the request of Chairman Kray, the minutes of the previous meeting were omitted.

After a few brief comments relative to the future meetings, Chairman Kray introduced the guest speakers of the evening, Mr. James D. Fitzgerald, Director of New Construction of the MBTA, whose subject was "The Employment of New Techniques in MBTA Construction Projects"; Mr. George Wey, Director of Planning, Massachusetts Department of Public Works, whose subject was "The Role of the Department of Public Works in Planning of Transportation Projects"; and Mr. John R. Davis, Deputy Chief Engineer, Massachusetts Port Authority, whose subject was "Logan International Airport".

The subject matter of all three speakers was timely, informative and interesting. The lively discussion period which followed brought out the fact that all three of these agencies have common problems when planning toward a complete transportation system for this area.

The meeting adjourned at 9:15 P.M. Seventy members and guests attended the meeting.

Respectfully submitted,

Robert J. Kiley, Clerk

January 25, 1967 - A joint meeting of the Boston Society of Civil Engineers with the Hydraulics Section was held this evening in the Adams Room, United Community Services Building, 14 Somerset Street, Boston, Mass., and was called to order by President John M. Biggs, at 7:00 P.M.

President Biggs stated that the minutes of the previous meeting held November 16, 1966, would be published in a forthcoming issue of the Journal, and that the reading of those minutes would be waived unless there was objection.

President Biggs announced the death of the following members: -

George F. Delano, elected a member May 9, 1928, who died December 23, 1966.

Albert C. Titcomb, elected a member June 29, 1923, who died January 25, 1966.

Harry M. Solomos, elected a member November 15, 1939, who died February 6, 1966.

Francis J. Crandell, elected a member May 20, 1942, who died January 19, 1967.

The Secretary announced the names of applicants for membership.

President Biggs requested the secretary to present a recommendation of the Board of Government to the society for action. The president stated that this matter was before the society in accordance with provisions of the by-laws and notice of such action published in the ESNE Journals dated November 14, 1966, and January 9, 1967.

The secretary presented the following recommendation of the Board of Government to the society for action to be taken at this meeting.

MOTION "to recommend to the society that the Board of Government be authorized to transfer an amount not to exceed $7000 from the principal of the permanent fund to the current fund for current expenditures".

On motion duly made and seconded it was VOTED "that the Board of Government be authorized to transfer an amount not to exceed $7000 from the principal of the permanent fund to the current fund for current expenditures".

President Biggs stated that this was the final action on this matter.

President Biggs requested the secretary to present a recommendation of the Board of Government on proposed amendment to the by-laws, Section 9 (Fees and Dues). The President stated that this matter was before the society in accordance with provisions of the by-laws, and notice of such action published in the ESNE Journals dated January 16, and February 13, 1967, and circulated to members by letter dated January 5, 1967.

The secretary presented the following recommendation of the Board of Government on proposed amendment to the by-laws, Section 9 (Fees and Dues).

MOTION "that the dues be increased beginning with those payable in March, 1967, and Section 9 of the by-laws be amended to read as follows:

The annual dues payable in advance at the annual meeting shall be as follows: resident members and associates, twenty dollars; non-resident members and associates, fifteen dollars; resident junior members, twelve dollars; and non-resident junior members, ten dollars; individual student members, two dollars and a half. The members of any grade except that of student, residing within one hundred miles of City Hall of Boston, shall be considered as resident and those beyond that limit as non-resident members.

On motion duly made and seconded it was VOTED "that Section 9, of the by-laws (Fees and Dues) be amended and that the dues of members be increased as listed above". President Biggs stated that final action will be taken on this matter at the February 15, 1967, meeting.

President Biggs stated that this was a joint meeting with the Hydraulics Section and called upon Nicholas Lally, chairman of that section to conduct any necessary business for that section at this time.

President Biggs stated that this meeting was sponsored by the John R. Freeman Fund-Committee as "A John R. Freeman Memorial Lecture", and turned the meeting over to Prof. Leslie J. Hooper, chairman of the John R. Freeman Fund Committee, who introduced the guest speaker of the evening Prof. Hans Gerber, Swiss Federal Institute of Technology, who gave a most interesting talk on "European Experience with the Thermodynamic Method."

At the conclusion of the lecture Prof. Hooper presented Prof. Gerber with an honorarium and a certificate of appreciation, and then turned the meeting back to President Biggs.

A discussion period followed the lecture. Forty four members and guests attended the dinner preceding the meeting and sixty members and guests attended the meeting. The meeting adjourned at 9:40 P.M.

Respectfully submitted.

Charles O. Baird, Jr., Secretary

February 15, 1967 - A joint meeting with the Massachusetts Section of the American Society of Civil Engineers was held this noon at the Red Coach Grill, Stanhope Street, Boston, Mass., Saul Namyet, Vice President of ASCE presiding.

After luncheon Vice-President Namyet called the meeting to order and turned the meeting over to President John M. Biggs of the B.S.C.E. to conduct any necessary business. President Biggs requested the secretary to present a recommendation from the Board of Government to the society for action at this meeting, stating that this matter was before the society in accordance with provisions of the by-laws, and notice of such action published in the ESNE Journal dated January 30, 1967, and sent by letter to members dated January 5, 1967.

The secretary presented the following recommendation of the Board of Government on proposed amendment to the by-laws, Section 9, (Fees and Dues).

MOTION "that the dues be increased beginning with those payable in March, 1967, and Section 9 of the by-laws be amended to read as follows: -

"The annual dues payable in advance at the annual meeting shall be as follows: resident members and associates, twenty dollars; non-resident members and associates, fifteen dollars; resident junior members, twelve dollars; and non-resident junior members, ten dollars; individual student members, two dollars and a half. The members of any grade except that of student, residing within one hundred miles of City Hall of Boston, shall be considered as resident members and those beyond that limit as non-resident members."

On motion duly made and seconded it was VOTED "that Section 9, of the by-laws (Fees and Dues) be amended and that the dues of members be increased as listed above."

President Biggs stated that this was the final action on this matter and then turned the meeting back to Vice President Saul Namyet of ASCE. 90 members and guests attended the meeting and luncheon. Meeting adjourned at 2:00 P.M.

Respectfully submitted,

Charles O. Baird, Jr. Secretary

February 21, 1967 - A meeting of the Transportation Section was held in the society rooms, 47 Winter Street, Boston, Mass. In the absence of Chairman Cas. J. Kray, the meeting was called to order at 7:10 P.M. by Clerk, Robert J. Kiley.

The speaker, Mr. Howard Whitmore, Jr., Commissioner of the Metropolitan District Commission, was introduced by Mr. Kiley. Mr. Whitmore spoke on the subject "The Metropolitan District Commission's formation in Transportation", tracing the history of the MDC from its formation in the later 1800's to the present, concluding with a summation of their future undertakings in the highway field.

After an interesting discussion period, the members of the Executive Committee were asked to remain for a short meeting. The meeting was adjourned at 8:20 P.M. by Mr. Kiley, Attendance was approximately 30.

Respectfully submitted,

Robert J. Kiley, Clerk

March 14, 1967 - The 119th annual meeting of the Boston Society of Civil Engineers was held today at the M.I.T. Faculty Club, 50 Memorial Drive, Cambridge, Mass., and was called to order at 4:00 P.M., by President John M. Biggs.

President Biggs stated that the reading of the minutes of society meetings had been omitted during the year. The minutes of the January and February 1967 meetings will be published in a forthcoming issue of the Journal. The minutes of the May, October and November 1966 meetings to be declared approved as published.

It was VOTED "to approve the minutes as published".

The Secretary announced the names of applicants for membership, and that the following had been elected to membership March 13, 1967 -

Grade of Member - Joseph J. Allegro *, John T. Christian, Robert H. Homer.

Grade of Junior - John E. Kavanagh, 3rd, Dean K. White #.

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, Subsoils of Boston, Advertising, Joint Legislative Affairs, Professional Conduct, and Public Relations.

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

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

President Biggs stated that all foregoing reports would be published in the April, 1967 issue of the Journal.

The report of the Tellers of Election, Charles E. Fuller, and William H. Parker was presented and in accordance therewith the president declared the following had been elected officers for the ensuing year: -

President	Harry L. Kinsel
Vice-President	Robert H. Culver
Secretary	Charles O. Baird, Jr.
Treasurer	Paul A. Dunkerley
Directors	Llewellyn T. Schofield
	Charles Y. Hitchcock, Jr.
Nominating Committee	Lee M. G. Wolman
	Robert L. Meserve
	Robert L. Fuller

* Transfer from Junior
\# Transfer from Student

The retiring President John M. Biggs, then gave his address entitled, 'Can Engineering be Automated?'

Thirty four members and guests attended the business meeting. The meeting adjourned at 5:45 P.M., to re-assemble at 8:00 P.M. The social hour and annual dinner being held during the interim.

President Biggs called the meeting to order at 8:00 P.M. Following general remarks and the introduction of the newly elected President Harry L. Kinsel, and other guests at the head table, the various prize awards were made.

The secretary read the various prize awards and asked the recipients to come forward, and President Biggs presented the following awards: -

Award	Recipient	Paper
Ralph R. Horne Fund Award	Llewellyn T. Schofield	
Desmond FitzGerald Award	Donald R. F. Harleman	"Stratified Flow"
Clemens Herschel Award	Z. Getzler	"The Virtual Differential Settlement Method".
Sanitary Section Award	Clair N. Sawyer	"Engineering Aspects of Problems in the Aquatic Environment Related to Excessive Nutrients".
Structural Section Award	Robert J. Hansen	"High Speed Ground Transportation"
Hydraulics Section Award	Arthur T. Ippen	"Waves and Tides in Coastal Processes".
Desmond FitzGerald Scholarship	Bruce O. Tobiasson Alexander Hekimian	Northeastern University
William P. Morse Scholarship	Robert A. Hiney	Tufts University

President Biggs introduced the guest speaker of the evening, Dr. Ruth Terzaghi, Research Fellow, Harvard University, who gave a most interesting illustrated talk on "The Geologist as Detective".

At the conclusion of the talk President Biggs turned the meeting over to President elect Harry L. Kinsel. President Kinsel presented retiring President John M. Biggs with a certificate of appreciation for services rendered.

One hundred seventy six members and guests attended the meeting. The meeting adjourned at 9:45 P.M.

Respectfully submitted,

Charles O. Baird, Jr., Secretary

ANNUAL REPORTS

REPORT OF THE BOARD OF GOVERNMENT FOR YEAR 1966 - 1967

Boston, Mass , March 14, 1967

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 14, 1967.

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

Honorary	11
Members	1042
Associates	4
Juniors	47
Students	4
Total	1108

Student Chapters 2

Summary of Additions

New Members	44
New Juniors	13

Reinstatements

Members	1

Summary of Transfer

Juniors to Members	4
Students to Juniors	2

Summary of Loss of Members

Deaths	13
Resignations	14
Dropped for Non-payment of dues	15
Dropped for failure to transfer	6

Life Members 109

Members eligible this year for life membership 15

Applications pending on March 14, 1967 7

Honorary Membership is as follows:

Harry P. Burden, elected, February 1, 1965
Thomas R. Camp, elected, February 3, 1964
Arthur Casagrande, elected, February 1, 1965
E. Sherman Chase, elected, February 3, 1964
Gordon M. Fair, elected, February 3, 1964
Frank M. Gunby, elected, February 15, 1950
Ralph W. Horne, elected, February 1, 1965
Karl R. Kennison, elected, February 7, 1951
Frank A. Marston, elected, February 15, 1960
Howard M. Turner, elected, February 18, 1952
Frederic N. Weaver, elected, February 1, 1965

The following members have been lost through death:

Francis J. Crandell, Jan. 19, 1967
Frank A. Cundari, Sept. 1965
George H. Delano, Dec. 22, 1966
John J. Devine, Mar. 9, 1966
Louis I. Dexter, June 3, 1966
Richard W. Johnson, Mar. 22, 1966
Frank Marcucello, July 11, 1966
George L. Newman, Sept. 20, 1966
Clarence E. Pethybridge, May, 1955
George A. Sampson, Mar. 3, 1966
Harry M. Solomos,Feb. 6, 1966
Albert C. Titcomb, June 25, 1966
William C. Vose, Dec. 31, 1966

Meetings Of The Society

March 23, 1966	Address of retiring President Leslie J. Hooper. "A Backsight".
April 14, 1966	Joint meeting with BSCE Structural Section. Edward H. Barker, Sverdup & Parcel & Assoc., Inc., "What the Structural Engineer Should Know about Welding".
May 25, 1966	Joint meeting with BSCE Construction Section. Richard Halloran, "A Descriptive System for Estimating for Heavy and Other Construction".
October 19, 1966	Joint meeting with Mass. Section, American Society of Civil Engineers (Student Night). Steven A. Coons, M.I.T., "Computer Graphics".
November 16, 1966	Bruce Graham and E.A. Picardi, of Skidmore, Owings and Merrill. "Design and

	Construction of the John Hancock Center in Chicago".
January 25, 1967	Joint meeting with BSCE Hydraulics Section. Hans Gerber, Swiss Federal Institute of Technology, "European Experience with Thermodynamic Method".
February 15, 1967	Joint meeting with Mass. Section, American Society of Civil Engineers, Dr. Albert J. Kelley, Deputy Dir. Electronics Research Center, NASA. "The NASA Electronics Research Center".

Attendance At Meetings

Date	Place	Meeting	Dinner
March 23, 1966	Hotel Vendome	37	250
April 14, 1966	United Community Services Bldg.	50	27
May 11, 1966	New Architects Bldg.	110	105
May 25, 1966	Society Rooms		
October 19, 1966	M.I.T.	200	200
November 16, 1966	United Community Services Bldg.	75	37
January 25, 1967	United Community Services Bldg.	60	44
February 15, 1967	Red Coach Grill		

21 meetings were held by the Sections of the Society during the year. These meetings of the Sections offering opportunity for more detailed discussions continue to demonstrate their value to their members and to the Society. A wide variety of subjects were presented. The annual reports of the various sections will be presented at the annual meeting and will be published in the Journal of the Society.

Funds of the Society

Permanent Fund. The President Fund of the society has a present value of $78,391.36. The Board of Government authorized the use of as much as necessary of the current income of this fund in payment of current expenses. By vote of the society (as prescribed by the by-laws) at the November 16, 1966, and January 25, 1967 meetings, the Board of Government was authorized to transfer an amount not to exceed $7000 from the principal of the Permanent Fund for current expenditures. The amount necessary to transfer from the principal of the Permanent Fund for current expenditures was $7000.

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 hydraulic science or art; or a portion 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. This year a "John R. Freeman Memorial Lecture" was given by Prof. Hans Gerber on "European Experience with the Thermodynamic Method". The expenditure from this fund during the year was $955.27.

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 to use $100 of the income of this fund for the purchase of books for the library. The expenditure from this fund during the year was $70.37.

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 to use $100 of the income of this fund for the purchase of books for the library. The expenditure from this fund during the year was $100.00.

Tinkham Memorial Fund. The "Samuel E. Tinkham Fund" established in 1921 at Massachusetts Institute of Technology, by the society, "to assist some worthy student of high standing to continue his studies in Civil Engineering", had a value of $3,507.24 on June 30. 1966. John Roger Mumford, a student in Civil Engineering, class of 1967, was awarded this scholarship of $250 for the year 1966-1967.

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 expenditure for this fund during the year was $59.15.

Desmond Fitz Gerald Fund. The Desmond Fitz Gerald Fund established in 1910, a bequest of $2,000 from the late Desmond Fitz Gerald, 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 22, 1965, to appropriate from the income of this Fund the sum of $100 to be known as the "Boston Society of Civil Engineers' Scholarship in Memory of Desmond Fitz Gerald," and be given to a student in Civil Engineering at Northeastern University. A donation of $400 was received in 1966 from four recipients of this scholarship which has been added to this fund. It was voted on January 26, 1966, "to adopt the recommendation of the committee at Northeastern University, namely a $100 scholarship be given to Craig E. Barnes ". Presentation was made at the annual meeting of the society on March 23, 1966.

Edward W. Howe Fund. This fund, a bequest of $1,000, was received in 1933 from the late Edward W. Howe, past president of the society. No restrictions were placed on the use of this bequest, but the recommendations of the Board of GOvernment were "that the fund be kept intact, and that the income be used for the benefit of the society or its members". The Board voted on April 20, 1966 "that no appropriation be made from this fund this year". The Board voted February 21, 1967 to borrow $583.33 from income for current expenditures.

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 recommendations of the Board of Government were "that this 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 the sum of $100 to be known as the Boston Society of Civil Engineers' Scholarship in Memory of William P. Morse", and be given to a Civil Engineering student at Tufts University. It was voted on January 26, 1966, "to adopt the recommendation of the Committee at Tufts University, namely, a $100 scholarship be given to Lewis D. Edgers." Presentation was made at the annual meeting of the society on March 23, 1966.

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 recommendations of the Board of Government were "that this fund be kept intact and that the income be used for the benefit of the society or its members". The Board voted April 20, 1966 "that no appropriation be made from this fund this year ".

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 the BSCE only eligible for the award. The Board voted unanimously on January 25, 1967, "to approve the recommendation of the Ralph W. Horne Fund Award Committee, namely, "that Llewellyn T. Schofield be the third recipient to receive the Ralph W. Horne Fund Award". Presentation to be made at the annual meeting of the society on March 14, 1967.

Prizes

Award	Recipient	Paper
Desmond Fitz Gerald Medal	Donald R.F. Harleman	'Stratified Flow'
Clemens Herschel Award	Z. Getzler	'The Virtual Differential Settlement Method'.

Award	Recipient	Paper
Sanitary Section Award	Clair N. Sawyer	"Engineering Aspects of Problems in the Aquatic Environment Related to Excessive Nutrients".
Structural Section Award	Leo Casagrande	"Construction of Embankments Across Peaty Soils".
Transportation Section Award	Robert J. Hansen	"High Speed Ground Transportation".
Hydraulics Section Award	Arthur T. Ippen	"Waves and Tides in Coastal Processes".

Library

The report of the Library Committee contains a complete account of the Library Committee's activities during the past year.

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 14, 1967.

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.

John M. Biggs,
President

REPORT OF THE SECRETARY

Boston, Mass., March 14, 1967

To the Boston Society of Civil Engineers:

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 MARCH 14, 1967

OFFICE	EXPENDITURES	RECEIPTS
Secretary's Salary & Expense	$ 1,199.40	
Treasurer's Honorarium	749.63	
Stationary, Printing & Postage	930.64	
Incidentals & Petty Cash	127.03	
Insurance & Treasurer's Bond	107.00	
Quarters, Rent, Tel. & Lights	5,175.74	
Office Secretary	5,998.00	
Soil Mechanics	35.30	$ 537.50
Social Security	369.46	

	EXPENDITURES	RECEIPTS
MEETINGS		
Rent of Halls	120.00	
Hospitality Committee	1,742.10	1,269.91
Reporting & Projection	5.48	
Annual Meeting (March 1966)	1,501.75	1,170.00
SECTIONS		
Sanitary Section	11.50	
Structural Section	81.24	
Transportation Section	85.49	
Hydraulics Section	12.00	
Construction Section	--	
JOURNAL		
Editor's Salary & Expense	741.13	
Editor's Secretary	105.63	
Printing & Postage	9,987.56	
Advertisements		2,016.20
Sale of Journals		2,191.75
Reprints	544.24	806.72
Copyright	24.00	
News Letter	238.40	
LIBRARY		
Periodicals	70.50	
Binding	53.76	
MISCELLANEOUS		
Binding Journals for Members	4.25	4.25
Badges		15.00
Bank Charges	20.03	
Miscellaneous	442.79	103.54
Engineering Societies Dues and Charge for Journal Space	1,223.00	
Public Relations Committee	57.59	
Sales Tax	4.77	6.32
Dues from B.S.C.E. Members		12,015.00
Trans. Income Perm Fund		4,049.89
Trans. Prin.		7,000.00
Trans. Howe Fund		583.33
	$ 31,769.41	$31,769.41

Entrance Fees to Permanent Fund $535.00

44 New Members; 13 New Junior Members; Junior Members Trans. to Members 4; Student Members trans. to Junior 2.

The above receipts have been paid to the treasurer whose receipt the secretary holds. The secretary holds cash amounting to $30 included as payment under item 25 (Petty Cash) to be used as a fixed fund or cash on hand. $289.28 withholding tax and $147.95 Social Security, which is payable to Collector of Internal Revenue and State of Massachusetts in April, 1967, is not included in the above tabulation.

Respectfully submitted,

Charles O. Baird, Jr.
Secretary

REPORT OF THE TREASURER

March 14, 1967

This report is for the fiscal year which began March 1, 1966 and concluded at the end of the business day on March 1, 1967.

The Boston Safe Deposit and Trust Company, 100 Franklin Street, Boston, continues to hold the investment securities and to serve as custodian and financial advisor. In accordance with the terms of the agreement, the custodian has furnished the treasurer of the Boston Society of Civil Engineers with a certified audit of the Income and Principal accounts. This audit from the bank, the receipts from the secretary, the bills paid by the treasurer, the savings bank pass book, and the check book have all been reviewed by the Auditing Committee of the society and the information contained in the tables of this report have been verified.

Twice each year the Investment Division of the Boston Safe Deposit and Trust Company reviews the portfolio of securities. After each review the custodian usually recommends changes in the account. Because of the conditions of the market, no changes were recommended this year.

Some minor changes in the securities were made during this fiscal year as follows:

International Business Machine Corp.
- Received in stock split 4 shares
- Received in stock split 1/2 share
- Bought 1/2 share
- Received in consolidation 1 share
- Received 14 rights
- Bought 26 rights
- Subscribed to 1 share using rights

National Dairy Products Corp.
- Received in stock split 100 shares

Jewel Tea-Co.
- Name changed to Jewel Companies Inc.

Monsanto Co.
- Received in stock dividend 2 shares
- Received in stock dividend 10/100 shares
- Bought 90/100 shares
- Received in consolidation 1 share

At the beginning of the fiscal year this account had $460.02 on hand. During the year $558.42 was expended on these transactions. Because of this the Principal Account is overdrawn by $98.40.

Cash on hand in the Income Account at the beginning of the fiscal year was $1,507.21. Interest and dividends received into the account were

$8494.89. The Board of Government authorized the transfer of $8,000.00 from this account to the checking account, and $927.64 was withdrawn from the account by the custodian for service charges leaving $1,074.46 at the close of the year.

The financial standing of the society as of March 1, 1967, is summarized in the seven tables which accompany this report. These tables are as follows:

TABLE I	DISTRIBUTION OF FUNDS
TABLE II	DISTRIBUTION OF FUNDS - RECEIPTS AND EXPENDITURES
TABLE III	RECORD OF INVESTMENTS - BONDS
TABLE IV	RECORD OF INVESTMENTS - STOCKS
TABLE V	RECORD OF INVESTMENTS - SAVINGS BANK
TABLE VI	COMPARISON OF BOOK AND MARKET VALUE OF INVESTMENTS
TABLE VII	COMPARISON OF BOOK AND MARKET VALUES OF FUNDS

In order to have sufficient cash in the checking account to pay the bills associated with the annual meeting, the sum of $1,000.00 was withdrawn from the savings bank on February 9, 1967, and deposited in the checking account. The resulting balance in the checking account at the close of the 1966 fiscal year was $2,374.66.

Receipts from the secretary including membership dues, advertisements in the Journal, the sale of Journals and some Soil Mechanics Volumes, and from miscellaneous other sources amounted to $20,136.19 and was credited to the Current Fund to be used to defray current expenditures. The Secretary also received $535.00 in entrance fees which was credited to the Permanent Fund.

The attention of the membership is directed to an error which occurred in Table IV of the Treasurer's Report as printed in the April, 1966 Journal. The numbers corresponding to the Dividends Received, Book Value, March 1, 1966, and the Market Value, March 1, 1966 were transposed for the common stocks International Business Machine Corporation and Pacific Gas and Electric Co.

CURRENT FUND

A total of $31,769.41 was expended from the Current Fund to meet current expenses. This is an increase of $5,814.14 over last years expenditures. More detailed information concerning these expenditures is given the Report of the Secretary. Because of the increasing costs, the society voted at the January and February meetings to adjust the dues.

PERMANENT FUND

The income from interest and dividends which was credited to the Permanent Fund was $4,534.95. That portion of the custodian charges which was attributable to the Permanent Fund came to $485.06. The remainder of the income ($4,049.89) was transferred by the Board of Government to the Current Fund to meet current expenses. At the November, 1966 and January

1967 meetings of the Society it was voted to transfer a sum not to exceed $7,000.00 from the principal of the Permanent Fund to the Current Fund to meet current expenses. It was necessary to transfer the entire amount authorized by these votes. See Table II of this Report.

EDWARD W. HOWE FUND

In January of 1967 it became apparent that the sums of money available for transfer from the Permanent Fund would be inadequate to meet the current expenses. The Board of Government voted on January 25, 1967 to borrow from the Edward W. Howe Fund a sum not to exceed $1,000.00 to be transferred to the Current Fund. It became necessary to transfer $583.33 from this fund to the current fund. This sum is to be replaced from income to the Current Fund as soon as possible.

SOIL MECHANICS FUND

Volumes I, II, and III of the Soil Mechanics series still enjoy a high demand. On January 25, 1967 the Board of Government voted to close the existing fund and to transfer the $6,020.10 remaining in the account to the Permanent Fund. Future receipts from the sale of the remaining volumes are to be credited to the Current Fund.

JOHN R. FREEMAN FUND

The Freeman Fund Committee continues to expend from this fund for outstanding lecturers in the fields of fluid mechanics and hydraulics. $535.37 was sent to Dr. Hunter Rouse to cover his expenses as the first Freeman Lecturer. Dr. Hans Gerber was the second Freeman Lecturer. The honorarium and incidental expenses of this lecture required the expenditure of $420.00 during this fiscal year.

EDMUND K. TURNER FUND

The sum of $70.37 was extended from the income to the Edmund K. Turner Fund for new library books.

DESMOND FITZGERALD FUND

A scholarship in the amount of $100.00 was awarded to Mr. Craig E. Barnes of Northeastern University from the income to the Desmond Fitzgerald Fund. An additional $3.00 was expended for a medal. Alumni of Northeastern University, former recipients of this award, contributed $400.00 to be added to the principal of this fund.

ALEXIS H. FRENCH FUND

The income to the Alexis H. French Fund was used to purchase new books for the library, and $100.00 was expended.

WILLIAM P. MORSE FUND

The sum of $100.00 was expended as a scholarship to Mr. Lewis Edgers of Tufts University from the income to the William P. Morse Fund.

RALPH W. HORNE FUND

The sum of $121.78 has been expended from the income to the Ralph W. Horne Fund to purchase a certificate which is to be presented to the recipient of this award at this annual Meeting.

STRUCTURAL LECTURES FUND

The remaining expenditures and transferral of funds associated with the series of Soil Mechanics Lectures given during the winter of 1965 and 1966 was completed during this fiscal year. The sum of $625.86 was paid out from this fund as the remainder of the expenses for this lecture series. $285.00 was transferred from this fund to the Current Fund. This amount corresponds to dues paid by persons who attended the lecture series and became members of the society.

BORING DATA FUND

The sale of Boring Data books has increased this fund by $49.50 during this fiscal year.

SANITARY LECTURES FUND

The sale of Sanitary Lectures volumes has provided an income of $29.75 to this fund.

JOURNAL OF THE BOSTON SOCIETY OF CIVIL ENGINEERS

Expenditures to publish the Journal are made from the Current Fund. The January, April, July, and October, 1966 issues of the Journal were published during the fiscal year. A summary of the figures associated with the publication are as follows:

Printing, Postage, and Copyright	$10,555.80
Receipts from Advertisements	2,016.20
Sale of Reprints	806.72
Net Expenditure	7,732.88

The typesetting and printing costs alone for the January, April, and July issues totaled $7369.16. When the printing bill for the April issue was received, the editor initiated an extensive study to find less expensive ways for continuing the publication. He reported his findings and made recommendations to the Board of Government. The Board voted to abandon the letterpress method of publishing the Journal and to employ offset methods. The New England Lithograph Company was selected and engaged to print the October, 1966 issue. In addition, the editor has increased the advertising income substantially by direct solicitation of potential advertisers.

TAXES AND SOCIAL SECURITY

Of the cash on hand as indicated in the following tables, $437.23 is held in escrow for Federal and Massachusetts withholding taxes and for social security payments. In addition, $1.55 in sales tax collections is being held for payment to Massachusetts Bureau of Corporations and Taxation.

KARL R. KENNISON FUND

On March 8, 1967 Mr. Richard. Claybourne reported to the Treasurer the status of the irrevocable trust established in behalf of the society by Mr. Karl R. Kennison. As of February 28, 1967, the two trusts involving shares in the Massachusetts Hospital Life Insurance Company were as follows:

Trust #4315	356.650 Shares	$4,426.03
Trust #4444	397.375 Shares	4,931.42
Total	754.025 Shares	$9,357.45

Paul A. Dunkerley
Treasurer

TABLE I

Distribution Of Funds

	Book Value	Interest and Dividends		Net Profit or Loss at sale or maturity		Transfer of Funds		Book Value
	Mar. 1, 1966	Cash	Credit			Purchased	Sold	Mar. 1, 1967
	1	2	3	4(+)	5(-)	6(+)	7(-)	8
Bonds	$ 75,197.22	$2,945.00						$ 75,197.22
Stocks	71,217.17	5,549.89				$558.42		71,775.59
Savings Bank	3,370.98		$153.39				$1,000.00	2,524.37
Available for Investment	3,218.00						1,367.28	1,850.72
Totals	$153,003.37	$8,494.89	$153.39			$558.42	$2,367.28	$151,347.90

Columns 1 +3 + 6 - 7 = 8

TABLE II

Distribution Of Funds - Receipts And Expenditures

Funds	Book Value Mar. 1, 1966	Allocation of Income — Profit and Loss: Income Col. 2+3	Allocation of Income — Profit and Loss: Net Profit Col. 4+5	Received	Expended	Book Value Mar. 1, 1967
Permanent	$ 78,836.26	$ 4,534.95		$ 6,555.10	$11,534.95	$ 78,391.36
John R. Freeman	49,634.26	2,794.55			1,256.39	51,162.42
Edmund K. Turner	1,997.50	112.19			82.50	2,007.19
Desmond FitzGerald	3,939.12	227.74		400.00	127.45	4,439.41
Alexis H. French	1,986.69	112.63			112.18	1,987.14
Clemens Herschel	1,563.99	85.40			84.04	1,565.35
Edward W. Howe	2,132.45	121.23			596.41	1,657.27
William P. Morse	4,113.70	229.10			124.61	4,217.19
Frank B. Walker	1,740.89	98.99			10.67	1,829.21
Ralph W. Horne	3,393.71	192.93			142.60	3,444.04
Transportation Lectures	445.98	25.36			2.73	468.61
Structural Lectures	2,640.88	113.21			906.76	1,847.33
Boring Data	350.50			49.50		400.00
Soil Mechanics	2,356.81			3,874.53	6,231.34	0.00
Sanitary Lectures	-2,098.37			29.75		-2,068.62
Subtotal	$153,003.37	$ 8,648.28		$10,908.88	$21,212.63	$151,347.90
Current	1,500.00	4,049.89		27,719.52	31,769.41	1,500.00
Totals	$154,503.37	$12,698.17		$38,628.40	$52,928.04	$152,847.90

Secretary's change fund of $30.00 should be added to show total cash.

Cash Balance	Investment Fund.	$ 1850.72
	Current Fund	1500.00
	Total	$ 3350.72

Transferred from Income to Permanent Fund	$ 4,049.89
Transferred from Principal of Permanent Fund	7,000.00
Total transferred from Permanent Fund	$11,049.89
Transferred from the Edward W. Howe Fund	583.33
Total transferred to Current Fund	$11,633.22

TABLE III

Record Of Investments - Bonds
March 1, 1966 to March 1, 1967

Bonds	Date of Maturity	Interest Rate	Interest Received	Par Value	Book Value Mar. 1, 1967	Market Value Mar. 1, 1967
Aluminum Company of America	Apr. 1, 1983	3-7/8	$193.75	$ 5,000.00	$ 5,037.50	$ 4,287.50
Associates Investment Co., Deb.	Aug. 1, 1979	5-1/8	307.50	6,000.00	6,000.00	5,580.00
Columbia Gas Systems Inc., Deb., Series D	July 1, 1979	3-1/2	70.00	2,000.00	2,066.17	1,625.00
Consumers Power Co., 1st Mortgage	Sept. 1, 1975	2-7/8	86.25	3,000.00	3,140.35	2,460.00
Flintkote Co.	Apr. 1, 1981	4-5/8	462.50	10,000.00	10,450.00	9,100.00
Florida Power Co., 1st Mortgage	July 1, 1984	3-1/8	31.25	1,000.00	1,017.50	777.50
Florida Power Co., 1st Mortgage	July 1, 1986	3-7/8	193.75	5,000.00	5,037.59	4,275.00
General Motors Acceptance Corp.	Sept. 1, 1975	3-5/8	181.25	5,000.00	5,101.80	4,256.25
Georgia Power Co., 1st Mortgage	Dec. 1, 1977	3-3/8	168.75	5,000.00	5,162.50	4,150.00
Marine Midland Corp., Deb.	July 1, 1989	4-1/2	225.00	5,000.00	5,000.00	4,450.00
Province of Ontario	Sept. 1, 1972	3-1/4	97.50	3,000.00	2,936.25	2,670.00
Public Service Electric and Gas Co.	Jun. 1, 1979	2-7/8	115.00	4,000.00	4,097.50	3,120.00
So. Pacific, 1st Series A, Oregon Lines	Mar. 1, 1977	4-1/2	180.00	4,000.00	4,191.30	3,680.00
Superior Oil Co., Deb.	July 1, 1981	3-3/4	150.00	4,000.00	4,000.00	3,405.00
Tidewater Oil Co., Deb.	Apr. 1, 1986	3-1/2	70.00	2,000.00	2,032.50	1,580.00
U.S.A. Treasury Bonds	Aug. 15, 1973	4	200.00	5,000.00	4,928.13	4,793.75
U.S.A. Treasury Bonds	May 15, 1974	4-1/4	212.50	5,000.00	4,998.13	4,850.00
Totals			$2,945.00	$74,000.00	$75,197.22	$65,060.00

TABLE IV

Record Of Investments - Stocks
March 1, 1966 to March 1, 1967

Stocks	Classification	Number of Shares	Dividend Received	Book Value Mar. 1, 1967	Market Value Mar. 1, 1967
American Telephone & Telegraph Co.	Common	250	$550.00	$4,505.87	$14,500.00
Commercial Credit Co.	Common	240	432.00	9,963.21	6,510.00
General Electric Co.	Common	150	390.00	2,341.47	12,937.50
General Motors Corp.	Common	126	573.30	5,576.32	9,119.25
Hartford Fire Insurance Co.	Common	107	171.20	1,534.39	7,623.75
Illinois Power Co.	Common	200	320.00	9,686.00	7,700.00
International Business Machine Corp.	Common	15	61.35	5,020.12	6,450.00
Jewel Companies Inc.	Common	187	224.40	4,976.81	5,843.75
Monsanto Co.	Common	108	168.00	7,296.33	4,684.50
National Dairy Products Corp.	Common	200	280.00	1,154.74	6,800.00
New England Electric System	Common	208	270.40	3,332.89	5,434.00
Scott Paper Co.	Common	263	263.00	5,944.04	7,298.25
Southern California Edison	Common	177	221.24	1,932.99	6,925.13
Standard Oil of New Jersey	Common	200	660.00	2,012.76	12,100.00
Texaco Inc.	Common	236	590.00	1,515.72	17,788.50
Pacific Gas and Electric Co.	Preferred	100	150.00	2,704.89	2,712.50
Southern California Edison Co. Ltd.	Preferred	120	150.00	1,140.24	4,162.56
Southern Railway Co.	Preferred	75	75.00	1,136.80	1,284.38
Totals			$5,549.89	$71,775.59	$139,874.07

TABLE V

Record Of Investments - Savings Bank

March 1, 1966 to March 1, 1967

Bank	Savings Account Number	Interest Received	Book Value Mar. 1, 1967	Market Value Mar. 1, 1967
First Federal Savings and Loan Association of Boston	1S-631	$153.39	$2,524.37	$2,524.37

NOTE: On February 9, 1967 the sum of $1000.00 was withdrawn from this account and transferred to the checking account.

TABLE VI

Comparison Of Book And Market Values Of Investments

	Book Value March 1, 1967	Market Value March 1, 1967
Bonds	$75,197.22	$ 65,060.00
Stocks	71,775.59	139,874.07
Savings Bank	2,524.37	2,524.37
Available for Investment	1,850.72	1,850.72
Total March 1, 1967	$151,347.90	$209,309.16
Total March 1, 1966	153,003.37	231,577.20
Increase or Decrease	-$ 1,655.47	-$ 22,268.04

TABLE VII

Comparison Of Book And Market Values Of Funds

	Book Value March 1, 1967	Market Value March 1, 1967
Permanent	$ 78,391.36	$108,085.29
John R. Freeman	51,162.42	70,542.28
Edmund K. Turner	2,007.19	2,767.50
Desmond FitzGerald	4,439.41	6,121.02
Alexis H. French	1,987.14	2,739.85
Clemens Herschel	1,565.35	2,158.29
Edward W. Howe	1,657.27	2,285.03
William P. Morse	4,217.19	5,814.62
Frank B. Walker	1,829.21	2,522.10
Ralph W. Horne	3,444.04	4,748.61
Transportation Lectures	468.61	646.11
Structural Lectures	1,847.33	2,547.08
Boring Data	400.00	400.00
Sanitary Lectures	-2,068.62	-2,068.62
Subtotal	$151,347.90	$209,309.16
Current	1,500.00	1,500.00
Totals	$152,847.90	$210,809.16

REPORT OF THE AUDITING COMMITTEE

Boston, Mass., March 14, 1967

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 have found them to be in order and to account accurately for the Society's Funds.

Respectfully submitted,

Myle J. Holley, Jr.

Frank J. Heger

REPORT OF THE EDITOR

March 14, 1967

To the Board of Government
Boston Society of Civil Engineers

The Journal was issued quarterly, for the months of April, July, and October, 1966, and January, 1967, the latter being in press as of this date, as authorized by the Board of Government on December 20, 1936.

During the year 16 articles were published, plus an index. Included in the papers were three from the John R. Freeman Hydraulics Lecture Series, ten presented at regular meetings of the society or its sections and three contributions to the Journal.

Cost of the Journal for the fiscal year:

Expenditures

Heffernan Press	$ 7,369.16
Folsom Engravers	1,384.44
New England Lithograph Co.	1,054.14
Copyright	24.00
Reprints	544.24
Postage	179.82
Editor's salary	741.13
Editor's secretary	105.63
	$11,402.56

Receipts

From sale of the journal	$2,191.75
From sale of reprints	806.72
From advertising	2,016.20
	$5,014.67
Net expense of publication of Journal ...	$6,387.89

The figures cited above include the cost of the January, 1966, issue, but not the January, 1967, issue.

During the year a revised "Guide to Authors" was approved to facilitate the preparation of manuscripts for publication. Also approved by the Board was a manuscript review procedure which includes closer communication with the authors and incorporates the opinions of three independent reviewers for each article. The reviewing process is handled through the section chairmen and has thus far functioned very well.

With the aid of a part-time secretary to the editor, a comprehensive program of soliciting additional professional cards and increased advertising by contacting consulting firms and manufacturers throughout the country was initiated. As a result, income from advertising and the sale of reprints increased 76.9% over the previous year and additional advertising contracts are still being received.

In order to decrease publication costs and add flexibility to processing requests for reprints, a survey was run which resulted in the selection of a new publisher and a change from the traditional letterpress composition to a photographic offset process beginning with the October, 1966, issue. Additional savings are anticipated through a revision of the type size and the new 5-1/2" x 8-1/2" page format beginning with the January, 1967, issue.

In view of the fact that the journal is now distributed in more than 33 foreign countries, it can no longer be considered a publication of limited geographical interest. Consequently, with the approval of the Board of Government, the editorial staff is preparing to contact noted authors and leading investigators not only in this country but throughout the world to solicit articles of interest and quality for publication. The aid of the members of the society in suggesting names for inclusion on such a contact list will be greatly appreciated, as well as information concerning articles of quality in preparation in any applicable phase of the civil engineering profession.

Respectfully submitted,

Ronald E. Bucknam
Editor

REPORT OF THE PUBLICATIONS COMMITTEE

March 14, 1967

To the Board of Government
Boston Society of Civil Engineers

This report covers the period from the annual meeting in March 1966 to the current annual meeting in 1967. It was compiled from reports by the chairmen of the five section committees: construction, hydraulics, sanitary, structural, and transportation.

25 papers were delivered at meetings, included meetings held jointly with the main body of the society or with other groups.

20 papers of the 25 were of general interest, and the other 5 were specifically regarding a single project reported by the respective author.

17 papers were requested from speakers.

16 speakers promised to send in their papers.

7 papers have been received, and 2 more will probably be received.

3 papers have been approved for publication, and four are being reviewed.

2 papers have been received from authors other than speakers who delivered their papers at meetings, and the papers are being currently reviewed.

16 papers were published.

It is again observed, as in the preceding year, that more papers were published than were received, and again it is due to the backlog of papers available from preceding years.

Respectfully submitted,

Simon Kirshen
Chairman

REPORT OF THE ADVERTISING COMMITTEE

March 14, 1967

To the Boston Society of Civil Engineers

The Advertising Committee has held one meeting and presents the following information and recommendations for increasing advertising revenue from the Journal.

Circulation	Approximate Circulation	Approximate % of Total
Total	1500	100
U.S.A.	1300	85
New England	1000	70
Massachusetts	900	60

Present Advertisers

There were 14 regular advertisers in addition to the list of Professional services during 1966-1967. The revenue from advertising for the year closing was $2016.20.

Conclusion

It is the committee's opinion that the number of advertisers can be increased substantially by contacting prospective advertisers, pointing out that engineers have control of product selection by contractors.

RECOMMENDATIONS:

1. Develop a list of prospective advertisers from various trade journals and magazines.
2. Develop a list of projects being constructed under the direction of member engineers.
3. Prepare a quality booklet or brochure depicting and listing projects under control of member engineers which will be reached by the Journal.
4. Send with covering letter on society stationery to the President, Vice-President in charge of Marketing, etc., of the various prospective advertisers.
5. Continue the advertising committee and appropriate $2,000 for carrying out the above recommendations. This amount is about equal to one year's revenue from advertising, but it is the committee's opinion that increased future advertising will more than compensate the society for this expenditure.

Richard F. Dutting,
Chairman

REPORT OF THE LIBRARY COMMITTEE

March 14, 1967

To the Boston Society of Civil Engineers:

A meeting of the Library Committee was held in the society rooms on November 15, 1966, to select and prepare a list of books to be purchased for this fiscal year.

The Committee reports the following list of books have been purchased at a cost of $170.37.

Economics of Regional Water Quality Management. A.L. Kneese, 1964
Ecology of Waste Water Treatment, H.A. Hawkes, 1963
Water Supply and Pollution Control. Clarke & Viessman, 1965
Ecology and the Industrial Society, Goodman, Edwards & Lambert, 1966
Economics of Air Pollution. H. Wolozin, 1966
Introduction to Oil Field Water Technology, A.G. Ostroff, 1965
Field Geology, F.H. Lahee, 1965
Introduction to Matrix Methods of Structural Analysts. H.C. Martin, 1965
Wind Effects on Buildings and Structures. British Inf. Serv. 1965
Deterioration, Maintenance and Repair of Structures. S.M. Johnson
Handbook of Rigging. W.E. Rossvagel
Formwork for Concrete Structures. R.L. Peurifoy
Practical Tables for Building Construction. N. Foster
Dam Geology. R.C.S. Walters
River Engineering and Water Conservation Works. R.B. Thorn
The Urban Transportation Problem, Harvard Univ. Press.

The following books were donated to the Library:

Handbook of Concrete Culvert Pipe Hydraulics, R.J. Van Epps
Model Analysis of Plane Structures. Pergamon Press
Fire Protection Through Modern Building Codes. Amer. Iron and Steel Inst.
Light Gage Cold-Formed Steel Design, Manal. Amer. Iron and Steel Inst.
Symposium on Fire Resistance of Concrete. Amer. Concrete Inst.
Guide to Design Criteria For Metal Compression Members. Column Research Council
Matrix Computer Analysis of Structures. Prentice-Hall Inc.

Joseph Capone, Jr.
Chairman

REPORT OF THE HOSPITALITY COMMITTEE

February 27, 1967

To the Boston Society of Civil Engineers:

The Hospitality Committee submits the following report for the year 1966-67.

A total of eight meetings of the society were held during the past year. Included in this total were the annual dinner, a student night meeting, joint meeting with the Fire Prevention Engineers and the American Society of Civil Engineers, and five regular meetings of the society.

Catered dinners were served prior to five of the eight meetings.

The average attendance of members and guests for all eight meetings or dinners (using the larger attendance figure) was 116, as compared to last year's average of 134.

Attendance at regular meetings of the society during the past year was 116 persons per meeting. This represents a 23 per cent increase in attendance over last year.

SUMMARY OF MEETINGS

Date	Place	Meeting	Dinner
March 23, 1966	Hotel Vendome	250	250
April 14, 1966	United Community Services Building	50	27
May 11, 1966	New Arcitects Building	110	105
May 25, 1966	Society Rooms	89	-
October 19, 1966	M.I.T.	200	200
November 16, 1966	United Community Services Building	75	37
January 25, 1967	United Community Services Building	60	44
February 15, 1967	Red Coach Grill	90	90

Respectfully Submitted,

William H. Parker III,
Chairman

REPORT OF COMMITTEE ON SUBSOILS OF BOSTON

March 14. 1967

To the Boston Society of Civil Engineers:

The Committee held two meetings, on October 26, 1966, and on February 1, 1967. It is actively planning to publish the boring logs that have become available since the publication of Boring Data From Greater Boston in 1961. These boring logs will be a necessary supplement to the subsurface geologic maps now being prepared by the Boston office of the U.S. Geological Survey. Sometime soon the Committee will submit to the Board of Government a formal report outlining the scope and budget for this project and requesting formal approval to proceed with the execution of the work.

Respectfully submitted,

H. P. Aldrich, Jr.
F. E. Brown
D. T. Goldberg
D. Linehan
R. C. Hirschfeld, Chairman

REPORT OF THE COMMITTEE ON PROFESSIONAL CONDUCT

March 14. 1967

To the Boston Society of Civil Engineers

The Joint Committee on Professional Conduct has met five times during the year which has passed since the 1966 annual meeting of the BSCE. Your representatives have been John H. Hesion, William L. Hyland and E. Sherman Chase. The latter succeeded Emory Ireland as chairman.

As in previous years the meetings have taken on problems with respect to advertising practices, political contributions and the indictments of two members of one of the societies represented on the committee. Resolution of these problems was not reached.

The most progressive step made by the committee was a rapprochment with State Representative Michael S. Dukakis who has offered to work with the committee in formulating methods which will assure the selection on merit of engineering consultants by state agencies. The purpose of such methods would be to eliminate the role of political contributions in the selection of consultants for state work.

Respectfully submitted,

E. Sherman Chase, Chairman

REPORT OF JOINT LEGISLATIVE COMMITTEE

Boston , Mass., March 13, 1967

To the Boston Society of Civil Engineers:

The following legislative acts of interest to engineers were enacted during the 1966 session of the Massachusetts General Court:

Bill No.	Subject	Chapter No.
S176	An act directing the Department of Public Works that advance planning for highway construction shall provide for the protection of water resources, fish and wildlife and recreational values.	470
S543	An act providing graduation from a service academy shall be considered as graduation from an engineering school for the purpose of registration of professional engineers.	76
S800	An act requiring certain officials not to accept or approve certain plans and specifications for the construction, reconstruction, enlargement or alteration of buildings or structures unless they bear the seal of a registered architect or a registered professional engineer.	238
H4055	An act establishing a Water Pollution Control Division in the Department of Natural Resources.	685
H4050	An act providing for an elective deduction and exemption for industrial waste treatment facilities under the business and manufacturing corporation excise.	701

A review of bills filed for the 1967 session shows the following items of interest:

Bill No.	Subject	Chapter No.
H3105	Petition of John O. O'Brien that persons passing a grade three civil service examination for civil engineer shall be qualified as a land surveyor.	Discharged to State Administration

Bill No.	Subject	Report
H750	Petition of James P. Hunnell that Provisions be made for state financial assistance to local or regional incinerator projects and for permitting application for federal funds.	No final action
H415	Petition of Joseph E. Bnett relative to the reimbursement by the Commonwealth of fifty per cent of the actual cost incurred by a city, town, or regional incinerator district for the construction of an incinerator.	To House Ways & Means Feb. 13
H829	Petition of David C. Ahearn that the Director of the Water Pollution Control Division be authorized ro require the immediate construction of water pollution abatement facilities.	No final action
H1721	Petition of Michael S. Dukakis that provisions be made for the protection of the public health in respect to the construction of nuclear facilities.	To House Ways & Means on Feb. 21
H2074	Petition of Francis W. Hatch, Jr., John W. Sears and Michael S. Dukakis for legislation to provide that no works or system for the disposal of refuse shall be established unless the plans or designs therefor have been approved by the department of Public Health.	Next Annual Session on Feb. 13
H2259	Petition of John F. Flaherty relative to the approval of places for the deposit of the residue from municipal refuse disposal incinerators.	House Bill 2259 on Feb. 13
H2446	Petition of Francis W. Hatch, Jr., and other members of the House and another for legislation to provide financial assistance by the Commonwealth to regional solid waste disposal districts.	No final action
S2447	Petition of Francis W. Hatch, Jr., and other members of the House and another for legislation to authorize the formation of regional solid wastes disposal districts.	No final action

Bill No.	Subject	Report
S2448	Petition of Francis W. Hatch, Jr., and other members of the House and another that the Department of Public Works be authorized to operate facilities for the sanitary disposal of solid wastes.	No final action
S763	Petition of the Mass. Municipal Engineers Assoc. by Frank S. Lagrotteria, for legislation to provide that persons in charge of certain work for cities and towns shall be registered professional engineers or registered land surveyors.	No final action
H2661	Petition of the Consulting Engineers Council of New England, Inc., that provisions be made for methods of payment on public consulting services performed by architects and engineers.	No final action
S184	Petition of Elliot L. Richardson and Oliver T. Ames for legislation to extend to authorities the application of law pertaining to rules and regulations governing the employment of consultants.	H. Resolve 4361 to Joint Rules on Feb. 8
S186	Petition of Morton B. Brown for legislation to establish a board of registration of professional community planners.	No final action
S824	Petition of James A. Kelly, Jr., for legislation to amend the statutes regulating competitive bidding in the award of contracts for public building projects.	H. Resolve 4361 to Joint Rules
H452	Petition of Francis W. Hatch, Jr., and John R. Buckley and other members of the House for legislation to extend to public authorities the application of certain laws pertaining to statements required from consultants.	To House Ways & Means on March 2
H1129	Petition of Charles W. Terenzio and Herbert S. Nollis for legislation to provide an executive secretary for the Board of Registration of Professional Engineers and of Land Surveyors.	No final action

Bill No.	Subject	Report
H1131	Petition of John P. O'Brien for an investigation by a special commission (Including members of the General Court) relative to certain practices of the Board of Registration of Professional Engineers and of Land Surveyors in the granting of certificates.	H. Resolve 1131 to Joint Rules on Feb. 6
H2117	Petition of Fred C. McClean and David N. Vigneault for legislation to require prompt decisions by the awarding authority, architect or engineer in public works contracts.	H. Resolve 4361 to Joint Rules on Feb. 8
H4005	Petition of James L. Frimaldi for regulating the appointment of architects and engineers by the designer selection board.	See H. Resolve 4361 to Joint rules on Feb. 8
Hi766	Petition of John F. Dolan for legislation to authorize a comprehensive ten-year program of water resources planning.	H. Bill 1766 to House Ways & Means on Jan. 24
H2328	Petition of Jerome A. Segal for establishing a certification board of personnel of water works and waste water disposal facilities.	H. Bill 2328 to House Ways & Means on Jan. 24
H3881	Petition of Walter T. Kostanski for legislation providing state aid to cities and towns for the purpose of increasing water supplies.	H. Bill 1766 to House Ways & Means on Jan. 24
H4351	Order that a special committee be established to make an investigation and study of air pollution of the atmosphere and environment of any part of the Commonwealth from any source.	Ought to be adopted H. Feb. 1

(N.B. All House and Senate bills pertaining to Air Pollution are being sent to this Committee for its study and recommendation).

Respectfully submitted,

CharlesA . Parthum
Ralph M. Soule
James L. Dallas, Chairman

REPORT OF THE JOHN R. FREEMAN FUND COMMITTEE

March 14, 1967

To the Boston Society of Civil Engineers:

During the past year the First John R. Freeman Memorial Lecture given by Dr. Hunter Rouse has been published in the Journal. The second John R. Freeman Memorial Lecture was given January 25th by Professor Hans Gerber of the Federal Institute of Technology in Zurich. His subject was "European Experience with the Thermodynamic Method."

The Freeman Fund Committee has voted to underwrite the publication of this lecture in the Journal and further to provide for extended distribution to libraries and interested workers in the field.

It is presently planned to have a third lecture next year and also to offer a research fellowship in the spring of 1968.

Respectfully submitted,

Thomas Camp
George R. Rich
Lee Wolman
Clyde W. Hubbard
Leslie J. Hooper, Chairman

REPORT OF THE RALPH W. HORNE FUND COMMITTEE

Boston, Mass., March 14, 1967

To the Boston Society of Civil Engineers:

This is the first 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.

The grantor was motivated by the conviction that engineers giving freely of their time in unpaid public service made a unique contribution toward improving the public image of the engineering profession, and that recognition should be given individuals who are outstanding in such service.

The Board of Government has established the basis for making an annual award as follows:

The award, an appropriate certificate, shall be made to the nominee designated by the Board 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 BSCE only are eligible for the award.

In 1965 the award was presented to Charles O. Baird, Jr. In 1966 the award was made to Miles N. Clair.

George G. Bogren
Ernest A. Herzog
William L. Hyland, Chairman

REPORT OF THE EXECUTIVE COMMITTEES OF THE STRUCTURAL SECTION

February 20, 1967

To the Boston Society of Civil Engineers:

The following meetings were held during the past year:

March 9, 1966 - Mr. Albert B. Rich, Sr. Assoc. Structural Engineer of Metcalf and Eddy, spoke on "Behavior of Buildings in Anchorage, Alaska during 1964 Earthquake," The attendance was 28.

April 14, 1966 - Mr. Edward H. Barker of Syerdrup Parcel and Association spoke on "Techniques of Construction of Chesapeake Bay Bridge and Tunnel Crossing." This was a joint meeting with the main society. The attendance was 46.

May 11, 1966 - Mr. Omar Blodgett, Consulting Engineer of Lincoln Electric Co., spoke on "What the Structural Engineer should know about Welding". This was a joint meeting with the main society and the Massachusetts Section of the American Society of Civil Engineers. The attendance was 126.

October 13, 1966 - Mr Paul S. Crandall of Crandall Dry Dock Engineers spoke on "Timber Design in Water Front Construction." The attendance was 25.

November 7, 1966 - Mr. William A. Henderson, Vice President Universal Engineers, spoke on "History and Development of Bridges". The attendance was 21.

December 14, 1966 - Mr. Mace Bell, Coordinator of Research and Development of American Institute of Steel Construction, spoke on "Structural Connections - Their Design and Economics". The attendance was 46.

January 11, 1967 - Mr. Philip Maslow of Grace Construction Materials spoke on "The use of Epoxy Resins in Concrete". This was a joint meeting with the Construction Section. The attendance was 48.

February 8, 1967 - Dr. Victor F. B. deMello, Visiting Professor of Civil Engineering at M.I.T. and Director of Geotecnica S.A. of Brazil, spoke on "Experiences with Foundations for high Buildings in Brazil." At this annual meeting of the Structural Section the following officers were elected for the forthcoming year; Chairman Charles C. Ladd; Vice Chairman, Fritz F. Hampe; Clerk Albert B. Rich; Executive Committee, Richard C. Jasper, Floyd E. Brown, Howard Simpson. The attendance was 55.

The total attendance at the eight meetings was 395, averaging 49 per meeting.

Fritz F. Hampe, Clerk

REPORT OF THE EXECUTIVE COMMITTEE OF THE SANITARY SECTION

February 23, 1967

To the Boston Society of Civil Engineers:

During the preceding year the Executive Committee of the Sanitary Section has included:

Robert L. Meserve, Chairman
Walter M. Newman, Vice Chairman
Charles A. Parthum, Clerk
Allison C. Hayes, Executive Committee
David C. Duncan, Executive Committee
Leland F. Carter, Executive Committee

Annual Meeting March 2, 1966

Following the election of officers, Mr. Robert C. Marini, of Camp, Dresser & McKee, presented an illustrated paper entitled "Water Supply Problems in East Pakistan". Meeting attendance was approximately 40.

Annual Outing June 1, 1966

The outing was held as a joint meeting with the Boston Society of Civil Engineers and included a tour of the Carling Brewing Company, Route 9, Natick, Massachusetts.

At the dinner meeting, Mr. Don Davidson, Quality Control Manager of Carling Brewery, gave an interesting and detailed talk on the bear and ale-making processes.

51 members and guests attended the meeting.

Meeting October 5, 1966

Dr. Alvin S. Goodman, Associate Professor of Civil Engineering at Northeastern University presented a paper entitled "Mathematical Model For Water Pollution Control Studies". 52 members and guests attended.

Meeting December 7, 1966

This meeting was cancelled because it conflicted with a testimonial dinner for the retiring Chief Engineer of the Sanitary Engineering Division of the State Department of Public Health. The scheduled speaker for the evening was also unable to be present.

The Executive Committee met three times during the year.

Respectfully,

Charles A. Parthum, Clerk

REPORT OF THE EXECUTIVE COMMITTEE OF HYDRAULICS SECTION

February 29, 1967

To the Boston Society of Civil Engineers:

The following meetings of the Hydraulics Section were held during the past year:

May 4, 1966 - Dr. Ronald T. McLaughlin, Associate Professor of Civil Engineering at Mass. Inst. of Technology, spoke on the "Sensitivity Analysis in the Design of Pipe Networks". Attendance 27.

November 2, 1966 - Mr. Peter A. Larsen, Assistant Professor of Civil Engineering at Worcester Polytechnic Institute, spoke on "Head Losses Caused by an Ice Cover in Open Channels", illustrated with slides. Attendance 16.

January 25, 1967 - The Annual Meeting was held jointly with the main society in the Adams Room, United Community Services Building, 14 Somerset Street, Boston, Mass. President John M. Biggs, presided.

Chairman Nicholas Lally of the Hydraulics Section presented the report of the Nominating Committee of the Hydraulics Section, consisting of Messrs. Richard F. Dutting, Chairman, Lawrence C. Neale and Keistutis P. Devenis, with the following slate of officers for the coming year 1967-1968, who were subsequently elected by unanimous voice vote:

Chairman	Allan Grieve, Jr.
Vice Chairman	Athanasios A. Vulgaropulos
Clerk	Ronald T. McLaughlin
Executive Committee	Stephen E. Dore, Jr.
	Albert G. Ferron
	Jerome Degen

President Biggs called on Past-President Leslie J. Hooper to introduce the speaker, Professor Hans Gerber, of the Swiss Federal Institute of Technology who gave the second John R. Freeman Memorial Lecture on the "European Experience with the Thermodynamic Method", illustrated with slides. Professor Gerber was presented with an honorarium and a certificate on behalf of the John R. Freeman Fund Committee.

Attendance at dinner 44. Total attendance 60.

Respectfully submitted,

Athanasios A. Vulgaropulos, Clerk

REPORT OF EXECUTIVE COMMITTEE OF TRANSPORTATION SECTION

March 1, 1967

To the Boston Society of Civil Engineers:

The Transportation Section of the BSCE held the following meetings during the past year:

April 27, 1966 - Major General Rush B. Lincoln, Jr., General Manager of the Massachusetts Bay Transit Authority, presented an illustrated talk on "System Management for Engineering Diciplines Involved in Expansion of a Mass. Transportation System." Attendance - 65.

October 26, 1966 - Mr. Alan S. Boyd, Under Secretary for Transportation from Washington, D.C., described "The Role of the Federal Government in Transportation". Prof. C. L. Miller of M.I.T. moderated the discussion period. Attendance - 75.

November 22, 1966 - Colonel Remi O. Reiner, Division of Engineering, Corps of Engineers, presented an illustrated talk entitled "Construction for Space Age".

January 18, 1967 - Mr. James D. Fitzgerald, Director of New Construction of the MBTA, spoke on "The Employment of New Techniques on MBTA Construction Projects; Mr. George Way, Director of Planning, Massachusetts Department of Public Works, spoke on "The Role of the Department of Public Works in Planning of Transportation Projects; and Mr. John R. Davis, Deputy Chief Engineer, Massachusetts Port Authority, spoke on the subject "Logan International Airport". Attendance - 70.

February 21, 1967 - Mr. Howard Whitmore, Jr., Commissioner, Metropolitan District Commission, spoke on the subject "The Metropolitan District Commission's Part in Transportation", Attendance - 30.

During the past year there have been two meetings of the Executive Committee.

Respectfully submitted,

Robert J. Kiley, Clerk

REPORT OF THE EXECUTIVE COMMITTEE OF CONSTRUCTION SECTION

March 13, 1967

To the Boston Society of Civil Engineers:

The Construction Section held two joint meetings during 1966. The first was held with the main society and the second was held with the Structural Section.

May 25, 1966 - Mr. Richard Halloran of the Perini Corporation described "Heavy Construction Estimating", using a descriptive system divided into six major categories;.

1. Construction Management
2. Joint Ventures and Partners
3. General Classification of Project Costs
4. Project Accounting, Cost Accounting and Costs Feedback
5. Bidding a Project
6. Estimating Engineers Specializations.

Attendance - 89.

January 11, 1967 - Mr. Phillip Maslow Grace Construction Materials Division of W. R. Grace & Co. lectures on the "Use of Expoxy Resin in Concrete".

Attendance 48.

Arthur Mosher, Clerk

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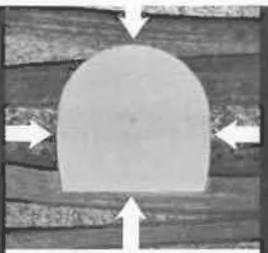
Terrametrics Instrumentation gives you precise measurements, enabling your support and structural designs to be based on known load conditions, not compromise or assumption! Terrametrics' in situ determination of rock and soil characteristics means new cost reductions, new design improvements, and new safety standards for your construction job!



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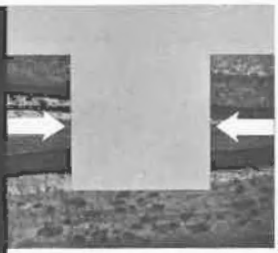

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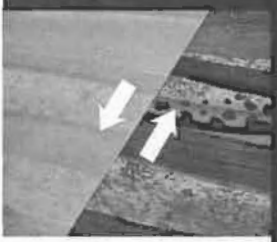

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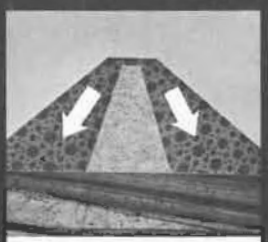

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Max D. Sceta
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(Term expires March, 1968)

John F. Flaherty
Robert L. Meserve
Robert L. Fuller
Lee M.G. Wolman
(Term expires March, 1969)

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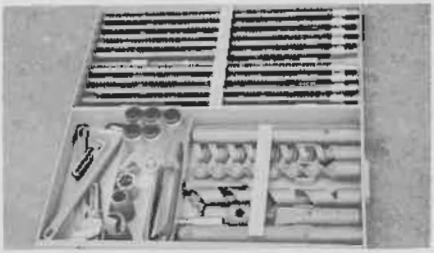

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