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An attempt to determine the relationship between the computer, the computer program exchange organization and today's practicing civil engineer has just been completed. A questionnaire was used to obtain information and opinions from 850 selected practicing civil engineers. Based on those questionnaires reaching their addresses, a return rate of 81.7 percent was achieved in this investigation.

From data supplied in the returned questionnaires, several significant points could be noted. Almost 60 percent of those responding indicated that the computer was used for civil engineering purposes within their firm. Although actual computer usage was only slightly in the majority, the overall opinion regarding a favorable attitude toward increased computer usage was on the order of 35 to 1. The engineer also expressed an approximate 12 to 1 favorable attitude toward the computer user group concept. But when asked to evaluate the effectiveness of the present day computer user group role within the civil engineering discipline, the attitude became

unfavorable with an almost 2 to 1 response against these organizations being rated as successful.

Several points of praise and criticism were made regarding the present day user groups. Much of the engineers' criticism appear to have justification based on contacts established with several of the current user groups. Although the engineer was generally critical when discussing the user group, he pointed to five primary areas where he desired to see improvements made.

Whether these suggested improvements would or could be implemented is subject to question. There also are several recent outside influences which could negate any present improvements in this area. The new hardware and software systems currently under development, the rise of the time sharing concept, the growth of the service bureau concept, the entrance into the computer applications field of the so-called computer consultant and the possible introduction of the professional society into this area may well remove the practicing civil engineer from present day computer user group activities.

The Computer, the Computer User Group, and the Civil Engineer

by

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INTRODUCTION

In the opening address of the first conference on electronic computation sponsored by the Structural Division of the American Society of Civil Engineers in November, 1958, Mr. N. M. Newmark made the following comments:

> In the history of Civil Engineering no single development has had as far reaching consequences as appears to be inherent in the electronic digital computer. The basis of civil engineering practice is changing rapidly. (23, p. 1-2)[1]

This statement, made almost nine years ago, still exhibits a timeless quality that almost any civil engineer today will recognize.

The computer has been utilized in the field of Civil Engineering for more than a decade, yet the ramifications of its introduction are still being felt in a variety of ways. It has been only recently that the computer has been fully accepted as an engineering tool, to take its place with and be used as the slide rule and handbook have been in the past. Resistance to the computer has existed in many forms and for a number of reasons, but as the accessibility of the computer becomes more widespread, and as the confidence of the computer user with regard to computer output increases, this resistance must

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[1] The number system method of citation will be used throughout this report.

correspondingly decrease.

We are now in the age of the computer. In civil engineering practice, the computer is providing the particular tool which is enabling the engineer to undertake the more rigorous design and analysis concepts, to investigate more thoroughly the optimal design technique, to relieve him of much of the routine and repetitious work he is so often faced with, and in certain cases, to assist in the area of decision making. Computers have made all this possible with the added bonus of a substantial savings in time and expense which the engineer can now devote to other phases of engineering practice. One major problem still remains, however. That problem, and the primary subject of this paper, is the computer program.

Statement of the Problem

Before the engineer can effectively utilize the computer, the problem of communicating with the computer must be overcome. This problem of getting from the step of problem definition to that of machine solution in the minimum amount of time and at a minimum cost is perhaps the most important one to the engineer considering computer utilization techniques. Until methods of programming have been perfected to the point that these goals can be achieved, the cost of program development can easily offset, to varying degrees, the original cost advantage in utilizing the computer.

A solution to part of this problem developed along with the computer. This solution involved the formation and utilization of the computer program exchange organization, or as more commonly known, the computer user group. Much of an engineer's computer utilization time can be involved in the stages of programming. It would, therefore, be reasonable to expect that the engineer is actively engaged in the computer user group activities since he would have much to gain by this association. The purpose of this investigation centers around this point and could be considered as fourfold: (1) to determine which computer makes are favored by the civil engineer; (2) to determine which computer languages seem to be predominant within this discipline; (3) to determine in what user group associations the civil engineer may be a member; and (4) to determine what the user groups really are, and what they may be able to offer to the practicing civil engineer.

The first two stated purposes are rather self-explanatory. With the large number of computing systems and computer languages readily available today, is there any single or narrowly defined group of systems or languages that the civil engineer prefers? If yes, what is the reason behind this preference? The third purpose stated is in essence, dependent upon the results of the first two. The choice of computer or computer language could easily dictate any potential user group affiliation or the utilization of such a group's services. Based

on the assumption that the engineer has these services available and is aware of them, is he utilizing them or not? What does the civil engineer think of the user group concept from the general point of view, as well as from that of his own discipline?

Last, but far from least, will be an attempt to evaluate the role of the user group itself. An attempt will be made to determine who these groups are, where they are, the level of computer utilization they are operating in currently, what the membership requirements are, what requirements exist for member as well as non-member utilization of the groups services, and perhaps most important of all, what exists in their program libraries that would prove to be of value to the civil engineer.

Purpose of the Investigation

The need for such a study as outlined above would be readily evident to anyone who has attempted to answer the questions just posed. A great deal of information regarding computers, computer languages, and various computer utilization techniques exists, not only in the civil engineering discipline literature, but also in other literature associated with the general field of data processing. But with the exception of a single investigation by Chang (6) in 1960, there appears to have been no attempt within the civil engineering discipline to investigate or evaluate the effectiveness of the computer

user groups. The Structural Division of the American Society of Civil Engineers is actively engaged in the area of electronic computation having already sponsored four conferences[2] on this subject matter, yet,with the exception noted above, appears to have neglected this phase of computer utilization in its investigative and promotional efforts. American Data Processing, Inc., publishes a yearbook (14, 15, 21) which provides a compiled listing of a large percentage of the existing computer user groups. No information on the group itself is provided except the name and address of a contact representative for each group listed. Through the efforts of this investigation, it was soon discovered that this contact information was badly out of date, if not entirely useless. How, then, can a potential user group member discover what groups exist, what services are offered, where contact can be established, in other words, answer all the many questions involved in considering potential user group association?

This investigation makes no claim that it has discovered the answer to this dilemma. Rather it does make the claim that it can provide a generalized opinion from practicing civil engineers regarding their thoughts on this subject area, narrow the field of existing user groups to those utilized by these engineers, provide some basic

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[2]Kansas City, Missouri, November, 1958; Pittsburgh, Pennsylvania, September, 1960; Boulder, Colorado, June, 1963; and Los Angeles, California, September, 1966.

data concerning the existing groups including current contact information where available, and in summary, perhaps predict the future role that the computer user group will play in the ensuing years of civil engineering computer utilization.

BACKGROUND

Computer Development

The computer was inevitable when man first began to make his own problems. First, man learned to count. He then created the first artificial memory system with the written record. Soon primitive counting devices were developed. The abacus, dated from antiquity and yet in many ways analogous to our present day computers, ushered in the age of mechanical computation.

The ancient Greeks may well have developed the first mechanical calculating machine (11) although most historical references reserve this credit for Pascal and the machine he developed about 1642. Leibnitz, a few years later, also is often credited with developing the first working calculating machine. It was not until 1833 that an Englishman named Babbage laid down the principles that formed the basis of our present day computing systems. In that year, Babbage designed his "Analytical Engine" (29) which was to have an internally stored memory of 1000 words of 50 digits each, was to be programmed by means of punched cards, and was to include the ability of having the course of calculations modified depending on the results obtained. Here were the plans for a programmable, internal memory, real-time computing system. Unfortunately, production techniques of that era were too crude and Babbage's finances too low

for the machine to ever be completed. Only recently have our present day computers been able to duplicate these basic principles.

By the end of the 19th Century, electricity had been added to the calculating machine. In 1936, the size had been reduced sufficiently so that the concept of the portable electrical calculator became practical. But it was not until 1946 that the first true digital electronic computer was placed in operation. This was the ENIAC (Electronic Numerical Integrator and Computer). Its major distinguishing feature was the lack of moving parts, a very significant step forward.

The final step to our present day computing systems was first proposed in 1945. This step involved the introduction of the binary numbering system into the realm of computer technology thereby allowing the development of the concept of the internally stored program computer. The EDSAC (Electronic Delay Storage Automatic Computer) in 1949, followed closely by the EDVAC (Electronic Discrete Variable Automatic Computer) in 1950, set the final stage. The dawn of the computer era began in 1951 with the installation of the first mass produced, commercially available, stored program, electronic digital computer--the UNIVAC I.

Many excellent books exist on this historical phase of computer development. Reference is now made to those sources for anyone interested in the details of computer history (2, 11, 17, 19, 29).

Present Computer Usage

Digital computers, in their present form, could not have been built prior to the 1950's. Only with the concept of the stored program and the replacement of the electro-mechanical devices by electronic circuits could the present day reliability and speed by obtained. The years following 1950 have seen an amazing technological growth in the computer field. In some cases, this has been received with mixed blessings. Old systems have become dated, new systems are being developed, the replacement of the old by the new is occurring at a rapid and perhaps even accelerating pace.

To date, chronologically and electronically, the present day computing systems can be divided into three general categories or "generations" (21). The first generation systems can be characterized by vacuum tube circuitry, magnetic drum and core storage devices, high power requirements, and typical operating speeds in the millisecond to microsecond range. By the late 1950's, second generation systems were being delivered. They can be characterized by the substitution of transistors for vacuum tubes in their circuitry, magnetic core storage, decrease in size, and operating speeds in the microsecond range. The switch to third generation systems, characterized by utilization of tunnel diodes, thin film storage, cryogenic approaches, and nanosecond operating speeds, is presently occurring.

There is an ever increasing demand for greater capacities, even higher speeds, better reliability, smaller sizes, less power consumption, more independence from the environment, lower costs, an almost endless list of improvements desired that may well lead to a fourth, fifth, or even higher generation of computing systems for the future. If past records are of any value, the fourth generation systems should not be far off.

The net effect of the first three generations of systems has been considerable. Although no single comprehensive survey of domestically produced systems has been undertaken, several efforts along these lines have been made. The U. S. Government has conducted four systems surveys (33, 34, 35, 36), the last being effective through 1963. Several data processing periodicals can be used to fill in the period from 1963 to date. Based on an approximate count of the number of different domestically produced electronic digital computing systems from the sources mentioned above, a total of some 552 different past and present day systems were encountered. There were approximately 100 various system producers also, including 18 educational institutions and six governmental agencies. These totals may well be inaccurate since no comprehensive survey has been made, but any inaccuracies in these counts would almost by necessity be toward the conservative side.

If, from the 552 systems encountered, a deduction was made

for all systems in which, based on best available information there appeared to be no opportunity for engineering application utilization, a net total of 303 systems would still remain. This would include a deduction for all 13 governmentally produced systems, all 31 educationally produced systems, and 205 commercially produced systems. Again, based on best available information, if a further deduction was made for all systems which are no longer in production even though there might be many fully operational installations still existing, a final net total of 144 different systems still in production remains. Many, if not all, of these systems may prove entirely suitable for engineering applications. There definitely appears to be no lack of system variety available today for the civil engineering computer user.

No accurate count of the actual number of units installed has ever been made either. Again several attempts have been made through various census schemes, but generally only selected producers and current systems are included. As a rule of thumb, the various census results can be used to obtain an estimate, but an accurate count would probably be impossible today. Based on two surveys ending during the same period (through December, 1966), one survey (18) indicated that presently 30, 785 domestic installations and 10, 470 foreign installations, or a 41, 255 installation total of domestically produced systems, existed. A second survey (22), which

included a large majority of identical producers, indicated an overall total of 41, 196 domestically produced systems existing. The second survey also indicated an additional 24, 366 installations were already on order, including the foreign as well as domestic market.

Although old systems are being phased out as the new systems enter the market, computing systems dating back to first generation equipment can still be found being utilized. For the numerical quantities indicated above, it is readily apparent that the engineer as a potential computer user has a wide variety of choice of computing systems to explore for possible utilization. Whether the civil engineer is using this opportunity or not is one of the projected goals of this investigation.

Computer Languages

Many computer language classification schemes have been proposed (3, 9), but none can be considered comprehensive. Three major categories do define the majority of languages, however. These categories can be referred to as low, intermediate and high level language systems.

The low level languages are often called machine languages or binary languages. These languages were the first communication tools available to the computer user. The intermediate or symbolic assembly languages provided the first major improvement in the

communication process. These languages maintained the one to one correspondence in instruction coding, but provided the user with a language that was more closely related to English instead of the binary system of the machine languages. The next major step occurred with the introduction of the high level or compiler languages. These languages allowed a one to many correspondence in translating into machine language which the computer still uses. These languages are much closer to conversational English, are much easier to learn, lead to less possible error introduction by the user, and for the first time, are independent of the individual computing system. The high level languages are in general use today, although much programming is still being done at the intermediate level. Low level programming is almost nonexistent.

Attempts at further language generalization are continuously occurring phenomena. As early as 1960 with the introduction of ALGOL 60, the idea of a universal programming language was launched. FORTRAN, which is generally recognized as the predominant engineering and scientific application language, has also been proposed as a universal language (15). But no programming language will be able to serve as a universal language if it is necessary to leave that language in order to perform some operation or control some part of the computer system. With the introduction of varied types of peripheral equipment, language system control is becoming

increasingly important. The need for a programming language to converge rapidly into a stable form is in a fundamental conflict with the rapidly occurring changes in the development of present day computing systems. It is, therefore, unlikely that any language will achieve universality, but rather that there will be a slow succession of improved languages, each processing a broader area of application than its predecessors. Once computing systems have become somewhat stabilized, perhaps optimal programming languages will exhibit a degree of stabilization also.

The engineer, on the other hand, seems now to desire less generalization. During the past few years, the rise of the problem-oriented languages has enabled the engineer to make more efficient use of the computer. These languages, less general but with a higher degree of sophistication, have proved very successful. The acceptance of these specialized programming languages is currently leading to the development of integrated program systems which will provide a degree of program flexibility never before achieved. Massachusetts Institute of Technology's developmental work with ICES (Integrated Civil Engineering Systems) is but one example.

Presently the civil engineer is in a transition period regarding computer language usage. With the wide variety of computing systems available, there is a correspondingly wide variety of languages also available. Accompanying the approximate count of computing

systems mentioned in the previous section, a rough count of the variously named machine, assembler, compiler, and processor languages was also made. Considering the obviously recognizable modifications as well as the basic language system, the count indicated well over 300 distinctly named computing languages. Until a fair degree of stabilization in system and language developmental levels is obtained, the civil engineer will be faced with a rather broad spectrum of not only computer systems, but also of the associated system programming languages. Which languages the engineer is presently using is another of the projected goals of this investigation.

Computer User Groups

As early as 1954 individuals and organizations associated with computing activities were meeting to discuss methods of more economical use of computers and computer languages (21). As more computing systems appeared on the commercial market, the tendency to form groups interested in using the same equipment became apparent. By 1960, there were over 20 such organizations in existence (6). This number may well have doubled during the intervening years.

While the interests in trading information, encouraging more efficient programming, and developing better machine utilization remained important, the emphasis of these groups has shifted to increased interest in computer languages, standards, and general

software development. Through the efforts of these groups and their associations with the hardware manufacturers, equipment changes have been introduced, advanced compiler languages have been developed, and in general, an overall increased efficiency has been achieved. The computer producers still provide the major directing force to computer system design,however.

As the number of different systems increased, the tendency grew for the groups to represent the views of those using many different machines rather than any one make or model. This period also saw the rise of the problem oriented groups although the actual number of these groups amounts to only a small fraction of the total. It is these specialized groups that have proven to be of the most value to the civil engineer since, almost without exception, they have all proven to be civil engineering oriented organizations.

What the future may hold for the computer user group is subject to debate. In 1960, it was proposed that the major contributions of the user groups in the future would be the following:

a. Standardization of languages and their representation for particular machines.

b. Manufacturer liason on both hardware and software.

c. Communication of ideas in programs between users of similar machines and/or of different machines.

d. The advancement of means for achieving machine independence of programs expressed in widely accepted languages. (21, p. 146)

The second contribution is perhaps the only one in which some high degree of success has been obtained. Through efforts of the user groups, software packages of a relatively comprehensive nature are offered with the systems as they now appear on the market. The computer producers are also generally connected in some manner with the user groups, if for no other reason than to promote their equipment. In many cases they will act as a group publication clearinghouse. Many of the producers will also finance the program exchange function as well as the majority of the user group publications. Much of this effort on the part of the producer could be attributed to self-interest, but for whatever the reason, the group members have benefited to varying degrees. Whether the civil engineer is obtaining any of the benefits of user group participation is the major issue of this investigation.

Summary

Computers have become widely accepted and used by civil engineers. This has been due in part to at least four basic characteristics the computer has introduced into the realm of problem solution. Computers are extremely fast, they are very accurate, they can store large amounts of data to which they have rapid access, and they are capable of executing long and complex sequences of operations automatically. The engineer has been freed of the routine and

repetitious work he so commonly faces, resulting in increased time to devote to investigating more detailed techniques, including such things as economical analyses and optimal design. Although the computer has entered the realm of decision making in many areas, the computer still remains as only a tool to be utilized. It can do no more than serve as an extension of its user's training, ingenuity, and experience.

In order to use a digital computer, it is necessary to write a program to accomplish the desired task. Since programming is necessary to make the computer operate, the language in which the program is written is the key to effective use of the computing system. It would, therefore, appear that communication between individual and computer is a very basic step in effectively utilizing the computer to its fullest advantage.

The past few years have seen rapid technological advances in the computer field. Hundreds of computer systems and languages have been made available to the potential user and no doubt many more are destined yet to come forth. But discernable in this massive proliferation of variety in the past and present are a few current trends which may well have a very significant effect upon the future. The computer producers are as numerous as ever, yet the line of marketable products is changing. The family concept, although not necessarily new, is becoming very heavily emphasized. Most

manufacturers are now producing families of compatible computers. IBM, for example, has discontinued production of the familiar 1400 and 7000 series of computers and is instead producing the System 360 line almost exclusively. Honeywell's H-200 series, RCA's SPECTRA series, Digital Equipment Corporation's PDP series, and Advance Scientific Instrument's line of ADVANCE computers are only a few of the many more examples of family type computing systems that are currently available on the commercial market.

Software development is also undergoing a somewhat radical emphasis alteration. Software development (basically the programming language and control system) is being geared to configuration size rather than family member, yet with the possibility of software use on the entire family of computers not being ruled out. The new determining factors will be the amount of memory available and the number of peripheral units associated with the new systems. Programming languages may even shift toward the problem-oriented language concept. Software systems are currently being considered that will include embedded routines such that the user would only have to define input, output, and their functional interrelationships, the new compilers introducing the step-by-step procedure necessary to produce the output as defined. The applications programmer may soon be out of business.

No investigation of computer utilization by engineers would be

complete without at least a brief mention of the future engineer who is the present day engineering student. The subject of computers in engineering education is an often discussed topic (3, 4, 5, 8, 13, 20). Computer usage in engineering on the undergraduate level has risen considerably over the past few years. In one survey which involved the 1964-65 engineering undergraduates in 134 accredited engineering schools, almost 87 percent received training in digital computers (8). The number of computer installations at educational institutions is also on the upswing. In 1962, there were 397 digital and 11 analog computing systems in colleges and universities within the United States (21). In 1963, the number increased to 518 digital and 24 analog systems, followed in 1964 by another large increase to 873 digital and 75 analog systems (15). By 1965, the number had again increased, this time to 1065 digital and 115 analog computing systems. These 1965 systems were distributed among 433 colleges and universities throughout the United States (14). Problems still remain in computer training at the educational level, however, but no one can doubt that the engineer of tomorrow will be aware of the computer potential which he can call upon in his endeavors if needed.

What position does the computer user group hold in this view of the future? From the positions the groups now occupy, two major paths appear evident. One path leads to complete oblivion as we now know the groups. If the new concepts of software development as

proposed are actually developed and implemented, the functions of the groups as they are now defined will cease to exist, followed shortly thereafter by the groups themselves. The second path leads to a high degree of consolidation with the number of individual groups decreasing to only a very few based, perhaps, solely on application areas. The functions would probably be reoriented to that of information dissemination with some localized highly specialized programming on a group effort basis. If, and the word "if" should be emphasized, these projected trends in computer system and software developments do occur, then the days of the user group as we are now familiar with them are numbered. What the future holds is only a guess, but considering what is happening in the hardware and software systems under proposal status now, coupled with a look at the computer user group of today, a generalized look at the future may yield some pertinent observations. The future of the computer user group, at least with respect to the civil engineer, might well be determinable in the present.

THE PRACTICING CIVIL ENGINEER

The Group Selected

The method of gathering information for this investigation was to be the questionnaire. To obtain any useful data, the selection of a representative cross-section of individuals was required. The individuals to be surveyed in this study were to be selected from the current membership directory of the American Society of Civil Engineers (1).

The American Society of Civil Engineers[3] membership list, effective as of March 15, 1966, indicated a United States membership of 50, 210 (with an additional 6, 697 members located outside the United States). It was decided that between 500 and 1000 questionnaires would provide sufficient returns upon which to base any judgment of current practice and trends. A minimum 30 percent return with a desired goal of 50 percent was to be considered acceptable.

The sampling method was to be of the "proportionally stratified" classification (24, p. 226-236). Three restrictions were placed on an otherwise random method of selection. These restrictions were as follows: (1) the total number of individuals selected within the confines of any one state were not to be less than one percent nor more

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[3] The American Society of Civil Engineers will hereafter be referred to as the A. S. C. E.

than two percent of the listed A. S. C. E. membership of that state, except where unavoidable; (2) no firm within any state was to be included more than once; and (3) only individuals who were specifically listed as structural engineers, or who worked for a firm which dealt primarily in structural engineering, were to be considered. The first two stated restrictions were imposed to insure a geographical as well as business firm representative distribution. An attempt was also made to prevent firms with offices in more than one state being included more than once. The third restriction, although not a necessity, was imposed since it was felt that the majority of civil engineering computer applications was occurring within this area.

Based on the foregoing restrictions, a selection of 850 individuals was made. The distribution obtained and used in this selection is shown in Appendix I.

The Questionnaire Used

The questionnaire, a copy of which is shown in Appendix II, was developed from basic techniques successfully used in the past (24, 25). A list of data desired from the individuals to be surveyed was made and then reduced to a minimum number of points which were considered to be essential in successfully utilizing the returns. The possibility of continuing the questionnaire to obtain additional information was introduced in the form of a closing question.

The final questionnaire form was composed of 13 questions. The method of answering these questions was to consist of a simple check mark, with brief word answers where applicable. The intent was to provide a questionnaire that could be completed in a minimum amount of time and inconvenience to the respondent, yet provide sufficient background material on the question of the civil engineer versus the computer and computer user group.

The questionnaire consisted of two basic parts. The first four questions were to be used to establish the size, type and primary area of emphasis of the firm to which the engineer being surveyed belonged. The fifth question was used to determine whether the computer was being used, with type, method of acquisition, and language being used to be indicated if the respondent indicated an affirmative reply to this question. This question was also used to segregate the nonuser for separate consideration in the analysis of the returns. The next three questions were aimed at the computer user. These questions were designed to indicate membership in a user group if applicable, to determine whether the firm maintained a personal program library, and to determine whether sources of programs existed which did not include the user group or firm library. The foregoing eight questions ended the section involving factual background data desired at that time.

Of the remaining five questions, the first four were designed to

obtain the personal opinion of the respondent regarding his views on the computer and computer user group within the civil engineering discipline. One question was devoted entirely to providing the engineer with an opportunity to express any personal view he might have on the subject of the user group. The thirteenth and last question was included to determine whether the individual would object to further questions, thus allowing an opportunity to investigate this subject area further as well as obtain clarification on any of the previous answers. It was felt that a greater tendency to return the questionnaire would exist if the individual was allowed to determine whether he wished to continue as a subject in this investigation. In the hope of obtaining valid answers to the opinion form of questions, the individual could also remain anonymous if he so desired.

The Sampling Technique

Accompanying the questionnaire was a letter of explanation and intent. A copy of this letter is shown in Appendix III. The purpose of this letter was threefold: (1) to create an interest in and explain the reason for this investigation; (2) to provide a general definition of the concept under investigation; and (3) to provide an explanation of the accompanying questionnaire with mention of how the results were to be utilized. To provide a semipersonal approach and avoid obvious mass production techniques, the letter of intent was

reproduced by high quality processes on Oregon State University, Department of Civil Engineering letterhead stationery. The individual's name and address as well as the current date was added to these letters immediately prior to mailing. A preaddressed stamped envelope was also provided as a matter of convenience to expedite the return of the questionnaire.

In the hope of increasing the number of returns, a follow-up program was initiated. This program was to consist of two appeal attempts, the first to be started approximately two to three weeks after the original mailings, the second to be based on a recorded decline in returns after the first appeal had been terminated.

The first appeal consisted of a brief note of inquiry regarding the disposition of the questionnaire. The method of reproduction was a ditto process, the note being applied to the back of a four cent U. S. postal card. The individual's name and address was added to the card front only.

The second and final appeal was initiated approximately ten weeks after the original mailings. The method of reproduction was again ditto process. The individual's name and address was added to the outer envelope only. A second copy of the questionnaire and another prepaid, preaddressed envelope were also included at this time. Copies of the first and second letters of appeal are also shown in Appendix III.

In addition to the three pieces of correspondence outlined above, selected individual follow-up correspondence was utilized to some degree. This was used primarily to obtain clarification where needed. Due to the individuality of this material, no standard or typical letter was used. No copy of this form of correspondence has been included in this report.

The Questionnaire Returns

Of the original 850 questionnaires sent out in this investigation, 70 were returned as unclaimed or nondeliverable. Of the remaining 780 questionnaires reaching their destination, 381 were returned as a result of the original mailings, an additional 155 were returned as a result of the first appeal, and a final 101 were returned as a result of the second appeal. The total returns numbered 637, representing an 81.7 percent return rate based on the 780 questionnaires which reached their addressees.

There was no particular classification of return resulting from the appeal programs. It was concluded that the sampling obtained with this questionnaire was valid and representational. The percentage returned provided a workable basis for valid analysis. The number of returns by state have been noted in Appendix I.

The Questionnaire Results

Of the 637 questionnaires returned, 19 were discarded as invalid. Of these 19 returns, seven were from retired individuals, two from noncomputer users, one from a computer user, two from engineers who were now students, one from an engineer now in the military service, and six from individuals with no note of explanation. In all cases, the questionnaires were returned blank except where, as noted above, sufficient data was included for proper identification. Of the remaining valid questionnaires, 259 were returned from noncomputer users with the remaining 359 from computer users.

The Noncomputer Users

Of the 618 valid questionnaires, 259 or 41.9 percent indicated the computer was not utilized for civil engineering purposes. Several returns included additional comments regarding this point. Eleven individuals indicated that their knowledge of the computer was very limited or altogether lacking. Four individuals indicated their firms had used the computer in the past but were not utilizing this tool at the present time. Thirteen individuals indicated their firms were presently interested in or studying the feasibility of obtaining computer facilities for the near future. Eleven individuals also indicated that access to a computer was currently possible if needed, the implication being that this need did not presently exist.

It was interesting to note that although none of these firms utilized a computer for civil engineering purposes or were members of a computer user group, seven individuals indicated that their firm maintained a computer program library, six indicated their firm had program sources outside of a company library or a user group, and an additional 28 indicated that programs were available from outside sources as well as a company program library. The implication here, although not confirmed, was that either the computer has been used in the past for civil engineering purposes more than indicated above, or that the computer is presently being used by these firms for other than engineering purposes such as accounting or billing functions. Selected follow-up inquiries were made regarding this point but the response to date has been negligible.

Replies to Questions 2, 3, and 4. The size, type and primary area of emphasis of the firms classified as nonusers of the computer for civil engineering purposes are shown in Table 2. To simplify the column and row designations used for this table and all subsequent tables, abbreviations have been introduced and are defined in Table 1.

In all cases, the individual respondents provided the data summarized in Table 2. This has led to possible introduction of erroneous data regarding classification by size of firm. Many individuals provided data based on their department or section only; whereas others provided data based on a company standard. Evidence of this

exists quite clearly in the F. G. (Federal Government) type of firm classification.

For clarification purposes, the seven COMB. (Combination) type of firm classifications were as follows: one "Research plus Promotion"; one 'Industrial plus Research"; two "Consulting plus Construction"; and three "Consulting plus Industrial". Included in the OTHER type of firm category were 27 "Architects" or "Architectural Engineers", eight "Manufacturers", eight "Contractors", four "Utilities", one "Material Supplier", one "Trade Association", one "Transportation", and one "Job Shop".

Table 1. Abbreviations used for all subsequent tables.

Firm Type Classifications		Area of Emphasis Classifications	
CONS.	= Consulting	P.	= Planning
IND.	= Industrial	D.	= Design
RES.	= Research	C.	= Construction
F. G.	= Federal Government		
S. /L. G.	= State/Local Government		
COMB.	= Combination		

Computer Acquisition Classifications	
OWN	= Firm Ownership
RENT	= Firm Direct Rental
TIME SHARE	= Time Sharing System
COMB.	= Combination

Table 2. Size, type and primary area of emphasis of firms classified as noncomputer users.

Items	Type of Firm							Total
	Cons.	Ind.	Res.	F.G.	S./L.G.	Comb.	Other	No.
1. Size of Firm:								
Less than 10:	74	0	0	2	0	1	6	83
10-50	49	3	0	11	3	1	22	89
50-100	6	3	0	2	8	1	6	26
100-500	7	8	0	3	1	3	3	25
500-1000	1	1	0	0	1	0	3	6
1000-5000	0	2	0	2	0	1	6	11
5000-10000	0	0	0	2	1	0	1	4
Greater than 10000	0	5	0	2	0	0	3	10
Not stated	1	1	0	1	1	0	1	5
	138	23	0	25	15	7	51	259
2. Emphasis of Firm:								
P.	0	0	0	1	0	0	1	2
D.	106	4	0	4	2	2	21	139
C.	2	6	0	3	2	0	11	24
P. and D.	21	1	0	1	1	0	10	34
P. and D. and C.	2	1	0	6	2	1	1	13
D. and C.	5	5	0	1	1	3	4	19
Other	1	6	0	9	7	1	2	26
Not Stated	1	0	0	0	0	0	1	2
	138	23	0	25	15	7	51	259

Replies to Questions 9, 10, and 11. The tabulated response to the opinion form of questions is shown in Table 3. A small percentage of the returns were not complete in this area. Where replies were left blank for these three questions, the investigator assumed the answer to be "no opinion" and recorded it as such in the Table 3 tabulation. There were 14 "no opinion" answers supplied by the investigator representing a possible 1.8 percent invalid opinion. This error source was considered to be negligible.

Table 3. Opinions expressed by the noncomputer user with regard to the computer and the computer user group within the civil engineering discipline.

Question 9: "Are you personally in favor of the increasing usage of computer applications in the field of Civil Engineering?"		
	Replies:	Yes - 196
		No - 12
		No opinion - 51
Question 10: "Are you in favor of the concept of the computer user group?"		
	Replies:	Yes - 141
		No - 12
		No opinion - 106
Question 11: "Do you feel the computer user groups are presently fulfilling their role, relative to the field of Civil Engineering?"		
	Replies:	Yes - 15
		No - 30
		No opinion - 214

The Computer User

Of the 618 valid questionnaires, 359 or 58.1 percent indicated that the computer was utilized for civil engineering purposes. The computer users have been further subdivided into nine general categories based on their replies to questions 5, 6, 7 and 8. The subdivisions used and the number of respondents in each group are shown in Table 4.

Table 4. Group subdivision of firms classified as computer users.

Group Classification	Computer User	User Group Member	Maintain a Firm Program Library	Programs Available from Other Sources	No. of Firms
Group I	Yes	No	No	No	44
Group II	Yes	No	Yes	No	37
Group III	Yes	No	No	Yes	38
Group IV	Yes	No	Yes	Yes	106
Group V	Yes	Yes	No	No	3
Group VI	Yes	Yes	Yes	No	8
Group VII	Yes	Yes	No	Yes	2
Group VIII	Yes	Yes	Yes	Yes	95
Group IX	Yes	-	-	-	26
					359

Special mention should be made regarding Group IX. The firms falling into this category are those which did not reply to the question regarding user group membership, or marked it as "unknown" or "not sure". Selected follow-up procedures were applied

to this group, but to date, 26 remain to be classified. Therefore, to utilize the remaining data supplied on these returns, a separate category was created.

Replies to Questions 2, 3, and 4. The size, type and primary emphasis of the firms classified as users of the computer for civil engineering purposes are shown in Table 5. For an explanation of the abbreviations used, refer to Table 1.

Table 5. Size, type and primary area of emphasis of firms classified as computer users.

Items	Type of Firm							Total
	Cons.	Ind.	Res.	F.G.	S./L.G.	Comb.	Other	No.
1. Size of Firm								
Less than 10	17	0	0	0	1	0	2	20
10-50	43	2	0	3	1	0	5	54
50-100	28	3	2	1	4	2	5	45
100-500	59	11	1	13	8	5	12	109
500-1000	13	2	1	10	2	1	1	30
1000-5000	1	8	0	7	16	1	4	37
5000-10000	0	7	0	1	4	4	1	17
Greater than 10000	1	14	2	6	5	2	10	40
Not Stated	1	2	0	0	1	2	1	7
	163	49	6	41	42	17	41	359
2. Emphasis of Firm								
P.	0	2	0	2	0	0	0	4
D.	107	11	1	14	11	4	13	161
C.	0	5	0	1	2	0	1	9
P. and D.	45	1	0	4	5	0	7	62
P. and D. and C.	4	7	0	12	12	6	5	46
D. and C.	6	7	0	1	5	3	5	27
Other	1	16	5	7	7	4	10	50
Not Stated	0	0	0	0	0	0	0	0
	163	49	6	41	42	17	41	359

Again, for clarification, the 17 COMB. (Combination) type of firm classifications were composed of the following: one "Consulting plus Research"; one "Consulting plus Manufacturing"; one "Consulting plus Industrial plus Construction"; two "Consulting plus Industrial"; two "Consulting plus Industrial plus Research"; four "Consulting plus Construction"; and six "Industrial plus Research". Included in the OTHER category were 15 "Architects" or "Architectural Engineers", one "Manufacturer; seven "Contractors", seven "Utilities", two "Trade Associations", seven "Transportation", one "Job Shop", and one not stated.

Replies to Question 5. The fifth question was designed to determine the method of acquiring the computer for subsequent use, the type of computers used, and the type of language or languages used on these computers. Response to this question, which required other than placing a checkmark, was generally poor. Based on the data that was supplied, the following tables have been formed.

The manner in which the firms classified as computer users acquired their equipment is shown in Table 6. Combination methods of acquisition indicated utilization of more than one system. Also, in some cases, a firm was utilizing more than one system but method of acquisition was the same for all systems concerned.

Table 6. Method of acquisition of computing systems utilized by firms classified as computer users.

1.	Single Source	
	OWN	77
	RENT	129
	TIME SHARE	32
	OTHER	62
2.	Multiple Source	
	OWN + RENT	25
	OWN + RENT + TIME SHARE	4
	OWN + RENT + OTHER	2
	OWN + TIME SHARE	3
	OWN + OTHER	1
	RENT + TIME SHARE	7
	RENT + OTHER	2
	TIME SHARE + OTHER	2
3.	Not Stated	
	NOT STATED	13
		359

Selected follow-up inquiries were made regarding the OTHER classification of acquisition method if the information had not been previously supplied. The overwhelming response was that OTHER

indicated a service bureau or computer consultant type of firm. There was an occasional reference to a "university" source (on a purchased time basis) and two references to "other firms".

The computing systems used, classified according to manufacturer only, are shown in Table 7. This summation also includes computing systems which the civil engineer is using indirectly. Sixteen computer manufacturers were mentioned. They included Advanced Scientific Instruments, Burroughs, Clary, Control Data, Digital Equipment, GE, Honeywell, IBM, NCR, Olivetti Underwood, Pacific Data Systems, Philco, RCA, Scientific Data Systems, Univac, and Wang Laboratories.

Table 7. Computer manufacturers listed by firms classified as computer users.

Advanced Scientific Instruments	1
Burroughs Corp.	2
Control Data Corp.	23
General Electric	11
International Business Machines	194
National Cash Register	1
Philco Corp.	1
Radio Corporation of America	4
Scientific Data Systems	3
Univac	6
Wang Laboratories	1
IBM plus others in combination	40
Other manufacturer combinations (excluding IBM)	4
Not Stated	68
	359

It is readily apparent that IBM systems are predominant among those used by the civil engineer. IBM systems, either singly or in combination, were listed by 234 of the 359 responding computer users. When specific systems were mentioned, either existing or on order as replacement systems, the IBM 1620, System 360 and 1130 models predominated. Other systems mentioned by the respondents included examples from all three previously defined computing system generation categories.

The computing languages used are not shown in tabular form. From those respondents who did supply this information, FORTRAN (and its associated derivatives) was readily evident although some 60 variously named languages were mentioned. The engineering problem-oriented languages were seldom mentioned, indicating possibly that this language level has not become widespread as yet.

Replies to Question 9, 10 and 11. The opinions expressed by the computer users with regard to these questions are shown in Table 8. There were 11 "no opinion" answers supplied for this group of respondents. Possible error introduction was again considered negligible.

The Computer User Group Opinion

Although the questionnaire had been formulated so that it could be effectively completed by using simple check marks, it was

Table 8. Opinions expressed by the computer users with regard to the computer and the computer user group within the civil engineering discipline.

Replies	GROUP I	II	III	IV	V	VI	VII	VIII	IX	Totals
Question 9: "Are you personally in favor of the increased usage of computer applications in the field of Civil Engineering?"										
Yes	37	33	34	102	3	8	2	93	23	335
No	2	0	1	0	0	0	0	0	0	3
No opinion	5	4	3	4	0	0	0	2	3	21
Question 10: "Are you in favor of the concept of the computer user group?"										
Yes	20	17	14	56	2	7	2	85	14	217
No	4	3	1	7	1	1	0	1	0	18
No opinion	20	17	23	43	0	0	0	9	12	124
Question 11: "Do you feel the computer user groups are presently fulfilling their role, relative to the field of Civil Engineering?"										
Yes	1	6	4	7	0	4	0	28	1	51
No	10	3	8	20	1	1	1	29	6	79
No opinion	33	28	26	79	2	3	1	38	19	229

significant to note that many respondents took the time to provide better returns by including additional information. A total of 136 respondents (105 computer users and 31 nonusers) from the 618 valid returns made specific comments regarding the computer user group concept in response to the twelfth question which asked for this comment. At least another 50 returns included additional information or clarification regarding the other opinions that were expressed. In many cases, these comments and opinions overlapped questionnaire space provided, resulting in at least one if not two additional pages of data returned with the questionnaire. Where written factual data was required, the returns were generally poor, but where the opportunity to express an opinion was permitted, not only did many engineers have an opinion to express but they took the time necessary to express it.

The general opinion held by the practicing engineer regarding the computer user group exhibits an interesting duality. A composite of the opinion question results (from Tables 3 and 8) is shown in Table 9.

The practicing civil engineer is overwhelmingly in favor of using the computer for civil engineering purposes. The resistance to this tool and the lack of opinion of this subject also shows a considerable decrease with exposure to the computer facility.

Accompanying this favorable attitude to using the computer, the

Table 9. Opinions expressed by selective groupings with regard to the computer and the computer user group within the civil engineering discipline.

Selected Groupings	Number Involved
TYPE A: Noncomputer User	259
TYPE B: Computer User; Nongroup Member (Groups I - IV)	225
TYPE C: Computer User; Group Member (Groups V - VIII)	108
TYPE D: Computer User (Group IX)	26
TOTAL	618

Replies:	TYPE A	TYPE B	TYPE C	TYPE D	TOTALS
Question 9: "Are you personally in favor of the increased usage of computer applications in the field of Civil Engineering?"					
Yes	196	206	106	23	531
No	12	3	0	0	15
No opinion	51	16	2	3	72
Question 10: "Are you in favor of the concept of the computer user group?"					
Yes	141	107	96	14	358
No	12	15	3	0	30
No opinion	106	103	9	12	230
Question 11: "Do you feel the computer user groups are presently fulfilling their role, relative to the field of Civil Engineering?"					
Yes	15	18	32	1	66
No	30	41	32	6	109
No opinion	214	166	44	19	443

majority again favors the concept of the computer user group. The higher incidence of the "no opinion" form of answer is understandable since the two groups reflecting this attitude are not involved with the user group.

With this predominantly favorable attitude toward the group concept, the duality arises in the evaluation of the effectiveness of the existing user groups. Where stated, the opinion was almost two to one against the groups being rated as successful. The investigator cannot help but wonder also about the heavy shift to a "no opinion" form of answer regarding this question. Could this "no opinion" answer represent the truly neutral position, or could it also harbor an unexpressed opinion? Even by discounting the nongroup member who also expressed a definite negative attitude, and considering only those actively engaged in group activities at the present time, there does appear serious question as to whether the user groups are successfully fulfilling their role for the civil engineering computer user.

Human nature permits man's ability to find fault or criticize to be more prevalent than his ability to praise. This was exhibited most profusely in the comments and opinions expressed regarding the computer user group. But it should also be kept in mind that of those expressing an opinion regarding user group success or failure, the majority were indicating failure as pointed out above and in Table 9.

Although in many cases the engineer was highly critical of user group performance, he did attempt to provide justification for his opinion, citing either examples or personal experiences. In many cases also, several suggestions were made regarding methods of improving these user groups. In relatively few cases were negative attitudes expressed without some justification or suggestion being included as an explanatory note. The main points of praise and criticism have been included in the following paragraphs. The suggestions for improvement made by these same engineers have been deferred to Summary and Conclusions section.

The major praise came from a distinct class of computer users and group members. This class was predominantly the smaller firm although many larger firms which had just entered into the field of computer utilization were in evidence. There were many references to the groups as being necessities to any organization just entering this new area of computerization. One individual went so far as to state that his firm had based their choice of computing system entirely on the existence of a compatible user group currently functioning.

The "small office benefits" point was stressed time after time. Those firms which had a very small programming staff, or a part-time staff, or no programming staff at all, repeatedly pointed to the savings in time and labor involved in computer programming brought about by group membership. To the small firm, computer user

group membership seemed to imply the combining of forces to overcome the major handicap of programming inexperience.

In addition to the foregoing which could easily be considered as self-centered motives, there was a general acknowledgment that the groups served broader based purposes of an overall beneficial nature. It was felt that the groups allowed the computer user to keep abreast of new developments and trends in the computer industry as well as to provide a method of collaboration with the computer manufacturer on new software system developments. For the members of the group itself, it permitted an effective method for the exchange of not only programs but also of programming techniques and problem solution ideas, thereby defeating the major problem of duplication of effort.

By contrast, the dissenters appeared to express a negative attitude toward most of the points considered favorable by the foregoing individuals. The major share of the dissenters were those individuals and firms which had been involved in computing activities for some period of time. The primary objections expressed consisted of three basic categories.

The first objection commonly mentioned was that of a general lack of information, not only on the user group itself but also on group activities and events as well as items and services available from the groups. There was a distinct reference made many times over to the lack of adequate information dissemination. Many

individuals indicated they received more information informally through such events as conferences and professional meetings than they received from the user group association meetings. There was also an apparent dissatisfaction with the promotional efforts (or perhaps the lack of same), particularly from the nongroup member.

The next category of negation was in the form of dissatisfaction with present group organizational and operational procedures. Contrasting viewpoints existed in some respects but the general feeling that the groups were disorganized was prevalent. Many felt the groups to be too flexible, others not flexible enough. It was definitely agreed that civil engineering firms existed in the minority of most groups, thereby receiving only a minority of benefits. Many felt that for any group presently in existence, there would be too great a diversity in background and experience for the group to ever really be successful.

Perhaps the underlying if not most often voiced objection centered around the computer programs themselves. The quality of programs encountered by the engineer were often referred to as "overrated", "unsophisticated", "trivial", "impractical", "too general", or "generally worthless". The demand was for the "good program", those programs which were obviously lacking from the program library of the user group, to be made available to all within the group. This point, and this point alone, may well prove to be the sole

reason the groups are rated as failures by the majority of members. The rebuttal to this demand for good programs was often given in the returns and should not be overlooked. When a great deal of time, effort and expense has been devoted to an involved and highly valuable program, what obvious resultant tendency would exist--to consider the program proprietary, or to let the program out for all users (including your competitors) to use at a relatively nil cost to themselves? Those firms which fell into this classification readily admitted they considered this type of programming effort to be completely proprietary and would refuse any request for group contribution of these programs.

Where programs were used, the objection centered around the lack of adequate program documentation for the user's benefit. There was general agreement that it was difficult to adapt the work of others since each firm did things differently resulting in programs that were peculiar unto themselves. Without adequate documentation it became an almost hopeless task, often resulting in output "errors" or even more serious consequences. In many examples cited, it proved more expensive overall in the attempt to prove someone else's program than it would have been to develop an original program from scratch. This lack of documentation in large part has led to a state of apprehension and lack of confidence by the user for all but the very basic and simple programs available in the group libraries.

Several other points were also mentioned, but not to the degree the preceding had been. Many felt that a lack of group participation incentive was in evidence. Others expressed a desire to see the number of programming languages reduced. Some felt that the groups should cease their activities altogether for a variety of reasons. The prominent reason stated was that by utilizing a program from someone else, a retardation effect on program improvements for a particular problem would result.

Whether the reader agrees or disagrees with the foregoing is not the real issue. The point to be made is simply that the computer user group may be in trouble from the practicing engineer's point of view. Obviously many of the dissenters could be those desiring "something-for-nothing", but these very same dissenters are the present group members. It should also be noted that the present group members are the only ones who can change the policies and functions of these user groups. Therefore, their opinions, pro or con, right or wrong, cannot be ignored.

To summarize the general opinion expressed by the engineers surveyed, three partial quotations from returns used in this analysis are now included. The passages provide good examples of the prevailing viewpoints held by today's engineering computer user group member.

In my opinion, efforts of user groups to promote interchange of applications programs are of trivial value to the Civil Engineering profession and, in certain instances, may actually be detrimental. I fail to see how an engineer can faithfully discharge his professional responsibility through the use of programs or procedures of others unless he is intimately familiar with the detailed operation of these programs. Gaining this degree of familiarity can represent a greater expenditure of effort than original authorship of (the same) program. On the other hand, computer user groups can perform a useful and necessary function if their activities are directed toward acquainting computer manufacturers with the needs of their clients, both in the hardware and systems software areas....

It is my feeling that user groups contribute greatly to the smaller installation. They encourage joint programming and provide a rapid means of dissemination of information and programs. They enable a user who is contemplating a change of system to discuss his problems and requirements with people who have had similar requirements, or who have previously used the equipment that he is contemplating.... The larger machine oriented user groups do not have as much to offer the small organization as the common subject area group... (but) both types of organizations serve a purpose and we belong to both because it is felt to be necessary for the continued growth of our organization.

..., I am not in favor of joining a group which engages in swapping routine computer programs. Here are my objections: (1) Firms which have good program libraries and make them all available to 'group' members are providing an unethical engineer with a tempting opportunity to enter a field in which he is inexperienced through use of 'group' programs. (2) In order to engage in program swapping each program must have a thorough flow chart and each assumption used must be meticulously listed. Nevertheless, I would not use someone else's program without checking it to some extent myself. These procedures may take longer than writing my own programs. (3) Writing ones own

programs allows him to 'custom-build' them using just what he wants as input and output (and) using the methods and assumptions he favors. (4) The question arises as to who is liable when a flow in a swapped program causes a failure. It appears that both the lender and borrower are sticking their neck out. I do feel, however, that a group of computer users can find it mutually advantageous to exchange information on computer techniques, short cuts and methods of saving computer time.

THE COMPUTER USER GROUP

Civil Engineer User Group Membership

In response to the survey conducted upon the selected group of practicing civil engineers, 359 indicated that the computer was utilized in their firms for civil engineering purposes. Of these 359 affirmative responses, 108 indicated membership in one or more user groups with an additional 26 not responding to this question as noted previously. Possible user group involvement by the computer user was by any count relatively low, ranging from a minimum of 30.1 percent to a maximum of 37.3 percent. The computer user group members, when compared against the total 618 valid returns, represented an approximate 20 percent involvement. If this estimate of user group membership may be taken as indicative of the profession as a whole, it may well indicate why no investigation of the user group concept has been undertaken by the A. S. C. E. in recent years.

From the 108 respondents involved with the computer user group, a total of 17 different user groups were mentioned. Additional sources, which were not true user groups, were also mentioned frequently. Discounting the previously mentioned 26 firms which remain presently unclassifiable, the 108 respondents indicated group memberships as shown in Table 10. Refer to Appendix VI for full user group name and other pertinent group information.

Table 10. User group membership as indicated by those responding as group members.

Group Name (abbreviated)	Number Indicating Membership
CEPA	27
CITA	1
COMMON	28
CO-OP	1
CUBE	1
EXCHANGE	10
GE	1
GET	1
GUIDE	4
HEEP	18
POOL	2
RCA	1
SDS	1
SHARE	8
SNUG	2
SWAP	1
UUA	1
Not stated	13
	121

Assuming those not stating were members of only one group, there were 98 respondents indicating firm membership in one group only, seven indicating firm membership in two groups, and three indicating firm membership in three groups. Table 11 indicates the other sources mentioned as "quasi-user groups". In general, these other sources were of the centralized agency library or professional organization library types.

Table 11. "Quasi-user group" membership as indicated by those responding as group members.

Source Name	Number Indicating Source
AASHO (American Association of State Highway Officials)	3
APWA (American Public Works Association)	1
Corps of Engineers Users Group	3
IBM Users Group	9
IEEE (Institute of Electrical and Electronics Engineers)	2
Tymshare Users Group	2
	20

Special note should be taken of the last mentioned source in Table 11. Tymshare is a commercial time sharing system located in the Los Angeles area. According to the two respondents, this organization began an active solicitation campaign to establish a time

sharing system program library. Whether it has been successful to any degree is presently unknown. Should it have been successful, it could possibly represent the first group of this kind in existence. Inquiry was made to this organization but no response has been forthcoming to date.

The Computer User Group Survey

Although five computer user groups appeared to be most favored by the engineers surveyed, the diversity of group membership was also evident. To include a valid analysis on the computer user group concept as a whole, it was decided to investigate each group discovered. There were 17 groups indicated by the practicing engineer. Approximately 25 additional user groups were noted from various other sources.

A questionnaire was again to be used as the investigative tool. This questionnaire was designed primarily to investigate the main points of praise and criticism that the civil engineers just surveyed had made. The questionnaire was composed of two parts.

The first part of the questionnaire was to determine basic background information on the user group. The name or names the group was known by, its size and present membership, the date of its formation, and its current growth rate were to be indicated. In addition, any computer manufacturer or national level data processing

organization affiliation was to be noted. Finally, the membership requirements and nonmember participation restrictions were to be stated.

The second part was to determine current operating conditions and services provided by the group. The first question was an attempt to determine the operational or group level of current activities. Four levels were defined, following closely those defined by Chang (6) in his 1960 investigation. Current computing systems and languages used by the group, type of group governing body and any special group activities or functions were to be indicated. Detailed questions were also included to determine the method, expense, documentation provided, and level of program exchange for that group. A sample of this questionnaire is shown in Appendix IV.

Shown in Appendix V is a copy of the letter of explanation which accompanied the user group questionnaire. The purpose of this type of letter was again threefold: (1) to explain the project currently under investigation; (2) to request specific information on the user group of which the individuals being contacted where representatives; and (3) to explain how this information was to be utilized. This letter was reproduced by ditto process and was printed on Oregon State University, Department of Civil Engineering letterhead stationery. The individual's name and address, and the current date, was added prior to mailing.

An intensive follow-up program had not been anticipated although it inadvertently developed. A first letter of appeal, also shown in Appendix V, was developed when it became apparent that questionnaire returns were not forthcoming. This letter was also produced by ditto process, with the individual's name and address, and the current date, again being added prior to mailing. In both these cases, prepaid, preaddressed return envelopes for the respondents' convenience had been included.

For those cases where the first appeal was proving unsuccessful, a second appeal was initiated. This appeal consisted of a personal individual contact without a standard format. Again, as a result of the individuality, no copy of this form of correspondence has been included with this report.

The User Group Survey Results

Of 46 user group inquiries originally mailed, 16 responses have been received to date. Twelve additional groups have been reclassified or confirmed as no longer existing. The status of the remaining 18 inquiries is uncertain. An additional three user groups were not included in this survey since they were special interest groups. These associations were BIO (Biological Information-Processing Organization), CAUSE (College and University System Exchange), and MCUG (Military Computer Users Group). A fourth

group, EAI-8400 (Electronic Associates Inc. Computer Model 8400 Users Group), was also omitted since it was only in the preliminary stages of formation according to the computer producer.

A complete analysis of the user group returns is impossible at this time. Of the 16 groups responding, some of the returns were incomplete or contained portions requiring clarification. Response to follow-up procedures has not yet occurred to any degree. Therefore, in deferment to a detailed analysis, a capsule synopsis of each user group considered has been included in Appendix VI. A listing of computer manufacturers associated with the existing user groups has also been included in Appendix VII. For further information on these user groups, the investigator recommends direct contact with the user group representative or the associated computer manufacturer.

As indicated in Table 10, CEPA, COMMON, EXCHANGE, HEEP, and SHARE were prominent among civil engineer user group memberships. Sufficient data presently exists on these groups and their inclusion at this time is warranted. The data follows and is presented in an itemized format.

CEPA: "Civil Engineer Program Applications", also known as the "IBM 1130 Users Group"; primary area of interest is civil engineering; uses the IBM 1130 computer with all FORTRAN programming; no computer manufacturer affiliation; group formed April, 1965, with a current membership of

126 installations; administered by a volunteer part-time committee; restricted program exchange (a one for one trade by the parties involved); program documentation includes a written description, program author data, and occasionally flow charts; membership requires having access to the IBM 1130 and being a civil engineering organization; no nonmember services provided.

COMMON: Primary area of interest is general with engineering and education forming the largest subinterest groups; uses the IBM 1130, 1620 (no longer produced), 1710 (no longer produced), 1800, and System 360 computers with programming in any acceptable language; IBM producer affiliation; group formed 1961, with a current membership of 900 installations; administered by an elected part-time committee; unrestricted program exchange; program documentation includes a written description, program author data, and flow charts; membership requires having access to computers listed above; nonmember may attend group meetings and obtain programs.

EXCHANGE: "G-15 User's EXCHANGE Organization"; primary area of interest is civil engineering; uses the CDC (formerly Bendix) G-15 computer (no longer produced) with programming in G-15 Machine, Intercom, DCDG-15 Algo, and

FORTRAN languages; CDC producer affiliation; group formed October, 1959, with a current membership of 250 installations; administered by an elected part-time committee; restricted program exchange (one submitted allows five withdrawals with a program secretary evaluating the submitted program); program documentation includes a written description, program author data, and flow charts; memberships requires access to G-15 computer; nonmember may attend meetings and receive group newsletter only.

HEEP: "Highway Engineering Exchange Program"; primary area of interest is highway and related structural engineering; uses the IBM 1401 (no longer produced), 1410 (no longer produced), 1440 (no longer produced), 1620 (no longer produced), System 360, and "others" with programming in any acceptable language; no producer affiliation; also member of GUIDE Users Group; group formed 1957, with a current membership of 40 organizations; administered on a part-time basis; unrestricted program exchange; program documentation includes a written description if available, program author data, and flow charts; membership requires an interest in exchanging programs of highway engineering type; no nonmember services provided

(this point not entirely confirmed at present).

SHARE: Primary area of interest is "scientific computing"; uses the IBM 704 (no longer in production), 709 (no longer in production), 7040 (no longer in production), 7044 (no longer in production), 7090 (no longer in production), 7094 (no longer in production), and System 360-Model 50 or higher, with programming in any acceptable language; IBM producer affiliation; group formed 1955, with a current membership of 600 installations; administered on a part-time basis; unrestricted program exchange; program documentation includes a written description, program author data, and occasionally flow charts; membership requires having access to computers listed above; nonmember may attend group meetings by permission and obtain programs.

These five groups, the most popular within the civil engineering discipline, are probably the exceptions in many respects to the typical user group. The typical user group, based on the data included in the remaining responses, is usually a general area of interest group, operates on an unrestrictive program exchange format, and provides documentation only if available. One group, CUBE, has even decreased its program submission documentation requirement in an attempt to expand its program library. With the general exception of the engineering oriented special interest groups and the IBM

associated groups, documentation requirements are apparently lax. Even with the program documentation provided in the five groups summarized above, it should be noted that the engineer group member has still expressed a complaint concerning incomplete documentation. This could possibly be considered the major problem area within the user group.

All the groups responding disclosed many common features. They are administered on a part-time basis, usually composed of a committee from the user membership. In some cases, the computer manufacturer provides a full-time secretarial service, usually a member of the manufacturer's firm and not necessarily a group member in the ordinary sense. With one exception (HUG), at least where stated, there were no charges for program acquisition. For those groups affiliated with a computer producer, the producer generally pays for this expense. There was no evidence of any membership dues being charged. The only requirement for membership is usually the problem of acquiring access to the computer being used within the group. Nonmember utilization of a group's services was generally restrictive, with the general exception of the IBM affiliated groups.

It must be remembered that the foregoing statements are based on an incomplete survey, and in some cases, on partial returns only. In only three cases were program library catalogs provided for analysis although many are allegedly in transit to the investigator.

Therefore, no valid investigation of the type and quality of available user group programs is currently possible. There does appear to be justification for many of the complaints expressed by the practicing civil engineer with regard to the computer user group, even based solely on the data presently available in this investigation. The computer program exchange organization may well be unsuccessful from the engineer's point of view.

The practicing engineer, although generally critical of the present day user group, put forth several suggestions for group improvements. How these suggestions may interact with the current trends in computing system and language development scheduled for the future are considered in the next section of this report.

SUMMARY AND CONCLUSIONS

Nothing is perhaps more difficult than extrapolating from the few and thereby claiming knowledge of the many. This applies equally as well to questionnaires as it does to experimental research work. If a representative sampling can be made, pertinent observations are justifiable. This report is attempting to do no more than that.

Several observations resulting from this investigation are probably quite applicable to the civil engineering discipline as a whole. It is readily apparent the practicing civil engineer is in favor of computer utilization within his discipline. Of the 618 valid questionnaire respondents, 531 or 85.9 percent expressed an affirmative viewpoint. Only 15 or 2.4 percent were specifically against computer usage, with the remaining 72 expressing no view on this subject.

Accompanying this favorable attitude regarding the computer, 358 were in favor of the user group concept, 30 were opposed, and 230 remained uncommitted. Of those actively engaged in computer activities presently, the preponderance of opinion was favorable. When it came to evaluating the user group role in the civil engineering area, the opinion shifted to a decidedly unfavorable one, at least when an opinion was expressed. The engineer pointed to the many good qualities as well as the poor qualities to be found in today's

computer user group. Much of the criticism expressed was of the constructive type, few cases being noted where the criticism could be considered truly prejudiced for one reason or another. Based on an incomplete investigation of the current user groups, much of the engineer's criticism may have justification.

Whether in the minority or majority of their respective user group associations, the civil engineer questionnaire respondents pointed to five basic areas where improvement was desired. First, and perhaps foremost, was the establishment of a set of documentation standards required for all programs submitted for user group utilization. The engineer advocated extensive documentation, including flow charts and written program descriptions which not only describe the program itself and its limitations but also include the theories, assumptions, and generalities made in the program development. Program author contact possibilities was also desired by many.

To induce the so-called good programs into the user group library, an incentive scheme was often proposed. Cash transactions, some form of point system, or at least a restrictive exchange basis were those schemes most commonly mentioned. There was general agreement that any incentive scheme used could only better the present system of exchange.

A full-time governing body was desired by many. More

manpower and financial support of the existing groups was expressed often. Whether the engineer was willing to pay a membership fee or whether the computer producers were to contribute these items was not made clear. General dissatisfaction with the present user group organizational patterns was readily evident.

There was an obvious desire to see more civil engineering groups, expressed almost exclusively by those whose user group associations excluded CEPA, EXCHANGE, and HEEP. There was an overall desire to see the user groups organized on the basis of field or application area rather than make or model of computing system. The engineer's dissatisfaction with the variety of computing languages was evident here also. The feeling was that by grouping independently of the computing system, the manufacturer would be forced to develop software systems compatible on all present and future hardware systems.

The last area, although not applicable to all user groups, was the desire for the centralized agency or governing body. A few wanted the federal government or an association of the computer producers to fill this role. The impracticality of these suggestions is fairly evident. The majority expressing this opinion were in favor of the A. S. C. E. assuming this role. There are indications that the professional societies have in some degree already assumed this role. AASHO (American Association of State Highway Officials),

APWA (American Public Works Association), and IEEE (Institute of Electrical and Electronics Engineers) are definitely involved in this area presently according to data contained in Table 11. The AIChE (American Institute of Chemical Engineers) is also known to be involved in this role. The ACI (American Concrete Institute) is presently engaged in soliciting information on computer programs which are applicable in concrete design and analysis. The Task Committee on Electronic Computation Within the Soil Mechanics and Foundations Division of the A. S. C. E. has just completed a survey of computer programs applicable within their area. Two subcommittees within the Committee on Electronic Computation of the Structural Division of the A. S. C. E., the Task Committee on Guide to Development and Use of Electronic Computer Programs and the Subcommittee on Publications, appear to indicate that the A. S. C. E. is also entering this area to some degree. It would not be unreasonable to expect better documentation, governing controls, and less duplication of effort if the professional societies assumed this organizational role. The sense of professionalism that the engineering society would impose certainly could not be considered as being detrimental to any improvement program.

There is certain evidence existing today indicating that many of the engineer's expressed desires may become reality. From the first commercial installation of a computing system in 1951, the number

of computers has grown considerably to a present day estimate of perhaps as many as 50,000 installations. The numbers of different systems and languages are well into the hundreds. But the present emphasis has suddenly become reoriented. We are now finding on the market the compatible family type of computing system which, as the older systems are retired, will become predominant. Software systems are presently being considered which should indicate a decline in the variety of computer languages so much in evidence today. For the engineer, at least, this is already occurring. The rise of the problem-oriented language, which is perhaps indirectly leading to the development of the integrated systems such as ICES, is a step in that direction. Most of the compiler languages are already independent of the computing system with further modifications and improvements appearing relatively frequently. The computer languages appear to be going in two directions, but without the variety of the past accompanying them. The specialized, problem-oriented or application area languages appear to be one direction, the other being the trend to the basic or universal concept language system. In either case, total machine independence will be a recognized by-product.

There appears to be little question that computer utilization is not also increasing within the civil engineering discipline. Almost 60 percent of the engineers responding to the questionnaire sent to

them indicated the computer was used by their firms for this purpose. Many also indicated that the introduction of the computer was a relatively recent event. Some of those presently classified as nonusers also indicated that studies were under way in their firms involving computer acquisition plans for the near future. Today's engineering graduate, tomorrow's practicing engineer, is entering his profession with a computer background the graduate of ten years ago had no opportunity to obtain. Who can really foresee what the next ten years will bring? But who could doubt that the computer has become, and will remain, the most significant engineering tool since the invention of the slide rule?

For today's engineer the question is not really one of deciding to acquire or not acquire the computer. It has been reduced through competition, technological advancement, and psychological acceptance, to a problem involving only the method of acquisition. Depending on the computer experience within a firm, and the economical considerations involved, five basic methods are available to the engineer. These are to buy a computing system outright, to lease a system, to become a member of a time sharing group, to use the facilities of a commercial service bureau, or to retain the services of a relatively new entrant into the computer field, the computer applications consultant. Each method has its own advantages and disadvantages, the point being that for any range of conditions a possible

solution to the acquisition problem presently exists.

What is in the future for the present day computer user group? They already appear to be in a state of transition. The numbers grew considerably during the past decade. Now, some are no longer in existence, others have merged. The tendency is definitely away from the single machine oriented group. Through the mergers and discontinuance of many of the older groups, those remaining are more single producer oriented. SDS, RAYTHEON, RCA, SNUG and COMMON are but a few examples. The reorientation to the applications area may be the next logical step. EXCHANGE and HEEP within the civil engineering discipline, joined by a relative newcomer CEPA, show that this is already occurring. BIO, MCUG, CAUSE and UAIDE show that this development is not confined solely to the engineering profession.

What role will the user group play in the future? This investigation cannot provide the answer. There are too many events presently occurring which will influence any prediction of the future. The advances in hardware and software developments proposed for the future will greatly influence the existing computer user group. The rise of the time sharing concept, the service bureau and the computer applications consultant are also too significant to be ignored. For the engineer, the possible professional society activities in this area, coupled with the just mentioned projections, could eventually

disassociate him from the present day computer user group. The computer user group concept, as we are now familiar with it, may well cease to exist.

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APPENDICES

APPENDIX I

QUESTIONNAIRE DISTRIBUTIONS AND RETURNS BY STATE

State	Membership		Total Mailed	Total Returned	Returned Unclaimed	Effective Returns
	Total	1%-2%				
Alabama	730	7-15	13	11	1	10
Alaska	242	2- 5	5	4	0	4
Arizona	492	5-10	5	4	1	3
Arkansas	295	3- 6	5	4	0	4
California	8777	88-176	137	121	11	110
Colorado	1042	10-21	17	15	2	13
Connecticut	621	6-12	11	9	0	9
Delaware	219	2- 4	4	3	0	3
District of Columbia	636	6-13	16	14	2	12
Florida	1297	13-26	24	21	5	16
Georgia	741	7-15	18	14	2	12
Hawaii	551	6-11	11	11	1	10
Idaho	207	2- 4	1	1	0	1
Illinois	2366	24-47	43	37	5	32
Indiana	718	7-14	12	11	0	11
Iowa	450	4- 9	10	8	1	7
Kansas	672	7-13	7	7	0	7
Kentucky	429	4- 9	7	6	1	5
Louisiana	878	9-18	15	9	2	7
Maine	246	2- 5	3	3	0	3
Maryland	1396	14-28	22	19	1	18
Massachusetts	1413	14-28	22	16	2	14
Michigan	1127	11-23	24	19	0	19
Minnesota	536	5-11	11	10	2	8
Missouri	1392	14-28	23	17	1	16
Mississippi	383	4- 8	7	5	0	5
Montana	233	2- 5	3	3	0	3
Nebraska	408	4- 8	9	8	0	8
Nevada	216	2- 4	6	5	0	5
New Hampshire	146	1- 3	3	2	0	2

State	Membership		Total Mailed	Total Returned	Returned Unclaimed	Effective Returns
	Total	1%-2%				
New Jersey	1610	16-32	24	21	4	17
New Mexico	352	4- 7	5	5	0	5
New York	4372	44-87	77	59	10	49
North Carolina	688	7-14	13	9	0	9
North Dakota	79	1- 2	2	2	0	2
Ohio	1704	17-34	32	30	2	28
Oklahoma	471	5- 9	9	9	1	8
Oregon	691	7-14	11	11	0	11
Pennsylvania	2590	26-52	43	29	4	25
Rhode Island	177	2- 4	6	5	0	5
South Carolina	392	4- 8	5	3	0	3
South Dakota	140	1- 3	3	3	0	3
Tennessee	942	9-19	15	9	0	9
Texas	2369	24-47	43	36	3	33
Utah	323	3- 6	5	5	2	3
Vermont	98	1- 2	1	1	0	1
Virginia	1659	17-33	19	16	0	16
Washington	1511	15-30	26	20	1	19
West Virginia	287	3- 6	3	3	0	3
Wisconsin	792	8-16	13	13	3	10
Wyoming	104	1- 2	1	1	0	1
TOTALS:	50210		850	707	70	637

APPENDIX II

SURVEY QUESTIONNAIRE

1. Name of your firm: _____

2. Type of firm: CONSULTING____ FEDERAL GOVERNMENT____
   INDUSTRIAL____ STATE/LOCAL GOV'T._____
   RESEARCH_____ OTHER_____

3. Size of firm: LESS THAN 10____ 100- 500 ___ 5000-10000_____
   10- 50_____ 500-1000____ GREATER
   50-100_____ 1000-5000____ THAN 10000____

4. Primary area of emphasis: PLANNING____ DESIGN____ CONSTRUCTION_____ OTHER____

5. Does your firm use the facilities of a computer for Civil Engineering purposes? YES____
   NO____

   If yes; Is this through FIRM OWNERSHIP____ FIRM DIRECT RENTAL____
   TIME SHARING SYSTEM____ OTHER_____
   Type of Computer(s):_____
   Language(s) used:_____

6. Is your firm a member of a "computer user group"? YES____ NO____

   If yes; NAME(S): _____
   ADDRESS(ES): _____
   _____

7. Does your firm maintain its own library of computer programs--either written by your firm or secured from outside sources?
   YES____ NO_____

8. Does your firm have programs available from sources outside of your own library or from a user group?
   YES____ NO_____

9. Are you personally in favor of the increasing usage of computer applications in the field of Civil Engineering?
   YES____ NO____ NO OPINION_____

10. Are you in favor of the concept of the computer user group?
    YES____ NO____ NO OPINION_____

11. Do you feel the computer user groups are presently fulfilling their role, relative to the field of Civil Engineering?
    YES____ NO____ NO OPINION_____

12. Do you have any comments (either PRO or CON) concerning the computer user group concept that you would care to make?
    YES____ NO____

    If yes; Please comment: _____
    _____

13. Would you object to further questions concerning the subject of computer user groups (from me at a later date if the need should arise)?

YES____ NO____

(Optional); Name:_____

Address: _____

_____

Thank you very much. When you have completed this form, would you please return it to me in the prepaid, preaddressed envelope that I have enclosed.

NOTE: If insufficient answer space exists, feel free to use additional paper to complete your answer.

APPENDIX III

CORRESPONDENCE WITH THE PRACTICING CIVIL ENGINEER

A. LETTER OF INTENT

(Mr. John Q. Engineer
c/o ABC Engineers, Inc.
1234 Any St.
Anytown, USA 10000)

Dear Fellow ASCE Member,

What is the role of the "Computer User Group" to the practicing engineer? Is this role being fulfilled? Under the auspices of a grant from the National Science Foundation, I am undertaking an investigation of this subject area and soon hope to be able to answer these and other similar questions.

The banding together of the users of similar model computers, or of engineers writing programs for a particular subject area, and in some cases with the assistance of the computer manufacturers themselves, has brought about the evolution of the "computer user group". Whether these groups have been successful in their endeavors is perhaps subject to question. There appears to have been little attempt in the past to evaluate the success or shortcomings of this fundamental and possibly highly important concept.

In my attempt to answer some of the pertinent questions on this subject, I need first-hand information on the current trend and opinion on this subject from the person most affected by it--the practicing engineer. Enclosed is a survey questionnaire for which I hope you will find the time to complete and return to me in the return envelope that I have provided. The survey form has questions of a general as well as a specific nature to aid in establishing current background information. Included also, are a few "personal opinion" questions that I hope you will answer freely (anonymity will be guaranteed). The results will be used in a form of tabular compilation, therefore completeness of the form is important. Where information is unknown to you, or not readily available, would you please note this.

If I may be of any assistance or answer any questions you may have, please feel free to contact me. Thank you for your time and effort in this quest.

Sincerely,

/s/Gerald R. Cunningham

Gerald R. Cunningham
Associate Member ASCE
NSF Trainee--O. S. U.

Enclosures: Survey Form
Return Envelope

B. FIRST LETTER OF APPEAL

(Front)

(Mr. John Q. Engineer
c/o ABC Engineers, Inc.
1234 Any St.
Anytown, USA 10000)

(Back)

Dear Fellow ASCE Member:

For reasons unknown, I still have not received my questionnaire back from you. This is an extensive survey, but to be effective, it must be complete. Therefore, every individual return is quite important in the final evaluation. As the sole representative of your organization involved in this investigation, your questionnaire forms an integral part of this survey. I hope it is nothing more than a short delay until you find the opportunity to return it to me.

My apologies if, by chance, our correspondence has crossed paths in mid-journey. Thank you.

Gerald R. Cunningham
Dept. of C. E. ----OSU
Corvallis, Oregon 97331

Sincerely yours,

/s/G. R. Cunningham

C. SECOND LETTER OF APPEAL

OREGON STATE UNIVERSITY
The Dept. of Civil Engineering
Corvallis, Oregon 97331

Dear ASCE Member:

Several recipients of my recent questionnaire concerning computers and computer user groups have written asking for a second copy of it, due either to misplacing or incorrectly filling out the original copy.

The tabulation and analysis of this questionnaire is now under way, and I note that I have not yet received your copy of the questionnaire either. You may possibly fall into the group mentioned above, and as a result, I am enclosing another copy for your use. Enclosed also, you will find another prepaid, preaddressed return envelope for your convenience. I hope that you will find the opportunity to provide the desired data for me shortly.

The eventual goal of this effort is to provide information of a beneficial nature to all of us in the field of Civil Engineering. Therefore, my thanks again for your assistance in making this endeavor successful.

Sincerely yours,

/s/ Gerald R. Cunningham

Gerald R. Cunningham
Assoc. Member--ASCE

Enclosures: Survey Form
Return Envelope

APPENDIX IV

SURVEY QUESTIONNAIRE

Part I: (Background and History)

1. Name of group or organization (including any abbreviated name by which it may be commonly known): _____

_____

2. Date of group formation: _____
3. Estimated current membership: _____
4. Primary field(s) of interest (i. e., General, Accounting, Engineering, etc. -----if more than one, would you please indicate the order of emphasis): _____

_____

5. Are you a member of any national organization (such as JUG, or AFIPS, etc.)? Please indicate which, with addresses if applicable--: _____

_____

6. Are you affiliated with any of the computer producers? If yes, please indicate which: ____

_____

7. Briefly, what are the requirements for membership in your organization: _____

_____

_____

8. What restrictions would a "nonmember" be under if he desired to utilize the services of your group without joining the organization? _____

_____

_____

9. Is your membership relatively static, or is your group continually expanding? _____

_____

_____

(END PART I)

PART II:

1. At which of the following organizational levels would you rate your group?

	Original Goal	At Present	Desired Goal
a. Program and information exchange among users regardless of field of activity and make of computer----------	_____	_____	_____
b. Program and information exchange among users regardless of computer make, but in same field of activity----------	_____	_____	_____
c. Program and information exchange among users regardless of field of activity, but in the same make of computer area---	_____	_____	_____
d. Program and information exchange among users in the same field of activity and who use the same make of computere---	_____	_____	_____

PART II (cont.)

2. How are the programs exchanged?
   a. Tape, cards, print-out, or ? _____
   b. Costs: _____
   c. Are flow charts provided? _____
   d. Is a written description listing assumptions, theories used, program limitations, etc., provided? _____
   e. Is the program author's name and address provided for any additional questions that may arise? _____
   f. Have the programs been fully "debugged"? _____

3. Which of the following distribution situations does your group best fit into (if not both)?
   a. UNRESTRICTED (program accessibility open to all members on an unrestricted basis):
   _____
   b. RESTRICTED (program accessibility based on an equivalent exchange or less situation):
   _____
   1) What is the exchange "rate"? _____
   _____
   2) Who determines the relative level or degree of value of the exchangeable program?
   _____

4. Is any programming done by the group itself (i.e.; programs for use by the membership, but not contributed by them? _____
   _____

5. Is, or has there been any attempt to place programs on a generalized non-specific computer make or language level? _____

6. What type (and models) of computers does your group use? _____
   _____

PART II (cont.)

7. What computer programming languages does your group use? _____

_____

8. Is your group administered on a part-time basis, or by a full-time committee or governing body? _____

_____

9. Would you please provide a complete contact name and address for future use by anyone desiring further information concerning your organization:

_____

_____

_____

_____

_____

(END PART II)

APPENDIX V

CORRESPONDENCE WITH THE COMPUTER USER GROUP

A. LETTER OF INTENT

(Mr. John Q. Doe
Secretary--ABC Computer User Group
c/o XYZ Corporation
1234 Some St.
Anytown, USA 10000)

Dear Sir:

An investigation of the role of the computer, and particularly its applications in the field of engineering, is currently under study here at Oregon State University. An extensive survey of engineers and engineering firms throughout the United States has just been completed. Part of this survey included questions regarding the so-called "computer user group", or more generally, the computer program exchange organization.

In our information quest, a point has now been reached where assistance from the computer user groups would prove invaluable. Your name and address, and the organization which you represent, was provided to us from this survey, or from other organizations which have had contact in one form or another with your group. I hope that I am not being too presumptive, but I have included several requests for specific information regarding your organization with this latter. I would appreciate it very much if you could provide the answers to these questions, returning them to me at your earliest convenience.

I would also like to inquire at this time about the possibility of obtaining a copy of your computer program library catalog for our use in evaluating the contents and areas of interest within your organization. I assure you that no part of it would be reproduced, and it would be returned to you if requested. If you are unable to provide the catalog, would you please include any reasons as to why not, and indicate whether it would be available at a later date.

The ultimate goal of this endeavor is to provide the practicing engineer with a composite source of information regarding the general area of computers. A large number of the survey recipients specifically indicated that knowledge of organizations such as yours was quite limited, if not altogether lacking. This investigation is an attempt to provide this information to those who may desire it in the future. Therefore, your assistance would be of much value.

I sincerely appreciate your time, effort, and cooperation in this undertaking. Thank you.

Sincerely yours,

/s/Gerald R. Cunningham

Gerald R. Cunningham

Enclosures

B. FIRST LETTER OF APPEAL

OREGON STATE UNIVERSITY
Dept. of Civil Engineering
Corvallis, Oregon 97331

(Mr. John Q. Doe
Secretary, ABC Computer User Group
c/o XYZ Corporation
1234 Some St.
Anytown, USA 10000)

Dear Sir:

I would like to inquire about the disposition of an information request made of you several weeks ago. The subject of the request was the "computer program exchange organization", more specifically, information regarding the group which you are representing as one of the officers or prominent committee members.

The information desired will form an integral part of the general investigative survey currently under study at this institution. Your cooperation and assistance would be of invaluable help in this undertaking.

If by chance the original "questionnaire" has been misplaced, would you please let me know and I will be more than happy to mail you a new one by return mail.

Thank you very much.

Sincerely yours,

/s/Gerald R. Cunningham

Gerald R. Cunningham

APPENDIX VI

COMPUTER USER ORGANIZATIONS

NOTE: All unconfirmed information is indicated within parentheses.

1. CEPA--"Civil Engineer Program Applications"
   - Field of Interest: Civil Engineering
   - Equipment Used: IBM 1130
   - Contact : Dr. Albert K. Spalding
     c/o Tippetts-Abbett-Mc Carthy-Stratton
     375 Park Ave.
     New York, N. Y. 10022

2. CITA
   - No information available

3. COMMON
   - Field of Interest: General
   - Equipment Used: IBM 1130, 1620, 1710, 1800, and System 360
   - Contact : Mr. Charles Maudlin, Jr.
     Secy-Treas. COMMON
     c/o Computer Center
     Indiana State University
     Terre Haute, Ind. 47809
     or
     Mr. James Stansbury
     Pres. COMMON
     c/o Halcon International
     2 Park Ave.
     New York, N. Y. 10016

4. CO-OP
   - Field of Interest: Unknown
   - Equipment Used: (CDC 1604, 1604A, 2400, 3600)
   - Contact : (Dr. Wallace Givens
     c/o Argonne National Laboratory
     9700 S. Cass Ave.
     Argonne, Ill. 60440)

5. CUBE--"Co-operating Users of Burroughs Equipment"
   - Field of Interest: Unknown
   - Equipment Used: Burroughs B100-B8500
   - Contact : Thomas S. Grier
     Special Representative to CUBE
     Burroughs Corp.
     6071 Second Ave.
     Detroit, Mich. 48232

6. DATA 620 USERS GROUP
   No information available

7. DECUS --"Digital Equipment Corp. Users Society"
   Field of Interest: Scientific
   Equipment Used: PDP-1, 4, 5, 6, 7, 8, 9, 10
   Contact : Mrs. Angela Cossette
   Exec. Secy-DECUS
   146 Main St.
   Maynard, Mass. 01754

8. DETAB/65
   Field of Interest: Unknown
   Equipment Used: Unknown
   Contact : (Mr. George Mc Kinney
   Honeywell, Inc., EDP Div.
   60 Walnut St.
   Wellesley Hills, Mass. 02181)

9. EXCHANGE --"Bendix G-15 Users EXCHANGE Organization"
   Field of Interest: Civil Engineering
   Equipment Used: CDC, formerly Bendix, G-15
   Contact : Mr. Douglas S. Bolitho
   User Group Liasion
   Control Data Corp.
   3145 Porter Drive
   Palo Alto, Calif. 94304

10. FAST
    Field of Interest: Unknown
    Equipment Used: Unknown
    Contact : (Mr. Bruce Clark
    Secy-FAST
    c/o Ramo Wooldridge
    P. O. Box 997
    Sierra Vista, Ariz.)

11. GE USERS GROUP
    Field of Interest: Unknown
    Equipment Used: Unknown
    Contact : (Mr. Robert B. Scott
    GE Computer Dept.
    Marketing, 400 Product Line
    P. O. Box 270
    Phoenix, Ariz.)

12. GET -- "General Electric 225 Users Association"
    Field of Interest: Unknown
    Equipment Used: (GE 225)
    Contact (Prof. W. A. Smith, Jr.
    President of GET
    c/o Computing Lab
    Lehigh University
    Bethlehem, Pa. 18105)

13. GUIDE --"Guidance for Users of Integrated Data Processing Equipment"
    Field of Interest: Commercial Data Processing
    Equipment Used: IBM 705, 1401, 7000 Series, System 360-Model 40 or higher
    Contact : Miss Lois E. Mecham
    Secy. --GUIDE International
    c/o United Services Automobile Assn.
    4119 Broadway
    San Antonio, Texas 78215

14. G-20 USERS GROUP
    Field of Interest: Unknown
    Equipment Used: CDC, formerly Bendix, G-20
    Contact : (Mr. John J. Hart
    c/o Bendix Corp.
    Bendix Radio Division
    Baltimore, Md.)

15. HEEP--"Highway Engineering Exchange Program"
    Field of Interest: Civil Engineering
    Equipment Used: IBM 1401, 1410, 1440, 1620, System 360
    Contact : Mr. Lloyd H. Morgan or Mr. A. J. Landry
    Secy-HEEP P. O. Box 4245
    c/o Washington State Hwy. Comm. Capitol Station
    Highways-Licenses Bldg. Baton Rouge, La. 70804
    Olympia, Wash. 98501

16. HONEYWELL 400/1400 USERS ASSOCIATION
    Field of Interest: Unknown
    Equipment Used: Unknown
    Contact : (Mr. T. S. Ansel, Secretary
    H 400/1400 Users Assn.
    c/o Beech Aircraft Corp.
    9709 East Central
    Wichita, Kansas 67201

17. HUG --"Honeywell Users Group"
    Field of Interest: Scientific, Business
    Equipment Used: H-200, 800, 2200
    Contact Mr. Earl Alwater
    Honeywell, Inc., EDP Div.
    60 Walnut St.
    Wellesley Hills, Mass. 02181

18. MAINLY MATH
    Field of Interest: Engineering, Scientific
    Equipment Used: Mathatron 428 Series, 848 Series, 4280
    Contact : Mr. Gordon Ripley, Programmer
    Mathatronics
    241 Crescent St.
    Waltham, Mass. 02154

19. NCR 304 USERS GROUP
    Field of Interest: Unknown
    Equipment Used: (NCR 304)
    Contact : (Mr. Dale R. Langford
    President-the 304 Assn.
    c/o American United Life Insurance Co.
    30 West Fall Creek Parkway
    Indianapolis, Ind.)

20. NCR 390 USERS ASSOCIATION
    Field of Interest: Unknown
    Equipment Used: (NCR 390)
    Contact : (Mr. C. Richard Fruth
    NCR 390 Users Assn.
    c/o Professional Bldg.
    Fostoria, Ohio)

21. OPCON
    Field of Interest: Unknown
    Equipment Used: Unknown
    Contact : (Mr. W. S. Filleman
    Director, Programming Systems Division
    Datatrol Corp.
    8115 Fenton St.
    Silver Spring, Md. 20910)

22. POOL

Field of Interest: Unknown
Equipment Used: CDC, formerly Royal McBee and General Precision, LGP-30, RPC-4000, RPC-9000
Contact : (Mr. Harold Farkas
Chmn. - POOL
c/o Diamond Alkali Co.
300 Union Commerce Bldg.
Cleveland, Ohio 44115)

23. RAYTHEON USERS GROUP

Field of Interest: Unknown
Equipment Used: (R 250, 440, 520)
Contact : (Mr. Orville Boyer
c/o Raytheon Computer
2700 S. Fairview St.
Santa Ana, Calif. 92704)

24. RCA COMPUTER USERS ASSOCIATION

Field of Interest: Unknown
Equipment Used: (RCA 301, 501, 601)
Contact : (Mr. Rex Mc Williams
President- RCA Users Assn.
U. S. No. 1, Lynwood Dr.
Princeton, N. J. 08540

25. SDS COMPUTER USERS GROUP

Field of Interest: General
Equipment Used: SDS 92, 910, 925, 930, 940, 9300, SIGMA 2, SIGMA 5, SIGMA 7
Contact : Harold J. Tuens
Secy-SDS Users Group
c/o Scientific Data Systems
1649 17th St.
Santa Monica, Calif. 90404

26. SHARE

Field of Interest: Scientific
Equipment Used: IBM 704, 709, 7040, 7044, 7090, 7094, System 360-Model 50 or higher
Contact : Mr. James Tupac
SHARE President
c/o The RAND Corp.
1700 Main St.
Santa Monica, Calif. 90406

27. SNUG--"Scientific NCR Users Group"
    Field of Interest: Business, Scientific, Engineering Process Controls
    Equipment Used: NCR 315-100, 315-RMC
    Contact : Mr. Nick Spillson
    NCR, EDP Products Div.
    Main and K Sts.
    Dayton, Ohio 45409

28. SPADE
    Field of Interest: Unknown
    Equipment Used: (IBM)
    Contact : (Mr. L. K. Albrecht
    c/o Massey-Ferguson, Ltd.
    915 King St., W.
    Toronto, Ontario, Canada)

29. SWAP
    Field of Interest: General
    Equipment Used: CDC 160, 160A, 924, 1700, 3100, 3200, 3300, 3500, 8090
    Contact : Mr. Thomas L. Yates
    Exec. Secy. - SWAP
    Statistics Dept.
    Oregon State University
    Corvallis, Oregon 97331

30. TUG -- "Transac Users Group"
    Field of Interest: Unknown
    Equipment Used: Philco (2000 Series)
    Contact : (Mr. Clifford Leventhal
    Exec. Secy. - TUG
    c/o Philco-Ford Corp.
    3900 Welsh Rd.
    Willow Grove, Pa.)

31. UAIDE "Users of Automatic Display Equipment: S-C 4020"
    Field of Interest: Unknown
    Equipment Used: Unknown
    Contact : (Mr. Thomas F. Penderghast
    Secy-UAIDE
    c/o Douglas Space Systems Center
    Dept. 813
    5301 Bolsa Ave.
    Huntington Beach, Calif. 92646)

32. USE -- "Univac Scientific Exchange"
    Field of Interest: General
    Equipment Used: Univac 1103A, 1105, 1107, 1108
    Contact : (Mr. C. D. Card
    Univac Data Processing Ctr.
    3443 N. Central Ave.
    Phoenix, Ariz. 85012)

33. UUA --"Univac Users Association"
    Field of Interest: General
    Equipment Used: Univac SS80/90, I, II, III, 418, 490 Series, 1004, 1005
    Contact : Mr. Murray F. Hepple
    President-UUA
    c/o Harris Trust and Savings Bank
    111 W. Monroe St.
    Chicago, Ill. 60690

34. VIM
    Field of Interest: (General)
    Equipment Used: CDC 6400, 6500, 6600
    Contact : Dr. Loren Meissner
    VIM Secy.
    USC Lawrence Radiation Laboratory
    Berkeley, Calif. 94720

35. Appendum: PAST GROUPS AND OLD NAMES
    a. AUA - "Alwac Users Association"
    (no longer active)
    b. CUE - "Cooperating Users Exchange"
    Merged with DUO to form CUBE in 1962
    c. DATAMATIC-1000 USERS GROUP
    absorbed into HUG
    d. DUO - "Datatron Users Organization"
    Merged with CUE to form CUBE in 1962
    e. FILE COMPUTER USERS
    (absorbed into UUA); check with Univac
    f. H-800/1800 USERS GROUP
    Now known as HUG
    g. IBM 1130 USERS GROUP
    Alternate name for CEPA
    h. IBM 1620 USERS GROUP
    Now known as COMMON
    i. IBM USERS GROUP
    Contact IBM Program Dept. directly
    j. LINC - "Univac LARK"
    (Absorbed into UUA); check with Univac
    k. PB 250 USERS GROUP
    See RAYTHEON USERS GROUP. Raytheon Computer acquired rights to all old Packard Bell computing systems.

l. RCA 501 USERS GROUP
Now known as RCA USERS GROUP

m. RUG - "Recomp Users Group"
No longer active

APPENDIX VII

COMPUTER MANUFACTURERS ASSOCIATED WITH EXISTING COMPUTER USER GROUPS

1. Burroughs Corporation ---------- CUBE
   6071 Second Ave.
   Detroit, Michigan 48232

2. Control Data Corporation ---------- CO-OP
   8100 34th Ave. South — EXCHANGE
   Minneapolis, Minnesota 55440 — G-20
   POOL
   SWAP
   VIM

3. Data Machines, Inc. ---------- DATA 620
   Div. of Decision Control Inc.
   1590 Monrovia Ave.
   Newport Beach, California 92660

4. Digital Equipment Corporation ---------- DECUS
   146 Main St.
   Maynard, Massachusetts 01754

5. Electronic Associates Inc. ---------- (EAI-8400)
   185 Monmouth Parkway
   West Long Branch, New Jersey 07764

6. General Electric Company ---------- GE
   Computer Department — GET
   13430 N. Black Canyon Highway
   Phoenix, Arizona 85029

7. Honeywell, Inc. ---------- DETAB/65
   EDP Division — H 400/1400
   60 Walnut St. — HUG
   Wellesley Hills, Massachusetts 02181

8. International Business Machines Corporation ---------- COMMON
   Program Information Dept. — GUIDE
   40 Saw Mill River Rd. — SHARE
   Hawthorne, New York 10532 — SPADE

9. Mathatronics ---------- MAINLY MATH
241 Crescent St.
Waltham, Massachusetts 02154

10. National Cash Register Company ---------- NCR 304
EDP Division NCR 390
Main and K Streets SNUG
Dayton, Ohio 45409

11. Philco-Ford Corporation ---------- TUG
Computer Division
3900 Welsh Road
Willow Grove, Pennsylvania 19090

12. Radio Corporation of America ---------- RCA
EDP Systems Division
Cherry Hill
Camden, New Jersey 08102

13. Raytheon Computer ---------- RAYTHEON
2700 S. Fairview St.
Santa Ana, California 92704

14. Scientific Data Systems, Inc. ---------- SDS
1649 17th St.
Santa Monica, California 90404

15. Univac ---------- USE
Div. of Sperry Rand Corporation UUA
315 Park Ave.
New York, New York 10010