COMPUTER USE IN LANDSCAPE ARCHITECTURE FIRMS WITH MEMBERSHIP IN THE ASLA

A National Survey : Spring 1984

by

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CHAPTER I

INTRODUCTION

Automation of information processing and management tasks is increasingly common, and apparently necessary, in environmental design offices today. Environmental designers collect and refer to information from many different sources: clients, consultants, and other people; catalogs, building codes, zoning ordinances and other written documents; maps, surveys and other graphic documents; and, increasingly, computerized service bureaus and electronic data bases via the telephone. They then process it in many ways: sorting abstracting, analyzing, checking, drawing inferences, and synthezing. In the course of project execution, they produce diagrams, drawings, charts, and reports of various kinds. They must disseminate information within the office, to clients and consultants, and to reviewing agencies and to job sites (Mitchell, 1984). Economic forces in the 1980's are forcing practitioners to increase their efficiency in an increasingly competitive market for environmental design, planning and management services.

The 1980's are witness to phenomenal innovation in the computer industry. At the same time that computers are becoming extremely powerful in memory capacity and other performance characteristics, they are becoming increasingly affordable. Micro computers now offer the computing capabilities of a 1970's minicomputer at a fraction of the 1970's cost (Toong and Gupta, 1982). Through access to vast amounts of useful information, the microcomputer promises to refine and enhance many kinds of communication, and to increase accuracy and speed of many repetitive office tasks. The promoters of the machines promise that computers will enable designers and other individuals to accomplish greater amounts of work in more flexible and efficient ways (Mileaf, 1982).

The 1990's promise to be a period in time when the term `design' implies `computer-aided design'(CAD), much as the term presently connotes the use of pencils and parallel bars (Mitchell, 1984). Sophisticated software has been developed for many

of the repetitive tasks which constitute much of the design process and management practices in design offices. Computing programs for numerous engineering and planning applications have been in use since the middle 1960's. Accounting and other business applications supporting office management, project management and the preparation of professional documents have been widely incorporated into practices in the public, private and academic sectors of the environmental design professions. As computer-aided design and drawing (CADD) system costs drop and software packages become easier to use, increasingly sophisticated design and graphics applications will likely spread throughout professional offices. (Milaef, 1982).

COMPUTING AND THE PRIVATE PRACTICE OF LANDSCAPE ARCHITECTURE

Monitoring the continued growth and breadth of computer applications in the environmental design fields is important. Practitioners are eager to learn new management methods and procedures which can streamline or otherwise enhance the business aspects of environmental design practice. They are eager to learn new techniques which can be employed in the design process to improve accuracy and speed in the production of drawings and specifications. Practitioners are searching for effective marketing strategies which will bring in additional or new types of business. One of the ways that this information can be gathered is to review the current status of computer applications in the fields by surveying the offices which are accessible (through professional organizations such as the American Society of Landscape Architects).

With these concerns in mind, a national survey of computer use in the private practice sector of the Landscape Architecture profession was conducted in March and April of 1984. The survey was sponsored and supported by the College of Architecture and Design at Kansas State University and the Professional Practice Institute of the American Society of Landscape Architects (ASLA). The primary intent of the study was to identify and analyze current trends in computer applications in ASLA firms, and to identify related needs and attitudes of landscape architects in landscape architecture and multidisciplinary design firms.

STUDY ISSUES

The following specific issues were addressed by this study:

1. What kinds of hardware do practitioners have in their firms, and how much money has been spent on computing equipment? Are they planning to increase their computing capabilities, and if so, what dollar amounts have they budgeted for acquistions?

2. What are the present computing capabilities of landscape architectural firms and multidisciplinary firms which employ landscape architects? How do computing capabilities vary with firm size and work load?

3. What are the perceptions of practitioners with regard to their computing needs, means for addressing those needs, and various roles for the ASLA concerning computing and the profession?

4. If practitioners do not intend to acquire computing equipment, what are their reasons, and what is the single most important "missing ingredient" for practitioners who are inclined to use computers in their offices but have not yet done so?

These four study issues constitute the core of the study and were expanded into the fifteen questions on the survey form (see Chapter III: Methodology). The findings of the study are reported in four major sections which correspond to these issues, and in a fifth section which reports and discusses the comments of the respondents, which were written at the end of the forms (see Chapter IV: FINDINGS).

The hypotheses with which this project began are as follows:

1. The larger the firm size, the broader and more sophisticated will be the applications of computer technology,

2. Multidisciplinary firms will exhibit a much stronger commitment to the technology than will strictly landscape architectural firms,

3. People in larger firms will exhibit more positive attitudes toward computers than those in smaller firms,

4. Office management applications such as word processing, specification writing and accounting will be the most heavily used applications,

5. The price and other costs of computer systems are still too high for many firms, but there are many practitioners who are close to making the decision to acquire computer technology in one form or another, and

6. If landscape architecture firms are intending to acquire a computer system, the choice will likely be a microcomputer system.

This study was undertaken to determine the current status of computer use in the profession of Landscape Architecture, with the intentions of establishing an overview of trends and perspectives, from a large sample of firms.

The findings of this survey will provide an overview of computer use in the profession, and insight into current attitudes held by landscape architects. It should also assist the ASLA in determining what additional services are needed by practitioners who are interested in incorporating computer technology into their practices.

CHAPTER II

BACKGROUND/LITERATURE REVIEW

TRENDS IN THE 1980'S

The business environment in which environmental designers practice is undergoing rapid and radical change. These changes are caused by the explosion in the development and aquisition of new information on one hand, and on the other, by the revolution in the computer tools that help practitioners to gather, interpret and apply this information to environmental design and decision-making. The purpose of this discussion is to review the current business information environment and the role that computer technology is playing in the management of environmental design practices. The following discussion of applications draws heavily on observations by Brooks and Clement (1984).

The Changing Business Information Environment. The environmental design professions have long been considered to be part of the service sector of the economy rather part of the product-oriented sector. In recent time, however, futurologists have identified a large portion of the economy as an "information sector" -- gathering and distributing information (Toffler 1980, Naisbett, 1982). Naisbett points out that:

> "Scientific and technical information now increases 13 percent per year, which means that it doubles every 5.5 years. The rate will soon jump to perhaps 40 percent per year because of new, more powerful information systems and increasing population of scientists. That means that data will double every twenty months. By 1985 the volume of information will be somewhere between four and seven times what it was only a few years earlier." (Naisbett, 1982, pg. 16)

One implication of this rapid information explosion is that the base of technical and professional environmental design information is changing faster than planners and designers can keep

up with it. The constant growth of new information and technologies creates new opportunities of design and implementation strategies and possibly new forms of practice. For educational institutions, this implies that the information that a student might need to be familiar with might have radically changed just in the five years necessary to complete a degree in that field.

In describing the office of the future, Cheney (1984) describes the way in which technology has and will continue to change the manner by which office functions are accomplished. There has been a trend for office automation. These trends are summarized by Cheney in Table 1 below. The technology suggested by Cheney for the 1990's is already commercially available.

Function	1950's	Now	1990's
Writing	Manual Typewriters	Word Processing	Speech Recognition Systems
Voice Communications	Plain Telephones	Multifeatured Telephones	Mobile/ Personal
Calculations	Mechanical	Electronic Calculations	Personal Computer
Travel	Trains	Planes	Video-conferencing

Table 1: TRENDS IN OFFICE AUTOMATION (After Cheney, 1984)

Trends in Computer Technology. Most of the above trends in office automation are based on digital electronic technology and will be managed and integrated with computers. The first personal computer was put on the market in 1975 and was considered appropriate only for hobby use. Since that time the personal computer has risen from the status of being a curiosity and a toy to a position of an essential tool in many offices. It was estimated in 1982 that the computer industry sold 2.8 million units for $4.9 billion (Friedrich 1983). In the 1960's and 1970's computers were considered too expensive and too limited in storage capacity for use by anyone other than large institutions or companies. However, Toong and Gupta (1982, p.1) have shown that "the cost of computer logic devices is falling at the rate of 25 percent per year and the cost of computer memory at the rate of 40 percent per year. Computational speed has increased by a factor of 200 in 25 years. In the same period the cost, the energy comsumption and the size of computers of comparable power have decreased by a factor of 10,000".

Emerging technologies may accelerate the rate of change within the industry as there are more applications of breakthroughs in materials processing, fiber optics, super-miniaturization and systems integration (Marshall n.d., Marbach and - others, 1983a, Marbach and others, 1983b). In 1980, microcomputing technology was based on 8-bit microprocessors and random-access memory was made up of 16K-byte chips. An internal memory capacity of 16K (kilobytes of Random Access Memory) to 48K was quite typical. The best selling computer hardware in 1984 uses 16-bit microprocessors and random-access memory made up of 64K chips. Most of the best selling software won't even load in 48K of memory. The minimum internal memory on many systems is 64K of RAM memory , and 256K of internal memory is a more typical capacity for business use. The development of 256K RAM chips, expected to be available for commercial use in 1985 or 1986, will further increase the power, speed, and capacity of microcomputing systems. Already, new Lisa operating system developed by Apple and the VisiOn operating system developed by VisiCorp use considerably more than 256K internal memory. Fiber optics are expected to create radical advancements in computer-assisted communications and bubble memory and/or biologically-based memory may have the same effect on data storage capacity. Flat-screen displays based on electroluminescence technology is expected to replace the larger, heavier, bulkier cathode ray tube monitors common on current microcomputer systems, allowing development of even more portable systems.

Numerous authors (Deken 1982, Friedrich 1983, and Toong and Gupta 1982) have described the potential impacts that microcomputers will be making on our society and the way we do business in the next decade. Table 2: CURRENT MICROCOMPUTER APPLICATIONS (page 9) is a list of types of applications for which microcomputers will be used. It lists generalized applications rather than specific professional planning and design applications. Many of the popular journals have listed categories of software applications (for instance, see the 1985 Annual Software Review Edition of PC World, Winter 1984-85).

Microcomputer Applications in the Environmental Design Professions. The list of current microcomputer applications in Table 2 does not directly list architecture, planning and design applications under a topic of Architecture and Design, however, most of the applications that are made in professional design offices are accounted for at some place in the listing. A number of planners and designers have seen the potential for expediting their work with the use of computer technology. Computer applications in architecture and design have been described by a number of people, including Brooks and Clement (1984), Coutts, Greig and Lansdown (1983), Fabos (1983, and 1984), MacDougall (1983), and Pohl and Conrad (1978). In a typical design practice, these authors write, microcomputers are starting to be used for a number of applications that include office management, project management, engineering calculations and technical decision-making, planning and design, and graphics.

In his article: Paperless Landscape Architecture: Future Prospects?, Julius Fabos writes of three major agents of change which are affecting the profession of landscape architecture:

1. the increased availability of spatial data in electronic or digital form,

2. the recent explosion in computer hardware and software technology (especially in microcomputers), and

3. the increase in activities concerning technology transfer during recent years (to public, private and academic practice).

Fabos discusses these agents from a historical perspective, noting that several government agencies are collecting data by satellite and other remote sensing devices, to build vast reserves of information which can be useful to land planning professionals. The spatial resolution is approaching 10 meters by 10 meters, which will provide site planners with temendous amounts of data at a useable scale.

The development of microcomputer technology, including graphic display devices and interactive design systems, is described by Fabos. He suggests that, through applications of this type of high technology, environmental designers will be enabled to evaluate more alternative solutions since time-consuming and tedious tasks (such as cost estimates and working drawings) will be done by machine. He also suggests that the costs of design services should decline to levels affordable by anyone building a house and/or garden.

Fabos reviews recent technology transfer programs sponsored by government, universities and corporations. NASA's promotion of Landsat data, for instance, has made thousands of people aware of the potentials of computer-assisted planning. Fabos predicts, "By the end of the decade...computer literacy will be as much a part of the education of landscape architects as is visual literacy today [1983]."

In the preface to his book: Microcomputers in Landscape Architecture, E. Bruce MacDougall states that microcomputers are becoming an integral part of landscape architecture practice. His book includes a review of current microcomputer hardware and the BASIC programming language, a discussion concerning the decision to computerize office procedures, and several chapters which describe applications written in the BASIC language. These applications include software for digital terrain models; slope, solar potential and runoff calculations; perspectives; sun and shadow calculations; earthwork calculations; plant selection and landscape assessment; and project management. The thesis of the book is that with a modest investment in equipment, programming and software, many office procedures can be streamlined and improved, which in turn will enhance a landscape architecture firm's creativity and profitability.

General Business
- accounts payable/receivable
- general ledger
- payroll
- personnel
- scheduling
- forecasting
- inventory

Spreadsheets & Financial
- spreadsheet analysis
- investment analysis
- tax preparation

Data & Information Management
- relational data bases
- filing systems
- mail lists, mail-merge

Word Processing & Text Editing
- word, text and document processing
- spellers, dictionaries, thesauri
- contract & specification preparation

Communications
- electronic mail, bulletin boards
- remote terminal uses

Graphics
- high resolution graphics & animation
- digital image processing
- computer-aided drafting

Science & Engineering Applications
- statistical analysis
- structural analysis
- systems analysis
- remote sensing, analysis & management
- construction project design
- cost-estimating

Geographic Information Systems
- resource classification
- resource modeling & management

Job & Industry Specific Applications
- computer-aided design
- computer-aided manufacture & robotics
- point-of-sale systems

Educational Applications
- tutorial programs
- computer-aided instruction

Personal Applications
- personal finance
- record-keeping
- electronic newspapers and libraries

Entertainment
- games, music & art

Table 2: CURRENT MICROCOMPUTER APPLICATIONS (After Brooks and Clement, 1984)

RECENT SURVEYS

The survey conducted as part of this research follows similar surveys made by the American Institute of Architects (AIA) (AIA, 1983) and by the Design Research Institute at Iowa State University (Anderson, 1983). The AIA has conducted a short survey for each of the past three years. They have documented, in a general way, the increasing growth and breadth of computer applications in firms of AIA members. The Anderson survey documents, in detail, computer use by practitioners with membership in the AIA, the American Institute of Certified Planners (AICP) and the ASLA. Anderson included public and academic practice as well as private practice firms in his sample.

These two surveys provide a basis for comparison, and, through Anderson's work, a means for estimating (very roughly) the growth of computer applications in the profession of Landscape Architecture. The discussion pertaining to the growth of computer applications in the environmental design professions appears in Chapter V: CONCLUSIONS.

The AIA Survey. The AIA survey consisted of eight questions, the first seven of which had been asked for three consecutive years (1981, 1982 and 1983). The questions were general in nature and permit a general description of present computer use in firms of AIA members. The data for 1983 is from a random sample of 10% of the AIA firm membership (1200 or so firms in the sample). A response rate of 50% for 1983 generated data for 615 firms. Seventyfive percent of the respondents were in firms of less than ten people. Practitioners in more than half of the firms indicated that they did not have computers currently, but planned to buy equipment this year.

With regard to present capabilities, the 1983 AIA survey asked respondents to identify capabilities that they currently had in the office or ones that they were considering acquiring (the level of use was not measured). Four distinct frequency ranges occur in the results. Word processing and other management applications are heavily used. These are indicated in Table 3: CAPABILITIES, AIA SURVEY FINDINGS,1983 on the following page.

Range	Application	Frequency	Percent of Respondents
1.	Word Processing	406	66
2.	Specifications	281	46
	Job Cost Accounting	262	43
	Financial Management	247	40
3.	Project Management	146	24
	Scheduling	127	21
	Graphics	122	20
4.	Struct./Mech. Design	78	13
	Library Storage	70	11
	Life Cycle Costing	43	7
	Other	42	7

Table 3: CAPABILITIES, AIA SURVEY FINDINGS, 1983.

The findings concerning budgeted dollars for computer equipment acquisition are as follows (the categories are from the AIA survey form).

Budget Range	Frequency	Percent of Respondents
Under $1,000	90	15
$1,000-$6,000	172	28
$6,000-$15,000	74	12
$15,000-$50,000	31	5
$50,000-$100,000	12	2
Over $100,000	8	1
Not Determined	113	18

Table 4: BUDGET, AIA SURVEY FINDINGS, 1983.

When asked what their computer-related needs and problems were, practitioners most frequently selected information-related needs. The highest ranked needs are presented in the following table.

Need or Problem	Frequency	Percent of Respondents
Knowledge of Software Availability	327	53
Basic Computer Applications Education	240	39
Evaluating Vendors	185	30
Access to Software	176	29
Upgrading Existing Hdwr./Sftwr.	113	18
Comparing System Cost to System Value	99	16
Evaluating Needs	96	16
Training Office User Personnel	61	10
Developing Software	60	10

Table 5: NEEDS AND PROBLEMS, AIA SURVEY FINDINGS, 1983.

The final question of the 1983 AIA survey concerned potential roles of the AIA with regard to computer technology and the field. The findings are summarized in the following table.

Role for the American Institute of Architects	Frequency	Percent of Respondents
Acts as Information Clearing House	278	45
Develops Software	129	21
Makes Programs Available by Computer	52	8
Offers Courses on Computer Use	47	8
Other	21	3

Table 6: ROLES, AIA SURVEY FINDINGS, 1983.

The findings of the AIA survey, which pertain to architectural firms with membership in the American Institute of Architects, are similar to the findings of this survey, which was directed toward landscape architectural firms with membership in the American Society of Landscape Architecture.

The Anderson Survey. Paul F. Anderson, of Iowa State University College of Design, mailed his questionnaire to 400 architecture, landscape architecture and urban and regional planning professionals in the spring of 1983. His principal purpose was to identify current computer use in the professions, in order to determine the need for addressing computer technology in undergraduate, graduate, and continuing education. He obtained a response rate of 62.75 percent, with 262 returned questionnaires. The following summary is taken almost directly from Prof. Anderson's summary of his report.

Prof. Anderson found that 66 percent of the respondents worked in organizations which used computer technology. As in the AIA survey results, the most common applications involved word processing. Office management and professional documents applications were used in a quarter to a half of the respondents' organizations; statistical analysis and engineering applications occurred in a tenth to a quarter of these organizations. Graphics applications were least used and occurred in less than a fifth of the organizations. Table 7: CURRENT APPLICATIONS, ANDERSON, 1983 (next page) is derived from Anderson's report and summarizes the use of various applications in 1983.

Graphics applications and correspondence were the newest applications in the organizations which use computer technology, while overlay mapping, simulation/modeling and various engineering applications were reported to have been used the longest.

The effects of computer technology on personnel numbers appeared to be negligible, but reports of 10 to 50 percent increases in efficiency in office procedures were common. Approximately half of the respondents to this survey indicated that 20 percent of their organizations' work loads were accomplished with the aid of computer technology.

Respondents identified their needs as: CADD, microcomputers, expanded random access memory, additional peripherals, and user-friendly software.

Prof. Anderson's survey also addressed perceptions concerning computing skills, and he discusses the implications of his findings for undergraduate, graduate and continuing education programs. About half of his respondents agreed that future professionals will need some hands-on skills, and a clear majority (sixty nine percent) indicated that a programming language should be learned, although there was little agreement on which one(s). One clear finding was that graduates of

professional programs must enter the job market with a basic knowledge of computing principles (Anderson, 1983).

Application	Frequency A	Frequency B	Percent A	Percent B *
Record Keeping	100	(32)	39.8	(33.6)
Budget/Accounting	113	(38)	45.0	(40.0)
Correspondence	96	(32)	38.2	(33.6)
Mailing Lists	84	(25)	33.4	(26.3)
Other Office	39	(13)	15.4	(13.6)
Cut and Fill	33	(19)	13.1	(20.0)
Surface Runoff	31	(16)	12.3	(16.8)
Road/Curve Layout	33	(17)	13.1	(17.8)
Structural Analysis	34	(9)	13.5	(9.4)
Energy Analysis	44	(12)	17.5	(12.6)
Other Engineering	23	(10)	9.0	(10.5)
Specifications	75	(27)	29.8	(28.4)
Cost Data	48	(14)	19.1	(14.7)
Contract Documents	54	(19)	21.5	(20.0)
Materials Selection	10	(4)	3.9	(4.2)
Other Documents	7	(0)	2.7	(0.0)
Technical Drawings	19	(6)	7.5	(6.3)
Perspective Drawings	7	(0)	2.7	(0.0)
Design Drawings	9	(3)	3.5	(3.1)
Charts / Graphs	42	(10)	16.7	(10.5)
Other Graphics	4	(0)	1.5	(0.0)
Design Programming	26	(8)	10.3	(8.4)
Statistical Analysis	64	(16)	25.5	(16.8)
Simulation and Modeling	38	(12)	15.1	(12.6)
Overlay Mapping	20	(7)	7.9	(7.3)
Other Design / Planning	9	(1)	3.5	(1.0)

* Column A = All Respondents
Column B = Landscape Architects

Table 7: CURRENT APPLICATIONS (From Anderson, 1983)

THE NEED FOR THIS RESEARCH

This research effort is broader in scope than that of the AIA survey, and incorporates approximate measurement of various uses of computer technology in the instrument. It is narrower in scope than Prof. Anderson's work, with the intention of providing a current overview, but utilizes a much larger sample. This survey, focused on landscape architects in private practice (strictly landscape architectural and multidisciplinary firms), is needed to bring to light the current uses of and attitudes toward computers in landscape architecture firms, and is needed in order to measure the growth in computer applications in these types of firms during the past year. Monitoring the trends in the applications of this rapidly evolving technology is needed to assess the impacts it has had to date, and to estimate the impacts that it will have on the design professions in the near future.

CHAPTER III

METHODOLOGY

THE SURVEY INSTRUMENT

A mail survey was used to collect the data for this study. This method was used since it was flexible and relatively efficient in terms of available resources. There was a minimum budget for this project, and partial funding was not secured until after a total commitment was made by the research team. Structured interviews and the use of telephone surveys were ruled as out as collection methods due to cost and scheduling difficulties. The use of a questionnaire seemed desirable since practitioners could fill the form out at a time that was convenient for them and could discuss the questions with others in their offices without pressure induced by the research method. The use of a questionnaire also assured a permanent record of the data, which could be compiled and analyzed on a flexible time schedule. Data was collected in the spring of 1984.

Population and sample. The desired population for the study would be all landscape architects in private practice. However, there is no all-inclusive sampling frame , or list, from which to draw the sample. The most current and comprehensive listing of firms available exists in the membership files of ASLA. Therefore, the ASLA was contacted and a mutually beneficial agreement was reached concerning the conduct of this research. The ASLA staff then generated a systematic random sample of 50% of the multidisciplinary and strictly landscape architectural firms engaged in private practice and employing ASLA members. The sample included 1,015 different firms.

The sample provided by the ASLA was sequentially ordered by zip code. The sequential ordering generated an even geographical distribution of firms (each firm had an equal chance of being selected, but there was an even geographical distributuion based on the number of firms located in a geographic region). The sample included the names of individuals to contact, which were used to personalize cover letters. Cover letters were created with word processing software and a data base manager (see Appendix A: COVER LETTER and Appendix H: MICROCOMPUTER HARDWARE AND SOFTWARE USED IN THIS STUDY).

Questionnaire format. The survey questions and format of the questionnaire (see Appendix B: SURVEY FORM) were developed with two primary objectives in mind. Collecting general information about current applications and attitudes was considered more important than obtaining exhaustive information. Brevity of the survey form was considered essential to permit rapid completion and to encourage participant response. The four study issues listed above were formulated into fifteen questions concerning firm background, computer use, perceptions of related needs, and means for addressing those needs. These were composed on four 8 1/2" x 11" sheets which were then photocopy-reduced and situated on two sides of one 8 1/2" x 11" sheet. This form was then folded and packaged with the personalized cover letter and an addressed, postage-paid return envelope for each respondent. The survey form was pretested in Manhattan by several faculty members in the College of Architecture and Design, and by four practitioners in firms in the Manhattan area. Unfortunately, the pretest was not rigorous enough to highlight several inadequacies in the form (see the last section of this chapter for discussion of the pretest).

DATA PROCESSING

Returns. On 16 March 1984, 1,015 survey packages were mailed to firms in the United States and Canada. There were no follow up postcards. A return rate of 35 percent was achieved by mid-April, with 358 forms returned by 12 April 1984. The data from these forms were entered into a computer file via keyboard, and descriptive statistics were generated using the Statistical Analysis System (SAS) on the Kansas State University mainframe computer. Forms which indicated misinterpretations of major questions were discarded, as were those returned by retired practitioners, yielding a total of 305 observations (30 percent of the sample) for statistical analysis.

Data Processing. Using the Statistical Analysis System (SAS), the compiled data for all responding firms was sorted by type and size to permit analysis at three levels: 1.) all firms together; 2.) by firm type -- strictly landscape architectural (L.A.) vs. multidisciplinary (MLTD.); and 3.) by firm type and size (four sizes for each type)(see fig. 1). Appendix F: SAS PROCEDURES consists of a listing of the SAS procedures (programs) which were used to generate the statistics.

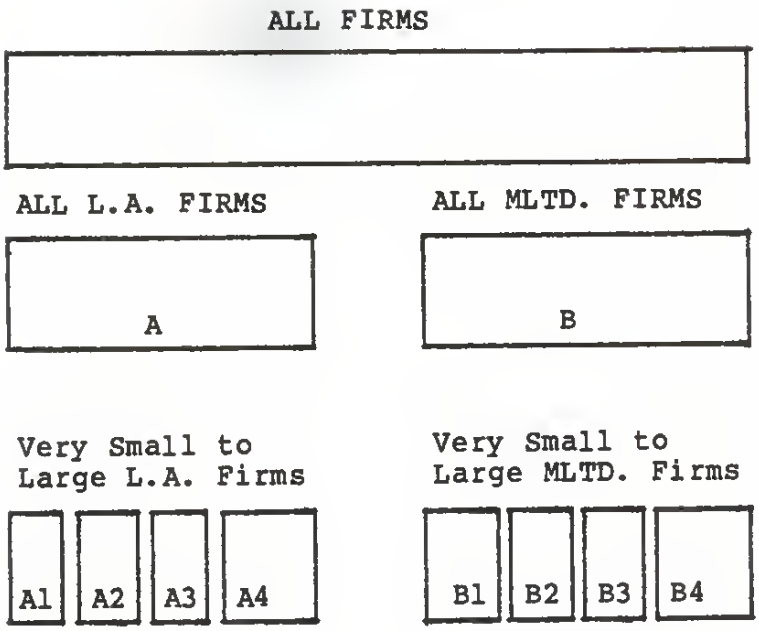


Figure 1: STRUCTURE FOR DATA ANALYSIS

Size categories for each type of firm were obtained by approximating quartiles of size frequencies. Quartiles were adjusted slightly so that size parameters would match those of the AIA and Anderson surveys. Size parameters for multidisciplinary firms were much larger than the corresponding ones for strictly landscape architectural firms.

The size parameters for landscape architectural firms were:

Very small firms : 0 - 2
Small firms : 3 - 5
Medium firms : 6 - 9
Large firms : 10 or more people.

For multidisciplinary firms, the size parameters were:

Very small firms : 0 - 5
Small firms : 6 - 15
Medium firms : 16 - 30
Large firms : 31 or more people.

Descriptive statistics were generated for the different combinations of respondents (there were eleven combinations in all). Spreadsheet software was used to sort and display the pertinent data for these groups. The tables for the aggregate are presented in Chapter IV: FINDINGS and in Appendix C: FINDINGS FOR FIRMS BY TYPE AND SIZE, tables for all three levels are presented.

METHODOLOGICAL LIMITATIONS

Format. The cover letters were chain-printed on high quality rag paper using a dot-matrix printer. Although dot-matrix printer output is considered less appealing than letter-quality printer output, it was chosen for the advantage of speed in getting the one thousand letters printed. The use of departmental letterhead stationary might have increased the return rate to some degree, and might have been worth the extra effort of single sheet feeding. The photoreduction of the questions on the survey form may have contributed to errors by respondents in filling out the form. There is evidence that respondents did not read the instructions for each question very carefully as they filled out the form. The small size of the words, coupled with some awkward phrases in the directions, apparently misled a number of respondents, so that approximately five percent of the survey sample (or one seventh of the returned forms) had to be discounted from the analysis. Most of these respondents, whose forms were discounted, had computer systems but did not fill out the essential parts of the questionnaire since they skipped to the end from question 8 (see Appendix B: SURVEY FORM). Question 8 asked;

> "Are you considering increasing your computer capabilities (or acquiring them) in the next 12 monthes?
>
> (Circle one) a. Yes. b. No (if you are not considering acquiring computer capabilities, please skip to question 15.)".

This wording was apparently misunderstood by a number of respondents, and suggests that two thoughts or questions should never be combined in one question in a survey form. As mentioned in the previous section, the return rate for usable respondents was 30 percent (305 forms).

Timing. Another apparent reason for a smaller-than-anticipated return, was the timing of questionnaire mailing. The forms were mailed bulk rate, which travels third or fourth class. This class of mail may sit in the post office for a week or two before actually going out, since it is not a high priority item. This fact was not known by the research team, which had requested in the cover letters that respondents respond within two weeks of the mailing date. Many respondents thus received the survey

package after the requested deadline. This clearly did not enhance the return rate, and is probably the most significant limiting factor affecting the return rate.

Pretest. The pretest failed to indicate problems in the form for two reasons. First, the pretest was done with a draft copy of the form and not a final, photoreduced copy. Thus the effects of the reduction were not appropriately tested during the pretest. Second, the conditions under which the forms would be filled out were not established in the pretest. The forms were not mailed to pretest participants, but instead were distributed in an interview situation. The presence of a research team member probably biased the respondents' attitude toward filling out the form, and inhibited them from expressing confusion or difficulties in interpreting instructions.

CHAPTER IV

FINDINGS

The findings of this study may be analyzed in several ways. First, they enable a comparison of computer use in strictly landscape architectural firms and multidisciplinary firms. Second, they enable a comparison of computer use in four size categories for each type of firm. Third, the findings shed some light on current attitudes and perceptions in the field, which are held by practitioners who are either inexperienced or experienced with computer applications in the firms in which they work. The major findings are presented and discussed in this chapter. Tables which comprehensively summarize the findings for the study may be found in Appendix C: FINDINGS FOR FIRMS BY TYPE AND SIZE.

The interpretations of the findings must take into account the reliability of the data. The statistical reliability, or trustworthiness, of the findings is related to the number of respondents in each category. Therefore, the data for the aggregates can be considered highly representative of the population of landscape architects as a whole, but the data for size categories must be interpreted with caution, due to a much wider margin of potential misrepresentation which results from a small number of respondents in the size categories. The relative reliability of the findings is indicated in this chapter, and the method for determining the reliability is presented in Appendix G: RELIABILITY CALCULATIONS. Despite the risks of misinterpreting data from small samples, the findings pertaining to differences between the sizes and types of firms are emphasized in this chapter, since they seem to be the most worthy of discussion.

SURVEY FINDINGS

The findings are presented and discussed in the same order as the questions on the survey form. After the demographic information for responding firms is presented, the major findings are discussed in five sections. These summarize the data for each study issue (four sections), and indicate the nature of the comments which were entered at the end of the survey forms (the fifth section). A full transcript of the comments may be found in Appendix E: COMMENTS OF RESPONDENTS.

DEMOGRAPHIC INFORMATION

Location. Question 1 asked respondents to indicate the state in which their firm is located (Figure 2: QUESTION 1).

1. Please indicate the state postal code for your office address.

_____ State Postal Code

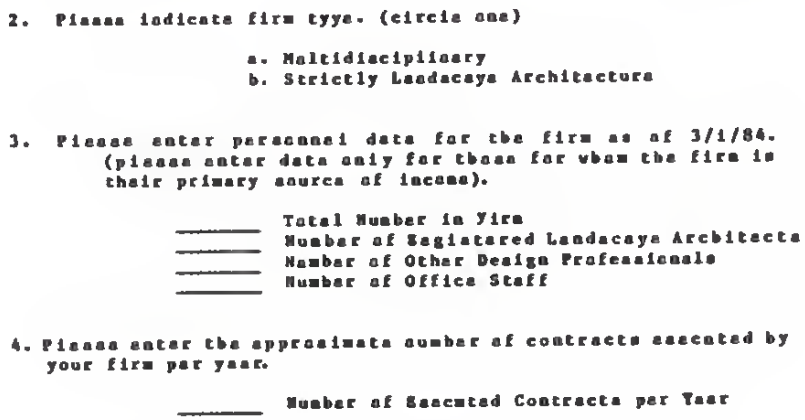
Figure 2: QUESTION 1

Table 8: LOCATION OF RESPONDING FIRMS (pg. 24) presents the frequencies of respondents by state (including the province of Ontario, Canada) for all firms and for the two types of firms. Figure 4: LOCATIONS OF RESPONDING FIRMS (pg. 25) presents the same information spatially, as quartiles which correspond to the density of respondents in the various regions of the country. Respondents in California and Florida, where there are large concentrations of landscape architects, constitute more than a fifth of the aggregate. The states of Michigan, New York, Texas, Pennsylvania and Washington are represented by twelve or more firms.

Almost a fifth of the strictly landscape architecture firms are in California, and there are concentrations of landscape architecture firms in Florida, Michigan, New York and Texas. With the exception of a concentration in Florida, responding multidisciplinary firms are more evenly distributed across the country (see Table 8: LOCATION OF RESPONDING FIRMS).

General Characteristics. Questions 2, 3 and 4 concerned background information such as firm type, the total number of people in the firm, the number of registered landscape architects

and other design professionals in the firm, the number of staff, and the number of contracts executed by the firm in 1983 (Figure 3: QUESTIONS 2,3, AND 4). Table 9: GENERAL CHARACTERISTICS OF RESPONDING FIRMS (pg. 26) presents summary statistics for these questions.


2. Please indicate firm type. (circle one)

a. Multidisciplinary
b. Strictly Landscape Architecture

3. Please enter personnel data for the firm as of 3/1/84. (please enter data only for those for whom the firm is their primary source of income).

_____ Total Number in Firm
_____ Number of Registered Landscape Architects
_____ Number of Other Design Professionals
_____ Number of Office Staff

4. Please enter the approximate number of contracts executed by your firm per year.

_____ Number of Executed Contracts per Year

Figure 3: QUESTIONS 2,3, AND 4

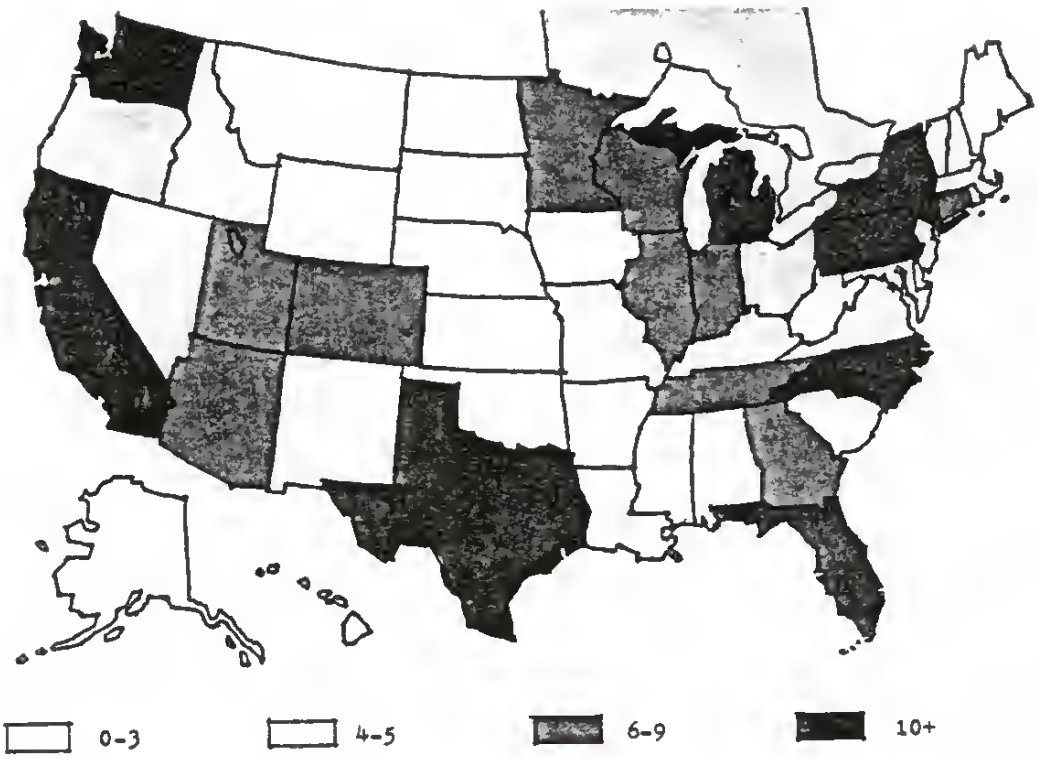
There is a significant difference in the size of the two types of firms which responded to the survey; multidisciplinary firms typically employ many more people than strictly landscape architectural firms. Consequently, the size parameters which were used to break the type aggregates into approximate quartiles differ significantly. Three quarters of the strictly landscape architectural firms are in the `very small' and `small' categories (these firms employ five or fewer people). In contrast, a third of the multidisciplinary firms are in the large category (thirty or more people in the firm).

Another important characteristic of these firms is that the largest multidisciplinary firms employ very few landscape architects. These firms typically exhibit the broadest and most advanced computer applications, but it cannot be assumed that these applications are germaine to the practice of Landscape Architecture. It should also be noted that not all states have registration acts, so this data cannot be interpreted too strictly.

Question 5, concerning the dollar volume of business, was not used in the analysis (see Chapter V: Limitations section).

LOCATION OF RESPONDING FIRMS						
	ALL FIRMS		L.A. FIRMS		MLTD. FIRMS	
State or Province	Freq.	Percent	Freq.	Percent	Freq.	Percent
No Data	13	4.17%	6	3.61%	7	4.90%
AK	3	0.96%	1	0.70%	2	0.64%
AL	2	0.64%	2	1.40%	0	0.00%
AR	3	0.96%	2	1.40%	1	0.32%
AZ	7	2.24%	6	4.20%	1	0.32%
CA	34	10.90%	25	17.48%	9	2.88%
CO	7	2.24%	5	3.50%	2	0.64%
CT	7	2.24%	5	3.50%	2	0.64%
DC	4	1.28%	1	0.70%	3	0.96%
DE	3	0.96%	2	1.40%	1	0.32%
FL	30	9.62%	15	10.49%	13	4.17%
GA	9	2.88%	1	0.70%	8	2.56%
HI	4	1.28%	1	0.70%	3	0.96%
IA	2	0.64%	1	0.70%	1	0.32%
IL	9	2.88%	7	4.90%	2	0.64%
IN	7	2.24%	3	2.10%	4	1.28%
KS	2	0.64%	0	0.00%	2	0.64%
KY	4	1.28%	0	0.00%	4	1.28%
LA	4	1.28%	2	1.40%	2	0.64%
MA	3	0.96%	2	1.40%	1	0.32%
MD	5	1.60%	4	2.80%	1	0.32%
MI	20	6.41%	12	8.39%	7	2.24%
MN	7	2.24%	4	2.80%	3	0.96%
MO	5	1.60%	0	0.00%	5	1.60%
MT	1	0.32%	1	0.70%	0	0.00%
NC	10	3.21%	7	4.90%	3	0.96%
NH	1	0.32%	0	0.00%	1	0.32%
NJ	4	1.28%	1	0.70%	3	0.96%
NM	1	0.32%	0	0.00%	1	0.32%
NY	15	4.81%	11	7.69%	4	1.28%
OH	4	1.28%	2	1.40%	2	0.64%
OK	3	0.96%	0	0.00%	3	0.96%
OR	4	1.28%	1	0.70%	3	0.96%
PA	13	4.17%	7	4.90%	6	1.92%
RI	3	0.96%	1	0.70%	2	0.64%
SC	3	0.96%	1	0.70%	2	0.64%
TN	6	1.92%	1	0.70%	5	1.60%
TX	15	4.81%	10	6.99%	5	1.60%
UT	6	1.92%	2	1.40%	4	1.28%
VA	4	1.28%	2	1.40%	2	0.64%
VT	1	0.32%	1	0.70%	0	0.00%
WA	12	3.85%	8	5.59%	4	1.28%
WI	6	1.92%	1	0.70%	5	1.60%
WY	1	0.32%	0	0.00%	1	0.32%
ONT.	5	1.60%	2	1.40%	3	0.96%

Table 8: LOCATION OF RESPONDING FIRMS



Legend

Number of respondents per state.
(See Table 8 on previous page).

Figure 4: LOCATIONS OF RESPONDING FIRMS

GENERAL CHARACTERISTICS OF RESPONDING FIRMS	
ALL TYPES AND SIZES	
Size Parameter (Total People in Firm)	all
Average Size of Firm (Mean)	35.3
Number of Reg. L.A.'s in Firm (Mean)	2.4
Number of Contracts in 1983	73.1
Number of Respondents in Category	304
Percent	100%

ALL STRICTLY L.A. FIRMS	
Size Parameter (Total People in Firm)	all
Average Size of Firm (Mean)	6.3
Number of Reg. L.A.'s in Firm (Mean)	2.5
Number of Contracts in 1983	51.6
Number of Respondents in Category	163
Percent	54%

ALL MULTIDISCPLINARY FIRMS	
Size Parameter (Total People in Firm)	all
Average Size of Firm (Mean)	69.2
Number of Reg. L.A.'s in Firm (Mean)	2.4
Number of Contracts in 1983	99.7
Number of Respondents in Category	141
Percent	46%

VERY SMALL L. A. FIRMS	
Size Parameter (Total People in Firm)	0 TO 2
Average Size of Firm (Mean)	1.5
Number of Reg. L.A.'s in Firm (Mean)	1.1
Number of Contracts in 1983	28.6
Number of Respondents in Category	63
Percent	39%

SMALL L. A. FIRMS	
Size Parameter (Total People in Firm)	3 TO 5
Average Size of Firm (Mean)	3.9
Number of Reg. L.A.'s in Firm (Mean)	1.7
Number of Contracts in 1983	39.8
Number of Respondents in Category	61
Percent	37%

MEDIUM L. A. FIRMS	
Size Parameter (Total People in Firm)	6 TO 9
Average Size of Firm (Mean)	7.3
Number of Reg. L.A.'s in Firm (Mean)	3.1
Number of Contracts in 1983	54.8
Number of Respondents in Category	20
Percent	12%

LARGE L. A. FIRMS	
Size Parameter (Total People in Firm)	9+
Average Size of Firm (Mean)	29.4
Number of Reg. L.A.'s in Firm (Mean)	9.4
Number of Contracts in 1983	167.6
Number of Respondents in Category	19
Percent	12%
L. A.	100%

VERY SMALL MULTIDISCIPLINARY FIRMS	
Size Parameter (Total People in Firm)	0 TO 5
Average Size of Firm (Mean)	2.5
Number of Reg. L.A.'s in Firm (Mean)	1.0
Number of Contracts in 1983	34.1
Number of Respondents in Category	36
Percent	25.5%

SMALL MULTIDISCIPLINARY FIRMS	
Size Parameter (Total People in Firm)	6 TO 15
Average Size of Firm (Mean)	9.9
Number of Reg. L.A.'s in Firm (Mean)	2.3
Number of Contracts in 1983	69.8
Number of Respondents in Category	36
Percent	25.5%

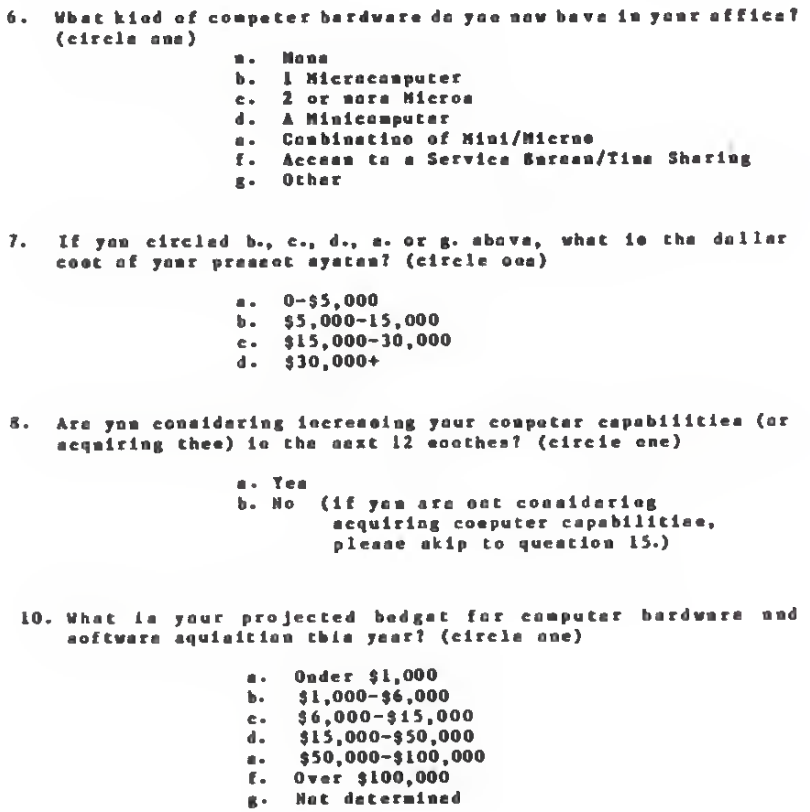
MEDIUM MULTIDISCIPLINARY FIRMS	
Size Parameter (Total People in Firm)	16 TO 30
Average Size of Firm (Mean)	21.6
Number of Reg. L.A.'s in Firm (Mean)	3.7
Number of Contracts in 1983	99.7
Number of Respondents in Category	27
Percent	19%

LARGE MULTIDISCIPLINARY FIRMS	
Size Parameter (Total People in Firm)	30+
Average Size of Firm (Mean)	207.4
Number of Reg. L.A.'s in Firm (Mean)	2.9
Number of Contracts in 1983	192.5
Number of Respondents in Category	42
Percent	30%
MLTD.	100%

Table 9: GENERAL CHARACTERISTICS OF RESPONDING FIRMS

PRESENT HARDWARE, COST, INTENTIONS AND BUDGET (PHCIB)

This section reports the responses to questions 6,7,8, and 10. Questions 6 and 7 requested information on the type of systems currently installed in firms, and on the dollar cost of these systems. Question 8 asked whether or not practitioners were planning to increase or acquire computing capabilities in the coming year. Question 10 requested an estimate of the amount of money budgeted for such acquistions (Figure 5: QUESTIONS 6,7,8, AND 10).



6. What kind of computer hardware do you now have in your office? (circle one)

a. None
b. 1 Microcomputer
c. 2 or more Micros
d. A Minicomputer
e. Combination of Mini/Micro
f. Access to a Service Bureau/Time Sharing
g. Other

7. If you circled b., c., d., e. or g. above, what is the dollar cost of your present system? (circle one)

a. 0-$5,000
b. $5,000-15,000
c. $15,000-30,000
d. $30,000+

8. Are you considering increasing your computer capabilities (or acquiring them) in the next 12 months? (circle one)

a. Yes
b. No (if you are not considering acquiring computer capabilities, please skip to question 15.)

10. What is your projected budget for computer hardware and software aquisition this year? (circle one)

a. Under $1,000
b. $1,000-$6,000
c. $6,000-$15,000
d. $15,000-$50,000
e. $50,000-$100,000
f. Over $100,000
g. Not determined

Figure 5: QUESTIONS 6,7,8, AND 10

All Firms (PHCIB). Table 10: PHCIB; ALL FIRMS (next page) presents the aggregate findings for these questions. Almost half of the respondents have no computer system, and a fifth have a microcomputer system. Another tenth of the respondents have two or more microcomputers in the office.

PRESENT HARDWARE/COST/BUDGET	FREQUENCY		PERCENT
ALL FIRMS	Value	Bar Chart	
Total Number of Firms	304	0 20 40 60 80 100 120 140 160 180 200 220	
PRESENT HARDWARE			
None	136	++++++++++++++++++++++++++++++++++	44.74%
One Microcomputer	62	++++++++++++++++	20.39%
Two or more Micros	30	+++++++	9.87%
Combination of Mini/Micros	18	++++	5.92%
Other	15	+++	4.93%
Access to Service Bureau	12	+++	3.95%
A Minicomputer	5	+	1.64%
COST OF PRESENT HARDWARE			
No data	145	++++++++++++++++++++++++++++++++++++	47.70%
$5,000 - $15,000	63	++++++++++++++++	20.72%
$30,000+	41	++++++++++	13.49%
$0 - $5,000	32	++++++++	10.53%
$15,000 - $30,000	23	+++++	7.57%
INCREASING COMPUTING CAPABILITIES			
Yes	183	+++	60.20%
No	100	++++++++++++++++++++++++++	32.89%
No data	21	+++++	6.91%
BUDGET FOR COMPUTER ACQUISITIONS			
No data	92	++++++++++++++++++++++++	30.26%
$1,000 - $6,000	71	++++++++++++++++++	23.36%
Under $1,000	50	++++++++++++	16.45%
Not Determined	29	+++++++	9.54%
$6,000 - $15,000	24	++++++	7.89%
$15,000 - $50,000	20	+++++	6.58%
Over $100,000	12	+++	3.95%
$50,000 - $100,000	6	+	1.97%
		0 20 40 60 80 100 120 140 160 180 200 220	

Table 10: PHCIB; ALL FIRMS. Frequency values show number responding; percentages are based on category total.

The costs of some of these systems appears to be greater than $5,000 since a fifth indicate that they had spent $5,000 to $15,000 on their systems. Two-thirds of the firms indicated that they were planning to increase or acquire computing capabilities in the coming year. The budget ranges with the highest frequencies suggest that these will be microcomputers and software packages for systems of that size.

Firms by Type (PHCIB). There are significant differences in the findings for strictly landscape architecture firms and multi-disciplinary firms. Strictly landscape architecture firms are using or are planning to use microcomputers generally. Half indicated that they would acquire or increase computing resources in 1984. Budgeted amounts suggest the acquisition of microcomputers, but fully 43 percent of these respondents are not planning to acquire computing capabilities this year. This is not surprising when one considers that three quarters of the landscape architecture firms consisted of five or fewer people. The volume of business for these firms appears to be insufficient to cover the overhead of even small computing systems (see Appendix E: COMMENTS OF RESPONDENTS).

Multidisciplinary firms clearly had more computing power and many more (three quarters) were planning to increase or acquire computing resources. The budgeted amounts again generally suggest the acquisition of microcomputers.

Firms by Size (PHCIB). Larger firms have more computing facilities, greater resources to spend for acquisitions, and probably intend to acquire microcomputers; except for the largest firms, which have allocated enough money to buy CADD systems (these purchases could be microcomputers and software, however).

Small and medium-sized landscape architecture firms apparently have similar amounts of computing equipment, proportionally, but a greater percentage of the small firm practitioners intend to acquire computers this year (56 percent compared to 45 percent). Although not statistically reliable, this is a particualrly interesting finding, since one would logically expect a positive correlation between firm size and intntions to acquire or increase equipment. That is to say, there would appear to be greater need for computers in the larger firms, but there are proportionally fewer practitioners in the medium-sized landscape architecture firms (compared to the small firms) who are planning to buy computers. Perhaps this is a result of bureaucratic problems which may exist in firms which have grown to the size of between six and nine people. It is likely that the smaller firms (between three and five individuals) have clear communications and coherence in office procedures (everybody does everything at one time or another), and that the `medium' firm size is a difficult size to manage. The `large' landscape architecture firms (of ten or more people)

have probably sorted out management procedures and office roles, and are clearer on directions and intentions.

PRESENT CAPABILITIES (PC)

This section reports the responses for Question 9 which asked, "What capabilities do you now have and how many hours per week are spent in each area?" (Figure 6: QUESTION 9, page 31). The capability categories were grouped in a similar way to that developed by Paul Anderson in his survey (Anderson, 1983, p7.).

The level-of-use scale, on this page, approximates very roughly the hours per week of use, utilizing an interval scale of 0 to 4. Hours of use were designated by ranges;

Range	Hours of Use per Week
0	0-10
1	10-20
2	20-30
3	30-40
4	40 plus

Table 11: PRESENT CAPABILITIES LEVEL-OF-USE SCALE

Mean levels of use have been calculated using the interval level data; therefore, the means should not be interpreted as an accurate measure of use in terms of exact hours per week. In the tables which present the data for present capabilities, frequencies of respondents are presented parallel to mean levels of use so that the reader can quickly determine the number of firms which actually constitute the basis for the mean level of use in each category.

All Firms (PC). Word processing and specification writing stand out as the most frequently and heavily used applications (used in half of the firms 20-30 hours per week). Accounting, budgeting, record keeping, preparing contract documents and cost estimating were the other "office/project management" applications of relatively high frequency and use (see Table 12: PC; ALL FIRMS, pg. 33).

9. What capabilities do you now have and how many hours per week are spent in each area?(circle yes or no; 4 = 40+, 3 = 30-40, 2 = 20-30, 1 = 10-20, 0 = 0-10 hrs; circle one number for each)

Present Capability		Level of Use	
			Office Management
Y	N	4 3 2 1 0	Records
Y	N	4 3 2 1 0	Budget/Accounting
Y	N	4 3 2 1 0	Wordprocessing
Y	N	4 3 2 1 0	Telecommunications
Y	N	4 3 2 1 0	Library Storage
Y	N	4 3 2 1 0	Other
			Project Management/Documents
Y	N	4 3 2 1 0	Scheduling
Y	N	4 3 2 1 0	Cost Data/Estimates
Y	N	4 3 2 1 0	Specifications
Y	N	4 3 2 1 0	Contract Documents
Y	N	4 3 2 1 0	Materials Selection
Y	N	4 3 2 1 0	Other
			Engineering Calc./Tech. Decisions
Y	N	4 3 2 1 0	Grading/Drainage
Y	N	4 3 2 1 0	Surveying/Highway Geometry
Y	N	4 3 2 1 0	Energy Analysis
Y	N	4 3 2 1 0	Structural/Mechanical/Utilities
Y	N	4 3 2 1 0	Other
			Planning and Design
Y	N	4 3 2 1 0	Design Programming
Y	N	4 3 2 1 0	Simulation/Modeling
Y	N	4 3 2 1 0	Overlay Mapping/GIS
Y	N	4 3 2 1 0	Statistical Analysis
Y	N	4 3 2 1 0	Life Cycle Costing
Y	N	4 3 2 1 0	Other
			Graphics
Y	N	4 3 2 1 0	Manuals (charts and graphs)
Y	N	4 3 2 1 0	Technical Drawings
Y	N	4 3 2 1 0	Design Development Drawings
Y	N	4 3 2 1 0	Perspectives
Y	N	4 3 2 1 0	Other

(please specify)

Figure 6: QUESTION 9

Firms by Type (PC). Proportionally, there were twice as many multidisciplinary firms as landscape architecture firms using office and project management applications. The ratios comparing the percentages of these groups increase to 3:1 for engineering applications, and 4:1 for the use of planning and design, and graphics applications. The levels of use (hours per week) for various applications were generally two to three times higher in multidisciplinary firms. The difference in mean levels of use for graphics applications (technical drawings and design drawings) was even higher; by a factor of 10 and 4 respectively.

Firms by Size (PC). For multidisciplinary firms, there were generally greater frequencies and higher use levels as firm size increased. For the few firms with the capabilities, computer-aided technical drawing was consistently high for level of use across all firm sizes.

As firm size increased in landscape architecture firms, frequencies of office and project management applications increased. However, there were only a very few medium and large landscape architecture firms using computers for engineering, planning and design, and graphics applications. A single medium-sized landscape architecture firm (representing 5 percent of that group) indicated 20-30 and 30-40 hours per week for five planning and design applications. It seems that only a few landscape architecture firms are using computers extensively for nonmanagement applications; regardless of firm size. There were a greater number of small landscape architecture firms than medium-sized landscape architecture firms that used computers for nonmanagement tasks (both groups indicate very low use levels). In the large-firm category, a quarter of the large landscape architecture firms (5 firms) used an engineering application (grading and drainage) at a mean use level of 0.4. This is the only nonmanagement application for the group that shows more than minimal use. Ten percent of this group (2 firms) indicated that they used other nonmanagement applications, but the means are all 0.0 (0-10 hours per week). This finding is surprising, since one would expect to find greater use of computers for nonmanagement tasks in the larger firms. Perhaps the finding can be explained by greater flexibilty and responsiveness in management attitudes extant in smaller firms, if they do indeed exhibit these characteristics; or, perhaps, the smaller firms offer greater access to the machines and encourage greater experimentation. More small and large landscape architecture firms indicated that they planned to acquire or increase computing capabilities than those responding negatively; but a larger percentage of medium-sized landscape architecture firms indicated that they would not be acquiring or expanding these capabilities.

As mentioned at the outset of this chapter, these particular findings may not be significant. They are subject to a great amount of potential error due to the very small number of respondents in these categories, and should not be considered very reliable.

PRESENT CAPABILITIES	FREQUENCY		PERCENT	MEAN USE	
ALL FIRMS	Value	Bar Chart		Value	Bar Chart
Total Number of Firms	304	0 20 40 60 80 100 120 140 160			0 1 2 3 4
OFFICE MANAGEMENT					
Word Processing	152	++	50.00%	2.2	++++++++++++
Budget/Accounting	132	++++++++++++++++++++++++++++++++++	43.42%	1.7	+++++++++
Records	126	++++++++++++++++++++++++++++++++	41.45%	1.4	+++++++
Library Storage	73	++++++++++++++++++++	24.01%	0.9	+++++
Telecommunications	58	+++++++++++++++	19.08%	0.8	+++++
Other	38	+++++++++	12.50%	1.1	++++++
PROJECT MANAGEMENT					
Specifications	131	++++++++++++++++++++++++++++++++++	43.09%	1.6	+++++++++
Contract Documents	105	++++++++++++++++++++++++++++	34.54%	1.3	+++++++
Cost Data/Estimates	99	+++++++++++++++++++++++++++	32.57%	1.1	++++++
Scheduling	76	++++++++++++++++++++	25.00%	1.1	++++++
Materials Selection	51	++++++++++++++	16.78%	1.0	++++++
Other	25	+++++++	8.22%	1.0	++++++
ENGINEERING CALCS./TECH.					
Grading/Drainage	73	++++++++++++++++++++	24.01%	1.1	++++++
Surveying/Highway Geometry	68	++++++++++++++++++	22.37%	1.5	++++++++
Strctrl/Mechncl/Utilities	57	+++++++++++++++	18.75%	1.3	+++++++
Energy Analysis	43	++++++++++++	14.14%	0.8	+++++
Other	24	+++++++	7.89%	1.3	+++++++
PLANNING & DESIGN					
Programming	47	++++++++++++	15.46%	0.9	+++++
Statistical Analysis	45	++++++++++++	14.80%	0.6	+++
Simulation/Modelling	37	++++++++++	12.17%	0.5	++
Overlay Mapping/GIS	35	+++++++++	11.51%	0.9	+++++
Life Cycle Costing	34	+++++++++	11.18%	0.6	+++
Other	18	++++	5.92%	0.5	++
GRAPHICS					
Business (charts & graphs)	58	+++++++++++++++	19.08%	0.5	++
Technical Drawings	50	++++++++++++++	16.45%	1.7	+++++++++
Design Development Dwgs.	49	++++++++++++++	16.12%	1.5	++++++++
Perspectives	43	++++++++++++	14.14%	0.6	+++
Other	17	++++	5.59%	0.3	++
		0 20 40 60 80 100 120 140 160			0 1 2 3 4

Table 12: PC; ALL FIRMS. Frequency values show number responding; percentages are based on category total; mean values indicate level of use.

PRESENT NEEDS, MEANS AND ROLES (PNMR)

Question 11 asked practitioners to indicate their perceived needs with regard to computing, and to indicate how serious those needs were (on a five-point scale). Questions 12 and 13 were asked to determine the perceptions of respondents concerning the best means for addressing those needs, and related roles for the ASLA (see Figure 7: QUESTIONS 11,12, AND 13).

11. Please indicate if you have an unfulfilled need in the following areas, and how serious those needs are. (circle yes or no; 4 = critical, 3 = serious, 2 = in between, 1 = not serious, 0 = insignificant; circle one number for each)

Present Need	Level of Need	
Y N	4 3 2 1 0	Office Management
Y N	4 3 2 1 0	Project Management
Y N	4 3 2 1 0	Engineering Calculations
Y N	4 3 2 1 0	Planning and Design
Y N	4 3 2 1 0	Computer Graphics
Y N	4 3 2 1 0	Other Software Applications _____
		_____
Y N	4 3 2 1 0	General Applications Education
Y N	4 3 2 1 0	Language/Programming Education
Y N	4 3 2 1 0	Software Development/Programming
Y N	4 3 2 1 0	Training Office Users
Y N	4 3 2 1 0	Hardware & Software Availability
Y N	4 3 2 1 0	Hardware Maintenance
Y N	4 3 2 1 0	Upgrading Existing Hardware/Software
Y N	4 3 2 1 0	Evaluation of Vendors
Y N	4 3 2 1 0	Determining Hardware/Software Needs
Y N	4 3 2 1 0	Comparing System Cost to System Value

12. What would be the best means for addressing your most critical computer needs? (4 = best, 0 = worst; circle one number for each)

4 3 2 1 0	ASLA Sponsored Seminars
4 3 2 1 0	Professional Consultants
4 3 2 1 0	Local Vendors
4 3 2 1 0	Local User Groups
4 3 2 1 0	SelfTeaching (books,articles)

13. What role(s) should the ASLA adopt with respect to computer technology and the profession? (4 = high priority, 0= low priority; circle one number for each)

4 3 2 1 0	Information Clearinghouse
4 3 2 1 0	Sponsor Educational Programs
4 3 2 1 0	Sponsor Software Development
4 3 2 1 0	Column in LA Magazine
4 3 2 1 0	Computing News Letter
4 3 2 1 0	Establish Software Library

Figure 7: QUESTIONS 11,12, AND 13

The five-point scale for questions 11, 12 and 13 permitted respondents to rate the level of need, the value of several approaches to addressing those needs, and the priority of various ASLA roles. The reader should note that the means have been calculated from interval level data (ranking on the scale of 0,1,2,3,4) and thus are not as precise a measurement as may be inferred. On this scale, 2.0, 2.2 and 2.4 all mean "in between serious and not serious" for question 11; "midpoint between best to worst" for question 12; and "midpoint between highest priority and lowest priority" for question 13.

All Firms (PNMR). The frequencies of responses for needs in general practice areas (office management, project management, planning and design, engineering and graphics) were all between 42 and 48 percent. The ratings for the levels of need in these areas clustered around 2.0 (in between serious and not serious), although needs in office and project management were rated a little more serious than those in the other practice areas. Of the needs concerning computers per se, three stood out as more important: `comparing system cost to system value'; `determining hardware and software needs'; and `training office users' (see Table 13: PNMR; ALL FIRMS, page 36).

For all firms, there was little differentiation in the evaluation of means for addressing needs. Professional consultants were deemed to be slightly more effective than ASLA sponsored seminars and local user groups. Self-teaching was rated just above local vendors, which received the lowest rank.

The most favored role for the ASLA with regard to computers was clearly acting as an information clearing house (a mean of 3.2), although none of the choices were ranked lower than the midpoint of the scale (2.0).

Firms by Type (PNMR). The response rate of multidisciplinary firms was fifteen to twenty percent higher than that of strictly landscape architecture firms. There appeared to be concensus that the needs concerning `office management', `project management', `comparison of system cost to system value', `training office users', and `determining hardware/software needs' were slightly more serious than others.

Firms by Size (PNMR). The frequency of response to the present needs question was generally ten to twenty percent lower for landscape architecture firms, compared to multidisciplinary firms. The most "serious" needs identified by the various sizes of firms corresponded closely to those of the aggregate. In addition to the needs of `office management, `project management', `comparison of system cost to system value', `determining hardware and software needs', and `training office users', practitioners in very small firms ranked `hardware and software availability' and `general applications education' as "in be-

PRESENT NEEDS/MEANS/ROLES	FREQUENCY		PERCENT	MEAN PRIORITY	
ALL FIRMS	Value	Bar Chart		Value	Bar Chart
Total Number of Firms	304	0 20 40 60 80 100 120 140 160 180 200 220			0 1 2 3 4
+PRESENT NEEDS					
Planning & Design	144	++++++++++++++++++++++++++++++++++++	47.37%	1.7	++++++++
Project Management	139	+++++++++++++++++++++++++++++++++++	45.72%	2.2	+++++++++++
Computer Graphics	134	++++++++++++++++++++++++++++++++++	44.08%	1.7	++++++++
Office Management	133	+++++++++++++++++++++++++++++++++	43.75%	2.2	+++++++++++
Engineering	129	++++++++++++++++++++++++++++++++	42.43%	1.7	++++++++
Determining Hdwr/Sftwr Needs	114	++++++++++++++++++++++++++++	37.50%	2.2	+++++++++++
Comprng Syts Cost/Syste Value	112	++++++++++++++++++++++++++++	36.84%	2.4	++++++++++++
Evaluating Vendors	111	+++++++++++++++++++++++++++	36.51%	2.0	++++++++++
Training Office Users	111	+++++++++++++++++++++++++++	36.51%	2.3	+++++++++++
Sftware Devalpmt/Programing	110	+++++++++++++++++++++++++++	36.18%	1.8	+++++++++
Hrdwr & Sftwr Availability	108	+++++++++++++++++++++++++++	35.53%	2.0	++++++++++
General Applications Ed.	96	++++++++++++++++++++++++	31.58%	1.8	+++++++++
Programming Education	93	++++++++++++++++++++++++	30.59%	1.7	++++++++
Upgrading Hardware & Software	87	++++++++++++++++++++++	28.62%	1.8	+++++++++
Hardware Maintenance	73	++++++++++++++++++	24.01%	1.3	++++++
Other Software Application	55	++++++++++++++	18.09%	1.8	+++++++++
+MEANS FOR ADDRESSING NEEDS					
Professional Consultants	203	+++	66.78%	2.6	+++++++++++++++
Self Teaching	202	++	66.45%	2.0	++++++++++
ASLA Sponsored Seminars	201	+++	66.12%	2.2	+++++++++++
Local Vendors	200	+++	65.79%	1.9	+++++++++
Local User Groups	196	+++	64.47%	2.2	+++++++++++
+ROLES FOR THE ASLA					
Information Clearinghouse	220	++	72.37%	3.2	++++++++++++++++
Establish Software Library	220	++	72.37%	2.8	++++++++++++++
Sponsor Educational Programs	218	+++	71.71%	2.7	+++++++++++++
Column ie LA Magazine	216	+++	71.05%	2.5	++++++++++++
Sponsor Software Development	213	++	70.07%	2.6	+++++++++++++
Computing News Letter	212	++	69.74%	2.1	++++++++++
		0 20 40 60 80 100 120 140 160 180 200 220			0 1 2 3 4

Table 13: PNMR; ALL FIRMS. Frequency values show number responding; percentages are based on category total; mean values indicate seriousness, value and priority.

tween" needs on the scale. Very small multidisciplinary firms ranked `computer graphics' needs as serious as `office management' needs. Several large landscape architecture firms ranked `upgrading existing hardware and software' as a relatively serious need (mean 2.6). Several large multidisciplinary firms marked `other software application' as a serious need (these were rarely specified; mapping, simulation, and perspective graphics were noted once each on separate forms).

The means (ways of addressing needs) categories were ranked consistently near the 2.0 mark by all sizes of each type of firm, except for large landscape architecture firms and medium multidisciplinary firms, which identified `professional consultants' as a "better" means for addressing their needs (3.2 and 3.0, respectively).

The highest ranking role for the ASLA, with regard to computers and the profession, was `information clearinghouse' for all sizes of firms except for large landscape architecture firms which ranked `establish software library' higher (3.0). `Establish software library' was generally ranked just below `information clearing house'. Medium landscape architecture firms ranked `sponsor educational porgrams' at 2.6 , but otherwise, most means clustered near 2.0. Printing a `computing news letter' seems to be the least popular role.

WHY NOT ACQUIRING / SINGLE MISSING INGREDIENT (WNA/SMI)

Question 14 asked respondents to indicate what they consider to be the most important "single missing ingredient" with regard to computers and their office, and question 15 asked them to indicate their reasons for not acquiring computing capabilities if they were not planning to do so (see Figure 8: QUESTIONS 14 AND 15).

14. What is the single most needed missing ingredient with regard to computers and your office?

_____

15. Please indicate why you are not considering the acquisition of computer capabilities.

a. Limited Interest
b. Expense
c. Staff Training Problems
d. Other

_____

_____
(please specify)

Figure 8: QUESTIONS 14 AND 15

All Firms (WNA/SMI). Table 14: WNA/SMI; ALL FIRMS (next page) summarizes the data for questions 14 and 15. In this table, the high values for `no data' for question 15 (why not acquiring) reflect the prevalent decision to increase or acquire computing capabilities. For question 14 (single missing ingredient), they reflect to a great extent the present limited use of computers in the profession. Several "missing ingredient" responses are closely related to the `expense' response as a primary reason for not acquiring computers. `Money', `cost/benefit information' and `business volume to cover overhead' are needed by many practitioners who are planning to acquire computers. Their absence constitutes the basis for the `not acquiring' decision of many practitioners (especially in landscape architecture firms). `Time to learn', `landscape architectural software' and `management software' are other prevalent "missing ingredients" identified by practitioners in all firms.

Appendix D: RESPONSES TO `OTHER' FOR QUESTIONS 6,9,11 AND 15 presents a list of responses specified under `other' for these questions. For question 15 the responses generally involve insufficient business volume to cover overhead costs associated with computers. It should be noted that the frequency percentages for question 15 may not total 100% due to the selection of more than one response by some practitioners.

Firms by Type (WNA/SMI). Firms of both types exhibit very similar frequency patterns in reasons for not acquiring computers, and in identifying the "single missing ingredient" (SMI) with regard to computers and the office. The tables confirm that multidisciplinary firms are generally not facing the volume problem of landscape architectural firms. Several practitioners in both types of firms considered `time to learn' the SMI, and a few in each type marked `education of personnel' as the SMI. Several practitioners in multidisciplinary firms noted `CADD' as the SMI. `Landscape architectural software' was an occasional response for landscape architecture firms and the most frequent SMI for multidisciplinary firms.

Firms by Size (WNA/SMI). Practitioners in landscape architecture firms consistly listed `expense' or `other' (insufficient volume) most frequently as the main reason for not acquiring computing capabilities. Practitioners in very small landscape architecture firms listed `limited interest' with a relatively high frequency, also. This pattern is repeated by practitioners in multidisciplinary firms.

The hurdles most frequently listed by practitioners in very small and small landscape architecture firms include `time to learn', `landscape architectural software', `volume to cover overhead', `management software' and `education of personnel'. In medium and large landscape architecture firms, the limiting factors with the highest frequencies are `time to learn' and `cost/benefit information'. Practitioners in very small multi-

NOT ACQUIRING/MISSING INGREDIENT	FREQUENCY		PERCENT
ALL FIRMS	Value	Bar Chart	
Total Number of Firms	304	0 20 40 60 80 100 120 140 160 180 200 220	
+IF NOT ACQUIRING, WHY NOT			
No data	213	++	70.07%
Expense	54	++++++++++++++	17.76%
Limited interest	31	++++++++	10.20%
Other	20	++++++	6.58%
Staff training problems	8	+++	2.63%
+SINGLE MISSING INGREDIENT			
No data	121	++++++++++++++++++++++++++++++	39.80%
Time to learn	24	+++++++	7.89%
"Land. Arch." software	20	++++++	6.58%
Management software	14	+++	4.61%
Money	12	+++	3.95%
Cost/benefit information	12	+++	3.95%
Values to cover overhead	11	+++	3.62%
Education of personnel	11	+++	3.62%
The computer	10	+++	3.29%
CADD	9	+++	2.96%
Lack of trained professionals	7	++	2.30%
Affordable graphics packages	7	++	2.30%
Particular programs	6	++	1.97%
Ease of use	4	++	1.32%
Particular hardware components	4	++	1.32%
Projects requiring computers	3	+.	0.99%
Full use of computers	3	+.	0.99%
Networking capability	1	+.	0.33%
Prelim. design software	1	+.	0.33%
Site-to-office communication	1	+.	0.33%
Staff interest	1	+.	0.33%
Security for data	1	+.	0.33%
Faster info. processing	1	+.	0.33%
Consultants do automated tasks	1	+.	0.33%
Too many users	1	+.	0.33%
		0 20 40 60 80 100 120 140 160 180 200 220	

Table 14: WNASMI; ALL FIRMS. Frequency values show number responding; percentages are based on category total.

disciplinary firms listed `time to learn' and `the computer' most frequently. In small and medium-sized multidisciplinary firms, practitioners identified `landscape architectural software', `management software', `trained professionals', `CADD', and `time to learn' most frequently. Respondents in large multidisciplinary firms indicated `landscape architectural software' and `education of personnel' as the most frequent concerns.

The lack of `time to learn' is perceived as a major obstacle by many practitioners in all types of firms except large landscape architecture firms. This, with the relatively high frequencies of `insufficient volume to cover overhead' suggests that practitioners in small and medium-sized firms consider themselves to be either too busy to learn or to be lacking the capital to buy systems. The frequent identification of `landscape architectural software' and `management software' as SMI's suggests that practitioners are not well served by the presently available software, or that they have not yet developed the ability to adapt currently available packages to suit their particular tasks.

COMMENTS OF RESPONDENTS

The comments which practitioners wrote at the end of the questionnaires (see Appendix E: COMMENTS) may be categorized into several groups which characterize the various perspectives and attitudes of practitioners.

1. Optimistic -- these comments express a flexible and exploratory attitude, and confidence that computer applications will enhance the practice of the profession. Practitioners making these comments expressed concerns for business improvement or strategies for survival. Examples of this type of comment are:

> "Our office has been using computers two plus years; we are just beginning to understand their uses; the future looks great."
>
> "This is the only way for medium-sized firms (ten to twenty people) to survive against small operations and giant big names. Namely be more efficient and drop old traditional systems for managing information and schedules."
>
> "I am very interested in the development of software applicable to the designer/owner of a small office."

The relative proportion of this type of remark in the comment is significant; between one half and one third of the comments were of this type.

2. Pessimistic -- These comments express attitudes which are rigid or reactionary with respect to computer applications, indicating a distrust in technology or its ability to improve the quality of work. These practitioners are concerned about the degree of sensitivity and quality of judgement with which a landscape architect approaches his/her work. Examples of this type include:

> "As far as Landscape Architecture is concerned, I can make more money by not having a computer. They have not as yet been shown to be needed in our profession. When it ceases to be so limited, then I'll be interested. It is cheaper to farm out what little limited use we now have."
>
> "Expensive toy. I cannot justify the costs for the volume of work that we now do in our office."
>
> "666! The planet is being ruined -- technology will not save us!!"

The relative proportion of this type of comment in the findings is fairly small. About one in seven comments were of this type.

3. Curious-but-Troubled -- Comments of this type express a positive but beleagured attitude. Practitioners in this group expressed concerns of system affordability and a need for cost/benefits analysis. There is, understandably, a strong desire to see demonstrations of software on systems installed in offices, which would afford reliable evaluations of performance. Examples of this type include:

> "The computer field is growing at such a rapid rate that decisions regarding what hardware is best, costs, and applications for long term use become confusing."
>
> "Need a solution to solving the timely and therefore costly transition to a system based solely on computing, without fear information loss (via fire, accidental erasing, disk damage, etc.)"
>
> "We need interaction with other offices -- only one in this city is using computers."
>
> "Still too small to benefit from computers but they are a first priority when the monies become available."

The relative proportion of this type is approximately one to two; half of the comments fall into this category.

4. What-Else-Can-We-Do-With-Them -- These comments are typically made by practitioners who have procured computer technology and are looking for better or different applications, especially those that are particularly suited to "landscape architecture" tasks. These could be classified as concerns for advanced applications. Examples of this type of comment are:

> "We need a broad range of programs developed by LA's for LA's."
>
> "Adapting software to the needs of the Landscape Architect and writing new programs seem to be our greatest need at this time."
>
> "There is a tremendous lack of appropriate software."

The relative proportion of this type of comment is one to forty (1:40). There are not many landscape architects that made this type of comment, but the need being expressed is a serious one (see section four of this chapter; Why Not Acquiring/ Single Missing Ingredient).

The proportions of the different types of comments indicate that practitioners (who responded to the request for comments) generally are optimistic about the impacts that computers will have on the profession, but presently cannot afford systems, or cannot find software that they think is truely useful to them.

RELIABILITY OF SOME FINDINGS

As described in the introduction to this chapter, the findings for this study vary in terms of reliability, or trustworthiness. In general, the reliability (which is expressed as a confidence interval) is inversely related to the number of respondents in the sample. That is to say, as the number of respondents in the analysis categories get smaller, the confidence intervals for the related findings get wider.

Table 15: RELIABILITY OF SOME FINDINGS, on the following page, diplays the confidence intervals for some of the findings of this study, and is intended to permit a sense of the reliability of the findings for the various categories of firms. The

formula and definitions for these calculations may be found in Appendix G: RELIABILITY CALCULATIONS. Confidence intervals have been calculated for the 95% level of confidence.

Some of the responses for three questions in the survey form are presented in Table 15: RELIABILITY OF SOME FINDINGS. The frequency which follows each response is the midpoint of the confidence interval, which is calculated by adding and subtracting two standard deviations to/from the midpoint. The size of the interval increases dramatically as the number of respondents decreases.

Finding	Frequency	Number Respond.	Two Std. Deviations	Confidence Interval
Present Hardware.				
no system (All)	45%	304	+/-5.70%	39.30-50.70%
one micro (All)	20%	304	+/-4.59%	15.41-24.59%
two micros (All)	10%	304	+/-3.44%	6.60-13.44%
combination (All)	6%	304	+/-2.72%	3.28- 8.72%
Cost of Present Hardware.				
Cost $5-15,000 (All)	21%	304	+/-4.67%	16.33-25.67%
Increasing Computer Resources = Yes or No.				
Increasing (All)	60%	304	+/-5.62%	54.38-65.62%
Increasing (LA)	50%	163	+/-7.83%	42.17-57.83%
Not increasing (LA)	43%	163	+/-7.76%	35.24-50.76%
Increasing (MLTD)	71%	141	+/-7.64%	63.36-78.64%
Increasing (Small LA)	56%	61	+/-12.71%	43.29-68.71%
Increasing (Med. LA)	45%	20	+/-22.25%	22.75-67.25%

Table 15: RELIABILITY OF SOME FINDINGS

LIMITATIONS

The findings of this study must be analyzed and considered within a certain perspective, as described by the following limitations.

SURVEY FORM

The pretest of the survey form turned out to be too limited to reveal a number of wording problems. The most serious wording problem occurred in question 5 (Figure 9: QUESTION 5).

5. Please indicate the approximate dollar volume of construction contracts for your firm for last year.

_____ Dollar Volume of Business

Figure 9: QUESTION 5

This question was determined to be invalid as the returns came in. The conflicting wording `dollar volume of construction contracts' and `dollar volume of business' asked for two different measures of business activity, and for some firms, was impossible to answer. The responses that were received could have been either one, and it was impossible to determine which had been specified. The term `Fee volume' should have been used as a measure of business activity.

An important question which was not asked is `For which applications, and to what extent, do you, as a Landscape Architect, personally use the computer?'. This question would have shed some light on the specific computing capabilities of landscape architects practicing in multidisciplinary firms.

POPULATION

The results of this study pertain to the population of landscape architects in strictly landscape architectural or multidisciplinary firms which have memberships in the ASLA. Therefore, they do not necessarily reflect the current status of computing technology in the profession as a whole.

POTENTIAL ERRORS

Errors could have occurred in data collection and processing. The photoreduction and wording of questions on the survey form may have caused errors or imprecision in data entry by respondents. Key-punching and transferral of data from SAS printouts to Lotus 1-2-3 files would be two potential sources for error in data processing.

Given the dramatic evolution of computing technology, it is important to keep in mind that these results are for April/May 1984. Future surveys will no doubt indicate broader and more sophisticated applications of computing technology in the environmental design fields. As practitioners become increasingly adept at adapting the technology to their particular methods and procedures (or vice versa), their attitudes will change.

As Prof. Anderson noted in his summary, the computer is a tool. Practitioners need to develop attitudes which view the computer neither as the salvation nor the ruination of the design and planning professions, but rather as a tool that should be available, to use when appropriate to the task at hand (Anderson, 1983, p 56).

CHAPTER V

CONCLUSIONS

The findings of this study generally confirm the hypotheses with which the research began. Conclusions are derived from these findings and are presented in the same order as were the findings. The following discussion, for each study issue, is arranged by firm type, with the main findings for multidisciplinary firms following those for strictly landscape architectural firms. The implications of the findings are then noted in each section. A section outlining the principal speculative thoughts concerning computer use in the environmental design professions follows these sections, and it is in turn followed by a section which addresses areas of future study.

STUDY ISSUES

PRESENT HARDWARE, COST, INTENTIONS AND BUDGET (PHCIB)

Summary Observations (PHCIB). Microcomputers constitute the present hardware in almost all strictly landscape architectural firms. Generally, it appears that the larger the firm, the more microcomputers are used. Almost two thirds of these respondents indicated that they had no computers in the firm; a fifth indicated the posession of one microcomputer. The reported expenditures for this equipment represent a small dollar investment in computing power by strictly landscape architectural firms; a fifth of the respondents indicated $5-15,000, and a tenth responded $0-5,000 spent to date. Although the investments appear small in dollar terms, they represent major decisions for the smaller firms which generally have limited capital.

The intentions of these practitioners, concerning acquistion of computing technology, changes with firm size; practitioners in

one or two-person offices are generally not planning to acquire equipment; those in larger firms generally do intend to increase or acquire computing resources. Of all practitioners in strictly landscape architectural firms, approximately one half responded `yes' and one half responded `no' when asked if they intended to increase or acquire computing resources. A third of these respondents indicated a budget of $0-6,000 for these acquisitions, and less than a tenth indicated a budget of over $6,000 (Table 10, page 28). The likely conclusion is that landscape architects in strictly landscape architectural firms will be buying microcomputers, if any. However, the rate of computer purchases will likely increase as dramatically as the cost/perfomance ratio decreases.

In multidisciplinary firms, there are larger systems and greater numbers of computers in larger firms. For the group as a whole (all multidisciplinary firms), a quarter reported no computers in the firm, approximately one third reported one or more microcomputers, and a tenth reported a combination of various types of computers. The costs of these systems, as reported, indicate a serious commitment to incorporating computing technology into practice routines; a quarter of these firms have spent $30,000 or more on systems, a quarter indicated $5-15,000, a tenth indicated $15-30,000, and another tenth indicated $0-5,000. The actual benefits of these systems is an important area for future study (see next section).

The intentions of practitioners in multidisciplinary firms, with regard to computer acquisitions, are generally positive. Three quarters of these practitioners indicated `yes' when asked if they intended to increase or acquire computing resources this year. The spread between `yes' and `no' widened as firm size increased; for very small multidisciplinary firms it was 53% to 31%, and for large firms it was 90% to 10%. The budgeted amounts for these acquisitions suggest that small firms will be buying microcomputers and that large firms will be buying CADD systems or combinations of minicomputers and microcomputers.

Interpretation and Implications (PHCIB). The growth of computer applications will likely occur at a much more rapid rate in multidisciplinary firms than in landscape architectural firms in the next few years. Greater resources will permit faster and wider acquisitions in the larger firms.

With the current fascination and apparent acceptance of the technology by clients, it is likely that firms without computers will be less attractive to potential clients, regardless of the hesitancy on the part of many practitioners, or the actual effectiveness of the computer in solving environmental design problems. The appearance of being up-to-date is clearly generally a part of the marketing strategy used by the typical firm, and will enter into the decisions concerning computer acquisitions.

Small firms will benefit tremendously from the rapid drop in the cost/performance ratio which will bring the microcomputer

technology within financial reach of any interested practitioner who is moderately successful in business. This should enhance the personal service and great attention to detail that these firms offer, allowing them to continue to compete with larger firms for small projects.

PRESENT CAPABILITIES (PC)

Summary Observations (PC). The use of office management and project management applications tend to increase with firm size for strictly landscape architectural firms. Overall, approximately a third of the respondents in this group report using computers for word processing, specification writing, cost estimating and budgeting. The levels of use for these applications are about ten hours per week, except for word processing which is twice that amount. Engineering, planning and design and graphics applications are presently used to a very limited degree; about a tenth of these practitioners report using computers for grading and drainage calculations, and the level of use appears to be only zero to ten hours per week.

Approximately two thirds of the respondents in multidisciplinary firms reported using office and project management applications such as word processing, specification writing, record keeping, budgeting, and preparing contract documents. Both frequency of use and level of use increased with firm size. With regard to engineering, planning and design, and graphics applications, more than a third reported using computers for grading and drainage calculations, and for surveying and highway geometry, and for business graphics. More than a quarter of the respondents in this group report using computers for technical drawing, design development drawings and energy analysis. The use levels for these applications are generally ten-to-twenty and twenty-to-thirty hours per week.

Interpretation and Implications (PC). A large percentage of multidisciplinary firms have incorporated computer technology into a wide array of practice routines, especially those involving the preparation of written documents and numerical calculations. It is doubtless that these firms are producing specifications and other repetitive professional documents more accurately and quickly than they did without the technology (Schuster, 1984). Computers have thus enhanced the competitive positions of these firms in the marketplace.

There appears to be a reluctance on the part of about half of the practitioners in strictly landscape architectural firms to adopt the technology, although the larger firms have generally incorporated word and number processing capabilities into practice. Where there is interest in these firms, there is a generally a lack of available capital. Applications which are

more sophisticated than word processing and numerical calculations are beyond the financial reach of most landscape architects in strictly landscape architectural firms. It should be noted, also, that many of these people do not think that computers would enhance the quality of their services, which are for the most part qualitative in nature and which often vary from project to project. Cumbersome input/output procedures presently can make computer applications in design process activities expensive and distracting. For many projects, and for many designers, conducting spatial and visual analysis, conceptualization and other design activities may still be best approached by a sensitive hand with a soft pencil.

However, landscape architects who acquire computer technology will soon be accessing electronic data bases for cost estimating, specification writing, materials selection (and ordering), resource inventories, and other information needs. Marketing strategies and feasibility studies will be enhanced by intelligent applications of computers. Office management and project management will become more efficient, accurate and reliable. In-house professional services will expand beyond the boundaries of traditional services as new applications of the technology are discovered or developed by computer literate practitioners.

One such area of new services is facilities management, which a number of small architectural firms are pursuing successfully (Schuster, 1984, p. 39). These practitioners are carrying space inventories for leasing-agent clients which allow them to determine maintenance needs and other characteristics of existing buildings. Another group of architects provide return-on-investment and energy-consumption analyses for buildings previously designed by the firms. Landscape architects could develop similar applications for their projects, and by incorporating additional services into their practices, free themselves (to a degree) from the cycles of the construction industry. As management services, these applications could have high profit margins.

PRESENT NEEDS, MEANS AND ROLES (PNMR).

Summary Observations (PNMR). None of the needs, as measured and summarized by this study, are perceived to be serious or critical by landscape architects. The most highly rated needs of practitioners in strictly landscape architectural firms relate to determining hardware/software needs and to procuring cost effective equipment. Additionally, practitioners in "small" landscape architecture firms frequently identified `software development/programming' as a `somewhat serious' need, suggesting innovation on their part. Practitioners in the largest firms indicated that `upgrading existing hardware/software' was a `somewhat serious' need.

For practitioners in multidisciplinary firms, the most

serious needs generally appear to pertain to procuring cost effective equipment, `training office users' and `project management'. Practitioners in large multidisciplinary firms also identified `other software application' as a `somewhat serious' need. It should be noted that these applications may not be germaine to the practice of landscape architecture.

Professional consultants were ranked highest as the most effective means for addressing these needs, although there was not a sizeable difference in the ranking of other choices. The seminars which have been sponsored by the American Society of Landscape Architects (ASLA), local user groups and self-teaching were also ranked higher than the midpoint of the scale.

In evaluating potential roles for the ASLA, practitioners in both strictly landscape architectural firms and multidisciplinary firms assigned the highest priority to `information clearing-house', followed closely by `establish software library'. `Sponsoring educational programs' and `software development' were also ranked relatively high, although all choices were ranked above the midpoint of the scale.

Interpretation and Implications (PNMR). The ambivalent attitude towards computers (for applications other than word/number processing) that seems evident in the findings of this study is confirmed by the lack of consensus on `serious' needs. Generally, there were no `serious' nor `critical' needs that were identified by either type of firm. The only group to identify a number of `serious' needs was the medium sized landscape architectural firms (these needs were `determining software/hardware needs' and `comparing system cost to system value'). This suggests that, as a group, landscape architects in medium sized firms (six to nine employees) are serious about figuring out what to do about computers.

The need for software which is truely designed for the way environmental designers work will probably not be met by the large software houses, since environmental design professions represent a small market with inconsistent needs and methods. Additionally, the group as a whole is "way down the economic ladder in terms of disposable income potential" (Schuster, 1984, pg. 39). The development of software for landscape architects, then, is much more likely to occur in universities and firms where the programmers are not dependent on the sale of their products for their livelihood.

WHY NOT ACQUIRING / SINGLE MISSING INGREDIENT (MNA/SMI).

Summary Observations (WNASMI). Generally, expense and time were reported as the major obstacles to computer acquisition by practitioners in both strictly landscape architectural firms and by those in multidisciplinary firms. Sufficient `volume to cover

overhead' (the costs of computer systems) and `cost/benefit information' (for small firms contemplating the acquistion of computers) were noted as missing ingredients by several practitioners in strictly landscape architectural firms. `Landscape Architectural Software', `management software' and `CADD' were identified by a number of practitioners in multidisciplinary firms.

Interpretation and Implications (WNA/SMI). Numerous landscape architects are presently evaluating the benefits and costs of computer technology in a rapidly evolving and highly competitive environment. There are apparently no clearly reliable studies or analyses which would make the appropriate time to "computerize" an easy decision. Presently many small firms cannot afford the initial outlays of time and money to incorporate computers into practice. However, as the prices of small systems drop, increasing numbers of practitioners will invest in the equipment, and applications will develop and filter through the networks which are being set up through organizations such as the Council of Educators in Landscape Architecture (CELA) and the ASLA.

As more sophisticated applications are developed, and as more landscape architects learn about and become proficient in the high technology arena, the questions concerning computer applications will shift to issues of "how best can we use the technology" instead of "should we use the technology".

COMMENTS OF RESPONDENTS.

Summary Observations. Practitioners in small firms, and especially very small firms, often commented (Appendix E: COMMENTS OF RESPONDENTS) that their work would not be enhanced by computer applications, or that they could not justify the expense of a system. Variability of project type, lengthy input procedures, potential system failures, and concern about losing touch, judgement and sensitivity are holding many landscape architects back. It is clear, however, that many landscape architects are watching the computer arena carefully, with the intention of acquiring systems when cost-effective hardware and software are demonstrated in the marketplace.

An important comment, which reflects this period of observation and questioning of traditional methods, was one which stated that practitioners in firms of 10 to 20 people may soon have to incorporate computers into office and project management procedures in order to compete in the marketplace with large, well-equipped firms and small, low-overhead firms. Along the same lines, another practitioner commented that there is now the potential to do "some fantastic work on computers if the right equipment is gotten into the hands of the right people". The professions educational need for computer-literate graduates

from the universities is encapsulated in the comment "any LA student who graduates today without computer literacy will be an instant antique".

Interpretation and Implications. Time for learning and adjusting is a critical factor which many practitioners have indicated that they do not have. But soon making that time may be essential for the future health and growth of environmental design businesses. Certainly, the complexity and competitiveness of the market place is increasing, and tools which enhance a firm's performance in that arena will be integrated into routine procedures, despite difficult or expensive transition periods. A comment of one respondent that reflects the benefits of such commitment is: "our office has been using computers for two plus years, and we are just beginning to understand their uses. The future looks great".

SUMMARY SPECULATIONS

Growth. The assumption that computing is expanding in the environmental design professions is unquestionnable. As stated at the outset of this thesis, one of the goals of this research was to measure the growth of computer use in the profession during the past year. The task proves to be elusive though, due to variations in the questions asked and different populations for the three different surveys which are available. This problem has been partially overcome with Prof. Anderson's assistance, as he has furthur analyzed his data to isolate private practitioners in his sample for the applications questions.

The AIA (American Institute of Architects) survey pertains to firms with AIA membership. Anderson's work pertains to architects, landscape architects and planners in firms with memberships in the American Institute of Architects, the American Society of Landscape Architects and the American Institute of Certified Planners. The sample of landscape architects in Anderson's survey represented all three areas of professional practice (public, private, and academic). The population for this study was limited to private practice firms with membership in the ASLA. Therefore, accurate comparisons of computer use from 1983 to 1984 are not possible for all of the questions in this study. As mentioned above, Prof. Anderson has provided data for the applications questions, which has enabled the author to calculate the growth of computer use (for various applications) from 1983 to 1984). Table 16: GROWTH IN COMPUTER USE :1983 to 1984, on the following page, presents this information.

Application	1983 Freq.	1983 %	1983 Mean *	1984 Freq.	1984 %	1984 Mean *	Growth %
Word Processing	22	34.4	19.9	152	50.0	22	45.4
Budget/Accting	22	34.4	17.3	132	43.4	17	26.2
Records	20	31.2	14.9	126	41.4	14	32.7
Library	not measured			73	24.0	9	-
Telecommunications	not measured			58	19.1	8	-
Other **	5	7.6	24.0	38	12.5	11	-
Specifications	18	28.1	14.4	131	43.1	16	53.4
Contract Docs.	10	15.6	5.8	105	34.5	13	121.2
Cost Data	6	9.4	4.3	99	32.6	11	246.8
Scheduling	not measured			76	25.0	11	-
Materials Select.	2	3.1	1.5	51	16.8	10	441.9
Other Docs. **	0	0.0	0.0	25	8.2	10	-
Grading/Drainage	-	-	-	73	24.0	11	-
Cut/Fill	10	15.6	5.6	not measured as			-
Surface Runoff	7	10.9	6.9	separate items			-
Survy./Hwy Geom.	8	12.5	9.6	68	22.4	15	79.2
Strct./Mech./Util.	5	7.8	6.0	57	18.8	13	141.0
Energy Analysis	7	10.9	5.4	43	14.1	8	29.4
Other **	5	7.8	5.2	24	7.9	13	-
Design Programming	4	6.2	3.3	47	15.5	9	150.0
Statistical Anal.	5	7.8	4.6	45	14.8	6	89.7
Simulation/Model.	4	6.2	18.8	37	12.2	5	96.8
Overlay Mapping	0	0.0	0.0	35	11.5	9	-
Life Cycle Cost.	not measured			34	11.2	6	-
Other **	1	1.6	15.0	18	5.9	5	-
Charts/Graphs	4	6.2	4.8	58	19.1	5	208.1
Technical Dwgs.	2	3.1	25.0	50	16.5	17	432.3
Design Dev. Dwgs.	0	0.0	0.0	49	16.2	15	-
Perspectives	0	0.0	0.0	43	14.1	6	-
Other **	0	0.0	0.0	17	5.6	3	-

* Mean is the average level of use, in hours per week.

** `Other' is not comparable for the two studies.

*** 1983 data is from Anderson's work. Respondents are ASLA members who list themselves as Design / Planning Consultants (sample size is 64).

*** 1984 data is from Clement's work. Respondents are members of ASLA, listed on the private practice roster in both multi-disciplinary and strictly landscape architectural firms (sample size is 304).

Table 16 :GROWTH IN COMPUTER USE : 1983 TO 1984

Table 16 presents frequencies of use (the number of firms in the ASLA population) for various applications, and the mean levels of use (hours per week) by firms, for 1983 and 1984. The two surveys did not match exactly in applications categories, which accounts for the `not measured' notes in the table.

The percentage of firms using each application is shown in column three for 1983 and column six for 1984. These values were used to calculate the growth of computer use (throughout the private practice sector of the profession), which appears in column eight. Several examples of rapid growth may be read from the table. The mean levels of use are indicated in columns four and seven, for 1983 and 1984, respectively. The growth in terms of hours per week of use was not calculated, but is generally rising in those firms which are using the applications.

It seems reasonable to speculate that there will be tremendous expansion in this arena in the next few years. Prices are dropping very quickly. As of January 1985, an IBM PC/XT system may be purchased for approximately $3,500; several months earlier the same system would have cost $5,000. In April 1984, Luhn (1984) described fortyfive different brands or models of microcomputers that were compatible with the IBM-PC microcomputer, ranging in cost from less than $2,000 to over $7,000.

Competition and Access. If practitioners in small firms are intent on competing for large or complex projects in the future, they will undoubtedly have to invest in computing equipment that can process large amounts of data quickly, perform numerical calculations efficiently and which can generate written documents quickly. Computer equipment that can manipulate and display spatial and visual information effectively will become increasingly attractive and affordable to these firms in the next few years. There will be a need for telecommunications capabilities, in order to access information which is stored electronically in centralized data banks (Means Cost Data and Kerr Cost services are examples of on-line data bases).

Efficiency and Expansion. Landscape architects who acquire computer technology will soon be accessing electronic data bases for cost estimating, specification writing, materials selection (and ordering), resource inventories, and other information needs. Marketing strategies and feasibility studies will be enhanced by intelligent applications of computers. Office management and project management will become more efficient, accurate and reliable. In-house professional services will likely expand beyond the boundaries of traditional services as new applications of the technology are discovered or developed by computer-literate practitioners.

AREAS FOR FUTURE STUDY

There are many areas of inquiry that could extend and supplement the findings of this study. One valid criticism of the research methodology concerns the depth of the investigation. If the questionnaire had been longer, and structured to gather more complete information on computer use in design firms, the findings might have been more meaningful. The assumption underlying the use of a brief form; that practitioners will fill out a short form more readily than a long one, may not have been correct. The use of photoreduction, to keep the form short, seems in retrospect to have been an error, since the form was not absolutely clear to a number of respondents. Accordingly, one area for future study is continued and deeper inventory and analysis of the applications of computer technology in the environmental design disciplines, to measure the growth and breadth of these applications in the professions.

A study of applications developed by practitioners would be very useful to those who are evaluating acquistions, to those who are trying to use the technology more efficiently, and also to those who are looking for more advanced applications for the systems already installed in their offices. Continual updating of available software, and evaluations of the performance of software packages would be beneficial to landscape architects in all areas of practice.

A study of costs versus benefits of computer systems in terms of hardware, software and people would be difficult to conduct, but would be extremely useful to many practitioners. The rapidly changing cost/performance ratio, and the emergence of computer-literate graduates will shift perceptions of costs and benefits, and will engender shifts in the decisions concerning what is possible. The impact of the technology on the quality of environmental design products is an important area to explore, perhaps as correlated to the various personality types (of practitioners) of users.

New and different services that landscape architects could offer with computer resources is another area for future study. The management of sites for longterm maintenance, interactive planning techniques, comprehensive resource inventories and other data-bank kinds of services could be developed by landscape architects who are skilled in landscape and resource management, and in land use planning. Financial, project and construction management services could be expanded and improved through applications of computer technology. There will undoubtedly be additional professional services that creative individuals will offer, through computer applications.

Changes in office procedures and methods, which result from the introduction of computers into offices, is an important area to study. Changes in the configuration of practices, and in management structures are bound to change as the flow of information changes. Working patterns or relationships of time, dura-

tion, focus, team composition or technique will likely be transformed by introductions of computer technology.

Another important area for future study is the evolving educational needs that are associated with computer applications. How much of the basics of document production, numerical calculations and data processing, and how much of more advanced applications in technical decision-making and management areas? How much programming should be addressed in schools; at the undergraduate and/or graduate levels?

These are the most obvious directions for additional research that have been identified in the course of conducting this study. Surely, there are other important areas to pursue. The study of applications of computer technology to environmental design would appear to offer many creative challenges, numerous opportunities for discovery, and multifaceted ways to make meaningful contributions to the design professions.

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APPENDIX A

COVER LETTER

The cover letters for the survey forms were created with Wordstar and PC-File III. They were printed on 50 percent rag paper (continuous feed / micro perforations) with a dot-matrix printer. The ampersands indicate where personalized information appears in each letter. Each one was signed in ink by the researchers.

14 March 1984

Department of Landscape Architecture
College of Architecture and Design
Seaton Hall
Kansas State University
Manhattan, KS 66506

&Mr-Ms& &Firstname& &Lastname&
&Companyname&
&Address&
&City&, &State& &Zip&

Dear &Mr-Ms& &Lastname&;

The faculty of this Department is intent on integrating micro-computers into educational progams in ways that are responsive to the evolving needs of Landscape Architecture students and practicing professionals. In collaboration with the ASLA, we are attempting to assess the current state of computer applications in L.A. firms, and hope to secure your assistance in this effort. The Professional Practice Institute of the ASLA and the College of Architecture and Design at KSU are cosponsoring the project. The results of this study will be published by the ASLA in late spring or early summer of this year.

A two-page survey is enclosed for your consideration. The survey form has been structured for rapid completion; if you could take a few minutes to assist us with this, we would be very grateful.

Respondents were selected by a systematic random sampling of of the ASLA membership list of firms, generating a sample of approximately 50%. With a high response rate, the study will provide very reliable data on current applications. In order to insure the statistical validity of the sample, it is vital that you complete the questionnaire and mail it by March 30, please.

The information you provide is confidential; published data will be aggregated so that no individual firm can be identified. The state postal code will be used for geographic distributions; firm names will not be recorded, so we can guarantee that they will not be released in any way.

Thank you very much for your assistance.

Sincerely,

Kenneth R. Brooks, ASLA
Associate Professor
Registered Landscape Architect
Dept. Landscape Architecture

Laurence A. Clement, Jr., ASLA
Instructor
Registered Landscape Architect
Dept. Pre- Design Professions

Figure A.1: COVER LETTER

APPENDIX B

SURVEY FORM

The following four figures present the survey questions as they appeared on the survey form. The type is shown at actual size. Figures B.1 and B.2 appeared on the front of the form, and figures B.3 and B.4 appeared on the back of the form. The size of the form was 8 1/2" X 11".

SURVEY OF COMPUTER USE IN ASLA FIRMS March 1984

1. Please indicate the state postal code for your office address.

_____ State Postal Code

2. Please indicate firm type. (circle one)

a. Multidisciplinary
b. Strictly Landscape Architecture

3. Please enter personnel data for the firm as of 3/1/84. (please enter data only for those for whom the firm is their primary source of income).

_____ Total Number in Firm
_____ Number of Registered Landscape Architects
_____ Number of Other Design Professionals
_____ Number of Office Staff

4. Please enter the approximate number of contracts executed by your firm per year.

_____ Number of Executed Contracts per Year

5. Please indicate the approximate dollar volume of construction contracts for your firm for last year.

_____ Dollar Volume of Business

6. What kind of computer hardware do you now have in your office? (circle one)

a. None
b. 1 Microcomputer
c. 2 or more Micros
d. A Minicomputer
e. Combination of Mini/Micros
f. Access to a Service Bureau/Time Sharing
g. Other

7. If you circled b., c., d., e. or g. above, what is the dollar cost of your present system? (circle one)

a. 0-$5,000
b. $5,000-15,000
c. $15,000-30,000
d. $30,000+

8. Are you considering increasing your computer capabilities (or acquiring them) in the next 12 months? (circle one)

a. Yes
b. No (If you are not considering acquiring computer capabilities, please skip to question 15.)

Figure B.1: SURVEY FORM; PAGE ONE

9. What capabilities do you now have and how many hours per week are spent in each area?(circle yes or no; 4 = 40+, 3 = 30-40, 2 = 20-30, 1 = 10-20, 0 = 0-10 hrs; circle one number for each)

Present Capability		Level of Use	
			Office Management
Y	N	4 3 2 1 0	Records
Y	N	4 3 2 1 0	Budget/Accounting
Y	N	4 3 2 1 0	Wordprocessing
Y	N	4 3 2 1 0	Telecommunications
Y	N	4 3 2 1 0	Library Storage
Y	N	4 3 2 1 0	Other
			Project Management/Documents
Y	N	4 3 2 1 0	Scheduling
Y	N	4 3 2 1 0	Cost Data/Estimates
Y	N	4 3 2 1 0	Specifications
Y	N	4 3 2 1 0	Contract Documents
Y	N	4 3 2 1 0	Materials Selection
Y	N	4 3 2 1 0	Other
			Engineering Calc./Tech. Manuals
Y	N	4 3 2 1 0	Grading/Drainage
Y	N	4 3 2 1 0	Surveying/Highway Geometry
Y	N	4 3 2 1 0	Energy Analysis
Y	N	4 3 2 1 0	Structural/Mechanical/Utilities
Y	N	4 3 2 1 0	Other
			Planning and Design
Y	N	4 3 2 1 0	Design Programming
Y	N	4 3 2 1 0	Simulation/Modeling
Y	N	4 3 2 1 0	Overlay Mapping/GIS
Y	N	4 3 2 1 0	Statistical Analysis
Y	N	4 3 2 1 0	Life Cycle Costing
Y	N	4 3 2 1 0	Other
			Graphics
Y	N	4 3 2 1 0	Sessions (charts and graphs)
Y	N	4 3 2 1 0	Technical Drawings
Y	N	4 3 2 1 0	Design Development Drawings
Y	N	4 3 2 1 0	Perspectives
Y	N	4 3 2 1 0	Other

_____
(please specify)

Figure B.2: SURVEY FORM; PAGE TWO

10. What is your projected budget for computer hardware and software acquisition this year? (circle one)

a. Under $1,000
b. $1,000-$6,000
c. $6,000-$15,000
d. $15,000-$50,000
e. $50,000-$100,000
f. Over $100,000
g. Not determined

11. Please indicate if you have an unfulfilled need in the following areas, and how serious those needs are. (circle yes or no; 4 = critical, 3 = serious, 2 = in between, 1 = not serious, 0 = insignificant; circle one number for each)

Present Need	Level of Need	
Y N	4 3 2 1 0	Office Management
Y N	4 3 2 1 0	Project Management
Y N	4 3 2 1 0	Engineering Calculations
Y N	4 3 2 1 0	Planning and Design
Y N	4 3 2 1 0	Computer Graphics
Y N	4 3 2 1 0	Other Software Application _____
		_____
Y N	4 3 2 1 0	General Applications Education
Y N	4 3 2 1 0	Language/Programming Education
Y N	4 3 2 1 0	Software Development/Programming
Y N	4 3 2 1 0	Training Office Users
Y N	4 3 2 1 0	Hardware & Software Availability
Y N	4 3 2 1 0	Hardware Maintenance
Y N	4 3 2 1 0	Upgrading Existing Hardware/Software
Y N	4 3 2 1 0	Evaluation of Vendors
Y N	4 3 2 1 0	Ontarmining Hardware/Software Needs
Y N	4 3 2 1 0	Comparing System Cost to System Value

12. What would be the best means for addressing your most critical computer needs? (4 = best, 0 = worst; circle one number for each)

4 3 2 1 0 ASLA Sponsored Seminars
4 3 2 1 0 Professional Consultants
4 3 2 1 0 Local Vendors
4 3 2 1 0 Local User Groups
4 3 2 1 0 SelfTeaching (books,articles)

13. What role(s) should the ASLA adopt with respect to computer technology and the profession? (4 = high priority, 0= low priority; circle one number for each)

4 3 2 1 0 Information Clearinghouse
4 3 2 1 0 Sponsor Educational Programs
4 3 2 1 0 Sponsor Software Development
4 3 2 1 0 Column in LA Magazine
4 3 2 1 0 Computing News Letter
4 3 2 1 0 Establish Software Library

Figure B.3: SURVEY FORM; PAGE THREE

14. What is the single most needed missing ingredient with regard to computers and your office?

_____

_____

_____

IF YOU HAVE ANSWERED THE ABOVE QUESTIONS PLEASE SKIP QUESTION 15.

15. Please indicate why you are not considering the acquisition of computer capabilities.

a. Limited interest
b. Expense
c. Staff Training Problems
d. Other

_____

_____
(please specify)

16. We would appreciate any comments that you would like to add.

_____

_____

_____

_____

THANK YOU VERY MUCH!!!!!

RETURN TO: (please use the enclosed postage-paid envelope)

Laurence A. Clement, Jr., ASLA
College of Architecture and Design
Kansas State University

Seaton Hall
Manhattan, KS 66506

If you have any problems completing the questionnaire, please contact Laurence A. Clement, Jr. (913) 532-6846.

Figure B.4: SURVEY FORM; PAGE FOUR

APPENDIX C

FINDINGS FOR FIRMS BY TYPE AND SIZE

The fortyfour tables which comprise this appendix present the findings of this study in tabular form. The tables are arranged in four sections, which correspond to the four main study issues. Each of the four sections contains eleven tables, which present data for the aggregate, then the two types of firms (strictly landscape architecture versus multidisciplinary), and then for the four sizes of each type of firm.

PRESENT HARDWARE/COST/BUDGET	FREQUENCY		PERCENT
ALL FIRMS	Value	Bar Chart	
Total Number of Firms	304		
PRESENT HARDWARE			
None	136	++++++++++++++++++++++++++++++++++	44.74%
One Microcomputer	62	++++++++++++++++	20.39%
Two or more Micros	30	+++++++	9.87%
Combination of Mini/Micros	18	++++	5.92%
Other	15	+++	4.93%
Access to Service Bureau	12	+++	3.95%
A Minicomputer	5	+	1.64%
COST OF PRESENT HARDWARE			
No data	145	++++++++++++++++++++++++++++++++++++	47.70%
$5,000 - $15,000	63	++++++++++++++++	20.72%
$30,000+	41	++++++++++	13.49%
$0 - $5,000	32	++++++++	10.53%
$15,000 - $30,000	23	+++++	7.57%
INCREASING COMPUTING CAPABILITIES			
Yes	183	+++	60.20%
No	100	++++++++++++++++++++++++++	32.89%
No data	21	+++++	6.91%
BUDGET FOR COMPUTER ACQUISITIONS			
No data	92	++++++++++++++++++++++++	30.26%
$1,000 - $6,000	71	++++++++++++++++++	23.36%
Under $1,000	50	++++++++++++	16.45%
Not Determined	29	+++++++	9.54%
$6,000 - $15,000	24	++++++	7.89%
$15,000 - $50,000	20	+++++	6.58%
Over $100,000	12	+++	3.95%
$50,000 - $100,000	6	+	1.97%
		0 20 40 60 80 100 120 140 160 180 200 220	

Table C.1: PHCIB; ALL FIRMS. Frequency values show number responding; percentages are based on category total.

PRESENT HARDWARE/COST/BUDGET	FREQUENCY		PERCENT
ALL L. A. FIRMS	Value	Bar Chart	
Total Number of Fires	163	0 20 40 60 80 100 120 140 160 180 200 220	
PRESENT HARDWARE			
None	101	++++++++++++++++++++++++++	61.96%
One Microcomputer	32	+++++++++	19.63%
Two or more Micros	9	+++	5.52%
Access to Service Bureau	8	+++	4.91%
Other	5	++	3.07%
A Minicomputer	2	.	1.23%
Combination of Mini/Micros	2	.	1.23%
COST OF PRESENT HARDWARE			
No data	106	++++++++++++++++++++++++++	65.03%
$5,000 - $15,000	29	+++++++	17.79%
$0 - $5,000	17	++++	10.43%
$15,000 - $30,000	6	++	3.68%
$30,000+	5	++	3.07%
INCREASING COMPUTING CAPABILITIES			
Yes	83	+++++++++++++++++++++	50.92%
No	70	++++++++++++++++++	42.94%
No data	10	++	6.13%
BUDGET FOR COMPUTER ACQUISITIONS			
No data	72	++++++++++++++++++	44.17%
$1,000 - $6,000	36	+++++++++	22.09%
Under $1,000	25	++++++	15.34%
Not Determined	18	++++	11.04%
$15,000 - $50,000	6	++	3.68%
$6,000 - $15,000	6	++	3.68%
$50,000 - $100,000	0	.	0.00%
Over $100,000	0	.	0.00%
	0 20 40 60 80 100 120 140 160 180 200 220		

Table C.2: PHCIB; ALL L. A. FIRMS. Frequency values show number responding; percentages are based on category total.

PRESENT HARDWARE/COST/BUDGET	FREQUENCY		PERCENT
ALL MULTIDISCIPLINARY FIRMS	Value	Bar Chart	
Total Number of Firms	141	0 20 40 60 80 100 120 140 160 180 200 220	
PRESENT HARDWARE			
None	35	++++++++	24.82%
One Microcomputer	30	+++++++	21.28%
Two or more Micros	21	+++++	14.89%
Combination of Mini/Micros	16	++++	11.35%
Other	10	++	7.09%
Access to Service Bureau	4	+	2.84%
A Minicomputer	3	.	2.13%
COST OF PRESENT HARDWARE			
No data	39	+++++++++	27.66%
$30,000+	36	+++++++++	25.53%
$5,000 - $15,000	34	+++++++++	24.11%
$15,000 - $30,000	17	++++	12.06%
$0 - $5,000	15	+++	10.64%
INCREASING COMPUTING CAPABILITIES			
Yes	100	++++++++++++++++++++++++	70.92%
No	30	+++++++	21.28%
No data	11	++	7.80%
BUDGET FOR COMPUTER ACQUISITIONS			
$1,000 - $6,000	35	++++++++	24.82%
Under $1,000	25	++++++	17.73%
No data	20	+++++	14.18%
$6,000 - $15,000	18	++++	12.77%
$15,000 - $50,000	14	+++	9.93%
Over $100,000	12	+++	8.51%
Not Determined	11	+++	7.80%
$50,000 - $100,000	6	++	4.26%
		0 20 40 60 80 100 120 140 160 180 200 220	1

Table C.3: PHCIB; ALL MLTD. FIRMS. Frequency values show number responding; percentages are based on category total.

PRESENT HARDWARE/COST/BUDGET	FREQUENCY		PERCENT
VERY SMALL L. A. FIRMS 0 to 2 total personnel	Value	Bar Chart	
Total Number of Firms	63		
PRESENT HARDWARE			
None	48	++++++++++++	76.19%
One Microcomputer	9	++	14.29%
Access to Service Bureau	3	+	4.76%
Other	2	+	3.17%
A Minicomputer	0	.	0.00%
Combination of Mini/Micros	0	.	0.00%
Two or more Micros	0	.	0.00%
COST OF PRESENT HARDWARE			
No data	50	++++++++++++	79.37%
$0 - $5,000	8	++	12.70%
$5,000 - $15,000	5	+	7.94%
$15,000 - $30,000	0	.	0.00%
$30,000+	0	.	0.00%
INCREASING COMPUTING CAPABILITIES			
No	33	++++++++	52.38%
Yes	25	+++++++	39.68%
No data	5	+	7.94%
BUDGET FOR COMPUTER ACQUISITIONS			
No data	34	++++++++	53.97%
$1,000 - $6,000	13	+++	20.63%
Under $1,000	10	++	15.87%
Not Determined	6	+	9.52%
$15,000 - $50,000	0	.	0.00%
$50,000 - $100,000	0	.	0.00%
Over $100,000	0	.	0.00%
$6,000 - $15,000	0	.	0.00%
	0 20 40 60 80 100 120 140 160 180 200 220		

Table C.4: PHCIB; VERY SMALL L. A. FIRMS. Frequency values show number responding; percentages are based on category total.

PRESENT HARDWARE/COST/BUDGET SMALL L. A. FIRMS 3 to 5 total personnel	FREQUENCY Value : Bar Chart 0 20 40 60 80 100 120 140 160 180 200 220	PERCENT
Total Number of Firms	61	
PRESENT HARDWARE		
None	38 :+++++++++	62.30%
One Microcomputer	15 :+++	24.59%
Other	3 :.	4.92%
Access to Service Bureau	2 :.	3.28%
A Minicomputer	1 :.	1.64%
Two or more Micros	1 :.	1.64%
Combination of Mini/Micros	0 :.	0.00%
COST OF PRESENT HARDWARE		
No data	39 :+++++++++	63.93%
$5,000 - $15,000	12 :+++	19.67%
$0 - $5,000	7 :+	11.48%
$15,000 - $30,000	2 :.	3.28%
$30,000+	1 :.	1.64%
INCREASING COMPUTING CAPABILITIES		
Yes	34 :++++++++	55.74%
No	24 :++++++	39.34%
No data	3 :.	4.92%
BUDGET FOR COMPUTER ACQUISITIONS		
No data	24 :++++++	39.34%
$1,000 - $6,000	17 :++++	27.87%
Under $1,000	10 :++	16.39%
Not Determined	7 :+	11.48%
$6,000 - $15,000	2 :.	3.28%
$15,000 - $50,000	1 :.	1.64%
Over $100,000	0 :.	0.00%
$50,000 - $100,000	0 :.	0.00%
	0 20 40 60 80 100 120 140 160 180 200 220	

Table C.5: PHCIB; SMALL L. A. FIRMS. Frequency values show number responding; percentages are based on category total.

PRESENT HARDWARE/COST/BUDGET	FREQUENCY		PERCENT
MEDIUM L. A. FIRMS 6 to 9 total personnel	Value	Bar Chart	
Total Number of Firms	20	0 20 40 60 80 100 120 140 160 180 200 220	
+PRESENT HARDWARE			
None	12	+++	60.00%
One Microcomputer	4	+	20.00%
Two or more Micros	2	.	10.00%
Access to Service Bureau	2	.	10.00%
A Minicomputer	0	.	0.00%
Combination of Mini/Micros	0	.	0.00%
Other	0	.	0.00%
+COST OF PRESENT HARDWARE			
No data	13	+++	65.00%
$5,000 - $15,000	6	+	30.00%
$0 - $5,000	1	.	5.00%
$15,000 - $30,000	0	.	0.00%
$30,000+	0	.	0.00%
+INCREASING COMPUTING CAPABILITIES			
No	10	++	50.00%
Yes	9	++	45.00%
No data	1	.	5.00%
+BUDGET FOR COMPUTER ACQUISITIONS			
No data	10	++	50.00%
Under $1,000	4	+	20.00%
$1,000 - $6,000	3	.	15.00%
$6,000 - $15,000	2	.	10.00%
Not Determined	1	.	5.00%
$15,000 - $50,000	0	.	0.00%
Over $100,000	0	.	0.00%
$50,000 - $100,000	0	.	0.00%
		0 20 40 60 80 100 120 140 160 180 200 220	

Table C.6: PHCIB; MEDIUM L. A. FIRMS. Frequency values show number responding; percentages are based on category total.

PRESENT HARDWARE/COST/BUDGET	FREQUENCY		PERCENT
LARGE L. A. FIRMS 10 or more personnel	Value	Bar Chart	
Total Number of Firms	19	0 20 40 60 80 100 120 140 160 180 200 220	
PRESENT HARDWARE			
Two or more Micros	6	:+	31.58%
One Microcomputer	4	:+	21.05%
None	3	:.	15.79%
Combination of Mini/Micros	2	:.	10.53%
A Minicomputer	1	:.	5.26%
Access to Service Bureau	1	:.	5.26%
Other	0	:.	0.00%
COST OF PRESENT HARDWARE			
$5,000 - $15,000	6	:+	31.58%
$30,000+	4	:+	21.05%
No data	4	:+	21.05%
$15,000 - $30,000	4	:+	21.05%
$0 - $5,000	1	:.	5.26%
INCREASING COMPUTING CAPABILITIES			
Yes	15	:+++	78.95%
No	3	:.	15.79%
No data	1	:.	5.26%
BUDGET FOR COMPUTER ACQUISITIONS			
$15,000 - $50,000	5	:+	26.32%
No data	4	:+	21.05%
Not Determined	4	:+	21.05%
$1,000 - $6,000	3	:.	15.79%
$6,000 - $15,000	2	:.	10.53%
Under $1,000	1	:.	5.26%
$50,000 - $100,000	0	:.	0.00%
Over $100,000	0	:.	0.00%
		0 20 40 60 80 100 120 140 160 180 200 220	

Table C.7: PHCIB; LARGE L. A. FIRMS. Frequency values show number responding; percentages are based on category total.

PRESENT HARDWARE/COST/BUDGET VERY SMALL MLTD. FIRMS 0 to 5 total personnel	FREQUENCY Value : Bar Chart 0 20 40 60 80 100 120 140 160 180 200 220	PERCENT
Total Number of Firms	36	
+PRESENT HARDWARE		
None	22 :+++++	61.11%
One Microcomputer	7 :+	19.44%
Access to Service Bureau	3 :.	8.33%
Other	1 :.	2.78%
A Minicomputer	0 :.	0.00%
Combination of Mini/Micros	0 :.	0.00%
Two or more Micros	0 :.	0.00%
+COST OF PRESENT HARDWARE		
No data	24 :++++++	66.67%
$5,000 - $15,000	6 :+	16.67%
$0 - $5,000	6 :+	16.67%
$15,000 - $30,000	0 :.	0.00%
$30,000+	0 :.	0.00%
+INCREASING COMPUTING CAPABILITIES		
Yes	19 :++++	52.78%
No	11 :++	30.56%
No data	6 :+	16.67%
+BUDGET FOR COMPUTER ACQUISITIONS		
$1,000 - $6,000	14 :+++	38.89%
No data	13 :+++	36.11%
Under $1,000	9 :++	25.00%
$15,000 - $50,000	0 :.	0.00%
$6,000 - $15,000	0 :.	0.00%
$50,000 - $100,000	0 :.	0.00%
Over $100,000	0 :.	0.00%
Not Determined	0 :.	0.00%
	0 20 40 60 80 100 120 140 160 180 200 220	

Table C.8: PHCIB; VERY SMALL MLTD. FIRMS. Frequency values show number responding; percentages are based on category total.

PRESENT HARDWARE/COST/BUDGET SMALL MLTD. FIRMS 6 to 15 total personnel	FREQUENCY Value	Bar Chart	PERCENT
Total Number of Fires	36		
PRESENT HARDWARE			
One Microcomputer	13	+++	36.11%
None	9	++	25.00%
Combination of Mini/Micros	4	+	11.11%
Two or more Micros	3	.	8.33%
Other	2	.	5.56%
A Minicomputer	0	.	0.00%
Access to Service Bureau	0	.	0.00%
COST OF PRESENT HARDWARE			
$5,000 - $15,000	14	+++	38.89%
No data	10	+++	27.78%
$15,000 - $30,000	6	+	16.67%
$0 - $5,000	4	+	11.11%
$30,000+	2	.	5.56%
INCREASING COMPUTING CAPABILITIES			
Yes	25	++++++	69.44%
No	9	++	25.00%
No data	2	.	5.56%
BUDGET FOR COMPUTER ACQUISITIONS			
$1,000 - $6,000	12	+++	33.33%
Under $1,000	6	+	16.67%
$6,000 - $15,000	5	+	13.89%
Not Determined	4	+	11.11%
No data	4	+	11.11%
$15,000 - $50,000	3	.	8.33%
$50,000 - $100,000	2	.	5.56%
Over $100,000	0	.	0.00%
	0 20 40 60 80 100 120 140 160 180 200 220		

Table C.9: PHCIB; SMALL MLTD. FIRMS. Frequency values show number responding; percentages are based on category total.

PRESENT HARDWARE/COST/BUDGET	FREQUENCY		PERCENT
MEDIUM MLTD. FIRMS 16 to 30 total personnel	Value	Bar Chart	
Total Number of Firms	27	0 20 40 60 80 100 120 140 160 180 200 220	
PRESENT HARDWARE			
Two or more Micros	8	++	29.63%
One Microcomputer	7	+	25.93%
None	4	+	14.81%
A Minicomputer	1	.	3.70%
Combination of Mini/Micros	1	.	3.70%
Access to Service Bureau	1	.	3.70%
Other	0	.	0.00%
COST OF PRESENT HARDWARE			
$5,000 - $15,000	8	++	29.63%
$15,000 - $30,000	6	+	22.22%
$30,000+	5	+	18.52%
No data	5	+	18.52%
$0 - $5,000	3	.	11.11%
INCREASING COMPUTING CAPABILITIES			
Yes	18	++++	66.67%
No	6	+	22.22%
No data	3	.	11.11%
BUDGET FOR COMPUTER ACQUISITIONS			
Under $1,000	8	++	29.63%
$6,000 - $15,000	6	+	22.22%
$1,000 - $6,000	5	+	18.52%
No data	3	.	11.11%
$15,000 - $50,000	2	.	7.41%
$50,000 - $100,000	1	.	3.70%
Over $100,000	1	.	3.70%
Not Determined	1	.	3.70%
		0 20 40 60 80 100 120 140 160 180 200 220	

Table C.10: PHCIB; MEDIUM MLTD. FIRMS. Frequency values show number responding; percentages are based on category total.

PRESENT HARDWARE/COST/BUDGET	FREQUENCY		PERCENT
LARGE MLTD. FIRMS 31 or more personnel	Value	Bar Chart	
Total Number of Firms	42	0 20 40 60 80 100 120 140 160 180 200 220	
+PRESENT HARDWARE			
Combination of Mini/Micros	11	++	26.19%
Two or more Micros	10	++	23.81%
Other	7	+	16.67%
One Microcomputer	3	.	7.14%
A Minicomputer	2	.	4.76%
Access to Service Bureau	0	.	0.00%
None	0	.	0.00%
+COST OF PRESENT HARDWARE			
$30,000+	29	+++++++	69.05%
$5,000 - $15,000	6	+	14.29%
$15,000 - $30,000	5	+	11.90%
$0 - $5,000	2	.	4.76%
No data	0	.	0.00%
+INCREASING COMPUTING CAPABILITIES			
Yes	38	+++++++++	90.48%
No	4	+	9.52%
No data	0	.	0.00%
+BUDGET FOR COMPUTER ACQUISITIONS			
Over $100,000	11	++	26.19%
$15,000 - $50,000	9	++	21.43%
$6,000 - $15,000	7	+	16.67%
Not Determined	6	+	14.29%
$1,000 - $6,000	4	+	9.52%
$50,000 - $100,000	3	.	7.14%
Under $1,000	2	.	4.76%
No data	0	.	0.00%
		0 20 40 60 80 100 120 140 160 180 200 220	

Table C.11: PHCIB; LARGE MLTD. FIRMS. Frequency values show number responding; percentages are based on category total.

PRESENT CAPABILITIES	FREQUENCY		PERCENT	MEAN USE	
ALL FIRMS	Value	Bar Chart		Value	Bar Chart
Total Number of Firms	304	0 20 40 60 80 100 120 140 160			0 1 2 3 4
OFFICE MANAGEMENT					
Word Processing	152	++	50.00%	2.2	++++++++++++
Budget/Accounting	132	++++++++++++++++++++++++++++++++++	43.42%	1.7	+++++++++
Records	126	+++++++++++++++++++++++++++++++++	41.45%	1.4	++++++++
Library Storage	73	++++++++++++++++++++	24.01%	0.9	++++
Telecommunications	58	++++++++++++++++	19.08%	0.8	++++
Other	38	+++++++++++	12.50%	1.1	+++++
PROJECT MANAGEMENT					
Specifications	131	+++++++++++++++++++++++++++++++++++	43.09%	1.6	++++++++
Contract Documents	105	++++++++++++++++++++++++++++	34.54%	1.3	+++++++
Cost Data/Estimates	99	+++++++++++++++++++++++++++	32.57%	1.1	+++++
Scheduling	76	+++++++++++++++++++++	25.00%	1.1	+++++
Materials Selection	51	++++++++++++++	16.78%	1.0	+++++
Other	25	+++++++	8.22%	1.0	+++++
ENGINEERING CALCS./TECH.					
Grading/Drainage	73	++++++++++++++++++++	24.01%	1.1	+++++
Surveying/Highway Geometry	68	+++++++++++++++++++	22.37%	1.5	++++++++
Strctrl/Mechncl/Utilities	57	++++++++++++++++	18.75%	1.3	+++++++
Energy Analysis	43	++++++++++++	14.14%	0.8	++++
Other	24	+++++++	7.89%	1.3	+++++++
PLANNING & DESIGN					
Programming	47	++++++++++++	15.46%	0.9	++++
Statistical Analysis	45	++++++++++++	14.80%	0.6	+++
Simulation/Modelling	37	++++++++++	12.17%	0.5	++
Overlay Mapping/GIS	35	+++++++++	11.51%	0.9	++++
Life Cycle Costing	34	+++++++++	11.18%	0.6	+++
Other	18	++++	5.92%	0.5	++
GRAPHICS					
Business (charts & graphs)	58	+++++++++++++++	19.08%	0.5	++
Technical Drawings	50	++++++++++++++	16.45%	1.7	+++++++++
Design Development Dwgs.	49	++++++++++++++	16.12%	1.5	+++++++
Perspectives	43	++++++++++++	14.14%	0.6	+++
Other	17	++++	5.59%	0.3	+
		0 20 40 60 80 100 120 140 160			0 1 2 3 4

Table C.12: PC; ALL FIRMS. Frequency values show number responding; percentages are based on category total; mean values indicate level of use.

PRESENT CAPABILITIES	FREQUENCY		PERCENT	MEAN USE	
ALL L. A. FIRMS	Value	Bar Chart		Value	Bar Chart
Total Nueber of Fires	163	0 20 40 60 80 100 120 140 160			0 1 2 3 4
+OFFICE MANAGEMENT					
Word Processing	54	++++++++++++++	33.13%	1.8	+++++++++
Budget/Accounting	46	++++++++++++	28.22%	1.0	+++++
Records	42	++++++++++	25.77%	0.9	++++
Library Storage	19	+++++	11.66%	0.4	++
Other	14	+++	8.59%	0.7	+++
Telecoeeunications	12	+++	7.36%	0.0	.
+PROJECT MANAGEMENT					
Specifications	49	+++++++++++++	30.06%	0.9	++++
Cost Data/Estimates	38	++++++++++	23.31%	0.6	+++
Contract Docueents	34	+++++++++	20.86%	0.6	+++
Scheduling	25	+++++++	15.34%	0.6	+++
Materials Selection	19	+++++	11.66%	0.4	++
Other	6	+	3.68%	0.2	+
+ENGINEERING CALCS./TECH.					
Grading/Drainage	20	++++++	12.27%	0.4	++
Surveying/Highway Geoeetry	15	+++	9.20%	0.1	.
Strctrl/Mechncl/Utilities	12	+++	7.36%	0.2	+
Energy Analysis	9	++	5.52%	0.0	.
Other	7	+	4.29%	0.4	++
+PLANNING & DESIGN					
Prograeeing	13	+++	7.98%	0.3	+
Statistical Analysis	11	+++	6.75%	0.2	+
Life Cycle Costing	9	++	5.52%	0.2	+
Sieulation/Modelling	9	++	5.52%	0.2	+
Overlay Mapping/GIS	8	++	4.91%	0.0	.
Other	7	+	4.29%	0.0	.
+GRAPHICS					
Perspectives	12	+++	7.36%	0.1	.
Business (charts & graphs)	11	+++	6.75%	0.2	+
Design Developeent Dwgs.	10	++	6.13%	0.4	++
Technical Orawings	10	++	6.13%	0.1	.
Other	7	+	4.29%	0.0	.
	0 20 40 60 80 100 120 140 160			0 1 2 3 4	

Table C.13: PC; ALL L. A. FIRMS. Frequency values show number responding; percentages are based on category total; mean values indicate level of use.

PRESENT CAPABILITIES	FREQUENCY		PERCENT	MEAN USE	
ALL MULTIDISCIPLINARY FIRMS	Value	Bar Chart		Value	Bar Chart
Total Number of Firms	141	0 20 40 60 80 100 120 140 160			0 1 2 3 4
OFFICE MANAGEMENT					
Word Processing	98	++++++++++++++++++++++++++	69.50%	2.5	++++++++++++
Budget/Accounting	86	++++++++++++++++++++++	60.99%	2.0	++++++++++
Records	84	+++++++++++++++++++++	59.57%	1.7	++++++++
Library Storage	54	++++++++++++++	38.30%	1.1	+++++
Telecommunications	46	++++++++++++	32.62%	1.0	+++++
Other	24	++++++	17.02%	1.4	+++++++
PROJECT MANAGEMENT					
Specifications	82	+++++++++++++++++++++	58.16%	1.9	+++++++++
Contract Documents	71	++++++++++++++++++	50.35%	1.6	++++++++
Cost Data/Estimates	61	++++++++++++++++	43.26%	1.4	+++++++
Scheduling	51	++++++++++++	36.17%	1.4	+++++++
Materials Selection	32	++++++++	22.70%	1.2	++++++
Other	19	++++	13.48%	1.1	+++++
ENGINEERING CALCS./TECH.					
Grading/Drainage	53	+++++++++++++	37.59%	1.4	+++++++
Surveying/Highway Geometry	53	+++++++++++++	37.59%	2.0	++++++++++
Strctrl/Mechncl/Utilities	45	++++++++++++	31.91%	1.6	++++++++
Energy Analysis	34	+++++++++	24.11%	1.0	+++++
Other	17	++++	12.06%	1.7	+++++++++
PLANNING & DESIGN					
Statistical Analysis	34	+++++++++	24.11%	0.7	+++
Programming	34	+++++++++	24.11%	1.1	+++++
Simulation/Modelling	28	+++++++	19.86%	0.5	++
Overlay Mapping/GIS	27	+++++++	19.15%	1.0	+++++
Life Cycle Costing	25	+++++++	17.73%	0.7	+++
Other	11	++	7.80%	0.9	++++
GRAPHICS					
Business (charts & graphs)	47	++++++++++++	33.33%	0.5	++
Technical Drawings	40	++++++++++	28.37%	2.1	++++++++++
Design Development Dwgs.	39	+++++++++	27.66%	1.8	+++++++++
Perspectives	31	+++++++	21.99%	0.8	++++
Other	10	++	7.09%	0.6	+++
		0 20 40 60 80 100 120 140 160			0 1 2 3 4

Table C.14: PC; ALL MLTD. FIRMS. Frequency values show number responding; percentages are based on category total; mean values indicate level of use.

PRESENT CAPABILITIES VERY SMALL L.A. FIRMS 0 to 2 total personnel	FREQUENCY Value : Bar Chart	PERCENT	MEAN USE Value : Bar Chart
Total Number of Firms	63 0 20 40 60 80 100 120 140 160		0 1 2 3 4
OFFICE MANAGEMENT			
Word Processing	12 :+++	19.05%:	1.5 :+++++++
Records	8 :++	12.70%:	0.5 :++
Budget/Accounting	7 :+	11.11%:	0.6 :+++
Telecommunications	3 :.	4.76%:	0.0 :.
Library Storage	3 :.	4.76%:	0.3 :+
Other	3 :.	4.76%:	0.0 :.
PROJECT MANAGEMENT			
Specifications	9 :++	14.29%:	1.0 :+++++
Contract Documents	6 :+	9.52%:	0.5 :++
Cost Data/Estimates	6 :+	9.52%:	0.3 :+
Materials Selection	4 :+	6.35%:	0.3 :+
Scheduling	3 :.	4.76%:	0.7 :+++
Other	2 :.	3.17%:	0.0 :.
ENGINEERING CALCS./TECH.			
Grading/Drainage	5 :+	7.94%:	0.2 :+
Surveying/Highway Geometry	3 :.	4.76%:	0.0 :.
Energy Analysis	2 :.	3.17%:	0.0 :.
Strctrl/Machncl/Utilities	2 :.	3.17%:	0.0 :.
Other	2 :.	3.17%:	0.0 :.
PLANNING & DESIGN			
Programming	3 :.	4.76%:	0.3 :+
Statistical Analysis	2 :.	3.17%:	0.0 :.
Overlay Mapping/GIS	2 :.	3.17%:	0.0 :.
Simulation/Modelling	2 :.	3.17%:	0.0 :.
Life Cycle Costing	2 :.	3.17%:	0.0 :.
Other	2 :.	3.17%:	0.0 :.
GRAPHICS			
Design Development Dwgs.	3 :.	4.76%:	0.3 :+
Technical Drawings	3 :.	4.76%:	0.3 :+
Perspectives	3 :.	4.76%:	0.0 :.
Business (charts & graphs)	2 :.	3.17%:	0.0 :.
Other	2 :.	3.17%:	0.0 :.
	0 20 40 60 80 100 120 140 160		0 1 2 3 4

Table C.15: PC; VERY SMALL L. A. FIRMS. Frequency values show number responding; percentages are based on category total; mean values indicate level of use.

PRESENT CAPABILITIES	FREQUENCY		PERCENT	MEAN USE	
SMALL L. A. FIRMS 3 to 5 totel personnel	Value	Bar Chart		Value	Bar Chart
Total Number of Fires	61	0 20 40 60 80 100 120 140 160			0 1 2 3 4
+OFFICE MANAGEMENT					
Word Processing	20	+++++	32.79%	1.6	+++++++++
Budget/Accounting	18	++++	29.51%	0.4	++
Records	16	++++	26.23%	0.6	+++
Library Storage	11	+++	18.03%	0.3	+
Telecoeeunicetions	7	+	11.48%	0.0	.
Other	6	+	9.84%	0.5	+++
+PROJECT NANAGENENT					
Specificetions	19	++++	31.15%	0.5	++
Contract Documents	17	++++	27.87%	0.4	++
Cost Deta/Estieates	14	+++	22.95%	0.4	++
Gcheduling	13	+++	21.31%	0.2	+
Materiels Gelection	8	++	13.11%	0.4	++
Other	1	.	1.64%	0.0	.
+ENGINEERING CALCG./TECH.					
Greding/Drainage	9	++	14.75%	0.3	+
Surveying/Highway Geoeetry	9	++	14.75%	0.1	.
Strctrl/Nechncl/Utilities	8	++	13.11%	0.3	+
Energy Anelysis	5	+	8.20%	0.0	.
Other	2	.	3.28%	0.0	.
+PLANNING & DESIGN					
Statisticel Anelysis	7	+	11.48%	0.3	+
Programming	7	+	11.48%	0.0	.
Overley Napping/GIS	4	+	6.56%	0.0	.
Simulation/Hodelling	4	+	6.56%	0.0	.
Life Cycle Costing	4	+	6.56%	0.0	.
Other	3	.	4.92%	0.0	.
+GRAPHICS					
Business (cherts & graphs)	7	+	11.48%	0.3	+
Perspectives	7	+	11.48%	0.1	.
Design Development Dwgs.	5	+	8.20%	0.6	+++
Technicel Orawings	5	+	8.20%	0.0	.
Other	3	.	4.92%	0.0	.
		0 20 40 60 80 100 120 140 160			0 1 2 3 4

Table C.16: PC; SMALL L. A. FIRMS. Frequency values show number responding; percentages are based on category total; mean values indicate level of use.

PRESENT CAPABILITIES	FREQUENCY		PERCENT	MEAN USE	
MEDIUM L. A. FIRMS 6 to 9 total personnel	Value	Bar Chart		Value	Bar Chart
Total Nueber of Fires	20	0 20 40 60 80 100 120 140 160			0 1 2 3 4
+OFFICE MANAGEMENT					
Word Processing	7	+++++++	35.00%	1.7	+++++++++
Budget/Accounting	6	++++++	30.00%	0.8	++++
Records	5	+++++	25.00%	0.6	+++
Library Storage	2	..	10.00%	1.5	+++++++
Telecoeeunications	1	.	5.00%	0.0	.
Other	1	.	5.00%	0.0	.
+PROJECT MANAGEMENT					
Specifications	7	+++++++	35.00%	1.0	+++++
Cost Data/Estieates	7	+++++++	35.00%	0.9	++++
Contract Docueents	4	++++	20.00%	1.0	+++++
Scheduling	3	...	15.00%	0.3	++
Materials Selection	3	...	15.00%	0.7	+++
Other	2	..	10.00%	0.5	+++
+ENGINEERING CALCS./TECH.					
Other	1	.	5.00%	3.0	+++++++++++++++
Surveying/Highway Geometry	1	.	5.00%	0.0	.
Grading/Drainage	1	.	5.00%	2.0	++++++++++
Energy Analysis	0	.	0.00%	0.0	.
Strctrl/Mechncl/Utilities	0	.	0.00%	0.0	.
+PLANNING & DESIGN					
Prograeeing	1	.	5.00%	3.0	+++++++++++++++
Siaulation/Modelling	1	.	5.00%	2.0	++++++++++
Life Cycle Costing	1	.	5.00%	2.0	++++++++++
Statistical Analysis	0	.	0.00%	0.0	.
Overlay Mapping/GIS	0	.	0.00%	0.0	.
Other	0	.	0.00%	0.0	.
+GRAPHICS					
Business (charts & graphs)	0	.	0.00%	0.0	.
Technical Drawings	0	.	0.00%	0.0	.
Design Developeent Dwgs.	0	.	0.00%	0.0	.
Perspectives	0	.	0.00%	0.0	.
Other	0	.	0.00%	0.0	.
	0 20 40 60 80 100 120 140 160			0 1 2 3 4	

Table C.17: PC; MEDIUM L. A. FIRMS. Frequency values show number responding; percentages are based on category total; mean values indicate level of use.

PRESENT CAPABILITIES LARGE L. A. FIRMS 10 or more total personnel	FREQUENCY Value	Bar Chart	PERCENT	MEAN USE Value	Bar Chart
Total Number of Firms	19	0 20 40 60 80 100 120 140 160			0 1 2 3 4
OFFICE MANAGEMENT					
Word Processing	15	+++	78.95%	2.3	++++++++++
Budget/Accounting	15	+++	78.95%	2.0	++++++++++
Records	13	+++	68.42%	1.8	+++++++++
Other	4	+	21.05%	1.8	+++++++++
Library Storage	3	.	15.79%	0.0	.
Telecommunications	1	.	5.26%	0.0	.
PROJECT MANAGEMENT					
Specifications	14	+++	73.68%	1.4	+++++++
Cost Data/Estimates	11	++	57.89%	0.9	++++
Contract Documents	7	+	36.84%	1.1	+++++
Scheduling	6	+	31.58%	1.5	+++++++
Materials Selection	4	+	21.05%	0.5	++
Other	1	.	5.26%	0.0	.
ENGINEERING CALCS./TECH.					
Grading/Drainage	5	+	26.32%	0.4	++
Energy Analysis	2	.	10.53%	0.0	.
Surveying/Highway Geometry	2	.	10.53%	0.0	.
Strctrl/Mechncl/Utilities	2	.	10.53%	0.0	.
Other	2	.	10.53%	0.0	.
PLANNING & DESIGN					
Statistical Analysis	2	.	10.53%	0.0	.
Programming	2	.	10.53%	0.0	.
Overlay Mapping/GIS	2	.	10.53%	0.0	.
Simulation/Modelling	2	.	10.53%	0.0	.
Life Cycle Costing	2	.	10.53%	0.0	.
Other	2	.	10.53%	0.0	.
GRAPHICS					
Design Development Dwgs.	2	.	10.53%	0.0	.
Technical Drawings	2	.	10.53%	0.0	.
Business (charts & graphs)	2	.	10.53%	0.0	.
Perspectives	2	.	10.53%	0.0	.
Other	2	.	10.53%	0.0	.
	0 20 40 60 80 100 120 140 160			0 1 2 3 4	

Table C.18: PC; LARGE L. A. FIRMS. Frequency values show number responding; percentages are based on category total; mean values indicate level of use.

PRESENT CAPABILITIES	FREQUENCY		PERCENT	MEAN USE	
VERY SMALL MLTD. FIRMS 0 to 5 total personnel	Value	Bar Chart		Value	Bar Chart
Total Number of Fires	36	0 20 40 60 80 100 120 140 160			0 1 2 3 4
OFFICE MANAGEMENT					
Word Processing	15	+++	41.67%	1.2	++++++
Budget/Accounting	12	+++	33.33%	0.3	+
Records	12	+++	33.33%	0.5	++
Library Storage	6	+	16.67%	0.5	++
Telecoeeunications	5	+	13.89%	0.2	+
Other	4	+	11.11%	0.3	+
PROJECT MANAGEMENT					
Specifications	11	++	30.56%	0.8	++++
Contract Oocueents	10	++	27.78%	0.6	+++
Cost Data/Estieates	9	++	25.00%	0.8	++++
Scheduling	5	+	13.89%	0.8	++++
Materials Selection	4	+	11.11%	0.3	+
Other	3	.	8.33%	0.0	.
ENGINEERING CALCS./TECH.					
Grading/Drainage	6	+	16.67%	1.0	+++++
Surveying/Highway Geoeetry	5	+	13.89%	0.8	++++
Energy Analysis	4	+	11.11%	0.0	.
Strctrl/Mechncl/Utilities	3	.	8.33%	0.3	+
Other	3	.	8.33%	0.0	.
PLANNING & DESIGN					
Statistical Analysis	4	+	11.11%	0.8	++++
Programeing	3	.	8.33%	0.3	+
Overlay Mapping/GIS	3	.	8.33%	0.3	+
Sieulation/Modelling	3	.	8.33%	0.0	.
Life Cycle Costing	2	.	5.56%	0.0	.
Other	1	.	2.78%	0.0	.
GRAPHICS					
Business (charts & graphs)	7	+	19.44%	0.3	+
Design Developeent Dwgs.	5	+	13.89%	1.2	++++++
Perspectives	5	+	13.89%	0.8	++++
Technical Drawings	4	+	11.11%	1.5	+++++++
Other	1	.	2.78%	0.0	.
		0 20 40 60 80 100 120 140 160			0 1 2 3 4

Table C.19: PC; VERY SMALL MLTD. FIRMS. Frequency values show number responding; percentages are based on category total; mean values indicate level of use.

PRESENT CAPABILITIES SMALL MLTD. FIRMS 6 to 15 total personnel	FREQUENCY Value	Bar Chart 0 20 40 60 80 100 120 140 160	PERCENT	MEAN USE Value	Bar Chart 0 1 2 3 4
Total Number of Firms	36				
OFFICE MANAGEMENT					
Word Processing	24	:++++++	66.67%	2.1	:++++++++++
Records	18	:++++	50.00%	1.1	:++++++
Budget/Accounting	16	:++++	44.44%	1.4	:+++++++
Library Storage	11	:+++	30.56%	0.5	:+++
Teleconeunications	8	:+++	22.22%	0.3	:+
Other	7	:+	19.44%	0.4	:+++
PROJECT MANAGEMENT					
Specifications	20	:+++++	55.56%	1.5	:+++++++
Contract Documents	17	:++++	47.22%	1.4	:+++++++
Cost Data/Estieates	14	:+++	38.89%	0.8	:++++
Scheduling	9	:++	25.00%	0.6	:+++
Materials Selection	7	:+	19.44%	1.1	:++++++
Other	6	:+	16.67%	0.5	:+++
ENGINEERING CALCS./TECH.					
Grading/Drainage	13	:+++	36.11%	1.1	:+++++
Surveying/Highway Seonetry	13	:+++	36.11%	1.5	:+++++++
Strctrl/Mechncl/Utilities	11	:++	30.56%	1.1	:++++++
Energy Analysis	5	:+	13.89%	0.2	:+
Other	2	:.	5.56%	0.0	:.
PLANNING & DESIGN					
Statistical Analysis	5	:+	13.89%	0.2	:+
Life Cycle Costing	4	:+	11.11%	0.3	:+
Programming	3	:.	8.33%	1.0	:+++++
Simulation/Modelling	3	:.	8.33%	0.0	:.
Overlay Mapping/GIS	3	:.	8.33%	0.0	:.
Other	1	:.	2.78%	0.0	:.
GRAPHICS					
Business (charts & graphs)	8	:++	22.22%	0.3	:+
Design Developeent Dwgs.	5	:+	13.89%	0.6	:+++
Technical Drawings	5	:+	13.89%	0.8	:++++
Perspectives	5	:+	13.89%	0.6	:+++
Other	2	:.	5.56%	0.0	:.
		0 20 40 60 80 100 120 140 160			0 1 2 3 4

Table C.20: PC; SMALL MLTD. FIRMS. Frequency values show number responding; percentages are based on category total; mean values indicate level of use.

PRESENT CAPABILITIES MEDIUM MLTD. FIRMS 16 to 30 total personnel	FREQUENCY Value : Bar Chart	PERCENT	MEAN USE Value : Bar Chart
Total Number of Fires	27		
	0 20 40 60 80 100 120 140 160		0 1 2 3 4
+OFFICE MANAGEMENT			
Word Processing	19 :++++	70.37%	2.7 :+++++++++++++
Budget/Accounting	19 :++++	70.37%	1.7 :++++++++
Records	16 :++++	59.26%	1.3 :++++++
Telecommunications	6 :+	22.22%	0.5 :++
Library Storage	6 :+	22.22%	1.0 :+++++
Other	2 :.	7.41%	2.5 :++++++++++++
+PROJECT MANAGEMENT			
Specifications	16 :++++	59.26%	1.9 :+++++++++
Contract Documents	12 :+++	44.44%	2.0 :++++++++++
Cost Data/Estimates	11 :++	40.74%	1.3 :++++++
Scheduling	7 :+	25.93%	1.0 :+++++
Materials Selection	4 :+	14.81%	1.0 :+++++
Other	0 :.	0.00%	0.0 :.
+ENGINEERING CALCS./TECH.			
Grading/Drainage	8 :++	29.63%	1.4 :+++++++
Surveying/Highway Geometry	8 :++	29.63%	2.0 :++++++++++
Energy Analysis	6 :+	22.22%	1.3 :++++++
Strctrl/Mechncl/Utilities	6 :+	22.22%	1.7 :++++++++
Other	0 :.	0.00%	0.0 :.
+PLANNING & DESIGN			
Statistical Analysis	7 :+	25.93%	0.7 :+++
Programming	7 :+	25.93%	1.3 :++++++
Life Cycle Costing	4 :+	14.81%	1.0 :+++++
Overlay Mapping/GIS	3 :.	11.11%	1.3 :++++++
Simulation/Modelling	3 :.	11.11%	0.7 :+++
Other	1 :.	3.70%	0.0 :.
+GRAPHICS			
Business (charts & graphs)	8 :++	29.63%	0.4 :++
Design Development Dwgs.	5 :+	18.52%	2.6 :+++++++++++++
Technical Drawings	5 :+	18.52%	2.4 :++++++++++++
Perspectives	3 :.	11.11%	1.3 :++++++
Other	1 :.	3.70%	0.0 :.
	0 20 40 60 80 100 120 140 160		0 1 2 3 4

Table C.21: PC; MEDIUM MLTD. FIRMS. Frequency values show number responding; percentages are based on category total; mean values indicate level of use.

PRESENT CAPABILITIES	FREQUENCY		PERCENT	MEAN USE	
LARGE MLTD. FIRMS 31 or more total personnel	Value	Bar Chart		Value	Bar Chart
Total Number of Firms	42	0 20 40 60 80 100 120 140 160			0 1 2 3 4
+OFFICE MANAGEMENT					
Word Processing	40	++++++++++	95.24%	3.1	++++++++++++++
Budget/Accounting	39	+++++++++	92.86%	2.9	+++++++++++++
Records	38	+++++++++	90.48%	2.5	++++++++++++
Library Storage	31	+++++++	73.81%	1.4	+++++++
Telecommunications	27	+++++++	64.29%	1.4	+++++++
Other	11	++	26.19%	2.2	++++++++++
+PROJECT MANAGEMENT					
Specifications	35	+++++++++	83.33%	2.4	++++++++++++
Contract Documents	32	+++++++++	76.19%	2.0	++++++++++
Scheduling	30	+++++++	71.43%	1.8	+++++++++
Cost Data/Estimates	27	++++++	64.29%	2.1	++++++++++
Materials Selection	17	++++	40.48%	1.5	+++++++
Other	10	++	23.81%	1.8	+++++++++
+ENGINEERING CALCS./TECH.					
Surveying/Highway Geometry	27	++++++	64.29%	2.4	++++++++++++
Grading/Drainage	26	++++++	61.90%	1.7	++++++++
Strctrl/Mechncl/Utilities	25	++++++	59.52%	1.9	+++++++++
Energy Analysis	19	++++	45.24%	1.3	++++++
Other	12	+++	28.57%	2.4	++++++++++++
+PLANNING & DESIGN					
Programming	21	+++++	50.00%	1.2	++++++
Simulation/Modelling	19	++++	45.24%	0.7	+++
Statistical Analysis	18	++++	42.86%	0.8	++++
Overlay Mapping/GIS	18	++++	42.86%	1.2	++++++
Life Cycle Costing	15	+++	35.71%	0.9	++++
Other	8	++	19.05%	1.3	++++++
+GRAPHICS					
Technical Drawings	26	++++++	61.90%	2.4	++++++++++++
Design Development Dwgs.	24	++++++	57.14%	2.0	++++++++++
Business (charts & graphs)	24	++++++	57.14%	0.8	++++
Perspectives	18	++++	42.86%	0.8	++++
Other	6	+	14.29%	1.0	+++++
		0 20 40 60 80 100 120 140 160			0 1 2 3 4

Table C.22: PC; LARGE MLTD. FIRMS. Frequency values show number responding; percentages are based on category total; mean values indicate level of use.

PRESENT NEEDS/MEANS/ROLES	FREQUENCY		PERCENT	MEAN PRIORITY	
ALL FIRMS	Value	Bar Chart		Value	Bar Chart
Total Number of Firms	304				
PRESENT NEEDS					
Planning & Design	144		47.37%	1.7	
Project Management	139		45.72%	2.2	
Computer Graphics	134		44.08%	1.7	
Office Management	133		43.75%	2.2	
Engineering	129		42.43%	1.7	
Determining Hdwr/Sftwr Needs	114		37.50%	2.2	
Cmprng Sytm Cost/System Value	112		36.84%	2.4	
Evaluating Vendors	111		36.51%	2.0	
Training Office Users	111		36.51%	2.3	
Sftware Develpmnt/Programming	110		36.18%	1.8	
Hrdwr & Sftwr Availability	108		35.53%	2.0	
General Applications Ed.	96		31.58%	1.8	
Programming Education	93		30.59%	1.7	
Upgrading Hardware & Software	87		28.62%	1.8	
Hardware Maintenance	73		24.01%	1.3	
Other Software Application	55		18.09%	1.8	
MEANS FOR ADDRESSING NEEDS					
Professional Consultants	203		66.78%	2.6	
Self Teaching	202		66.45%	2.0	
ASLA Sponsored Seminars	201		66.12%	2.2	
Local Vendors	200		65.79%	1.9	
Local User Groups	196		64.47%	2.2	
ROLES FOR THE ASLA					
Information Clearinghouse	220		72.37%	3.2	
Establish Software Library	220		72.37%	2.8	
Sponsor Educational Programs	218		71.71%	2.7	
Column in LA Magazine	216		71.05%	2.5	
Sponsor Software Development	213		70.07%	2.6	
Computing News Letter	212		69.74%	2.1	
		0 20 40 60 80 100 120 140 160 180 200 220			0 1 2 3 4

Table C.23: PNMR; ALL FIRMS. Frequency values show number responding; percentages are based on category total; mean values indicate seriousness, value and priority.

PRESENT NEEDS/MEANS/ROLES	FREQUENCY		PERCENT	MEAN PRIORITY	
ALL L. A. FIRMS	Value	Bar Chart		Value	Bar Chart
Total Number of Fires	163				
PRESENT NEEDS					
Office Management	66		40.49%	2.3	
Planning & Design	64		39.26%	1.6	
Project Management	64		39.26%	2.1	
Computer Graphics	59		36.20%	1.3	
Engineering	56		34.36%	1.6	
Determining Hdwr/Sftwr Needs	55		33.74%	2.4	
Coprng Gyts Cost/Systm Value	53		32.52%	2.7	
Sftware Develpmnt/Programming	52		31.90%	1.9	
Evaluating Vendors	52		31.90%	2.2	
Hrdwr & Sftwr Availability	51		31.29%	2.3	
Training Office Users	48		29.45%	2.3	
General Applications Ed.	46		28.22%	1.8	
Programming Education	43		26.38%	1.7	
Upgrading Hardware & Software	36		22.09%	1.9	
Hardware Maintenance	33		20.25%	1.7	
Other Software Application	28		17.18%	1.7	
MEANS FOR ADDRESSING NEEDS					
Self Teaching	93		57.06%	1.9	
Professional Consultants	93		57.06%	2.6	
Local Vendors	92		56.44%	1.9	
ASLA Sponsored Seminars	91		55.83%	2.2	
Local User Broups	88		53.99%	2.4	
ROLES FOR THE ASLA					
Sponsor Educational Programs	101		61.96%	2.6	
Column in LA Magazine	100		61.35%	2.5	
Sponsor Software Developeent	100		61.35%	2.6	
Information Clearinghouse	100		61.35%	3.2	
Establish Software Library	99		60.74%	2.9	
Computing News Letter	95		58.28%	2.1	

Bar Chart scale: 0 20 40 60 80 100 120 140 160 180 200 220

Mean Priority Bar Chart scale: 0 1 2 3 4

Table C.24: PNMR; ALL L. A. FIRMS. Frequency values show number responding; percentages are based on category total; mean values indicate seriousness, value and priority.

PRESENT NEEDS/MEANS/ROLES	FREQUENCY		PERCENT	MEAN PRIORITY	
ALL MULTIDISCIPLINARY FIRMS	Value	Bar Chart		Value	Bar Chart
Total Number of Firms	141	0 20 40 60 80 100 120 140 160 180 200 220			0 1 2 3 4
PRESENT NEEDS					
Planning & Design	80	++++++++++++++++++++	56.74%	1.8	+++++++++
Computer Graphics	75	++++++++++++++++++++	53.19%	1.9	+++++++++
Project Management	75	++++++++++++++++++++	53.19%	2.2	++++++++++++
Engineering	73	++++++++++++++++++++	51.77%	1.7	++++++++
Office Management	67	++++++++++++++++++	47.52%	2.1	++++++++++
Training Office Users	63	++++++++++++++++	44.68%	2.3	++++++++++++
Comprng Syts Cost/Syst Value	59	++++++++++++++++	41.84%	2.1	++++++++++
Evaluating Vendors	59	++++++++++++++++	41.84%	1.9	+++++++++
Determining Hdwr/Sftwr Needs	59	++++++++++++++++	41.84%	2.1	++++++++++
Software Development/Programming	58	++++++++++++++++	41.13%	1.6	++++++++
Hrdwr & Sftwr Availability	57	++++++++++++++++	40.43%	1.7	++++++++
Upgrading Hardware & Software	51	++++++++++++++	36.17%	1.7	++++++++
Programming Education	50	++++++++++++++	35.46%	1.6	++++++++
General Applications Ed.	50	++++++++++++++	35.46%	1.8	+++++++++
Hardware Maintenance	40	++++++++++	28.37%	0.8	++++
Other Software Application	27	+++++++	19.15%	1.9	+++++++++
MEANS FOR ADDRESSING NEEDS					
ASLA Sponsored Seminars	110	++++++++++++++++++++++++++++	78.01%	2.2	++++++++++++
Professional Consultants	110	++++++++++++++++++++++++++++	78.01%	2.5	++++++++++++
Self Teaching	109	++++++++++++++++++++++++++++	77.30%	2.1	++++++++++
Local Vendors	108	++++++++++++++++++++++++++++	76.60%	1.9	+++++++++
Local User Groups	108	++++++++++++++++++++++++++++	76.60%	2.0	++++++++++
ROLES FOR THE ASLA					
Establish Software Library	121	++++++++++++++++++++++++++++++++	85.82%	2.8	+++++++++++++++
Information Clearinghouse	120	++++++++++++++++++++++++++++++++	85.11%	3.2	++++++++++++++++++
Sponsor Educational Progrms	117	+++++++++++++++++++++++++++++++	82.98%	2.7	++++++++++++++
Computing News Letter	117	+++++++++++++++++++++++++++++++	82.98%	2.1	++++++++++
Column in LA Magazine	116	+++++++++++++++++++++++++++++++	82.27%	2.6	++++++++++++++
Sponsor Software Development	113	++++++++++++++++++++++++++++++	80.14%	2.6	++++++++++++++
		0 20 40 60 80 100 120 140 160 180 200 220			0 1 2 3 4

Table C.25: PNMR; ALL MLTD. FIRMS. Frequency values show number responding; percentages are based on category total; mean values indicate seriousness, value and priority.

PRESENT NEEDS/MEANS/ROLES	FREQUENCY		PERCENT	MEAN PRIORITY	
VERY SMALL L. A. FIRMS 0 to 2 total personnel	Value	Bar Chart		Value	Bar Chart
Total Nueber of Fires	63				
	0 20 40 60 80 100 120 140 160 180 200 220			0 1 2 3 4	
+PRESENT NEEDS					
Office Management	22	+++++	34.92%	2.2	++++++++++++
Project Manageeent	20	+++++	31.75%	1.9	+++++++++
Planning & Design	16	++++	25.40%	1.7	++++++++
Coeputer Graphics	16	++++	25.40%	1.8	+++++++++
Oetereining Hdwr/Sftwr Neede	15	+++	23.81%	2.2	++++++++++++
Ceprng Syte Cost/Syste Value	14	+++	22.22%	2.9	+++++++++++++++
Hrdwr & Sftwr Availability	14	+++	22.22%	2.3	++++++++++++
Engineering	14	+++	22.22%	1.5	+++++++
Evaluating Vendors	13	+++	20.63%	2.1	++++++++++
Sftware Develpent/Prograeeing	12	+++	19.05%	1.9	+++++++++
Prograeeing Education	11	++	17.46%	1.6	++++++++
Upgrading Hardware & Software	11	++	17.46%	t.7	++++++++
General Applications Ed.	10	++	15.87%	2.2	++++++++++++
Hardware Maintenance	10	++	15.87%	1.6	++++++++
Training Office Users	9	++	14.29%	1.9	+++++++++
Other Software Application	8	++	t2.70%	1.6	++++++++
+MEANS FOR ADDRESSING NEEDS					
Self Teaching	28	+++++++	44.44%	2.3	++++++++++++
Locat Vendors	27	+++++++	42.86%	2.0	++++++++++
ASLA Sponsored Seminars	27	+++++++	42.86%	2.6	+++++++++++++
Professional Consultante	26	+++++++	41.27%	2.2	++++++++++++
Local User Groups	25	+++++++	39.68%	2.5	++++++++++++
+ROLES FOR THE ASLA					
Sponsor Educational Prograes	30	+++++++	47.62%	2.8	+++++++++++++++
Sponsor Software Developeent	29	+++++++	46.03%	2.8	+++++++++++++++
Eetablish Software Library	29	+++++++	46.03%	2.8	+++++++++++++++
Inforeation Clearinghouse	29	+++++++	46.03%	3.4	++++++++++++++++++
Coluen in LA Magazine	28	+++++++	44.44%	2.6	+++++++++++++
Computing News Letter	27	+++++++	42.86%	2.0	++++++++++
	0 20 40 60 80 100 120 140 160 180 200 220			0 1 2 3 4	

Table C.26: PNMR; VERY SMALL L. A. FIRMS. Frequency values show number responding; percentages are based on category total; mean values indicate seriousness, value and priority.

PRESENT NEEDS/MEANS/ROLES	FREQUENCY		PERCENT	MEAN PRIORITY	
SMALL L. A. FIRMS 3 to 5 total personnel	Value	Bar Chart		Value	Bar Chart
Total Nueber of Fires	61	0 20 40 60 80 100 120 140 160 180 200 220			0 1 2 3 4
+PRESENT NEEOS					
Planning & Oesign	30	;+++++++	49.18%	1.6	;+++++++++
Computer Graphics	28	;+++++++	45.90%	1.0	;+++++
Sftware Oevelpent/Prograeeing	27	;++++++	44.26%	2.0	;++++++++++
Office Manageeent	27	;++++++	44.26%	2.3	;++++++++++
Engineering	27	;++++++	44.26%	1.7	;+++++++++
Training Office Users	23	;+++++	37.70%	2.5	;++++++++++
Ceprng Syta Cost/Syste Value	23	;+++++	37.70%	2.5	;++++++++++
Oeterening Hdwr/Gftwr Needs	23	;+++++	37.70%	2.4	;++++++++++
Evaluating Vendors	22	;+++++	36.07%	2.3	;++++++++++
Project Management	22	;+++++	36.07%	2.1	;++++++++++
General Applications Ed.	21	;+++++	34.43%	1.9	;+++++++++
Hrdwr & Gftwr Availability	21	;+++++	34.43%	2.2	;++++++++++
Programming Education	20	;+++++	32.79%	1.9	;+++++++++
Other Software Application	14	;+++	22.95%	1.9	;+++++++++
Upgrading Hardware & Software	14	;+++	22.95%	1.6	;++++++++
Hardware Maintenance	12	;+++	19.67%	1.5	;+++++++
+MEANS FOR AOORESSINO NEEOS					
Professional Consultants	38	;+++++++++	62.30%	2.7	;+++++++++++++
Local Vendors	37	;+++++++++	60.66%	2.1	;++++++++++
Self Teaching	37	;+++++++++	60.66%	1.9	;+++++++++
ASLA Sponsored Seeinars	35	;++++++++	57.38%	2.0	;++++++++++
Local User Groups	35	;++++++++	57.38%	2.7	;+++++++++++++
+ROLES FOR THE ASLA					
Coluen in LA Magazine	40	;++++++++++	65.57%	2.5	;++++++++++++
Inforeation Clearieghouse	39	;+++++++++	63.93%	3.1	;+++++++++++++++
Sponsor Software Oevelopeent	39	;+++++++++	63.93%	2.6	;++++++++++++
Sponsor Educational Prograes	39	;+++++++++	63.93%	2.3	;++++++++++
Establish Software Library	39	;+++++++++	63.93%	2.9	;+++++++++++++++
Coeputing News Letter	36	;+++++++++	59.02%	2.2	;++++++++++
		0 20 40 60 80 100 120 140 160 180 200 220			0 1 2 3 4

Table C.27: PNMR; SMALL L. A. FIRMS. Frequency values show number responding; percentages are based on category total; mean values indicate seriousness, value and priority.

PRESENT NEEDS/MEANS/ROLES	FREQUENCY		PERCENT	MEAN PRIORITY	
MEDIUM L. A. FIRMS 6 to 9 total personnel	Value	Bar Chart		Value	Bar Chart
Total Number of Firms	20	0 20 40 60 80 100 120 140 160 180 200 220			0 1 2 3 4
PRESENT NEEDS					
Project Management	9	++	45.00%	2.6	++++++++++++++
Training Office Users	8	++	40.00%	2.1	++++++++++
Determining Hdwr/Sftwr Needs	8	++	40.00%	3.0	++++++++++++++++
Sftware Develpmnt/Programming	7	+	35.00%	1.7	+++++++++
Hrdwr & Sftwr Availability	7	+	35.00%	2.3	++++++++++++
Office Management	7	+	35.00%	2.6	++++++++++++++
Caprng Syts Cost/Syste Value	7	+	35.00%	3.0	++++++++++++++++
General Applications Ed.	7	+	35.00%	1.7	+++++++++
Evalwating Vendors	7	+	35.00%	2.6	++++++++++++++
Programming Education	6	+	30.00%	1.7	+++++++++
Engineering	6	+	30.00%	1.5	++++++++
Computer Graphics	5	+	25.00%	1.4	++++++++
Planning & Design	5	+	25.00%	1.2	+++++++
Hardware Maintenance	5	+	25.00%	2.2	++++++++++++
Upgrading Hardware & Software	4	+	20.00%	2.3	++++++++++++
Other Software Application	3	.	15.00%	2.7	++++++++++++++
MEANS FOR ADDRESSING NEEDS					
ASLA Sponsored Seminars	13	+++	65.00%	2.3	++++++++++++
Local Vendors	12	+++	60.00%	1.5	++++++++
Professional Consultants	12	+++	60.00%	2.3	++++++++++++
Local User Groups	12	+++	60.00%	2.3	++++++++++++
Self Teaching	12	+++	60.00%	2.0	++++++++++
ROLES FOR THE ASLA					
Column in LA Magazine	13	+++	65.00%	2.1	++++++++++
Information Clearinghouse	13	+++	65.00%	3.4	++++++++++++++++++
Sponsor Software Development	13	+++	65.00%	1.7	+++++++++
Sponsor Educational Programs	13	+++	65.00%	2.6	++++++++++++++
Computing News Letter	13	+++	65.00%	1.5	++++++++
Establish Software Library	12	+++	60.00%	2.7	++++++++++++++
		0 20 40 60 80 100 120 140 160 180 200 220			0 1 2 3 4

Table C.28: PNMR; MEDIUM L. A. FIRMS. Frequency values show number responding; percentages are based on category total; mean values indicate seriousness, value and priority.

PRESENT NEEDS/MEANS/ROLES	FREQUENCY		PERCENT	MEAN PRIORITY	
LARGE L. A. FIRMS 10 or more personnel	Value	Bar Chart		Value	Bar Chart
Total Number of Firms	19	0 20 40 60 80 100 120 140 160 180 200 220			0 1 2 3 4
+PRESENT NEEDS					
Planning & Design	13	+++	68.42%	1.8	+++++++++
Project Management	13	+++	68.42%	2.2	+++++++++++
Evaluating Vendors	10	++	52.63%	2.0	++++++++++
Office Management	10	++	52.63%	2.1	++++++++++
Computer Graphics	10	++	52.63%	1.6	++++++++
Comprng Syte Cost/Syete Value	9	++	47.37%	2.7	+++++++++++++
Hrdwr & Sftwr Availability	9	++	47.37%	2.4	++++++++++++
Determining Hdwr/Sftwr Needs	9	++	47.37%	2.1	++++++++++
Engineering	9	++	47.37%	1.4	+++++++
General Applications Ed.	8	++	42.11%	1.4	+++++++
Training Office Users	8	++	42.11%	2.3	+++++++++++
Upgrading Hardware & Software	7	+	36.84%	2.6	+++++++++++++
Sftware Develpmnt/Programming	6	+	31.58%	1.8	+++++++++
Hardware Maintenance	6	+	31.58%	1.7	++++++++
Programming Education	6	+	31.58%	1.2	++++++
Other Software Application	3	.	15.79%	0.3	+
+MEANS FOR ADDRESSING NEEDS					
Professional Consultants	17	++++	89.47%	3.2	++++++++++++++++
Local Vendors	16	++++	84.21%	1.6	++++++++
ASLA Sponsored Seminars	16	++++	84.21%	2.3	+++++++++++
Local User Groups	16	++++	84.21%	2.0	++++++++++
Self Teaching	16	++++	84.21%	1.3	++++++
+ROLES FOR THE ASLA					
Column in LA Magazine	19	+++++	100.00%	2.4	++++++++++++
Information Clearinghouse	19	+++++	100.00%	2.7	+++++++++++++
Sponsor Software Developemnt	19	+++++	100.00%	2.7	+++++++++++++
Sponsor Educational Programs	19	+++++	100.00%	2.8	++++++++++++++
Computing News Letter	19	+++++	100.00%	2.5	++++++++++++
Establish Software Library	19	+++++	100.00%	3.0	+++++++++++++++
		0 20 40 60 80 100 120 140 160 180 200 220			0 1 2 3 4

Table C.29: PNMR; LARGE L. A. FIRMS. Frequency values show number responding; percentages are based on category total; mean values indicate seriousness, value, and priority.

PRESENT NEEDS/MEANS/RDLES	FREQUENCY		PERCENT	MEAN PRIORITY	
VERY SMALL MLTO. FIRMS 0 to 5 total personnel	Value	Bar Chart		Value	Bar Chart
Total Nueber of Fires	36	0 20 40 60 80 100 120 140 160 180 200 220			0 1 2 3 4
+PRESENT NEEDS					
Project Manageeent	16	++++	44.44%	1.9	+++++++++
Office Manageeent	14	+++	38.89%	2.1	++++++++++
Computer Graphics	14	+++	38.89%	2.1	++++++++++
Engineering	13	+++	36.11%	1.6	++++++++
Detereining Hdwr/Sftwr Needs	12	+++	33.33%	1.8	+++++++++
Prograneing Education	12	+++	33.33%	1.5	+++++++
Sftware Develpent/Prograneing	11	++	30.56%	1.9	+++++++++
General Applications Ed.	11	++	30.56%	1.1	+++++
Planning & Oesign	11	++	30.56%	1.5	+++++++
Training Office Users	11	++	30.56%	1.6	++++++++
Ceprng Syte Cost/Syste Value	11	++	30.56%	2.3	++++++++++
Evaluating Vendors	11	++	30.56%	1.6	++++++++
Upgrading Hardware & Software	10	++	27.78%	1.1	+++++
Other Software Application	10	++	27.78%	1.5	+++++++
Hardware Maintenance	9	++	25.00%	0.8	++++
Hrdwr & Sftwr Availability	9	++	25.00%	1.4	+++++++
+MEANS FOR ADDRESSING NEEDS					
Self Teaching	22	+++++	61.11%	2.1	++++++++++
Local Vendors	21	+++++	58.33%	2.3	++++++++++
ASLA Sponsored Seminars	21	+++++	58.33%	2.0	++++++++++
Professional Consultants	21	+++++	58.33%	2.0	++++++++++
Local User Groups	20	+++++	55.56%	2.1	++++++++++
+ROLES FOR THE ASLA					
Establish Software Library	24	++++++	66.67%	2.6	+++++++++++++
Sponsor Educational Prograes	23	+++++	63.89%	2.5	++++++++++++
Coeputing News Letter	23	+++++	63.89%	2.4	++++++++++++
Inforeation Clearinghouse	23	+++++	63.89%	3.3	+++++++++++++++++
Coluen in LA Magazine	22	+++++	61.11%	2.9	+++++++++++++++
Sponsor Software Oevelopnent	22	+++++	61.11%	2.3	++++++++++
		0 20 40 60 80 100 120 140 160 180 200 220			0 1 2 3 4

Table C.30: PNMR; VERY SMALL MLTD. FIRMS. Frequency values show number responding; percentages are based on category total; mean values indicate seriousness, value and priority.

PRESENT NEEDS/MEANS/ROLES	FREQUENCY		PERCENT	MEAN PRIORITY	
SMALL MLTD. FIRMS 6 to 15 total personnel	Value	Bar Chart		Value	Bar Chart
Total Number of Firms	36	0 20 40 60 80 100 120 140 160 180 200 220			0 1 2 3 4
PRESENT NEEDS					
Planning & Design	19	++++	52.78%	1.9	+++++++++
Project Management	19	++++	52.78%	2.7	+++++++++++++
Office Management	18	++++	50.00%	2.6	+++++++++++++
Computer Graphics	17	++++	47.22%	1.9	+++++++++
Engineering	17	++++	47.22%	1.8	+++++++++
Training Office Users	16	++++	44.44%	2.7	+++++++++++++
Comprng Sytm Cost/Systm Value	14	+++	38.89%	2.2	++++++++++
Hrdwr & Sftwr Availability	14	+++	38.89%	2.1	++++++++++
Evaluating Vendors	13	+++	36.11%	2.4	++++++++++++
Determining Hdwr/Sftwr Needs	13	+++	36.11%	2.7	+++++++++++++
Sftwarm Develpmnt/Programming	12	+++	33.33%	2.3	++++++++++
Programming Education	11	++	30.56%	2.2	++++++++++
General Applicationm Ed.	11	++	30.56%	2.2	++++++++++
Upgrading Hardwarm & Softwarm	9	++	25.00%	2.4	++++++++++
Hardware Maintenance	8	++	22.22%	1.6	++++++++
Other Softwarm Application	8	++	22.22%	1.1	+++++
MEANS FOR ADDRESSING NEEDS					
Local Vendors	30	+++++++	83.33%	2.1	++++++++++
Local User Groupm	30	+++++++	83.33%	1.9	+++++++++
ASLA Sponsormd Seminars	30	+++++++	83.33%	2.2	++++++++++
Professional Consultantm	29	+++++++	80.56%	2.5	++++++++++++
Self Teaching	29	+++++++	80.56%	2.3	++++++++++
ROLES FOR THE ASLA					
Computing News Letter	33	++++++++	91.67%	2.1	++++++++++
Establish Softwarm Library	33	++++++++	91.67%	2.8	+++++++++++++++
Column in LA Magazine	32	++++++++	88.89%	2.7	+++++++++++++
Information Clmaringhousm	32	++++++++	88.89%	3.3	++++++++++++++++
Sponsor Educational Programm	32	++++++++	88.89%	2.8	+++++++++++++++
Sponsor Softwarm Development	31	+++++++	86.11%	2.7	++++++++++++
		0 20 40 60 80 100 120 140 160 180 200 220			0 1 2 3 4

Table C.31: PNMR; SMALL MLTD. FIRMS. Frequency values show number responding; percentages are based on category total; mean values indicate seriousness, value and priority.

PRESENT NEEDS/MEANS/ROLES	FREQUENCY		PERCENT	MEAN PRIORITY	
MEDIUM MLTD. FIRMS 16 to 30 total personnel	Value	Bar Chart		Value	Bar Chart
Total Nweber of Fires	27				
		0 20 40 60 80 100 120 140 160 180 200 220			0 1 2 3 4
+PRESENT NEEDS					
Planning & Design	16	++++	59.26%	1.7	+++++++++
Engineering	16	++++	59.26%	1.5	+++++++
Project Manageeent	13	+++	48.15%	2.6	++++++++++++++
Coepwter Graphics	12	+++	44.44%	1.3	++++++
Evalwating Vendors	11	++	40.74%	1.7	+++++++++
Training Office Users	11	++	40.74%	2.1	++++++++++
Office Manageeent	11	++	40.74%	2.6	++++++++++++++
Ceprng Syte Cost/Syste Value	10	++	37.04%	2.3	++++++++++++
Detereining Hdwr/Sftwr Needs	10	++	37.04%	2.4	+++++++++++++
Sftware Develpent/Prograeeing	9	++	33.33%	1.1	+++++
Hrdwr & Sftwr Availability	9	++	33.33%	1.7	+++++++++
Prograeming Edwcation	8	++	29.63%	1.8	++++++++++
Upgrading Hardware & Software	7	+	25.93%	1.4	+++++++
General Applications Ed.	7	+	25.93%	2.4	++++++++++++
Hardware Maintenance	6	+	22.22%	0.7	+++
Other Software Application	1	.	3.70%	2.0	++++++++++
+MEANS FOR ADDRESSING NEEDS					
Local User Groups	21	+++++	77.78%	2.1	++++++++++
Professional Consultants	21	+++++	77.78%	3.0	++++++++++++++++
ASLA Sponsored Seeinars	21	+++++	77.78%	2.1	++++++++++
Local Vendors	20	+++++	74.07%	1.8	+++++++++
Self Teaching	19	++++	70.37%	2.3	++++++++++++
+ROLES FOR THE ASLA					
Inforeation Clearinghowse	24	++++++	88.89%	3.1	++++++++++++++++
Establish Software Library	24	++++++	88.89%	2.9	+++++++++++++++
Sponsor Edwcational Prograes	22	+++++	81.48%	2.5	++++++++++++
Coluen in LA Magazine	21	+++++	77.78%	2.5	++++++++++++
Coepwting News Letter	21	+++++	77.78%	2.2	++++++++++
Sponsor Software Developeent	21	+++++	77.78%	2.6	+++++++++++++
		0 20 40 60 80 100 120 140 160 180 200 220			0 1 2 3 4

Table C.32: PNMR; MEDIUM MLTD. FIRMS. Frequency values show number responding; percentages are based on category total; mean values indicate seriousness, value and priority.

PRESENT NEEDS/MEANS/ROLES	FREQUENCY		PERCENT	MEAN PRIORITY	
LARGE MLTD. FIRMS 31 or more personnel	Value	Bar Chart		Value	Bar Chart
Total Number of Firms	42	0 20 40 60 80 100 120 140 160 180 200 220			0 1 2 3 4
+PRESENT NEEDS					
Planning & Design	34	++++++++	80.95%	1.9	++++++++++
Conpwter Graphics	32	++++++++	76.19%	2.1	++++++++++
Engineering	27	++++++	64.29%	1.8	++++++++++
Project Management	27	++++++	64.29%	2.0	++++++++++
Sftware Develpmnt/Programming	26	++++++	61.90%	1.4	++++++++
Hrdwr & Sftwr Availability	25	++++++	59.52%	1.7	+++++++++
Training Office Users	25	++++++	59.52%	2.4	++++++++++++
Upgrading Hardware & Software	25	++++++	59.52%	1.8	+++++++++
Cmprng Sytm Cost/Systm Value	24	++++++	57.14%	1.9	++++++++++
Office Management	24	++++++	57.14%	1.8	+++++++++
Determining Hdwr/Sftwr Needs	24	++++++	57.14%	1.8	+++++++++
Evalwating Vendors	24	++++++	57.14%	1.8	+++++++++
General Applications Ed.	21	+++++	50.00%	1.7	+++++++++
Programming Edwcation	19	++++	45.24%	1.3	+++++++
Hardware Maintenance	17	++++	40.48%	0.6	+++
Other Software Application	8	++	19.05%	3.1	+++++++++++++++++
+MEANS FOR ADDRESSING NEEDS					
Self Teaching	39	+++++++++	92.86%	2.0	++++++++++
Professional Consultants	39	+++++++++	92.86%	2.6	++++++++++++++
ASLA Gponsored Seminars	38	+++++++++	90.48%	2.3	++++++++++++
Local Vendors	37	+++++++++	88.10%	1.6	+++++++++
Local User Groups	37	+++++++++	88.10%	2.0	++++++++++
+ROLES FOR THE ASLA					
Colwmn in LA Magazine	41	++++++++++	97.62%	2.5	++++++++++++
Information Clearinghouse	41	++++++++++	97.62%	3.0	+++++++++++++++++
Establish Software Library	40	++++++++++	95.24%	2.8	++++++++++++++++
Sponsor Educational Prograns	40	++++++++++	95.24%	2.9	+++++++++++++++++
Computing News Letter	40	++++++++++	95.24%	2.0	++++++++++
Sponsor Software Development	39	+++++++++	92.86%	2.5	++++++++++++
		0 20 40 60 80 100 120 140 160 180 200 220			0 1 2 3 4

Table C.33: PNMR; LARGE MLTD. FIRMS. Frequency values show number responding; percentages abased on category total; mean values indicate seriousness, value and priority.

NOT ACQUIRING/MISSING INGREDIENT	FREQUENCY		PERCENT
ALL FIRMS	Value	Bar Chart	
Total Number of Firms	304	0 20 40 60 80 100 120 140 160 180 200 220	
IF NOT ACQUIRING, WHY NOT			
No data	213	+++	70.07%
Expense	54	+++++++++++++	17.76%
Limited interest	31	+++++++	10.20%
Other	20	+++++	6.58%
Staff training problems	8	++	2.63%
SINGLE MISSING INGREDIENT			
No data	121	++++++++++++++++++++++++++++++	39.80%
Time to learn	24	++++++	7.89%
"Land. Arch." software	20	+++++	6.58%
Management software	14	+++	4.61%
Money	12	+++	3.95%
Cost/benefit information	12	+++	3.95%
Volume to cover overhead	11	++	3.62%
Education of personnel	11	++	3.62%
The computer	10	++	3.29%
CADD	9	++	2.96%
Lack of trained professionals	7	+	2.30%
Affordable graphics packagen	7	+	2.30%
Particular programs	6	+	1.97%
Ease of use	4	+	1.32%
Particular hardware components	4	+	1.32%
Projects requiring computern	3	.	0.99%
Full use of computers	3	.	0.99%
Networking capability	1	.	0.33%
Prelim. design software	1	.	0.33%
Site-to-office communication	1	.	0.33%
Staff interest	1	.	0.33%
Security for data	1	.	0.33%
Faster info. processing	1	.	0.33%
Consultants do automated tasks	1	.	0.33%
Too many users	1	.	0.33%
		0 20 40 60 80 100 120 140 160 180 200 220	

Table C.34: WNASMI; ALL FIRMS. Frequency values show number responding; percentages are based on category total.

NOT ACQUIRING/MISSING INGREDIENT	FREQUENCY		PERCENT
ALL L. A. FIRMS	Value	Bar Chart	
Total Nueber of Fires	163	0 20 40 60 80 100 120 140 160 180 200 220	
IF NOT ACQUIRING, WHY NOT			
No data	98	++++++++++++++++++++++++	60.12%
Expenee	37	+++++++++	22.70%
Lieited interest	25	++++++	15.34%
Other	16	++++	9.82%
Staff training probleee	5	+	3.07%
SINGLE MISSING INGREDIENT			
No data	83	++++++++++++++++++++	50.92%
Tiee to learn	13	+++	7.98%
Voluee to cover overhead	9	++	5.52%
Coet/benefit inforeafion	9	++	5.52%
"Land. Arch." eoftware	8	++	4.91%
Manageeent eoftware	7	+	4.29%
Education of personnel	5	+	3.07%
Money	5	+	3.07%
The coeputer	4	+	2.45%
CADD	2	.	1.23%
Lack of trained profeeeionals	2	.	1.23%
Particular prograes	2	.	1.23%
Projects requiring coeputers	1	.	0.61%
Faeter info. processing	1	.	0.61%
Site-to-office coeeunication	1	.	0.61%
Particular hardware coeponente	1	.	0.61%
Fulf use of coeputere	1	.	0.61%
Affordable graphics packagee	1	.	0.61%
Staff interest	0	.	0.00%
Security for data	0	.	0.00%
Ease of uee	0	.	0.00%
Prelie. design software	0	.	0.00%
Networking capabifity	0	.	0.00%
Coneultante do autoeated tasks	0	.	0.00%
Too eany ueere	0	.	0.00%
		0 20 40 60 80 100 120 140 160 180 200 220	

Table C.35: WNASMI; ALL L. A. FIRMS. Frequency values show number responding; pecentages are based on category total.

NOT ACQUIRING/MISSING INGREDIENT	FREQUENCY		PERCENT
ALL MULTIDISCIPLINARY FIRMS	Value	Bar Chart	
Total Number of Firms	141		
IF NOT ACQUIRING, WHY NOT			
No data	115	++++++++++++++++++++++++++++++	81.56%
Expense	17	++++	12.06%
Limited interest	6	+	4.26%
Other	4	+	2.84%
Staff training problem	3	.	2.13%
SINGLE MISSING INGREDIENT			
No data	38	+++++++++	26.95%
"Land. Arch." software	12	+++	8.51%
Time to learn	11	++	7.80%
CADD	7	+	4.96%
Management software	7	+	4.96%
Money	7	+	4.96%
Education of personnel	6	+	4.26%
Affordable graphics packages	6	+	4.26%
The computer	6	+	4.26%
Lack of trained professionals	5	+	3.55%
Particular programs	4	+	2.84%
Ease of use	4	+	2.84%
Particular hardware components	3	.	2.13%
Cost/benefit information	3	.	2.13%
Full use of computers	2	.	1.42%
Volume to cover overhead	2	.	1.42%
Projects requiring computers	2	.	1.42%
Networking capability	1	.	0.71%
Prelim. design software	1	.	0.71%
Too easy users	1	.	0.71%
Security for data	1	.	0.71%
Consultants do automated tasks	1	.	0.71%
Staff interest	1	.	0.71%
Site-to-office communication	0	.	0.00%
Faster info. processing	0	.	0.00%
	0 20 40 60 80 100 120 140 160 180 200 220		

Table C.36: WNASMI; ALL MLTD. FIRMS. Frequency values show number responding; percentages are based on category total.

NOT ACQUIRING/MISSING INGREDIENT	FREQUENCY		PERCENT
VERY SMALL L. A. FIRMS 0 to 2 total personnel	Value	Bar Chart	
Total Nueber of Fires	63		
	0	20 40 60 80 100 120 140 160 180 200 220	
+IF NOT ACQUIRING, WHY NOT			
No data	28	:+++++++	44.44%:
Expense	20	:+++++	31.75%:
Lieited interest	16	:++++	25.40%:
Dther	7	:+	11.11%:
Staff training problees	2	:.	3.t7%:
		:	:
		:	:
+SINGLE MISSING INGREDIENT			
No data	37	:+++++++++	58.73%:
Tiee to learn	8	:++	12.70%:
"Land. Arch." software	4	:+	6.35%:
Voluee to cover overhead	4	:+	6.35%:
Money	3	:.	4.76%:
The coepeter	1	:.	1.59%:
Particular prograns	1	:.	t.59%:
Projects reqeiring coeputers	1	:.	1.59%:
Management software	1	:.	1.59%:
CADD	0	:.	0.00%:
Lack of trained professionals	0	:.	0.00%:
Edecation of personnel	0	:.	0.00%:
Security for data	0	:.	0.00%:
Staff interest	0	:.	0.00%:
Cost/benefit inforeation	0	:.	0.00%:
Networking capability	0	:.	0.00%:
Ease of use	0	:.	0.00%:
Prelin. design software	0	:.	0.00%:
Affordable graphics packages	0	:.	0.00%:
Site-to-office communication	0	:.	0.00%:
Fell ese of coepeters	0	:.	0.00%:
Particelar hardware coeponents	0	:.	0.00%:
Faster info. processing	0	:.	0.00%:
Conseltants do autoeated tasks	0	:.	0.00%:
Too eany esers	0	:.	0.00%:
	0	20 40 60 80 100 120 t40 160 180 200 220	

Table C.37: WNASMI; VERY SMALL L. A. FIRMS. Frequency values show number responding; percentages are based on category total.

NOT ACQUIRING/MISSING INGREDIENT	FREQUENCY		PERCENT
SMALL L. A. FIRMS 3 to 5 total personnel	Value	Bar Chart	
Total Number of Firms	61		
0 20 40 60 80 100 120 140 160 180 200 220			
IF NOT ACQUIRING, WHY NOT			
No data	39	++++++++++	63.93%
Expense	13	+++	21.31%
Limited interest	9	++	14.75%
Other	5	+	8.20%
Staff training problems	2	.	3.28%
SINGLE MISSING INGREDIENT			
No data	27	++++++	44.26%
Management software	5	+	8.20%
Volume to cover overhead	5	+	8.20%
Education of personnel	4	+	6.56%
Cost/benefit information	3	.	4.92%
Time to learn	3	.	4.92%
CADD	2	.	3.28%
"Land. Arch." software	2	.	3.28%
The computer	2	.	3.28%
Faster info. processing	1	.	1.64%
Money	1	.	1.64%
Lack of trained professionals	1	.	1.64%
Site-to-office communication	1	.	1.64%
Particular programs	1	.	1.64%
Affordable graphics packages	1	.	1.64%
Projects requiring computers	0	.	0.00%
Networking capability	0	.	0.00%
Prelim. design software	0	.	0.00%
Full use of computers	0	.	0.00%
Ease of use	0	.	0.00%
Staff interest	0	.	0.00%
Security for data	0	.	0.00%
Particular hardware components	0	.	0.00%
Consultants do automated tasks	0	.	0.00%
Too many users	0	.	0.00%
0 20 40 60 80 100 120 140 160 180 200 220			

Table C.38: WNASMI; SMALL L. A. FIRMS. Frequency values show number responding; percentages are based on category total.

NOT ACQUIRING/MISSING INGREDIENT	FREQUENCY		PERCENT
MEDIUM L. A. FIRMS 6 to 9 total personnel	Value	Bar Chart	
Total Number of Firms	20	0 20 40 60 80 100 120 140 160 180 200 220	
+IF NOT ACQUIRING, WHY NOT			
No data	13	+++	65.00%
Other	4	+	20.00%
Expense	3	.	15.00%
Staff training problems	1	.	5.00%
Limited interest	0	.	0.00%
+SINGLE MISSING INGREDIENT			
No data	11	+++	55.00%
Time to learn	2	.	10.00%
Lack of trained professionals	1	.	5.00%
"Land. Arch." software	1	.	5.00%
Cost/benefit information	1	.	5.00%
Money	1	.	5.00%
Management software	1	.	5.00%
Particular hardware components	1	.	5.00%
CAD	0	.	0.00%
Volume to cover overhead	0	.	0.00%
Ease of use	0	.	0.00%
Projects requiring computers	0	.	0.00%
Security for data	0	.	0.00%
Staff interest	0	.	0.00%
Education of personnel	0	.	0.00%
Networking capability	0	.	0.00%
Particular programs	0	.	0.00%
Prelim. design software	0	.	0.00%
Affordable graphics packages	0	.	0.00%
Site-to-office communication	0	.	0.00%
Full use of computers	0	.	0.00%
The computer	0	.	0.00%
Faster info. processing	0	.	0.00%
Consultants do automated tasks	0	.	0.00%
Too many users	0	.	0.00%
		0 20 40 60 80 100 120 140 160 180 200 220	

Table C.39: WNASMI; MEDIUM L. A. FIRMS. Frequency values show number responding; percentages are based on category total.

NOT ACQUIRING/MISSING INGREDIENT	FREQUENCY		PERCENT
LARGE L. A. FIRMS 10 or eore personnel	Value	Bar Chart	
Total Nueber of Fires	19		
	0	20 40 60 80 100 120 140 160 180 200 220	
IF NOT ACQUIRING, WHY NOT			
No data	18	:++++	94.74%
Expense	1	:.	5.26%
Lieited interest	0	:.	0.00%
Staff training problens	0	:.	0.00%
Other	0	:.	0.00%
	1		1
		:	1
SINGLE MISSING INGREDIENT			
No data	8	:++	42.11%
Cost/benefit inforeation	5	:+	26.32%
Education of personnel	1	:.	5.26%
"Land. Arch." software	1	:.	5.26%
Full use of coeputers	1	:.	5.26%
The conputer	1	:.	5.26%
CADD	0	:.	0.00%
Faster info. processing	0	:.	0.00%
Particular hardware coeponents	0	:.	0.00%
Voluee to cover overhead	0	:.	0.00%
Ease of use	0	:.	0.00%
Projects requiriee coeputers	0	:.	0.00%
Security for data	0	:.	0.00%
Staff interest	0	:.	0.00%
Tiee to learn	0	:.	0.00%
Networking capability	0	:.	0.00%
Particular prograes	0	:.	0.00%
Prelie. design software	0	:.	0.00%
Affordable graphics packages	0	:.	0.00%
Site-to-office coeeunication	0	:.	0.00%
Money	0	:.	0.00%
Lack of trained professionals	0	:.	0.00%
Manageeent software	0	:.	0.00%
Consultants do autoeated tasks	0	:.	0.00%
Too eany users	0	:.	0.00%
	0	20 40 60 80 100 120 140 160 180 200 220	

Table C.40: WNASMI; LARGE L. A. FIRMS. Frequency values show number responding; percentages are based on category total.

NOT ACQUIRING/MISSING INGREDIENT	FREQUENCY		PERCENT
VERY SMALL MLTD. FIRMS 0 to 5 total personnel	Value	Bar Chart	
Total Number of Fires	36	0 20 40 60 80 100 120 140 160 180 200 220	
+IF NOT ACQUIRING, WHY NOT			
No data	22	+++++	61.11%
Expense	11	+++	30.56%
Limited interest	4	+	11.11%
Other	2	.	5.56%
Staff training problems	1	.	2.78%
+SINGLE MISSING INGREDIENT			
No data	13	+++	36.11%
Time to learn	4	+	11.11%
The computer	3	.	8.33%
Money	3	.	8.33%
Affordable graphics packages	2	.	5.56%
Particular hardware components	1	.	2.78%
Projects requiring computers	1	.	2.78%
Ease of use	1	.	2.78%
Security for data	1	.	2.78%
Volume to cover overhead	1	.	2.78%
Cost/benefit information	1	.	2.78%
Full use of computers	1	.	2.78%
Networking capability	1	.	2.78%
CADD	0	.	0.00%
Staff interest	0	.	0.00%
Education of personnel	0	.	0.00%
Particular programs	0	.	0.00%
Prelim. design software	0	.	0.00%
Management software	0	.	0.00%
Site-to-office communication	0	.	0.00%
"Land. Arch." software	0	.	0.00%
Lack of trained professionals	0	.	0.00%
Faster info. processing	0	.	0.00%
Consultants do automated tasks	0	.	0.00%
Too many users	0	.	0.00%
		0 20 40 60 80 100 120 140 160 180 200 220	

Table C.41: WNASMI; VERY SMALL MLTD. FIRMS. Frequency values show number responding; percentages are based on category total.

NOT ACQUIRING/MISSING INGREDIENT SMALL MLTD. FIRMS 6 to 15 total personnel	FREQUENCY Value	Bar Chart	PERCENT
Total Number of Firms	36	0 20 40 60 80 100 120 140 160 180 200 220	
IF NOT ACQUIRING, WHY NOT			
No data	31	*******	86.11%
Expense	2	.	5.56%
Other	1	.	2.78%
Limited interest	1	.	2.78%
Staff training problems	1	.	2.78%
SINGLE MISSING INGREDIENT			
No data	8	**	22.22%
CADD	3	.	8.33%
"Land. Arch." software	3	.	8.33%
Management software	3	.	8.33%
Lack of trained professionals	3	.	8.33%
Time to learn	2	.	5.56%
The computer	2	.	5.56%
Affordable graphics packages	2	.	5.56%
Particular programs	2	.	5.56%
Cost/benefit information	1	.	2.78%
Money	1	.	2.78%
Projects requiring computers	1	.	2.78%
Education of personnel	1	.	2.78%
Ease of use	1	.	2.78%
Volume to cover overhead	0	.	0.00%
Networking capability	0	.	0.00%
Full use of computers	0	.	0.00%
Prelim. design software	0	.	0.00%
Particular hardware components	0	.	0.00%
Site-to-office communication	0	.	0.00%
Staff interest	0	.	0.00%
Security for data	0	.	0.00%
Faster info. processing	0	.	0.00%
Consultants do autonated tasks	0	.	0.00%
Too many users	0	.	0.00%
		0 20 40 60 80 100 120 140 160 180 200 220	

Table C.42: WNASMI; SMALL MLTD. FIRMS. Frequency values show number responding; percentages are based on category total.

NOT ACQUIRING/MISSING INGREDIENT	FREQUENCY		PERCENT
MEDIUM MLTD. FIRMS 16 to 30 total personnel	Value	Bar Chart	
Total Number of Firms	27		
0 20 40 60 80 100 120 140 160 180 200 220			
+IF NOT ACQUIRING, WHY NOT			
No data	21	+++++	77.78%
Expense	4	+	14.81%
Limited interest	1	.	3.70%
Staff training problems	1	.	3.70%
Other	0	.	0.00%
+SINGLE MISSING INGREDIENT			
No data	10	++	37.04%
"Land. Arch." software	3	.	11.11%
CADD	2	.	7.41%
Management software	2	.	7.41%
Time to learn	2	.	7.41%
Volume to cover overhead	1	.	3.70%
Lack of trained professionals	1	.	3.70%
Ease of use	1	.	3.70%
Staff interest	1	.	3.70%
Cost/benefit information	1	.	3.70%
Education of personnel	1	.	3.70%
Full use of computers	0	.	0.00%
Projects requiring computers	0	.	0.00%
The computer	0	.	0.00%
Security for data	0	.	0.00%
Networking capability	0	.	0.00%
Particular programs	0	.	0.00%
Prelim. design software	0	.	0.00%
Particular hardware components	0	.	0.00%
Site-to-office communication	0	.	0.00%
Affordable graphics packages	0	.	0.00%
Money	0	.	0.00%
Faster info. processing	0	.	0.00%
Consultants do automated tasks	0	.	0.00%
Too many users	0	.	0.00%
0 20 40 60 80 100 120 140 160 180 200 220			

Table C.43: WNASMI; MEDIUM MLTD. FIRMS. Frequency values show number responding; percentages are based on category total.

NOT ACQUIRING/MISSING INGREDIENT	FREQUENCY		PERCENT
LARGE MLTD. FIRMS 31 or more personnel	Value	Bar Chart	
Total Number of Fires	42		
	0	20 40 60 80 100 120 140 160 180 200 220	
+IF NOT ACQUIRING, WHY NOT			
No data	41	++++++++++	97.62%
Other	1	.	2.38%
Expense	0	.	0.00%
Staff training problems	0	.	0.00%
Limited interest	0	.	0.00%
+SINGLE MISSING INGREDIENT			
No data	7	+	16.67%
"Land. Arch." software	6	+	14.29%
Education of personnel	4	+	9.52%
Time to learn	3	.	7.14%
Money	3	.	7.14%
CADD	2	.	4.76%
Particular programs	2	.	4.76%
Affordable graphics packages	2	.	4.76%
Management software	2	.	4.76%
Particular hardware components	2	.	4.76%
Lack of trained professionals	1	.	2.38%
Full use of computers	1	.	2.38%
Ease of use	1	.	2.38%
Prelim. design software	1	.	2.38%
Too many users	1	.	2.38%
Consultants do automated tasks	1	.	2.38%
The computer	1	.	2.38%
Faster info. processing	0	.	0.00%
Volume to cover overhead	0	.	0.00%
Site-to-office communication	0	.	0.00%
Staff interest	0	.	0.00%
Projects requiring computers	0	.	0.00%
Networking capability	0	.	0.00%
Cost/benefit information	0	.	0.00%
Security for data	0	.	0.00%
	0	20 40 60 80 100 120 140 160 180 200 220	

Table C.44: WNASMI; LARGE MLTD. FIRMS. Frequency values show number responding; percentages are based on category total.

APPENDIX D

RESPONSES TO `OTHER' FOR QUESTIONS 6,9,11 AND 15

QUESTION 6. PRESENT HARDWARE. `OTHER':

Word Processors, CAD Systems.
Mainframe and Mini.
Wang.
Word Processors.
Word Processors.
Word Processors.
Word Processors.

QUESTION 9. PRESENT CAPABILITIES. `OTHER':

Many.
Traffic/Transportation.
Plant Materials Inventory.
Research and Analysis.
Proposal Preparation.

QUESTION 11. NEEDS. `OTHER SOFTWARE APPLICATIONS'

Plant Inventory Management.
Landscape Specifications of Plants/Microclimatic/
Aesthetic Uses.

QUESTION 15. WHY NOT ACQUIRING. `OTHER':

No need.
Can hire out computer time.
Not a viable tool.
Volume not sufficient yet.
Variety of projects and low frequency of use make computers impractical in my business so far.
Limited applications to LA needs.
Too small a business.

Small organization.
Little to be gained -- converting to computer capabilities would be more grief than is warranted.
Little application to a small office, except for word processing -- it may happen this year.
Anticipate purchasing a micro in 2-3 years.
Amount of start up time and expense in relation to small office.
Cost ratio of equipment, maintenance, materials to operate vs. size of contracts.
Time involved for a small office.
Most of us entered Landscape Architecture because we like to draw rather than compute; also mc's just create more paper work and collect more information which may or may not be of future use.
Not cost effective (small office).
No use at this time.
Not cost effective.
Not yet satisfied that computers will actually enhance my professional capabilities. It would be useful for certain standardized office procedures.
Don't feel that we are large enough to make it cost effective (3 in the firm).
Expense compared to value.
It would take too much time to input informaton for the results obtained. I can do the same functions in less time than it would take for input to get same results. Also, the sofware is not that extensive for LA.
Scope and size of practice (1) vs. value for dollars spent.

APPENDIX E

COMMENTS; RESPONSES TO QUESTION 16

QUESTION 16. We mould appreciate any comments that you would like to add.

Computer capability is growing; we need to stride with the other professions.

Access to university resources keeps costs down -- presently computers cost too much.

Justification of the expense/returns value of office computer will determine purchase.

We hire a consultant for marketing/mailing lists and word processing.

Would like to know more about computers and their relationship to LA design.

Would like to see ASLA take the lead in helping members with computer educaton, software development, etc.

Unless there is considerable need or if you have one trained person, it requires more time for program plus you have to double check all processes manually since you are responsible for the answers the computer issues.

Computerization in the creative design field is highly over rated!

The computer field is growing at such a rapid rate that it becomes confusing as to what hardware is best, cost and applications for long term use.

I guess that even though I am a very small office I have quite a bit of knowledge on micros, although insufficient funds to implement the system I would like. I am 100% convinced that LA's must "get with the program" or be lost in the dust.

Any LA student that graduates today without computer literacy will be an instant antique.

We are a peculiar profession with peculiar needs that most software vendors don't address. If we are to compete with other design professions for work we had better catch up. They have been using computers for quite some time. ASLA should help us compete.

The computer will be a big asset when we can utilize it to its fullest.

I have an Apple + at home and have tried to incorporate it into office procedures -- so far it has not proven effective (6 in the firm).

ASLA sponsored software programs (seminars) have generally been poor for those already acquainted with computers.

Computers are only as good as the people using them -- they are not magical.

ASLA could provide a data sheet on current, available technology that best fulfills typical LA needs. A newsletter could deal with unique applications and new product evaluation.

There is a tremendous lack of appropriate software.

There does not seem to be hardware or software suitable for our practice and firm size (59 total) that is affordable.

We need a realistic understanding of the true value and usefulness of computer in an office of 15 people. We receive all kinds of conflicting reports and horror stories of system problems and failures.

Adapting software to the needs of the LA and writing new programs seem to be our greatest need at this time.

Since a great deal of work in the profession that is truely successful relies on individual creativity and imagination, there should be an emphasis on the abilities of the computer to enhance this process and not stagnate it because of the ease of using a particular program.

A progressional workshop to help develop a complete system would be useful -- details, working drawings, billing, etc.

When computers are simple enough for me to use. A system that does not require typing skills nor computer language knowledge, but has stylus type equipment and a very simple keyboard with plain language directories will be the answer.

As far as we can see now, only writing and specifications can be helped now. Listings of materials a possibility but input time is very great. (5 in the firm).

The ASLA seminars focused too much on esoteric applications; go for the basics: word processing, accounting, project management, life cycle costs and data management. We need a software clearing house with good evaluations of available software.

We need a broad range of simple programs developed by LA's for LA's.

ASLA should establish a network of computer users to establish the various uses of computers in our profession. Iowa State University has attempted to start a communication network with LAMUG's newsletter.

Right now we have many hourly contracts; the speed of a computer is perceived by some as a penalty. The ujiqu quality of our projects makes the primary strenght of the CAD systems -- repetition -- irelevant. The new Apple system may have some possibilities if it could be made more powerful and have a better printer.

It's not the lack of interest but the lack of money at this time.

The biggest help to us at this juncture would be having a source for information for asking questions on all aspects of computers.

Need evaluation and knowledge of worth of available software.

Need to see installed systems in normal operation.

We feel that the state of the art of CAD systems is prohibitve at present but anticipate that future price reductions may make a purchase more likely in five or more years from now (8 in the firm).

Need an unbiased publication addressing the usefulness of various micros and their adaptability to LA firms -- ie, some software and computers are not easily set up for use in Planning / LA environment. A handbook would greatly assist users.

We need designers that understand computers and computers that understand designers.

The computer has very limited use in urban design and urban planning on a cost/benefits basis.

Not cost effective at present size (2 in the firm).

We are considering computers for use with accounting and inventory of plant materials, as well as cost estimation calculations.

I would like to have a seminar held in Florida.

On the best means for addressing needs: just purchase software and use it.

Questionnaire should have asked about applications that we have developed. The computer industry has enormous capabilities. ASLA should avail themselves of the information. However they should avoid trying to be originators of systems or programs.

The technology now exists to do some fantastic work on computers if the right equipment is gotten into the right hands of the right people. Our needs include the availability of appropriately priced hardware and software which will allow more of the preliminary design processes to be accomplished cost effectively on the computer.

I have seen and heard of too many problems caused by them. Also, they can't complete curve data, earthwork volumes, etc. as fast as we can by present means. Actual time and accuracy trials in competition with present methodology prove that as of this time they are not productive or reliable.

Need to know specific applications for a small practice.

I like the touchy/feely aspects of LA and have no interest in computers myself, although I recognize their potentials.

The flat site areas of the world can benefit from computer applications first. The unique nature of the profession is the diversity of sites -- let's not lose touch.

Our office has been using computers for two plus years, we are just beginning to understand their uses -- the future looks great.

We know that we could use a computer in our firm, but are unclear as to what ways. It would be helpful if there were some information source regarding landscape architectural and land use planning applications.

Stay focused on practicality -- use and develop programs for solutions to repetitive kinds of problems -- ie the machine isn't everything and we can waste a lot of time trying to make it do some design things that are better done conventionally.

Software development and the sharing of such information is our (the profession's) critical problem.

How would a software library work.. how do we get access at what cost.. education seminars are helpful only if local and without overnights. The biggest problem is knowing what a program will <u>not</u> do. Vendors are not very helpful. Need to

be able to try out programs prior to buying them.

President of company is an "old time" engineer and feels computers are only needed for bookkeeping. Staff feels they could be very valuable.

Need to know of software slanted toward LA plant selections, irrigation calculations.

There are so many sofrware packages and types of hardware and every vendor says that they are "the best thing since sliced bread" -- It's confusing!

Very important to any practice small or large. Money has kept us from purchasing one thus far.

Primary functions will be office management, inventory, estimating.

Computer language gives common words new abstract meanings based upon who wrote the program -- simplify and use English (correctly!).

Computer capabilities -- definitely intended for the future (with growth of the business.. perhaps within 24 monthes).

What are other landscape architects using their systems for (need an information clearinghouse)?

Please emphasize graphics and computer capabilities for land analysis and resource evaluation; types, costs, sizes of plotters and capabilities related to reducing the tedious tasks at the drawing board. Please consider design build for all the things that landscape architects design.

Expensive toy. I can't justify the costs for the volume of work we now do in our office.

Re: sponsoring software development: let the free market system govern. Re. computing lews letter: news letters of this type tend to be a "turn off" to those people most in need of a general "down to earth" approach to the role which computers can play in the design field and business as a whole.

The information should be mixed into LA magazine, etc.

Need a solution to the problem of the timely and therefore costly transition to a system based solely on computing without a fear of information loss (via fire, accidental erasing, damage to disks, etc.).

Offerings by ASLA must be adaptable and updatable...could really use a basic and comprehensive overview in print of how computers apply to LA.

We needed this yesterday -- don't delay in doing something.

We are identifying potential uses for our small office -- justification from an economics point of view is the difficulty.

Our firm is of a size (10 total) and the projects are of a complexity that make the use of a computer unnecessary. Not sure to what degree they would improve our capabilities, efficiency, or productivity. We need to get through the "band wagon effect".

Computers have enhanced our practice, although better software and user training are needed.

I believe computer use in LA is great for data storage and information recall. I am opposed to the use of computers to make decisions and analysis.

ASLA would be an ineffective organization to rely on for computer

hardware and software information. They are too generalized and would be too slow to respond to a technology which evolves so quickly.

666! The planet is being ruined -- technology will not save us. Thank you.

I am very interested in the development of software applicable to the designer/owner of a small office.

Need to know software availability.

I do plan to acquire a microcomputer sometime when I feel I can devote enough time to it to be able to use it to advantage.

We do see a potential application of computers. However both cost and the changing hardware make it difficult for a small firm to participate.

If we expand to a staff of four or more we will probably get into computers. I believe that computers are over-emphasized for the 10-25 man office, other than for general record keeping and word processing.

Need the ability to implement "plant select" on software -- no one seems to be able to understand what we want to do and how best we can do it.

ASLA seminars are too distant and too few per year.

Each project is too different from previous projects; computer/plotter would not be used often enough. There might be a danger of becoming specialized in a specific field and thus increasing competiton which would make the firm more vulnerable to economic fluctuations.

Still too small to benefit from computers but they are a first priority if the monies become available.

I like the idea of a software library as an ASLA role.

I have poured through computer journals and find it hard to locate usable software for LA's -- and find it hard to understand software programs which may be useful. Most of them go for $350 or more a clip and are nonreturnable.

As far as landscape architecture is concerned, I can make more profit by not having a computer. They have not as yet been shown to be needed in our profession. When it ceases to be so limited, then I'd be interested. It is cheaper for our firm to farm out what little limited use we now have. (9 in the firm).

This is the only way for a medium sized (10-20 people) firm to survive aganist small operations and giant big names. Namely be more efficient and drop old traditional systems of managing information and schedules. (9 in the firm).

Our office (six total) is utilizing a word processing service for large reports and specifications, and one project manager owns an IBM PC. He uses it for estimating, writing and editing for the office. We hope to get an IBM for the office in the near future.

I personally feel that we need a maniframe/workstation setup with a terminal at each desk, rather than micros all over the place.

We need interaction with other offices -- only one in this city is using computers.

APPENDIX F

SAS PROCEDURES

Three jobs were run on the Kansas State University main frame computer, with the Statistical Analysis System software. The SAS output consisted of frequency and mean values for each variable (each possible answer) in the study. The first job, Figure F.1, was run to sort the aggregate by type of firm, and to permit the determination of approximate quartiles by firm size. The second job, Figures F.2 and F.3, yielded pertinent statistics for all responding firms as an aggregate, and for each type of firm. The third job, Figures F.4 and F.5, yielded statistics for firms by type and size.

```
1       S A S   L O G    OS SAS 82.3          OS/MVT JOB VM164318 STEP SAS      PROC

NOTE: THE JOB VM164318 HAS BEEN RUN UNDER RELEASE 82.3 OF SAS AT KANSAS STATE UNIVERSITY

NOTE: SAS OPTIONS SPECIFIED ARE:
      NOINCLUDE NOGRAPHICS  SORT=4

SAS/OR HAS  BEEN INSTALLED.    SAS/OR INCLUDES  PROCEDURES FOR  SOLVING
GENERAL ASSIGNMENT,  TRANSPORTATION,  AND  LINEAR PROGRAMMING PROBLEMS;
DETERMINING MINIMUM COST FLOW, MAXIMUM FLOW,  AND SHORTEST PATH THROUGH
A NETWORK; AND SCHEDULING ACTIVITIES THAT MAKE UP A PROJECT.


1          DATA ASLAALL;
2          INPUT ID DATE POSTCODE $ TYPE $ TOTAL RLA DOP STAFF CNTPCTS VOLUME
3                   MOWR $ COST $ INCRSNG $ CM1 $ CM1LV CM2 $ CM2LV CM3 $ CM3LV
4                   CM4 $ CM4LV CM5 $ CM5LV CM6 $ CM6LV PM1 $ PM1LV PM2 $ PM2LV
5                   PM3 $ PM3LV PM4 $ PM4LV PM5 $ PM5LV PM6 $ PM6LV EC1 $ EC1LV
6                   EC2 $ EC2LV EC3 $ EC3LV EC4 $ EC4LV EC5 $ EC5LV PD1 $ PD1LV
7                   PD2 $ PD2LV PD3 $ PD3LV PD4 $ PD4LV PD5 $ PD5LV PD6 $ PD6LV
8                   GR1 $ GR1LV GR2 $ GR2LV GR3 $ GR3LV GP4 $ GP4LV GP5 $ GR5LV
9                   BUDGET $ NEEDOM $ LVOM NEEDPM $ LVPM NEEDEC $ LVEC NEEDPD $
10                  LVPD NEEDCG $ LVCG NEEDDSA $ LVDSA NEEDGAE $ LVGAE
11                  NEEDLPE $ LVLPE NEEDSDP $ LVSDP
12                  NEEDTDU $ LVTDU NEEDMSA $ LVMSA NEEDHM $ LVHM NEEDUEHS $
13                  LVUEHS NEEDEV $ LVEV NEEDDHSN $ LVDHSN NEEDCSC $ LVCSC
14                  MEANS1 MEANS2 MEANS3 MEANS4 MEANS5
15                  POLES1 POLES2 POLES3 POLES4 POLES5 POLES6 WHYNOT $ SMI $
16         ;
17         CARDS;

NOTE: SAS WENT TO A NEW LINE WHEN INPUT STATEMENT
      REACHED PAST THE END OF A LINE.
NOTE: DATA SET WORK.ASLAALL HAS 301 OBSERVATIONS AND 115 VARIABLES. 20 OBS/TRK.
NOTE: THE DATA STATEMENT USED 2.30 SECONDS AND 220K.

1524       ;
1525       PROC SORT;
1526          BY TYPE;

NOTE: DATA SET WORK.ASLAALL WAS 301 OBSERVATIONS AND 115 VARIABLES. 20 OBS/TRK.
NOTE: THE PROCEDURE SORT USED 1.06 SECONDS AND 440K.

1527       PROC FREQ;
1528          TABLES TOTAL; BY TYPE;

NOTE: THE PROCEDURE FREQ USED 0.60 SECONDS AND 224K AND PRINTED PAGES 1 TO 4.

1529       PROC CHART;
1530          HBAR TOTAL/DISCRETE; BY TYPE;

NOTE: THE PROCEDURE CHART USED 0.72 SECONDS AND 226K AND PRINTED PAGES 5 TO 8.

1531       PROC UNIVARIATE; VAR TOTAL; BY TYPE;

NOTE: THE PROCEDURE UNIVARIATE USED 0.55 SECONDS AND 224K AND PRINTED PAGES 9 TO 11.
NOTE: SAS USED 440K MEMORY.
```

Figure F.1: SAS PROCEDURES; JOB ONE

```
1       S A S   L O G    OS SAS 82.3          OS/MVT J08 VM201704 STEP SAS      PROC

NOTE: THE J08 VM201704 HAS BEEN RUN UNDER RELEASE 82.3 OF SAS AT KANSAS STATE UNIVERSITY

NOTE: SAS OPTIONS SPECIFIED ARE:
      NOINCLUDE NOGRAPHICS  SORT=4

SAS/OR HAS  BEEN INSTALLED.    SAS/OR INCLUDES  PROCEDURES FOR  SOLVING
GENERAL ASSIGNMENT,  TRANSPORTATION,  AND  LINEAR PROGRAMMING PROBLEMS;
DETERMINING MINIMUM COST FLOW, MAXIMUM FLOW,  AND SHORTEST PATH THROUGH
A NETWORK; AND SCHEDULING ACTIVITIES THAT MAKE UP A PROJECT.


1           DATA ASLAALL;
2           INPUT ID DATE POSTCODE $ TYPE $ TOTAL RLA ODP STAFF CNTRCTS VOLUME
3                   MDWR $ COST $ INCRSNG $ CM1 $ OM1LV OM2 $ OM2LV OM3 $ OM3LV
4                   OM4 $ OM4LV CM5 $ OM5LV CM6 $ OM6LV PM1 $ PM1LV PM2 $ PM2LV
5                   PM3 $ PM3LV PM4 $ PM4LV PM5 $ PM5LV PM6 $ PM6LV EC1 $ EC1LV
6                   EC2 $ EC2LV EC3 $ EC3LV EC4 $ EC4LV EC5 $ EC5LV PO1 $ PO1LV
7                   PO2 $ PO2LV PO3 $ PO3LV PO4 $ PO4LV PO5 $ PO5LV PO6 $ PO6LV
8                   GR1 $ GR1LV GR2 $ GR2LV GR3 $ GR3LV GR4 $ GR4LV GR5 $ GR5LV
9                   BUDGET $ NEEDOM $ LVOM NEEDPM $ LVPM NEEDEC $ LVEC NEEDPO $
10                  LVPO NEEDCG $ LVCG NEEDUSA $ LVUSA NEEDGAE $ LVGAE
11                  NEEDLPE $ LVLPE NEEDSOP $ LVSOP
12                  NEEDTOU $ LVTOU NEEDHSA $ LVHSA NEEDHM $ LVHM NEEDUEHS $
13                  LVUEMS NEEDEV $ LVEV NEEDDHSN $ LVDHSN NEEDCSC $ LVCSC
14                  MEANS1 MEANS2 MEANS3 MEANS4 MEANS5
15                  ROLES1 ROLES2 ROLES3 ROLES4 ROLES5 ROLES6 WHYNOT $ SM1 $
16          ;
17          CARDS;

NOTE: SAS WENT TO A NEW LINE WHEN INPUT STATEMENT
      REACHED PAST THE END OF A LINE.
NOTE: DATA SET WORK.ASLAALL HAS 312 OBSERVATIONS AND 115 VARIABLES. 20 OBS/TRK.
NOTE: THE DATA STATEMENT USED 2.55 SECONDS AND 220K.

1580        ;
1581        DATA A;
1582        SET ASLAALL;
1583        IF TYPE = 'A';
1584        IF TOTAL GE 0 AND TOTAL LE 5 THEN SIZE=1;
1585        IF TOTAL GE 6 AND TOTAL LE 15 THEN SIZE=2;
1586        IF TOTAL GE 16 AND TOTAL LE 30 THEN SIZE=3;
1587        IF TOTAL GT 30 THEN SIZE=4;

NOTE: DATA SET WORK.A HAS 143 OBSERVATIONS AND 116 VARIABLES. 20 OBS/TRK.
NOTE: THE DATA STATEMENT USED 0.41 SECONDS AND 220K.

1588        DATA B;
1589        SET ASLAALL;
1590        IF TYPE = 'B';
1591        IF TOTAL GE 0 AND TOTAL LE 2 THEN SIZE=1;
1592        IF TOTAL GE 3 AND TOTAL LE 5 THEN SIZE=2;
1593        IF TOTAL GE 6 AND TOTAL LE 9 THEN SIZE=3;
1594        IF TOTAL GT 9 THEN SIZE=4;

NOTE: DATA SET WORK.B HAS 166 OBSERVATIONS AND 116 VARIABLES. 20 OBS/TRK.
NOTE: THE DATA STATEMENT USED 0.42 SECONDS AND 220K.

1595        DATA AB;
```

Figure F.2: SAS PROCEDURES; JOB TWO; PAGE ONE

```
2       S A S   L O G    OS SAS 82.3          OS/MVT JOB VM2017d4 STEP SAS      PROC

1596        SET A B;

NOTE: OATA SET WORK.AB MAS 309 OBSERVATIONS ANO 116 VARIABLES. 20 OBS/TRK.
NOTE: TME OATA STATEMENT USEO 0.46 SECONOS ANO 220K.

1597        PROC SORT;
1598          BY TYPE SIZE;

NOTE: OATA SET WORK.AB MAS 309 OBSERVATIONS ANO 116 VARIABLES. 20 OBS/TRK.
NOTE: TME PROCEDURE SORT USEO 0.90 SECONOS ANO 430K.

1599        PROC MEANS MAXOEC=1;
1600          BY TYPE SIZE;
1601        VAR TOTAL RLA CNTRCTS VOLUME
1602        OMILV OM2LV OM3LV OM4LV OM5LV OM6LV PM1LV PM2LV PM3LV PM4LV PM5LV PM6LV
1603        EC1LV EC2LV EC3LV EC4LV EC5LV P01LV P02LV P03LV P04LV P05LV P06LV
1604        GR1LV GR2LV GR3LV GR4LV GR5LV ·       LVOM LVPM LVEC LVPO LVCG LVOSA
1605        LVGAE LVLPE LVSOP LVTOU LVMSA LVMM LVUEMS LVEV LVOMSN LVCSC
1606        MEANS1 MEANS2 MEANS3 MEANS4 MEANS5 ROLES1 ROLES2 ROLES3 ROLES4 ROLES5
1607        ROLES6;

NOTE: TME PROCEDURE MEANS USEO 3.27 SECONOS ANO 224K ANO PRINTEO PAGES 1 TO 20.

1608        PROC FREO;
1609          TABLES TYPE*SIZE*MOWR TYPE*SIZE*COST_TYPE*SIZE*INCRSNG
1610          TYPE*SIZE*BUOGET TYPE*SIZE*WMYNOT TYPE*SIZE*SMI POSTCOOE
1611        ;

NOTE: SEE---------FOR TABLE LOCATION IN PRINT FILE
      PAGE   21  TYPE*SIZE*MOWR
      PAGE   25  TYPE*SIZE*COST
      PAGE   27  TYPE*SIZE*INCRSNG
      PAGE   29  TYPE*SIZE*BUOGET
      PAGE   31  TYPE*SIZE*WMYNOT
      PAGE   35  TYPE*SIZE*SMI
      PAGE   43  POSTCOOE
NOTE: TME PROCEDURE FREQ USEO 1.92 SECONOS ANO 224K ANO PRINTEO PAGES 21 TO 43.
NOTE: SAS USEO 430K MEMORY.

NCTE: SAS INSTITUTE INC.
      SAS CIRCLE
      PO BOX 8000
      CARY, N.C.  27511-8000
```

Figure F.3: SAS PROCEDURES; JOB TWO; PAGE TWO

```
1       S A S   L O G    OS SAS 82.3      -   OS/MVT JOB VM154630 STEP SAS

NOTE: THE JOB VM154630 HAS BEEN RUN UNDER RELEASE 82.3 OF SAS AT KANSAS STATE UNIVERSITY

NOTE: SAS OPTIONS SPECIFIED ARE:
      NOINCLUDE NOGRAPHICS  SORT=4

SAS/OR HAS  BEEN INSTALLED.    SAS/OR INCLUDES  PROCEDURES FOR  SOLVING
GENERAL ASSIGNMENT,  TRANSPORTATION,  AND  LINEAR PROGRAMMING PROBLEMS;
DETERMINING MINIMUM COST FLOW, MAXIMUM FLOW,  AND SHORTEST PATH THROUGH
A NETWORK; AND SCHEDULING ACTIVITIES THAT MAKE UP A PROJECT.


1          DATA ASLAALL;
2          INPUT ID DATE POSTCODE $ TYPE $ TOTAL RLA UDP STAFF CNTPCTS VOLUME
3                   HOWR $ COST $ INCRSNG $ OM1 $ OM1LV OM2 $ OM2LV OM3 $ OM3LV
4                   OM4 $ OM4LV OM5 $ OM5LV OM6 $ OM6LV PM1 $ PM1LV PM2 $ PM2LV
5                   PM3 $ PM3LV PM4 $ PM4LV PM5 $ PM5LV PM6 $ PM6LV EC1 $ EC1LV
6                   EC2 $ EC2LV EC3 $ EC3LV EC4 $ EC4LV EC5 $ EC5LV PD1 $ PD1LV
7                   PD2 $ PD2LV PD3 $ PD3LV PD4 $ PL4LV PD5 $ PD5LV PD6 $ PD6LV
8                   GR1 $ GR1LV GR2 $ GP2LV GR3 $ GR3LV GR4 $ GR4LV GR5 $ GR5LV
9                   BUDGET $ NEEDOM $ LVOM NEEDPM $ LVPM NEEDEC $ LVEC NEEDPO $
10                  LVPO NEEDCG $ LVCG NEEDCSA $ LVCSA NEEDGAE $ LVGAE
11                  NEEDLPE $ LVLPE NEEDSOP $ LVSOP
12                  NEEDTUU $ LVTUU NEEDHSA $ LVHSA NEEDHM $ LVHM NEEDUEHS $
13                  LVUEHS NEEDEV $ LVEV NEEDDHSN $ LVDHSN NEEDCSC $ LVCSC
14                  MEANS1 MEANS2 MEANS3 MEANS4 MEANS5
15                  ROLES1 ROLES2 ROLES3 ROLES4 ROLES5 ROLES6 WHYNOT $ SMI $
16         ;
17         CARDS;

NOTE: SAS WENT TO A NEW LINE WHEN INPUT STATEMENT
      REACHED PAST THE END OF A LINE.
NOTE: DATA SET WORK.ASLAALL HAS 312 OBSERVATIONS AND 115 VARIABLES. 20 OBS/TRK.
NOTE: THE DATA STATEMENT USED 2.41 SECONDS AND 220K.

1580       ;
1581       PROC FREQ;
1582          TABLES POSTCODE TYPE HOWR COST INCRSNG BUDGET WHYNOT SMI;

NOTE: SEE--------FOR TABLE LOCATION IN PRINT FILE
      PAGE     1  POSTCODE
      PAGE     2  TYPE
      PAGE     2  HOWR
      PAGE     2  COST
      PAGE     2  INCRSNG
      PAGE     2  BUDGET
      PAGE     3  WHYNOT
      PAGE     4  SMI
NOTE: THE PROCEDURE FREQ USED 0.71 SECONDS AND 224K AND PRINTED PAGES 1 TO 4.

1583       PROC SORT;
1584          BY TYPE;

NOTE: DATA SET WORK.ASLAALL HAS 312 OBSERVATIONS AND 115 VARIABLES. 20 OBS/TRK.
NOTE: THE PROCEDURE SORT USED 1.07 SECONDS AND 440K.

1585       PROC CHART;
1586          HBAR TOTAL/DISCRETE; BY TYPE;
```

Figure F.4: SAS PROCEDURES; JOB THREE; PAGE ONE

```
2       S A S   L U G     US SAS 82.3          OS/MVT JOB VM154(3) STEP SAS      PRO
NOTE: THE PROCEDURE CHART USED 0.72 SECONDS AND 226K AND PRINTED PAGES 5 TO 8.

1587        PROC FREQ;
1588           TABLES TOTAL POSTCODE HOWP COST INCPSNG BUDGET WHYNOT SMI; BY TYPE;

NOTE: SEE---------FOR TABLE LOCATION IN PRINT FILE
      PAGE     9  TOTAL
      PAGE     9  POSTCODE
      PAGE     9  HOWR
      PAGE     9  COST
      PAGE     9  INCRSNG
      PAGE     9  BUDGET
      PAGE     9  WHYNOT
      PAGE     9  SMI
NOTE: ABOVE MESSAGE FOR BY GROUP:
      TYPE=
NOTE: SEE---------FOR TABLE LOCATION IN PRINT FILE
      PAGE    10  TOTAL
      PAGE    12  POSTCODE
      PAGE    13  HOWP
      PAGE    13  COST
      PAGE    13  INCRSNG
      PAGE    13  BUDGET
      PAGE    14  WHYNOT
      PAGE    14  SMI
NOTE: ABOVE MESSAGE FOR BY GROUP:
      TYPE=A
NOTE: SEE---------FOR TABLE LOCATION IN PRINT FILE
      PAGE    15  TOTAL
      PAGE    16  POSTCODE
      PAGE    17  HOWR
      PAGE    17  COST
      PAGE    17  INCRSNG
      PAGE    17  BUDGET
      PAGE    17  WHYNOT
      PAGE    18  SMI
NOTE: ABOVE MESSAGE FOR BY GROUP:
      TYPE=B
NOTE: THE PROCEDURE FREQ USED 1.12 SECONDS AND 224K AND PRINTED PAGES 9 TO 18.

1589        PROC MEANS;
1590           VAR TOTAL RLA CNTRCTS
1591        OM1LV OM2LV OM3LV OM4LV OM5LV OM6LV PM1LV PM2LV PM3LV PM4LV PM5LV PM6LV
1592        EC1LV EC2LV EC3LV EC4LV EC5LV PD1LV PD2LV PD3LV PD4LV PD5LV PD6LV
1593        GP1LV GP2LV GP3LV GP4LV GP5LV          LVLM LVPM LVEC LVPD LVCG LVUSA
1594        LVGAE LVLPE LVSDP LVTDU LVHSA LVHM LVUEHS LVEV LVDHSN LVCSC
1595        MEANS1 MEANS2 MEANS3 MEANS4 MEANS5 ROLES1 ROLES2 ROLES3 ROLES4 ROLES5
1596        ROLES6;

NOTE: THE PROCEDURE MEANS USED 1.61 SECONDS AND 224K AND PRINTED PAGES 19 TO 20.

1597        PROC MEANS; BY TYPE;
1598           VAR TOTAL RLA CNTRCTS
1599        OM1LV OM2LV OM3LV OM4LV OM5LV OM6LV PM1LV PM2LV PM3LV PM4LV PM5LV PM6LV
1600        EC1LV EC2LV EC3LV EC4LV EC5LV PD1LV PD2LV PD3LV PD4LV PD5LV PD6LV
1601        GR1LV GP2LV GP3LV GR4LV GR5LV          LVLM LVPM LVEC LVPD LVCG LVUSA
1602        LVGAE LVLPE LVSDP LVTDU LVHSA LVHM LVUEHS LVEV LVDHSN LVCSC
1603        MEANS1 MEANS2 MEANS3 MEANS4 MEANS5 ROLES1 ROLES2 ROLES3 ROLES4 ROLES5
1604        ROLES6;

NOTE: THE PROCEDURE MEANS USED 1.97 SECONDS AND 224K AND PRINTED PAGES 21 TO 26.
NOTE: SAS USED 440K MEMORY.

NOTE: SAS INSTITUTE INC.
      SAS CIRCLE
      PO BOX 8000
      CARY, N.C.  27511-8000
```

Figure F.5: SAS PROCEDURES; JOB THREE; PAGE TWO

APPENDIX G

RELIABILITY CALCULATIONS

The findings of this study should not be extrapolated to represent exact frequencies and percentages for the total population, nor, especially, for various firm types and sizes. The relative accuracy of the findings may best be expressed as ranges with the relevant statistics as midpoints. We may state that we can be confident to a certain degree that the true value (of the statistic) lies in a certain sized range of values. The 95% level of confidence is typically used, which indicates that ninety five out of a hundred times that a mean value will fall in a range specified by the confidence interval of plus or minus two standard deviations.

Confidence Intervals. The ranges can be derived from confidence intervals, which can be calculated from the following formula (Babbie 1973, pg. 86):

$$S = \sqrt{(PQ)/n}$$

where; S is the standard deviation in percent, plus or minus;

PQ is the proportion of respondents selecting each response; and

n is the total number of respondents.

The standard deviation, and multiples of it, allow us to set confidence intervals for different confidence levels. As the number of respondents decreases, the magnitude of the standard deviation increases.

The reliability of results should be expressed in terms of both confidence intervals and confidence levels (allowing us to state, with a certain degree of confidence, that the true value for a statistic falls within a certain range of values).

Probability theory dictates that we can be 68 percent confident that our statistic is within one standard deviation (plus or minus) of the true value; that we can be 95 percent confident that our statistic is within two standard deviations (plus or minus) of the true value; and that we can be 99.9

percent confident that our statistic is within three standard deviations (plus or minus) of the true value. The examples that follow will be for a confidence level of 95 percent, which has a confidence interval of minus two standard deviations to plus two standard deviations around the statistic. The standard deviation is inversely related to the number of respondents, and because of the square root function, varies exponentially with the number of respondents. For instance, to reduce the standard deviation by half, we would have to quadruple the number of respondents. This means that the data for the aggregate, all firms, is many more times reliable than that for the various firm types and sizes.

Examples. The following examples use data from Tables C.1, C.2 and C.4, for question 8 (`Are you considering increasing your computing capabilites, or acquiring them, in the next twelve monthes?'). They are intended to illustrate, approximately, the varying degrees of reliability for the three levels of analysis (Figure 1., pg. 18).

Example 1.) All Firms; n = 304.

When questioned about their intentions to increase or acquire computing capabilities, practitioners in 60 percent of all firms responded `yes' and 33 percent responded `no'. The standard deviation in this case is (plus or minus) 2.55 percent ($2.55\% = \sqrt{(.60)(.33)/304}$), which must be doubled to set the confidence interval for the 95 percent confidence level. We may state, then, that we can be 95 percent confident that between 54.9 (60% - 5.1%) and 65.1 (60% + 5.1%) percent of the practitioners in all firms would say `yes', that they are planning to increase or acquire computing capabilities.

Example 2.) All Landscape Architectural Firms; n = 163.

In this case, 51 percent of the respondents indicated `yes', and 43 percent indicated `no'. The standard deviation is 3.67 percent ($3.67\% = \sqrt{(.51)(.43)/163}$) and the confidence interval is (plus or minus) 7.34 percent. We may be 95 percent confident that between 43.7 percent and 58.3 percent of the practitioners in strictly landscape architectural firms would respond `yes' to this question.

Example 3.) Very Small L.A. Firms; n = 63.

In this case, 52 percent responded `no', and 40 percent responded `yes'. The standard deviation is 5.7 percent ($5.7\% = \sqrt{(.52)(.40)/63}$) and the confidence interval (for the 95 percent confidence level) is, plus or minus, 11.4 percent. We may state that we can be 95 percent confident that between 40.6 percent and 63.4 percent of practitioners in very small landscape architectural firms would not be planning to increase or acquire computing capabilities before April 1985.

Example 4.) Large L.A. Firms; n = 19.

In this group, seventy nine percent responded `yes'. The standard deviation is 8.16 percent (8.16% = $\sqrt{(.79)(.16)/19}$ ) and the 95% confidence interval is 16.32%. Therefore, we can be ninety five percent certain that between 62.68% and 95.32% of all large landscape architectural firm practitioners would respond `yes' to this question.

Clearly, the reliability of data for various firm types and sizes is much lower than it is for the aggregate. The data and conclusions pertaining to these third level categories should be reviewed cautiously.

The same equation can be used to calculate standard deviations and confidence intervals for questions with more than two responses. Two categories (P and Q), or clusters of responses, would be defined as desired, and the sums of their percentages would be substituted into the formula. For example, there were seven responses for question 6, on present hardware. Category P could be defined by `one microcomputer', and category Q by all the other responses to this question. The confidence interval for the response `one microcomputer' (Table C.1) would be 4.3% (4.3% = 2 $\sqrt{(.20)(.45 + .10 + .06 + .05 + .04 + .02)/304}$). We can be 95% confident that between 15.7 and 24.3 percent of all firms would have one microcomputer (constituting their computer resources) at the present time.

An alternative form of this equation is:

$$s = \sqrt{P(1-P)/n}$$

This form shortens calculations considerably, and is actually more accurate. Slightly larger confidence intervals result from its application if the sums of "all the other responses" do not add up to "1-P".

As Prof. Anderson noted in his report, the use of this equation involves two assumptions; 1.) that simple random sampling was used, and 2.) that there were no non-sampling errors. The confidence intervals for this study would never be smaller (indicating greater accuracy) than those calculated with the above equation (Anderson, 1983, pg. 55).

APPENDIX H

MICROCOMPUTER HARDWARE AND SOFTWARE USED IN THIS STUDY

Microcomputers and associated software have made this study possible. Without the following hardware and software, the scope of the research would have been considerably reduced, and the analysis could not have been as sophisticated. Nor would the final document have been edited and rewritten so thoroughly.

Hardware:

IBM-PC with 256 K RAM, two 360K disk drives, Hercules Graphics Card

Epson FX-100 dot-matrix printer

Software:

Lotus 1-2-3 1a
(Lotus Development Corp.)

Lotus 1-2-3 was used to present the data in meaningful ways (via spreadsheets) and to create most of the tables.

Wordstar Professional 3.3 (with Spellstar and Mailmerge)
(MicroPro International Corp.)

Wordstar was used for word-processing and creating personalized cover letters.

PC-File III
(Jim Button, Bellevue, WA)

PC-File III was used to create the data base for the survey mailing from the mailing labels provided by the ASLA.

COMPUTER USE IN LANDSCAPE ARCHITECTURE FIRMS WITH MEMBERSHIP IN THE ASLA

A National Survey : Spring 1984

by

LAURENCE A. CLEMENT, JR., ASLA

Bachelor of Landscape Architecture

SUNY College of Environmental Science and Forestry

1980

ABSTRACT OF A
MASTER'S THESIS

Submitted in partial fulfillment of the
requirements for the degree

MASTER OF LANDSCAPE ARCHITECTURE

Department of Landscape Architecture

KANSAS STATE UNIVERSITY

Manhattan, Kansas

1985

Computer technology is rapidly becoming accepted as a means of maintaining or establishing a competitive edge in environmental design practice. The recent advances in hardware and software development and the continuing reduction in prices are stimulating wider and increasingly sophisticated applications of computers in design offices. This trend is expected to continue and to accelerate. Changes in office procedures and perhaps reconfiguration of practice will result.

The purpose of this study is to provide the Landscape Architecture profession with a clear picture of current member capabilities and attitudes relative to computer applications, and to suggest products and services that might be developed for practitioners. Monitoring the trends in computer use, and disseminating the findings, will help enable practitioners to respond creatively to the challenges posed by computer technology. Professional organizations such as the American Society of Landscape Architects and the Council of Educators in Landscape Architecture can utilize this information in their efforts to assist practitioners in public, private and academic practice.

Currently, environmental design and planning offices use computer technology mostly for word-processing and several office management tasks, such as specification writing, job cost accounting and financial management. Specialized professional applications programs for project management, earthwork and drainage calculations, perspective drawing and others are becoming increasingly available and affordable for the smaller firms.

This thesis reports the results of a recent survey (spring of 1984) of computer applications in private practice firms of members of the ASLA. Trends of current capabilities and needs of practitioners are identified and analyzed. The results of this survey are compared to those of similar studies that have been made by the American Institute of Architects and by the Design Research Institute at Iowa State University.

Following the interpretation and comparison of survey findings, implications for professional practice are discussed, with notes and observations on apparent trends and current developments. The research was supported by the Professional Practice Institute of the ASLA and the College of Architecture and Design at Kansas State University.