MSPEC/TSO:
ARCHITECTURAL SPECIFICATION MANAGEMENT UTILIZING THE IBM TIME SHARING OPTION

by

Ronald Lee Collier

Thesis submitted to the Graduate Faculty of the
Virginia Polytechnic Institute and State University
in partial fulfillment of the requirements for the degree of

MASTER OF ARCHITECTURE

IN

Environmental Systems

APPROVED:

H. J. Sabaroff, Chairman

Robert N. S. Chiang

Donald Bergeson

Andy N. C. Kaneg

May, 1974

Blacksburg, Virginia

ACKNOWLEDGMENT

The author wishes to express his gratitude to the thesis committee, Benard J. Sabaroff, Director of the Environmental Systems Laboratory, Robert N. S. Chiang, Professor of Architecture and Environmental Design and Donald Bergeson, Assistant Professor of Architecture and Environmental Design. Their guidance has been invaluable in the development of this thesis. Also, the author wishes to thank Andy N. C. Kaneg for the reading and evaluation of this thesis.

No less is the moral support given to me by my wife, , who has been most patient and encouraging.

The author extends his gratitude to the School of Design, North Carolina State University for the use of their computer time for the development of the software. The author extends a special thanks to , Professor of Professional Practice at North Carolina State University, for his assistance in the preparation of Chapter Four, Educational Use of MSPEC/TSO.

TABLE OF CONTENTS

ACKNOWLEDGEMENTS..... ii

TABLE OF CONTENTS..... iii

LIST OF ILLUSTRATIONS..... v

CHAPTER ONE: INTRODUCTION AND PROBLEM STATEMENT. 1

Architectural Office Management - A Review

Scope of Thesis

CHAPTER TWO: RECENT DEVELOPMENT IN SPECIFICATION ORGANIZATION AND PRODUCTION..... 5

Introduction - Communication in the Construction Industry

Specification Organization
Construction Specification Institute Format, Uniform Construction Index and Master Specifications.

Production Techniques
Offset Printing, Cut and Patch Method

Automated Methods
Magnetic Tape Selectric Typewriter, Magnetic Card Selectric Typewriter, Computerized Specifications, PSAE'S MASTERSPEC, and Time Sharing Computer Operation.

CHAPTER THREE: MSPEC/TSO..... 32

Introduction

Hardware, Software

Operation Costs

CHAPTER FOUR: EDUCATIONAL USES OF MSPEC/TSO..... 62

Reorganization of Traditional Methods, Development of Master Specifications and Project Specifications by the Student by the use of MSPEC/TSO.

APPENDICES..... 70

A. MSPEC/TSO User's Guide

B. Example of Input and Output

C. MSPEC/TSO Software

REFERENCES CITED..... 113

BIBLIOGRAPHY..... 115

ABSTRACT..... 120

VITA..... 121

LIST OF ILLUSTRATIONS

Figure 2-1.	The CSI 16-Division Format.....	8
Figure 2-2.	Example of the CSI Division-Section Concept	12
Figure 2-3.	Typical Section Numbering of the Uniform Construction Index	13
Figure 2-4.	Specification Development Flow Chart.....	18
Figure 2-5.	The Magnetic Tape Selectric Typewriter....	23
Figure 2-6.	The Operation of PSAE's MASTERSPEC ...	26
Figure 2-7.	The Cost of PSAE's MASTERSPEC	29
Figure 3-1.	The IBM 3270 Information Display Station...	36
Figure 3-2.	Operation Procedure for MSPEC/TSO.....	38
Figure 3-3.	Flow Chart - One Procedure Options(main)..	40
Figure 3-4.	Flow Chart - Four Procedure Options(main).	46
Figure 3-5.	Flow Chart - Five Procedure Options(main).	49
Figure 3-6.	Hardware Cost for MSPEC/TSO	56
Figure 3-7.	Time Sharing Schedule of Charges	58
Figure 3-8.	Time Sharing Support Services Pricing Schedule	59
Figure 3-9.	Comparison of Production Methods	60
Figure 4-1.	Preinstructional Reorganization	63
Figure 4-2.	Educational Use of MSPEC/TSO	64

CHAPTER FOUR: EDUCATIONAL USES OF MSPEC/TSO..... 62

Reorganization of Traditional Methods, Development of Master Specifications and Project Specifications by the Student by the use of MSPEC/TSO.

APPENDICES..... 70

A. MSPEC/TSO User's Guide

B. Example of Input and Output

C. MSPEC/TSO Software

REFERENCES CITED..... 113

BIBLIOGRAPHY..... 115

VITA..... 120

ABSTRACT

CHAPTER ONE

INTRODUCTION AND PROBLEM STATEMENT

Architectural Office Management - A Review

Architectural practice has experienced changes in office procedures within the past two decades in order to meet the complex problems of building demanded by a rapidly advancing technological world. More recently much research has evolved in areas of office procedure due to the shifting of emphasis from activities of design to those of administrative duties. It is estimated that in the course of practice that upwards of 60% of the design professionals time is spent in activities outside of creative work in which he is gifted.

Several factors that have caused the concentration of a disproportuate effort in areas of business activities are as follows:

1. The design professional is educated as an artist/scientist rather than as a businessman.

2. There seems to be a definite attitude against the study of business management in schools of design. (It must be realized, however, that a new student awareness of the necessity of these studies is causing an evaluation of the problem.)

3. That experience must be gained on a trial and error basis in personal practice since the majority of firms do not share information on business management with their employees nor with the profession on a local basis.

These factors result in the experimenting with business efforts by the professional rather than concentrating on the design of buildings.

Another factor which has evolved in the past decade is one of an increased legal exposure of the design professional. "Judicial decisions extending the professional's liability for negligent performance to third person's with whom he has no contractural relationship, have been of continuing concern to the profession."(1) This has forced the professional to shift more time from creative work to production of the contract documents. With all considered most construction projects are deprived of the detailed research and creative activity which is needed to create viable environments.

In 1966, the Committee on Research of the American Institute of Architects responded to the need for more efficiency in office practice. The study prepared by the committee "assessed the opportunities and need for the application of new and emerging techniques in management." They stated that architectural practices have not adopted the new techniques and advances offered to them by the same technological world that is forcing them to change. Other disciplines, the study states, have adopted progressive new techniques for improvement for efficiency.(2)

Excluding large professional firms who have sufficient financial backing for research and development, most firms do not see the need for change, either for reluctance to change itself or for satisfaction with their existing condition. Yet, with efficient operation of the business, an increase in the profits can be experienced, more viable environmental

solutions created and greater satisfaction can be achieved by the envolvement in creative activities by the professional for which he received his training. Since the desire of most professionals is the achievement of these goals and since a need for improved efficiency definitely exists, any research in this area merits consideration.

Scope of Thesis

Previous research in the area of architectural office management has concentrated its studies on the total scale of practice. This has produced vague generalized solutions to the problem and has been of little value to the design professional. It is the purpose of this thesis, not to solve all of the architects management problems, but to concentrate on the solution to one time-consuming activity in the area of production management, that of specification text manipulation.

It is recognized that the preparation of specifications is an essential activity in office practice. "Working drawings and specifications are the visible product of the design office. With several jobs in the office at one time and with several sections of specifications on each job, it is obvious that time spent in specification writing and editing can become a significant part of the expense of the job."(3)

The approach with which the author researched the problem began with a thorough review of new techniques available in the organization and

mechanical production of specification. The pertinent results of the research as it applies to the solution offered by the author is recorded in this thesis.

The solution, offered by the author, to the problem of improving efficiency in specification text manipulation involves four new developments available to the construction industry:

1. the IBM System/360 Time Sharing Option
2. the Construction Specification Institutes Specification Format
3. the Uniform Construction Index
4. the Master Specification concept of specification development

These four developments were incorporated in a series of original computer programs which are entitled MSPEC/TSO. MSPEC/TSO can offer an improved efficiency in text manipulation in the office situation. An additional use has been developed as a teaching aid for specification writing. This is detailed in Chapter Four.

It should be noted that this thesis is not meant to be an instructive source of computer programing, the CSI Format, the Uniform System or of specification writing. A basic understanding of these by the reader is assumed by the author. It may be noted that reference is made to detailed sources of information on these topics which may prove beneficial to the reader inexperienced in these areas.

CHAPTER TWO

RECENT DEVELOPMENTS IN SPECIFICATION ORGANIZATION AND PRODUCTION

Introduction - Communication in the Construction Industry

The building specification is defined in its simpliest terms as a written document that defines the products, their quality and the method of installation into the building. "The Specification is a written or printed description of the work to be done forming a part of the contract (between the Owner and Contractor) and describing qualities of materials and mode of construction, and also giving dimensions and other information not shown on the drawings."(4) The specification is a means of communication of information.

Communication has become a prime topic of contemporary research. The development of communications technology has increased human knowledge at an astounding rate. "By 1950, the sum of all human knowledge was doubling every ten years; today it is doubling every five years." (5) To deal with the challenge of communication of information in the construction industry, professional organizations such as the American Institute of Architects and the Construction Specification Institute have devoted much research into establishing a uniform system of handling industry information. These are discussed as they apply to specifications since they form a viable part of the problem solution introduced in

this thesis.

Office machinery companies have devoted considerable time to the research and development of word processing equipment to store, retrieve and communicate information. Some of the more significant equipment is discussed in conjunction with text handling equipment as these are needed to have a comparison with the problem solution offered in this thesis.

Specification Organization
Construction Specification Institute Format

The Construction Specification Institute (CSI) is a professional organization devoted to the improving of communication of information within the construction industry. The CSI objectives are the promotion of better specification writing and as an educational source for those interested in improving specifications. Its members consist of professionals from all areas of the industry: architects, engineers, contractors and product suppliers and manufacturers.

From its formation in 1949, the CSI has been the major source of research in specifications. This research has produced what is known as the CSI Format. The philosophy of the format is "based on the Division - Section concept that each Section constitutes a unit of work and that related "Sections" are grouped under broad generic headings known as "Divisions",each of which is based on an interrelationship of

place, trade, function, or materials."(6) The 16 Division Format is listed in Figure 2-1.

The CSI Format has implemented a uniformity in the arrangement of construction documents. Several advantages of its use are as follows:

1. Contractors are able to increase accuracy of bids while reducing the efforts normally associated with bidding.
2. Contractors find projects easier to control.
3. Architects and engineers have greater assurance that specifications are complete.
4. The building owner stands to reduce his expenditures through increased efficiency.
5. Specifiers are able to relate all files, product literature, references and specifications to a single unified system.(7)

The CSI Format also includes another concept worth noting: the development of the "Project Manual" concept of organization. The Project Manual groups information under four headings as follows:

1. Bidding Requirements
2. Contract Forms
3. General Conditions
4. Specifications

The first item is generally unique to each project. The next two are static since most firms use standard documents. The fourth item is also unique to the project but may be retrieved from a standard master specification. Therefore, this thesis concentrates on the fourth item

DIVISION 1	GENERAL REQUIREMENTS
DIVISION 2	SITE WORK
DIVISION 3	CONCRETE
DIVISION 4	MASONRY
DIVISION 5	METALS
DIVISION 6	WOOD and PLASTICS
DIVISION 7	THERMAL and MOISTURE PROTECTION
DIVISION 8	DOORS and WINDOWS
DIVISION 9	FINISHES
DIVISION 10	SPECIALTIES
DIVISION 11	EQUIPMENT
DIVISION 12	FURNISHINGS
DIVISION 13	SPECIAL CONSTRUCTION
DIVISION 14	CONVEYING SYSTEMS
DIVISION 15	MECHANICAL
DIVISION 16	ELECTRICAL

Figure 2-1. The CSI 16-Division Format

rather than the former three since it can be automated, thus, improving the efficiency of the total system of the Project Manual.

The internal organization of the technical sections (Units of Work) is divided into three parts, namely: General, Products and Execution. The "General" part consist of technical and administrative paragraphs which pertain only to that particular section but by their nature cannot be included under "Products" or "Execution". This part refers to areas of concern which may relate to the accomplishment of work of a particular section. The CSI Format defines the following for inclusion in this part:

1. Description of System
2. Quality Assurance
3. Submittals
4. Product Delivery, Storage and Handling
5. Job Conditions
6. Alternatives
7. Guarantee(8)

The "Product" part of the section format defines the product to be used in one of the following means:

1. Descriptive Specification
2. Proprietary Specification
3. Reference Standard
4. Performance Specification

5. Cash Allowance(9)

The "Execution" part of the section "amplifies the project drawings by establishing "how" a product is incorporated into the Construction." This part will include "field" functions and requirements as they relate to the section. The following items are included in this part:

1. Inspection
2. Preparation
3. Installation/Application/Performance/Erection
4. Field Quality Control
5. Adjustments and Clearing
6. Schedules(10)

The CSI Format, as defined previously and broken down into parts, established a uniformity of presentation and shows importance for several reasons. The use of a definite repetitive procedure minimizes the chance of omissions of items by oversight. It facilitates the location of specific information by users of the specifications as they become familiar with the format. Its outline may serve as a checklist during the design stage of a project.(11)

The inclusion of the provision in a chronologial order offers the following advantages:

1. Increases comprehension and understanding of requirements by

the contractor for the preparation of bid and accomplishment of work.

2. Provides a well defined guide for the field representative or inspector to follow during the process of construction.

A typical specification section utilizing the CSI Format is illustrated in Figure 2-2.

Uniform Construction Index

The Uniform System for Construction Specifications, Data Filing and Cost Accounting was developed, by the Conference on Uniform Indexing Systems, in responce to the need for uniformity in the handling of information. The first publication was introduced in 1966 as the results of a search for a simple, logical and flexible system for rapid classification and retrieval of technical data in the construction industry. Among others the following unrelated documents were examined for possible use:

1. The CSI Format for building specifications originally published by the Construction Specification Institute.

2. The Standard Filing System and Alphabitcial Index, originally published by the American Institute of Architects in 1920.

3. Suggested Guide for Field Cost Accounting, original published by the Associated General Contractors of America, Inc. in 1961.

The interrelationship of place, trade, function or material inherent in the 16-Division grouping of The CSI Format For Building Specifications was determined to be the most appropriate arrangement for a system.(12) The adoption of the CSI Format into the Uniform Construction Index

0320.0 CONCRETE REINFORCEMENT

GENERAL

1. Steel bars, welded wire fabric, supports and other incidentals for the placing of reinforcement for concrete work is included under this Section.
2. Work not included: Masonry Reinforcing.
3. Detailing: Reinforcing steel detailed in accordance with ACI Manual of Standard Practice for Detailing Reinforced Concrete Structures, ACI-315.

PRODUCTS

1. Size of mesh and bars as shown on drawings.
2. Reinforcing bars shall be rolled from intermediate grade new billet steel conforming to ASTM Designation A615 with a minimum yield point of 60,000 psi.
3. Welded wire fabric: Mesh shall be electric welded wire fabric and conform to ASTM Designation A-185.
4. Cold-drawn steel wire: Wire shall conform to ASTM Designation A-82.

EXECUTION

1. Reinforcing steel handled and placed in accordance with ACI-318.
2. Cleaning and bending reinforcing: Metal reinforcement at the time concrete is placed shall be free from scale, oil, and structural defects (cracks, excessive rust, and pitting), or other coatings that will reduce or destroy the strength of bond. All bars shall be bent cold and accurately to conform in size and position to requirements of drawings.
3. Placing: Metal reinforcement accurately placed and rigidly secured in position in such a manner that all steel will remain in place. Support reinforcement in footings and other places over earth by masonry blocking. Reinforcement for slabs, and other floor members supported on wire chairs or other approved supports. Unless otherwise specified supports shall conform to the ACI Detailing Manual (ACI-315).
4. ETC.

Figure 2-2. Example of the CSI Division-Section Concept

DIVISION 3—CONCRETE

03050	Concrete Accessories
03100	**CONCRETE FORMWORK**
03105	Form Liners and Coatings
03110	Wood Forms
03120	Prefabricated Forms
03121	Panel Forms
03123	Pan Forms
03125	Custom Steel Forms
03128	Fiberglass Reinforced Plastic Forms
03129	Prefabricated Stair Forms
03150	**EXPANSION AND CONTRACTION JOINTS**
03200	**CONCRETE REINFORCEMENT**
03210	Steel Bar and Welded Wire Fabric Reinforcing
03230	Stressing Tendons
03300	**CAST-IN-PLACE CONCRETE**
03305	Concrete Curing
03310	Concrete
03311	Shrinkage Compensating Concrete
03320	Lightweight Concrete
03321	Insulating Concrete
03322	Lightweight Structural Concrete
03330	Heavyweight Concrete
03340	Prestressed Concrete
03341	Post-Tensioned Concrete: Bridge Girders
03350	**SPECIALLY FINISHED CONCRETE**
03351	Exposed Aggregate Concrete
03352	Tooled Concrete
03353	Blasted Concrete
03354	Heavy Duty Concrete Floor Finishes
03355	Grooved-Surface Concrete
03360	**SPECIALLY PLACED CONCRETE**
03361	Shotcrete
03370	Grout
03371	Catalyzed Metallic Aggregate Grout
03372	Non-Shrink Non-Corrosive Aggregate Grout
03373	Epoxy Grout
03400	**PRECAST CONCRETE**
03410	Precast Concrete Panels
03411	Tilt-Up Wall Panels
03420	Precast Structural Concrete
03425	Precast Concrete Deck
03430	Precast Prestressed Concrete
03431	Precast Prestressed Concrete Standard Sections
03432	Precast Prestressed Concrete Custom Sections
03500	**CEMENTITIOUS DECKS**
03510	Gypsum Concrete
03530	Cementitious Wood Fiber Deck

DIVISION 4—MASONRY

04100	**MORTAR**
04110	Cement and Lime Mortars
04120	Acid Resisting Mortars
04130	Premixed Mortars
04150	**MASONRY ACCESSORIES**
04160	Joint Reinforcement
04170	Anchors and Tie Systems
04180	Control Joints
04200	**UNIT MASONRY**
04210	Brick Masonry
04212	Adobe Masonry
04220	Concrete Unit Masonry
04230	Reinforced Unit Masonry
04232	High Lift Grouted Masonry
04233	High-Lift Grouted Concrete Block
04235	Preassembled Masonry Panels
04240	Clay Backing Tile
04245	Clay Facing Tile
04250	Ceramic Veneer
04251	Terra Cotta Veneer
04252	Mechanically Supported Masonry Veneer
04270	Glass Unit Masonry
04280	Gypsum Unit Masonry
04285	Sound Absorbing Perforated Hollow Masonry Units
04400	**STONE**
04410	Rough Stone
04420	Cut Stone
04422	Marble
04423	Limestone
04424	Granite
04425	Sandstone
04430	Simulated Masonry
04435	Cast Stone
04440	Flagstone
04450	Natural Stone Veneer
04500	**MASONRY RESTORATION AND CLEANING**
04510	Masonry Cleaning
04520	Masonry Restoration
04550	**REFACTORIES**
04451	Flue Liners
04452	Corrosion Resistant Brick Lining
04453	Combustion Chambers

Figure 2-3.
Typical Section Numbering of the Uniform Construction Index

has created acceptance of the CSI Format, previously discussed, industry wide. Because of this widespread acceptance it was determined that this format should be used as a section guide for any system of specification text manipulation and was included in the authors solution. (See Figure 2-3.)

Master Specifications

The master specification is a document that comprises standard specifications for the many sections of the Uniform System. Its use finds merit in the formation of project specifications by the retrieval of pertinent sections applicable to the buidling project.

"In the 1960's, the Architectural and Engineering design profession became interested in the use of master specifications as a method of producing project specifications. Several factors were known to be major stimulators:

1. The advent of automated text handling systems provided a modern and efficient means of utilizing the text of a master.

2. A virtual explosion in new building products made it necessary to systematize the decision-making procedure, in order to obtionize the set of choices for each project.

3. Air travel led many firms to expand to a wider basis of practice, which further extended their need for comprehensive capability in specifications.

4. The professional's exposure to liability based on his documentation of the project has increased substantially, making accuracy and defensibility essential for contract documents.

5. The drudgery and inefficiency of traditional specifying methods

were no longer acceptable to highly skilled technical personnel or to managers of modern offices."(13)

In September 1973, in Rotterdam, The Netherlands the First International Congress on Construction Communications was held. The Conference was successful in revealing the common efforts of several international organizations in the development of related construction communication and information systems. The subject matter presented was divided into areas of (1) Automated Specifying and Qualifying Systems, (2) Information Storage and Retrieval Systems, and (3) Automated Graphic Systems. During this conference K. E. Stubbs, Chief, Specification Section of the Design Branch of the Department of Public Works of Canada introduced the "Automated Master Specification System of the Department of Public Works of Canada." He stated that the following requirements for the development of this System are common to Master Specification Systems throughout the world and are worth mention here:

1. There must be sufficient and appropriate text to justify its use.
2. There must also be the capability of safe storage of this text and a method to provide a simple up-dating capability by authorized personnel only.
3. It must provide for rapid and reliable retrieval and text manipulation to form accurate, reproducible copy.(14)

The Construction Specification Institutes has evaluated the advantages of the use of the master specification approach to specification writing. These advantages are as follows:

1. Improved Efficiency in Project Specifying: Reports indicate a possible 50% to 67% savings in spec-oriented technical labor when using an optimum master specification. Although the overhead cost for developing and maintaining a master specification system (or buying a service) must be charged against that savings, a net savings can be easily realized if the volume of use is substantial.

2. Expanded Decision - Making Capability: Form optimum master specification content (which presents the widest range of normal choices) the specifier can make the best possible choice for each item on each project. Traditionally, a thorough search for each item has not been scaled to the volume or importance of each item needed for each project.

3. Delays Avoided in Project Development: The use of a master specification allows specification production to precede drawing production, thereby avoiding the traditional delay and confusion caused by last-minute specification decisions. Drawing personnel are automatically compelled to more proficient performance.

4. Minimize Repetitive Work: A master specification can free key technical personnel from the drudgery of repetitive work, allowing them to concentrate upon the unique project considerations, which can be customized more effectively to the owner's needs.

5. Reduce Errors and Omissions: Both inadvertent mistakes and wrong decisions can be minimized through the use of a carefully maintained master specification depending, of course, upon the quality of its content.

6. Reduce Exposure to Liability: There are a number of ways other than beyond lessening errors and omissions in which a master specification can be used to minimize liability, the most important of which is conformance with the recognized norm. To maximize this benefit, the master specification must be a recognized national standard of the profession. An individual office master specification based upon the profession's recognized standards, will achieve a major part of the liability reduction.

7. Unify Office Technology: The master specification can be instrumental in unifying technical terminology, scope of service

to clients, and office policy on a wide range of technical considerations.

8. Stabilize Office Practice: In this general objective, the master specification can be used to educate the less experienced personnel and establish a standard production procedure. Expanding and updating the master during "slow" periods can level the work load and initiate systematic office improvements. Many offices use the master specification in their in-house technical education program.

9. Automated Specification Output: Automation by Computer, typewriter or other equipment, either in-house or out, is virtually impossible without using master specification content. Even if the firm isn't interested in automation for automation's sake, there may be advantages in speed, cost, accuracy, appearance of documents, and other fringe benefits worth considering. Automated specifications are the logical step in preparation for more sophisticated practices of the future.(15)

Production Techniques

Through the research for this thesis of the possible techniques for improved efficiency in the production of specifications for buildings, several stood out among the others as being feasible to accomplish this goal. It is not the intent of this thesis to explore in detail all of the available techniques; but, rather it is the intent to present the most prevalent techniques as they apply to the development of the solution developed by the author.

As explained previously the master specification is a document that is gaining widespread use by practioners. Its use finds merit as an aid in the compilation of project specifications (see figure 2-4). To compile

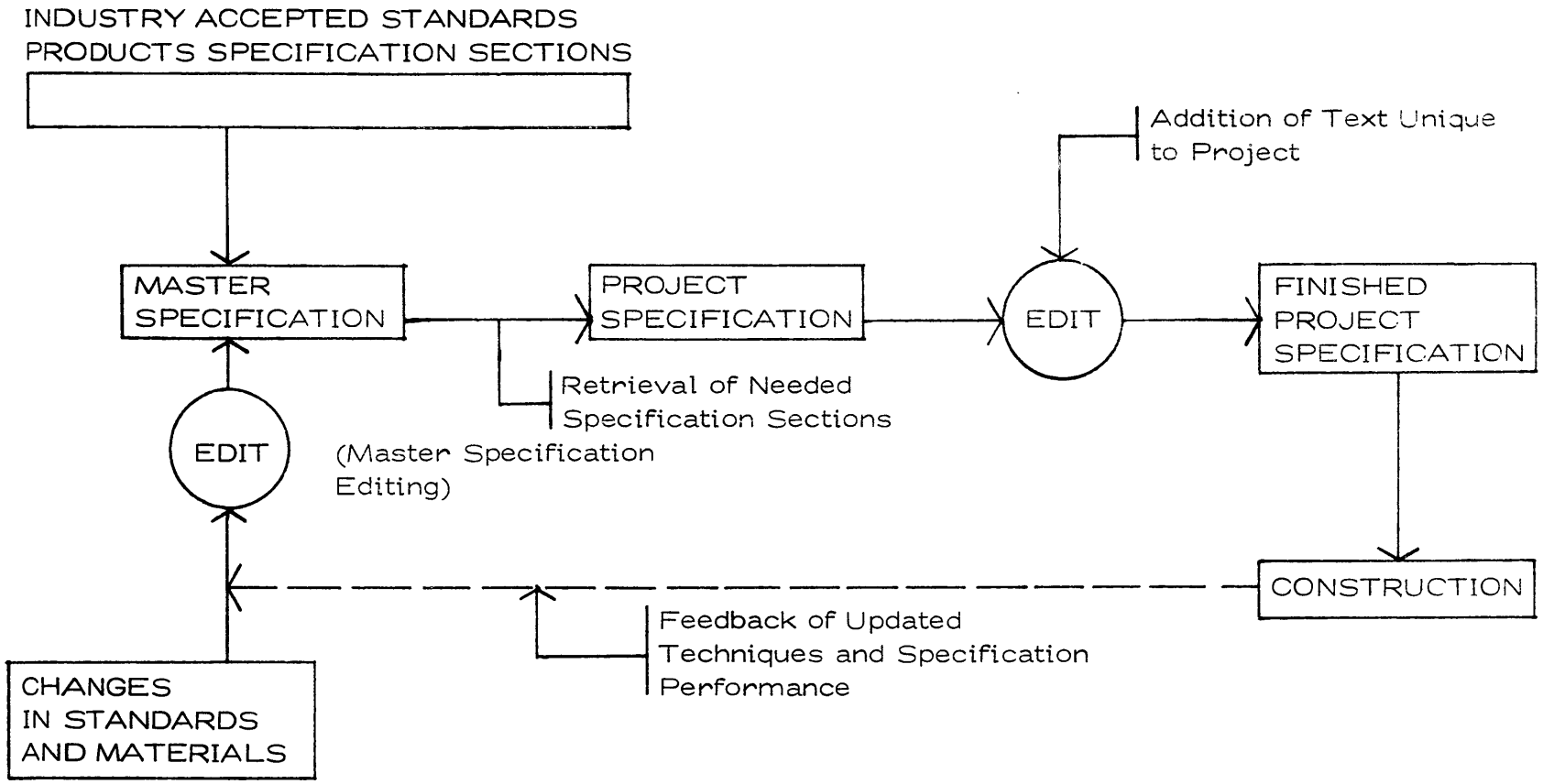


Figure 2-4. Specification Development Flow Chart

a project specification, the sections that are needed to define materials and methods are retreived from the master and placed into the project specification. The project specification is edited to suit the requirements of the building project at hand. At this time, it is reproduced to form a part of the Contract Documents. There are several methods available to perform the task of developing the project specification. The most prevelant will be discussed here.

Offset Printing

Most readers are aware of several methods of reproducing project specifications. Memeographing of typed masters is probably the most widely used. It would be feasible to introduce another method, offset printing, that is used by the majority of firms in Raleigh, North Carolina. This method has proven to be far superior in speed and economics and is applicable to the reproducing of copy regardless of the technique used for developing that copy.

Offset printing as used in Raleigh is a method by which the master is made from a "copy-ready" original by a photographic process. One advantage of use is that the original need not be perfectly clear of tape, erasures, glue or marks as these will disappear. Copies are reproduced as required from the master.

A service has been established to meet the demand of this system.

The costs of the service averages $1.00 per original sheet for 50 copies, printed, color coded, collated and bound complete with cover. For example, the costs is $100.00 for 50 complete sets of a 100 page specification. The cost is estimated to be one-third of the costs of in-house conventional memeograph techniques. The "turn-around time" is generally one day.

Cut and Patch Method

The majority of architectural firms use a technique known as the "cut and patch method" to produce the project specification. The use of this method is simple. The specification writer reworks an old specification or copies of the master specification by retyping altered paragraphs. These paragraphs are then pasted over the old ones. In combination with offset printing and photocopied masters the cuts, glue, "white-outs" and patching disappear, thus giving a finished appearance.

This method involves the manual editing of the master specification. The "cut and patch method" is the most efficient method short of an automated system. It still proves to be very time consuming though much less than complete retyping of the specification. This practice has the danger of omitting important requirements, improper use of reference standards and the perpetuation of previous errors. The clip and paste practice allows one previous specification to be used as a check list for another. However, some requirements necessary for a

project specification have the possibility of being omitted if they do not appear in any of the previous specifications being clipped.(16)

Automated Methods

The development of a system of automation evolves from the procedures of traditional practices. The master specification is adapted to the automated equipment. This equipment whether an automatic typewriter or a computer can be used to handle those items requiring manual work.

The process is a simple one. The master specification is edited as required for a particular project and the automatic equipment is used to produce the project specification. This can be done as often as possible to achieve the final specification.

The advantages can be found in the speed at which the equipment can produce copy, the ease of editing, and the achievement of copy requiring a minimum amount of proof reading.

Magnetic Tape Selectric Typewriters

The most inexpensive efficient automated method of specification text manipulation came about with the development of the Magnetic Tape Selectric Typewriter (MT/ST) by International Business Machine Corporation. With this system master specification text is recorded onto a magnetic tape by typing. The information can be retreived and typed out automatically upon demand by the operator. See the

illustration in Figure 2-5.

For use with specification writing the master specification is stored on the magnetic tape. To retreive the needed sections the clerical staff monitors the tape. When found, the typewriter will produce the needed copy upon command at the rate of 180 words per minute. The MT/ST has the ability to stop the copy, insert copy over copy or between copy and respace the lines (when used with the MT/ST composer). This method produces error free copy at an efficient rate.(17) The firm of Reynolds, Smith and Hill, Architects of Jacksonville, Florida found that it took a typist one day to produce 20 to 24 offset masters that had not been proofread; where, the MT/ST could produce 40 to 50 proofed masters a day.(18)

Some disadvantages seen by this system is that locating the sections on the tape can be a problem. This is minor compared to the advantage of efficient production.

Magnetic Card Selectric Typewriter

Another system available from IBM is the Magnetic Card Selectric Typewriter (MT/ST). Its operation is very similar to the MC/ST except that the information is stored on a magnetic card.

Each magnetic card holds one page of type. Because of this a distinct advantage lies in the use of this system. When installing a master

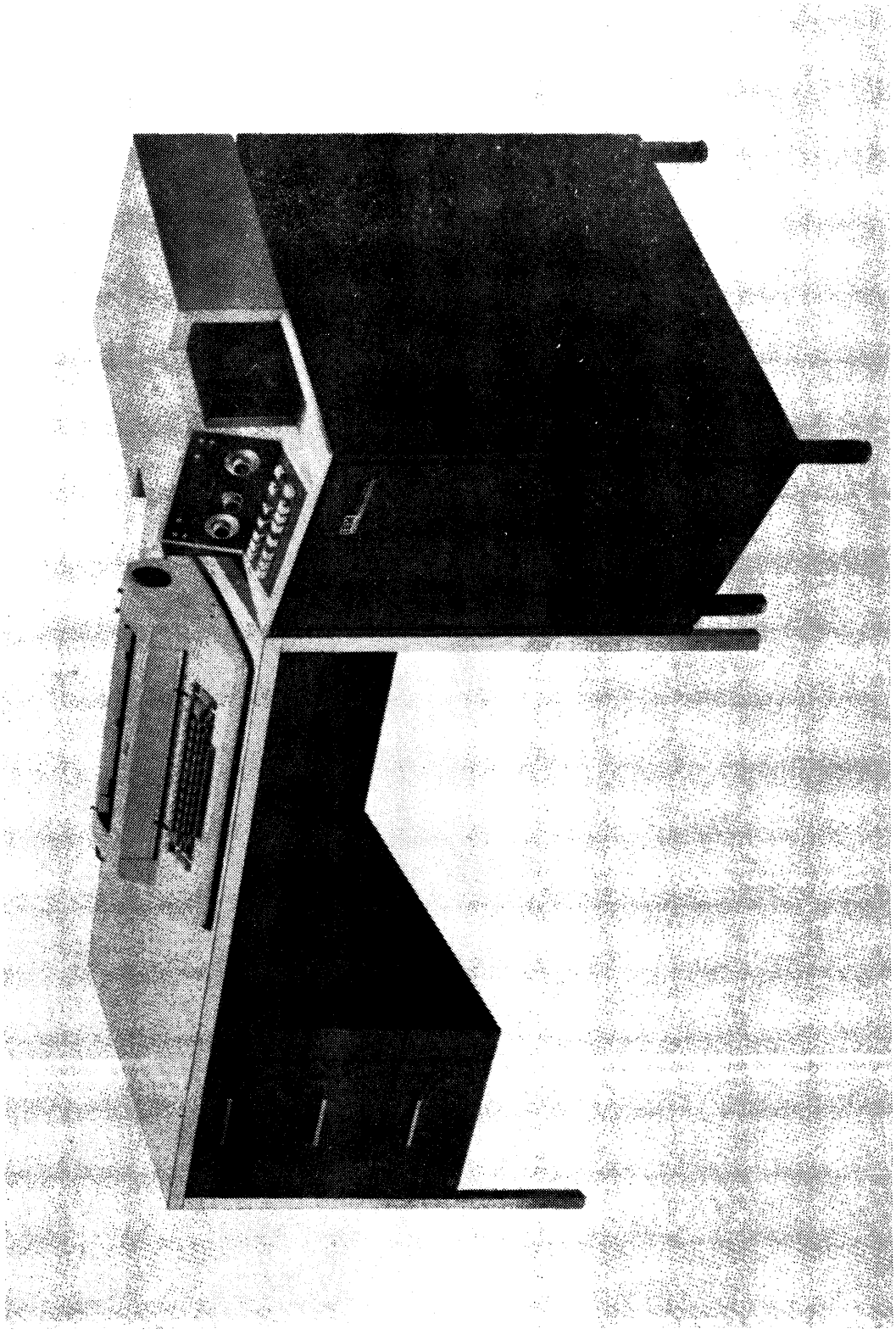


Figure 2-5. The Magnetic Tape Selectric Typewriter

specification the magnetic cards can receive the sections. If the cards are filed according to section number, then the required cards can be pulled and copy obtained. Updating and additions of sections are easily made without disturbing other sections. The cards can be erased easier and lines can be rejustified when using the MT/ST composer.(19)

Computerized Specifications

The computer offers the most promising method for data handling and specification writing. Generally, if one speaks of the computer as a tool for the solution of the architect's management problems or as an aid to production and design most practicioners would look upon it as an impractical investment. It is true that the expense of in-house computer operation is very prohibitive. Thus far only the large architectural firms have been able to enjoy the benefits of the use of in-house computers.

There have been many theoretical uses of the computer as a tool for architectural firms developed in schools of design. But many have proven impractical for use considering the availability of computer systems in the majority of firms. Only within the past several years has professional organizations and a few commerical groups developed computer uses applicable for use by practicitioners in small and medium size firms.

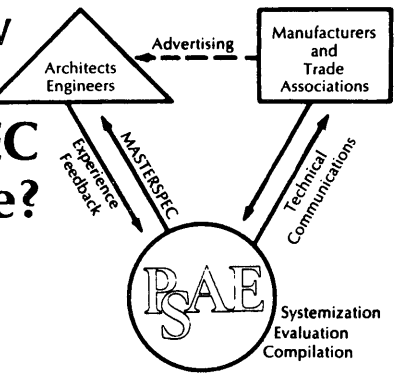
PSAE'S Masterspec

The American Institute of Architects, through its suborganization Production Systems for Architects and Engineers (PSAE) have developed computer oriented management systems.

In addition to a financial management program PSAE has developed MASTERSPEC, a computerized specification package available to all practicioners at a very modest cost. PSAE's MASTERSPEC program has been a slowly evolving development of a national master specification and an associated computer retrieval system. MASTERSPEC is designed for use with the Uniform Construction Index and does not require any in-house computer hardware or one's own master specification.

As defined by PSAE "MASTERSPEC is a national automated master-specification system with emphasis on content. Each subscriber is provided with reference catalogs that contain hundreds of master specifications sections. Each section contains comprehensive text from which the specifier chooses those materials, systems, processes and procedures he wishes to specify for the project."(20) PSAE maintains a constant communication with manufacturers and trade association in order to produce the most up to date specification material. This is illustrated in figure 2-6(a) and 2-6(b). MASTERSPEC has been designed to operate on three levels:

How Does MASTERSPEC Operate?



Upon subscribing, the user firm receives the initial MASTERSPEC package consisting of the User's Manual, Reference Catalog, and extra copies of the TOC. These are used in the following manner:

1. After the definitive design stages of a project, the user indicates on a TOC those sections of MASTERSPEC needed for the project. This marked-up TOC is sent to PSAE.

2. Work on the nonautomated sections of the specification may also begin. The MASTERSPEC format may or may not be followed for these sections.

3. PSAE sends the user the most recent version of all available MASTERSPEC sections requested on the marked-up TOC. This is the Project MASTERSPEC.

4. Upon receipt of the Project MASTERSPEC the drawing coordination sheets should be removed, then reviewed with and retained by the draftsmen.

5. The Project MASTERSPEC is edited as desired. Deletions and inserts are made by a simple mark-up of the copy. Instruction notes in the text remind the editor of basic editing requirements and the instruction sheets provide additional information and product evaluation. Certain required materials may be specified in any of several sections. Also, if only a minor item is required from one section, it may be inserted in a related section to reduce the number of sections.

6. The edited Project MASTERSPEC is reviewed by other project personnel as needed and may also be reviewed with the client to show him which possible choices were rejected. After all final reviews, the edited Project MASTERSPEC is sent to the regional data processing center.

   It is possible to make a preliminary computer printout for the client's review; however, this is not recommended. Review of the edited Project MASTERSPEC is a superior form of review and obviates the need for this additional costly and time-consuming step.

7. The data processing center prepares the input for the computer run to produce printout of the final project specification. Deletions and insertions are accomplished at this point; instructions in the text are automatically omitted. Line and page length are automatically adjusted. The highly legible format includes uppercase and lowercase printing, page numbering, right margin justification, indentions, and underscoring.

8. The final project specification printout is returned to the user for reproduction, together with his edited Project MASTERSPEC.

Figure 2-6. The Operation of PSAE's MASTERSPEC

Level 1. For use as a reference.

Level 2. For up-to-date copies of master sections to be edited for a project.

Level 3. For automatic processing. To produce the project specification.

The major advantages offered in the use of MASTERSPEC are as follows:

1. The speed of computer automation is offered to the small firm without the cost of computer programming and operation.

2. The master specification has been written and reviewed with the aid of the A.I.A.'s legal council. In fact, Victor O. Schinnerer & Company, underwriters for the architect's professional liability insurance, have endorsed the system by offering a reduction of insurance premiums to subscribers of MASTERSPEC.

Even though these advantages exist there are reservations in the use of the system by many practicioners. There is a reluctance of the use of an unfamiliar master specification in place of one that has been proven to be used comfortably for many years in the user's firm. The remoteness of the processing facilities and the delays that result in the use of facilities outside the user's city offer no real advantage in speed of turn around time. Of course the practicioner is freed from in-house processing.

It must be recognized that MASTERSPEC's specification content is excellent. Only the processing into project specification by the facilities

that must rely on the mails to produce these specifications has its disadvantages. The MASTERSPEC content can be purchased for use with the traditional cut and patch method or can be placed onto some automated device (MT/ST or computer). The cost of the MASTERSPEC system is illustrated in figure 2-7 (c).

Time Sharing Computer Operation

Many computer operation centers now offer "time sharing" as a means of allowing users to have access to the computer at a reasonable cost. In the use of time sharing the expense of operating the computer is shared by the many users in proporation to the actual time and hardware used. Different pieces of hardware operate at different costs. The compiler, as an example, will demand a much higher price for its use than the printer. The user is billed according to the time he uses the hardware.

Use of time sharing in conjunction with terminals has been known to the engineering field for several years. The architectural profession has yet to see the advantage, even though it exists.

Terminals are a specially designed piece of computer hardware for use as a means of remote operation of the computer. There are several types and makes of terminals available. The typewriter terminal appears and operates much like an ordinary typewriter. When used, the main computer center can be centrally located outside the terminal location,

Annual Fee*

For Services performed by PSAE (Initial Subscription or Renewal):		Summation of Fee
Basic Contribution to Development and Updating of MASTERSPEC Text:		$ 200
Contribution for Additional Operating Addresses (attach list):	$ 40 x ___ =	____
Quarterly Issues of Additional and Updated Sections, main address:	$ 50	$ 50
Quarterly Issues for Catalog sets at addl. operating addresses:	$ 50 x ___ =	____
Quarterly Issues for Extra Catalog sets at same address:	$ 40 x ___ =	____
Supplementary Fee Based on Office Size and Type:		
Arch. or A/E firm, per tech. person (defined on reverse) up to 75:	$ 3 x ___ =	____
per tech. person in excess of 75:	$ 2 x ___ =	____
Spec. Consulting Firm (in lieu of above), first specifier:	$45	____
Spec. Cons. Firm's additional specifiers:	$30 x ___ =	____

Reference Catalog Sets, unbound but including bound User's Manual: (Mandatory with Initial Subscription; select cost for current date)	Qtr. 1 Feb.	Qtr. 2 May	Qtr. 3 Aug.	Qtr. 4 Nov.
1972	~~$ 90~~	~~$100~~	~~$110~~	$120
1973	130	140	150	160
1974	170	180	190	200

$ __ x ___ = ____

Special Binders; split-ring type; set of 10, 2" cap., 5-ring (optional)	$ 30 x ___ = ____
Special Binders; nylon-post type; set of 5, 4" cap., 4-post (optional):	$ 30 x ___ = ____
Total Subscription Fee, for period of ___ Qtr. 19__ thru ___ Qtr. 19__:	$ ____

*Prices subject to adjustment, depending upon actual text increases per quarter.

* Quotation obtained from PSAE, 1785 Massachusettes Ave., N.W., Washington, D.C. Cost of MASTERSPEC varies with the size of firm and useage of computing facility.

Figure 2-7. The Cost of PSAE's MASTERSPEC

even in another city. The terminal can be connected to the computer through existing telephone lines. The connection is made by what is known as a coupler. The coupler is another part of the terminal whose purpose is to transmit and receive signals which are interpreted by the computer and the terminal for their use. Commands are typed onto the terminal keyboard and are received instantly by the computer. Computer output can be displayed at the terminal or on a printer. The printer has an output capacity that varies from one hundred to five thousand lines per minute depending on the particular printer installed. The terminal typewriter has an output capacity of approximately 180 words per minute.

Most terminal typewriters have a carriage similar to the IBM Selectric Typewriter. Hard copy input and output can be received at the terminal without the necessity of a printer. But the low speed output causes it to be uneconomical for output of large amounts of data.

Another type of terminal is the visual display terminal. The visual display terminal incorporates an electronic keyboard that is assocated with a cathode ray tube (CRT) similar to what is used in a television set. As information is transmitted and received the messages are projected on the CRT screen. Responce time is excellent in comparison to the typewriter terminal since the printing is instant. Features built into the system allow much more simplicity in the editing of character data.

The disadvantage is that no hard copy is produced without the use of additional hardware such as a printer. A visual display terminal is illustrated in figure 3-1.

CHAPTER THREE

MSPEC / TSO

Introduction

In the previous two chapters several criteria and procedures that stood out among all others as being worthy of consideration for inclusion into an active system for specification text manipulation were introduced. Briefly, these include the CSI Format, the Uniform Construction Index, master specifications and an efficient mechanical means for manipulating and producing the specification text.

From this criteria for design it was discovered that a successful specification text manipulation system would have to incorporate the following:

1. Direct user interaction with the mechanical system employed for input, manipulation and output. Input, manipulation and output should be on one system for ease of storage and retrieval and to prevent the necessity of transforming data from one system to another.

2. A complete master specification is necessary to justify any successful system used.

3. A direct means for the user to have rapid access to the master specification.

4. An interactive method for the user and the system for the updating, retrieval and reduction of the master specification and the project specification.

5. An interactive method of retrieval from the master specification of the desired sections for inclusion in the project specification.

6. An easily operated system so that clerical staff members could handle all manual work thus freeing the architect from this task.

The authors early research into the development of an efficient specification production system led to the incorporation of the electronic computer as a possible tool for use. Several criteria existed for the selection of the computer but the prime approval was made because of its speed and its ability to be programmed to suit the particular requirements of the problem. The early uses of the computer by the author incorporated hollerith (punched) cards as a source of input of the master specification text and as control cards for editing and manipulating text. The use of cards proved to have several disadvantages that should be noted.

1. Punched cards did not allow direct interaction between the user and the text material to be manipulated. The delayed review was very time consuming and thus determined to be costly.

2. Errors made in punching cards made it necessary to repunch the complete card rather than correcting the individual error.

3. No significant time savings was noted over existing text systems (see Chapter Two).

The computer language used in the softwave was FORTRAN. This language proved difficult in manipulating character data. After investigation of several other languages (SNOBOL, PL/1, BASIC) it was determined that Program Language One (PL/1) offered the most advantages; since, the language contains built-in command procedures for manipulating

character string data as well as the ability to handle numerical date for mathematical functions which was needed.

In combination with the development and research of other management software, the advantages of time sharing and terminal communication proved to have the greatest advantages for use. The obvious advantages were low-cost operation (in comparison to a fun in-house computer system), the ability for programming of other management problems (such as project budgeting and control, financial management, manpower utilization, etc.) and the ability for direct interaction in the office with the use of terminals. It was discovered that several computer companies (namely General Electric and I.B.M.) had developed time sharing text manipulation software for use with their respective systems. After thorough research these time sharing software package proved to be an asset to the development of a specification text manipulating system and thus were considered in the operating system developed by the author.

The IBM System/360 Time Sharing Option (TSO) was chosen for use in the author's specification system because of its availability. It must be recognized that several other time-sharing systems exist and are equally suited for use. For use with the software developed herein the time-sharing system must be able to handle the PL/1 computer language.

Hardware

The Hardware used in the development and operation of MSPEC/TSO was the IBM 3275 Information Display Station (Video Display Terminal). The main computer was an IBM 360/370 computer in which the TSO option was installed.

The 3270 Information Display Station (see figure 3-1) can be attached to the computer facility by direct lines or over high speed communication lines with the use of 1200 Bits/Second Coupler. The System used was located at Virginia Polytechnic Institute and State University and did not require a coupler. When the Display Station is incorporated with a high speed printer the advantage of rapid review of data and hard copy capability proved to an asset to the user.

For use with MSPEC/TSO the Display Station was combined with the main system's high speed printer. All input, manipulation or editing and review was completed without hard copy. When final approval of the specification was completed, the command was given for hard copy to be obtained for printing.

In earlier use of MSPEC/TSO, a Datel Typewriter Terminal in combination with a coupler was used for input and output. The output proved to be very slow in comparison to the Display Station. Where the Datel Typewriter Terminal types the output line by line at 180 words/per minute, the Display Station will instantly project a full page for review.

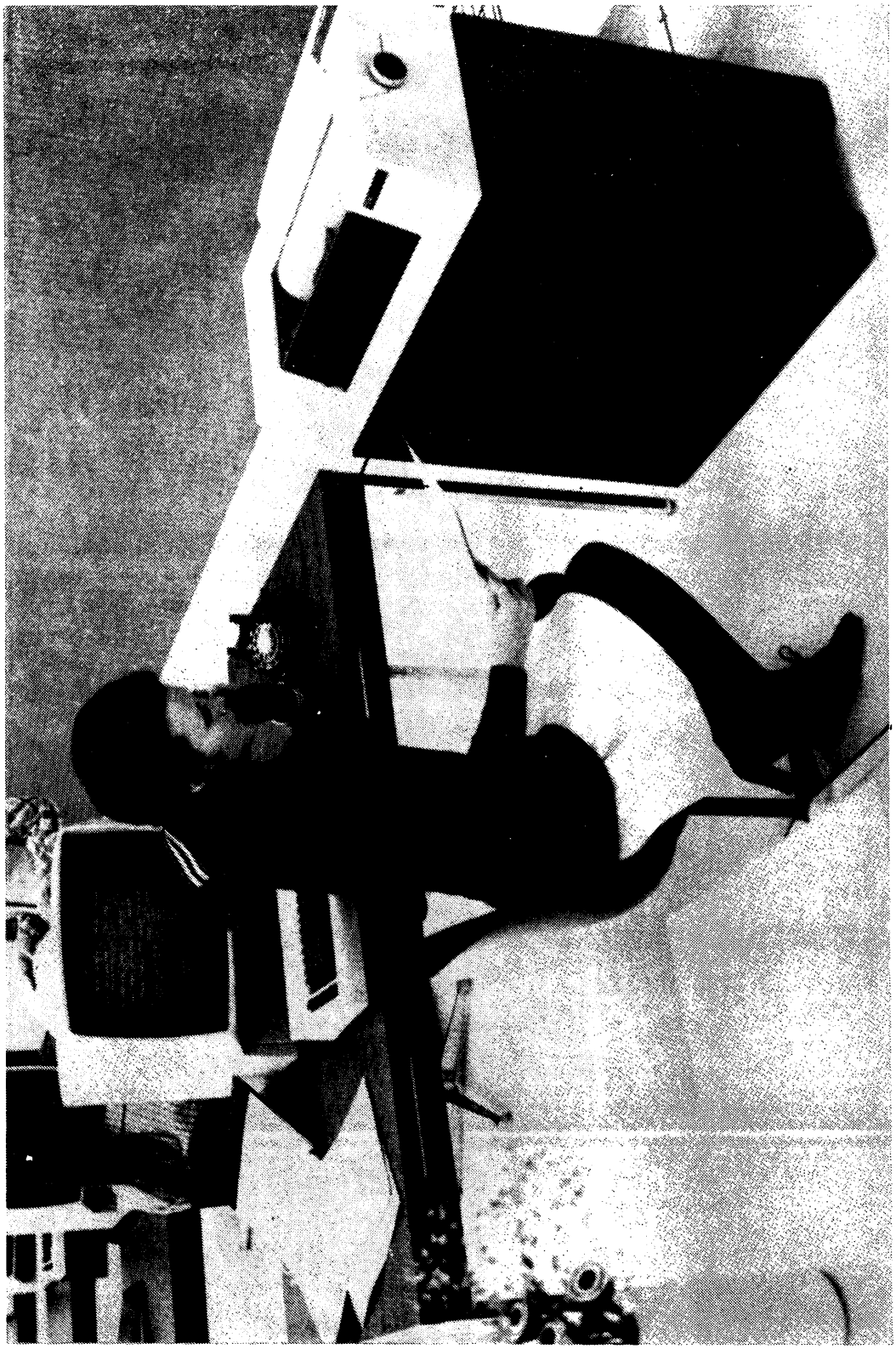


Figure 3-1. The IBM 3270 Information Display Station

The costs of the IBM 3275 Display Station and 3284 Printer (which is recommended for use in the office situation) is detailed in Figure 3-6.

Software

MSPEC/TSO consists of four original command procedures which are made possible through the use of the IBM System/360 Time Sharing Option. A command procedure is a set of TSO commands and sub-commands and data that have been placed in a data set. Whenever one desires to accomplish the functions performed by the command procedure he can use the EXEC command to call the procedure. The EXEC command is a command built into the TSO System. By use of the command procedure the user does not have to understand how and in what order the computer is manipulating the data.

The four command procedures implement four phases of the specification system by executing three software programs written in PL/1. The complete MSPEC/TSO user operation is illustrated in figure 3-2 for reference. A detailed explanation of the use of MSPEC/TSO can be found in Appendix A. The software can be found in Appendix C. The four command procedures' function follow.

EXEC LISTMSPC To implement this procedure the user will type at the terminal the phrase. The computer will return a complete up-to-date listing of all CSI Section numbers and titles and their respective location in storage in the master specification dataset. This listing

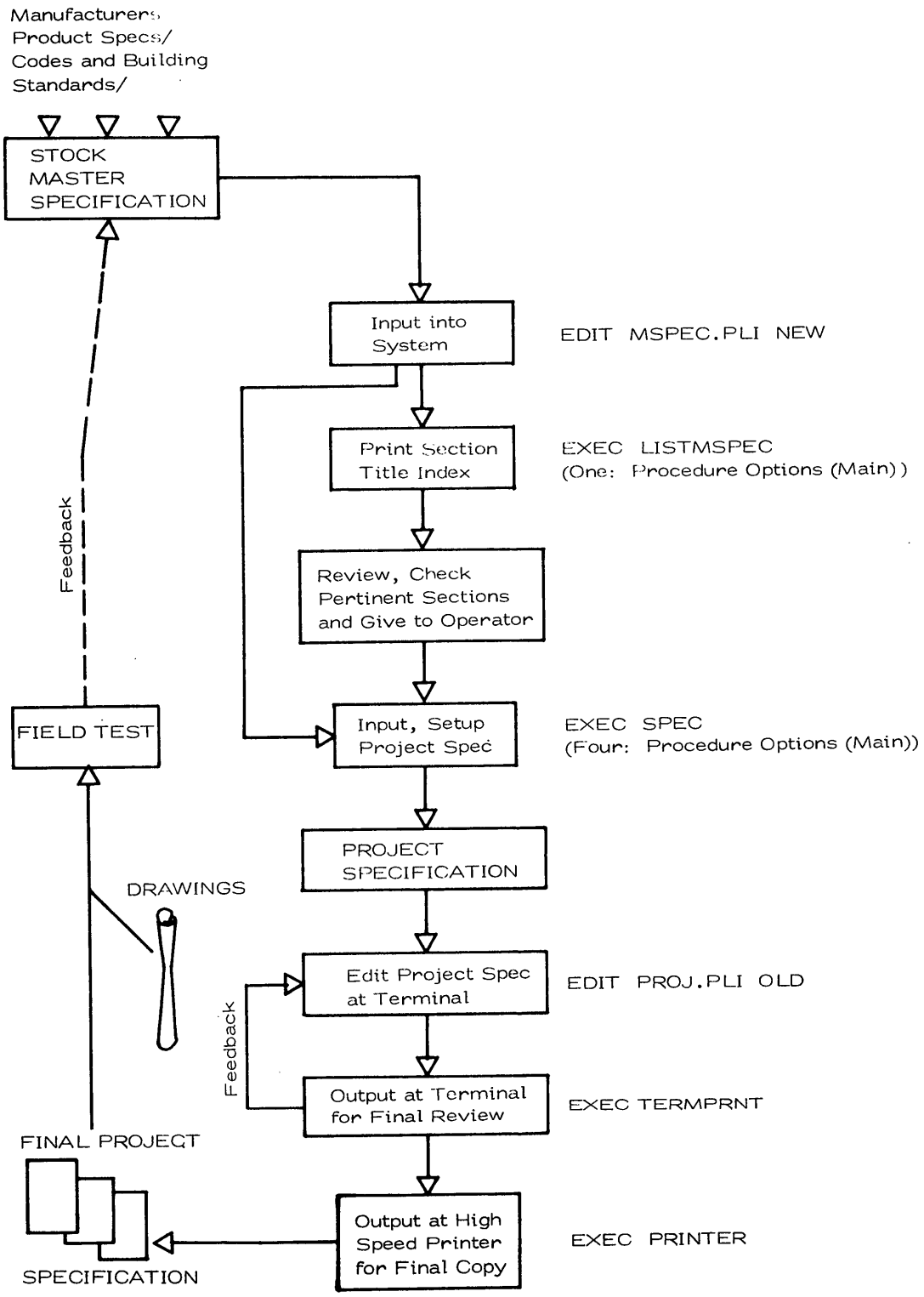


Figure 3-2. Operation Procedure for MSPEC/TSO

was needed to provide a checklist of sections to be used in the project specifications. The procedure executes software program One: Procedure Option (Main). See figures 3-3 (a) through 3-3 (f).

EXEC SPEC This command procedure is inputed into the system when it is desired to begin a project specification. This command procedure will free and allocate automatically all datasets required for the retrieval of the pertinent project sections from the master specification and place them in a project file. This procedure implements the software program Four: Procedure Option (Main) which was designed for direct interaction with the operator. When the operator enters section numbers and special delimeters, the system will respond with pertinent information necessary for the development of the project specification. Complete sections are retrieved automatically from the master specification and placed into the project specification. The command procedure and associated software is illustrated in figures 3-4 (a) through 3-4 (b).

EXEC TERMPRNT This command procedure will print at the terminal display the project specification in its final form, complete with title page, index and page numbers. This command is inputed when it is desired to instigate a review of the final copy. The final copy is displayed at the terminal. The associated software, Five: PROCEDURE OPTIONS (Main), is also used in the next command procedure. The

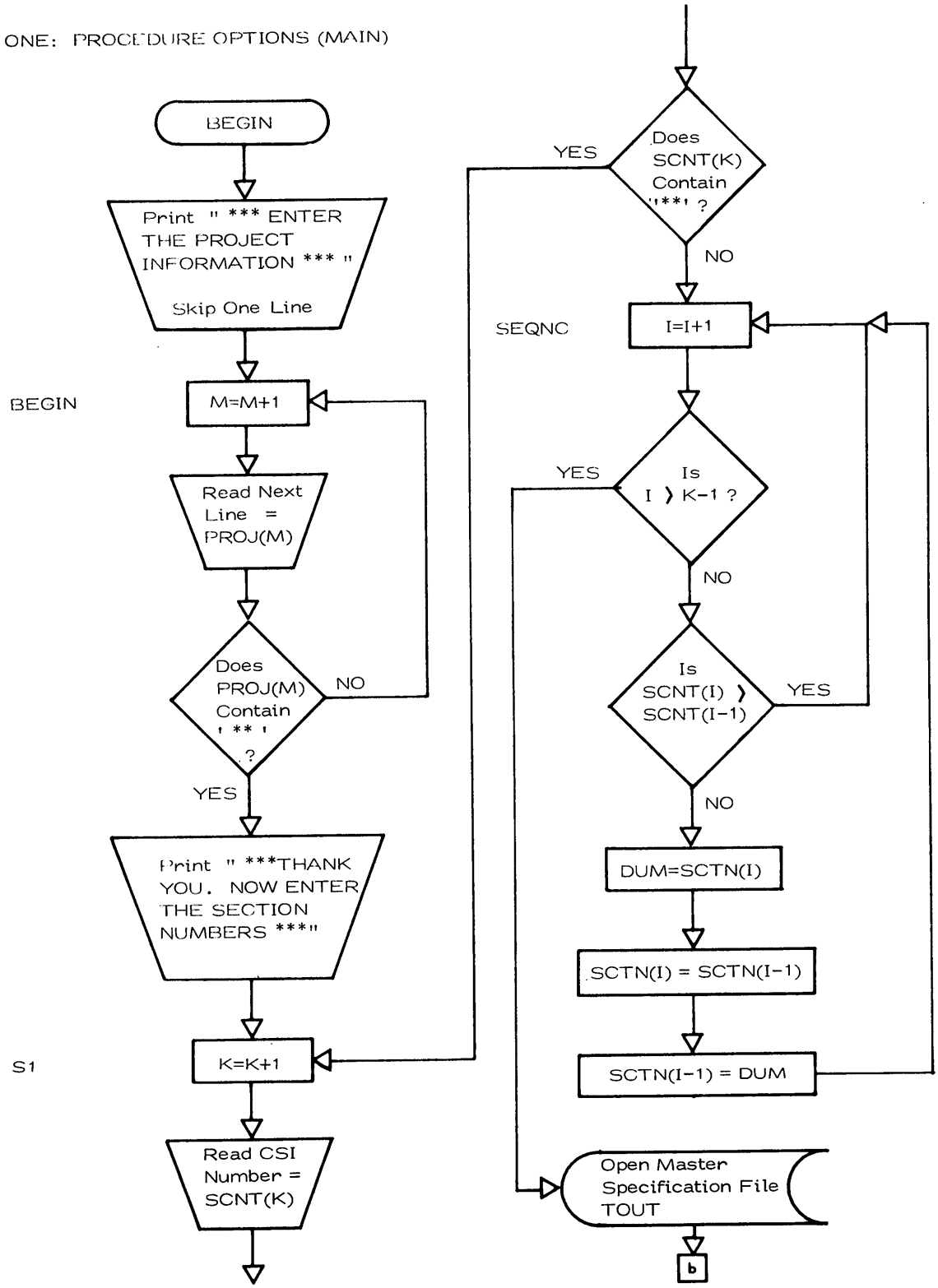


Figure 3-3(a). Flow Chart - One Procedure Options(main)

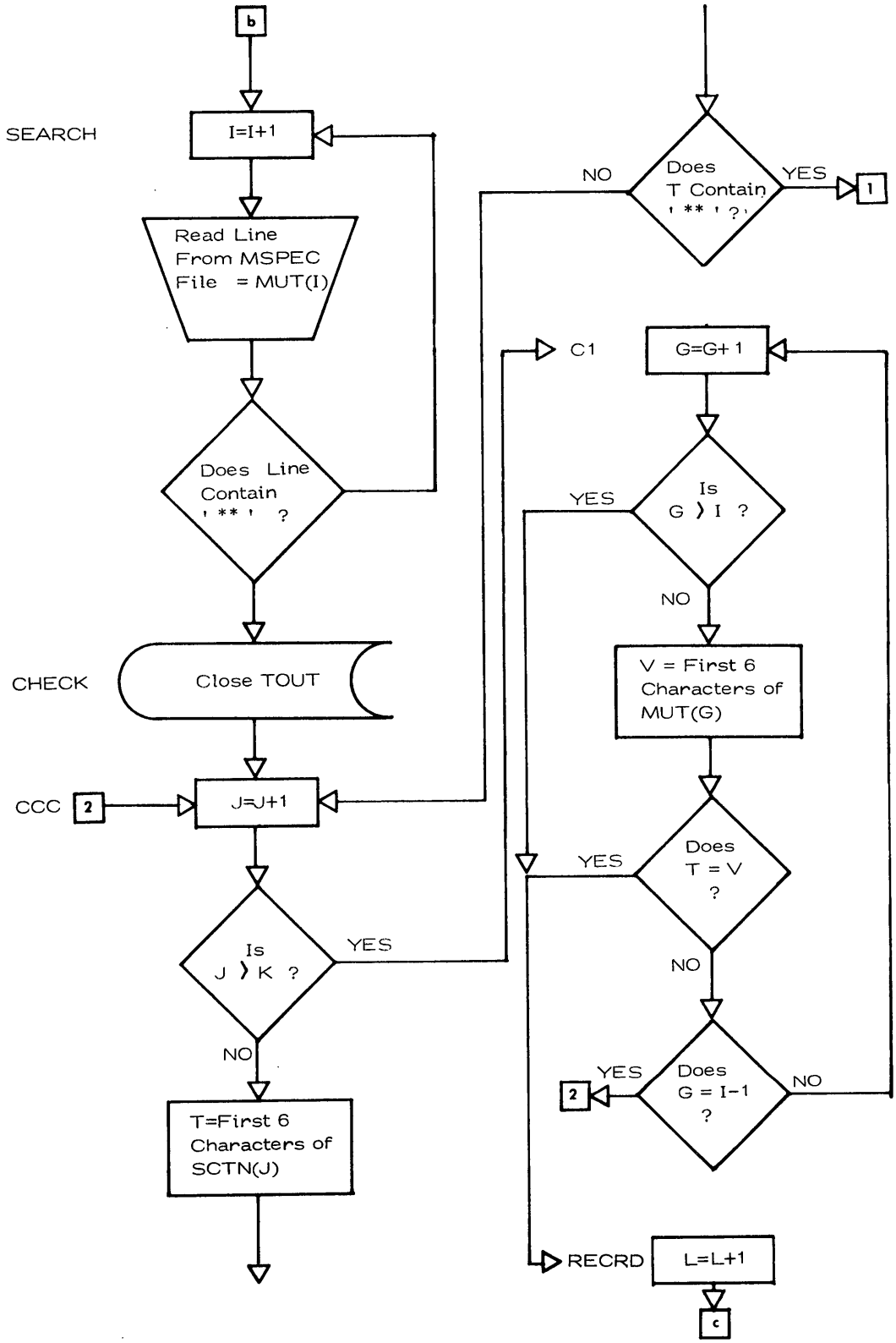


Figure 3-3(b). Flow Chart - One Procedure Options(main)

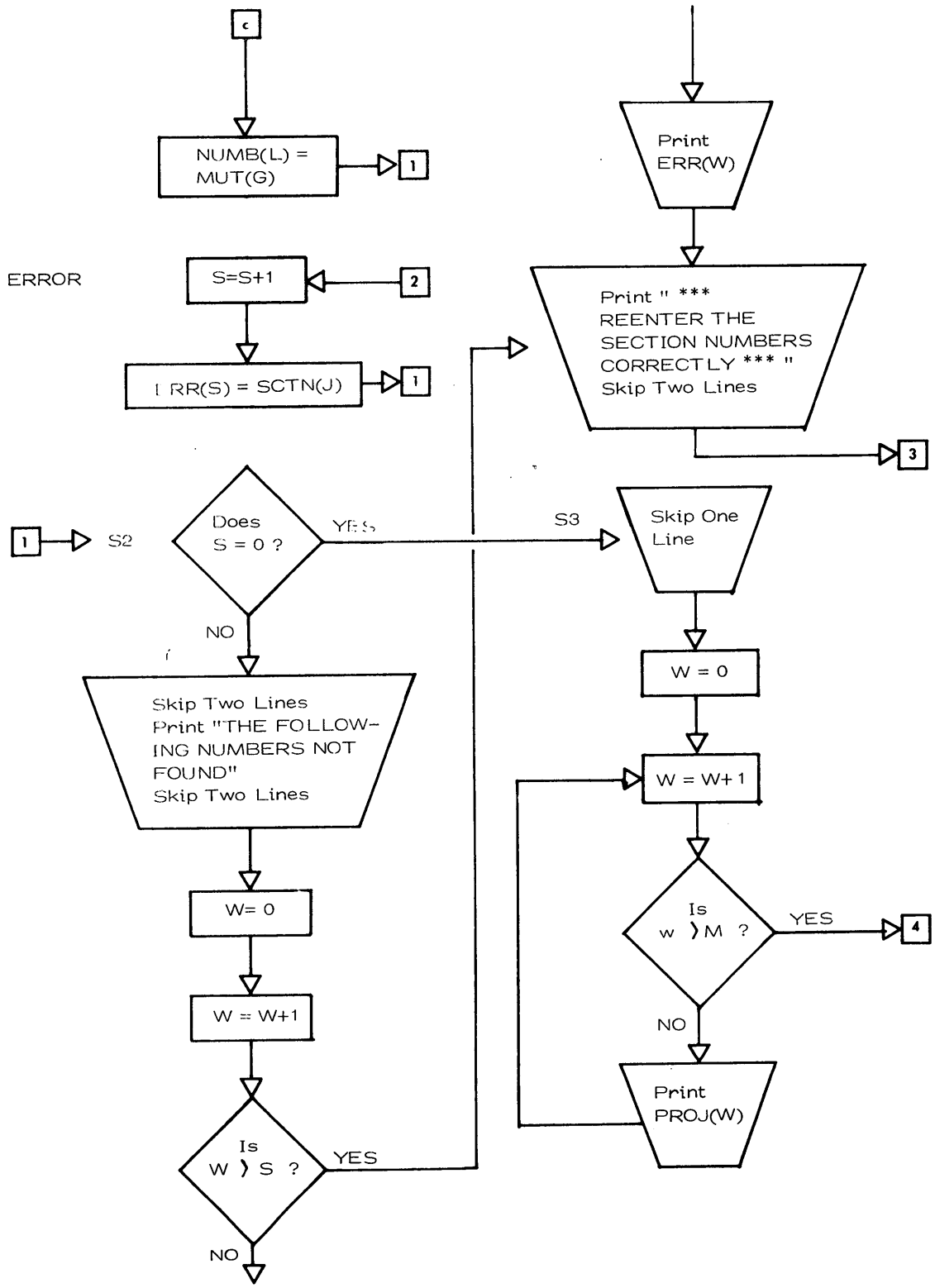


Figure 3-3(c). Flow Chart - One Procedure Options(main)

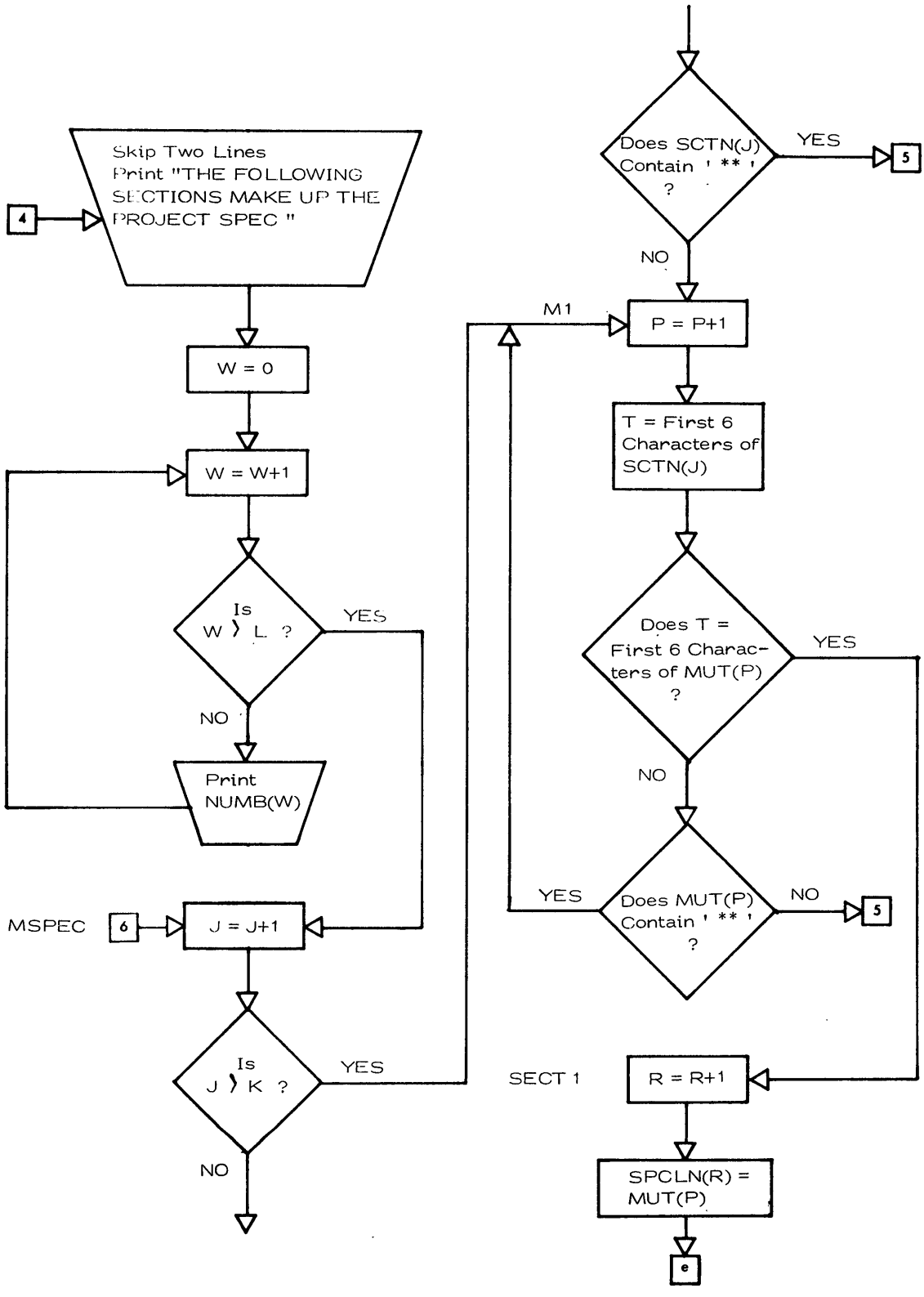


Figure 3-3(d). Flow Chart - One Procedure Options(main)

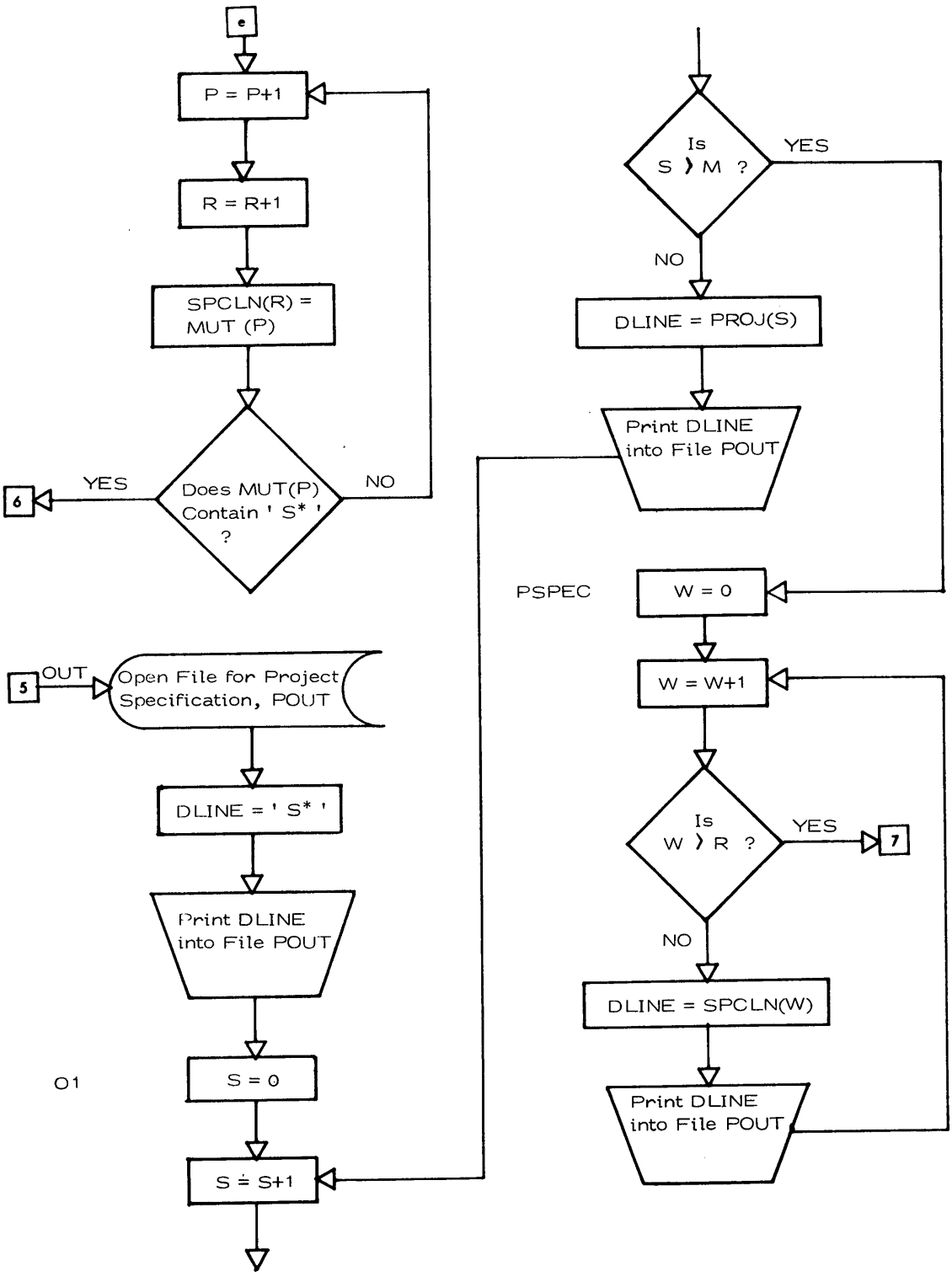


Figure 3-3(e). Flow Chart - One Procedure Options(main)

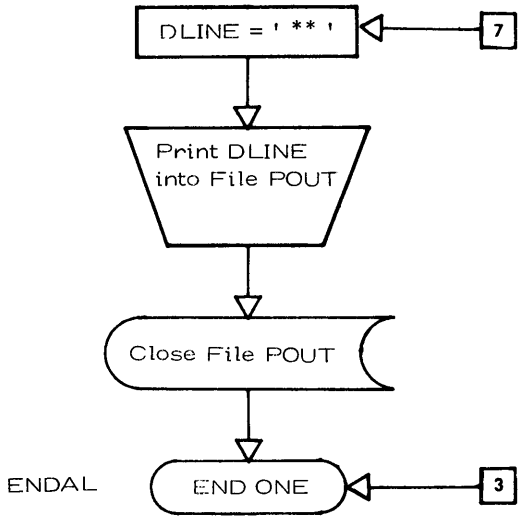


Figure 3-3(f). Flow Chart - One Procedure Options(main)

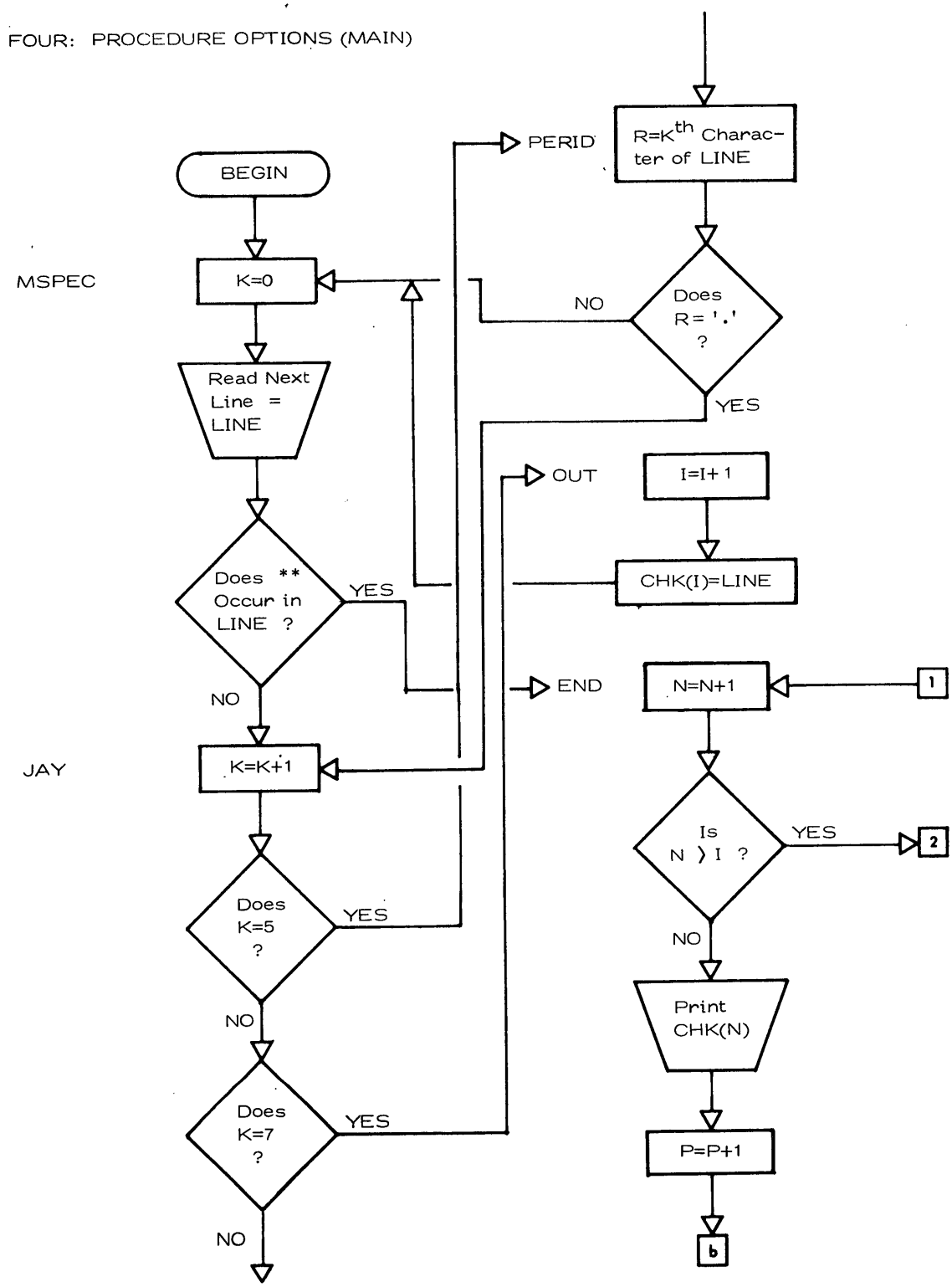


Figure 3-4(a). Flow Chart - Four Procedure Options(main)

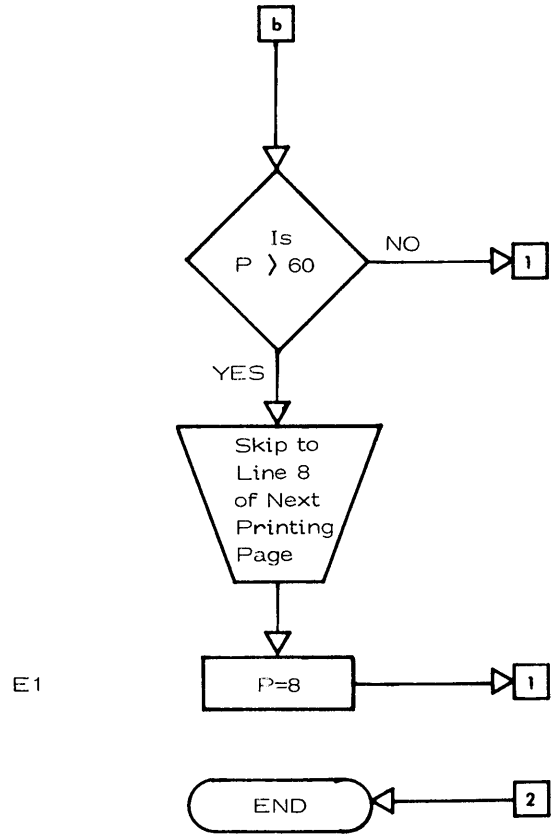


Figure 3-4(b). Flow Chart - Four Procedure Options(main)

content and flow chart of the command and associated software is illustrated in figures 3-5 (a) through 3-5 (g).

SUBMIT PRINTER This command procedure is used for printing the final specification text on the high speed printer. As in the previous command procedure the copy is complete with title page, index and page numbers. This copy can then be offset printed to obtain the amount of copies desired. The command procedure and associated software is illustrated in figure 3-5 (a) through 3-5 (g).

Operation Costs

MSPEC/TSO is designed to be part of a larger system of management programs. Evaluation without the incorporation of other packages would be pointless. But, for reference to other specification systems it is desired to introduce some typical expenditures that will be necessary to operate such a system. The costs of any in-house remote computer operation system can be broken down into two parts: initial expenditures for hardware (assuming software already exists) and operational costs.

The use of MSPEC/TSO will require basic hardware of a Display Station Terminal and a Printer. Prices were obtained from IBM since their equipment was used in the development of MSPEC/TSO. These are illustrated in Figure 3-6. Of course it must be realized that the costs will be reduced per hour of useage as the use of the system

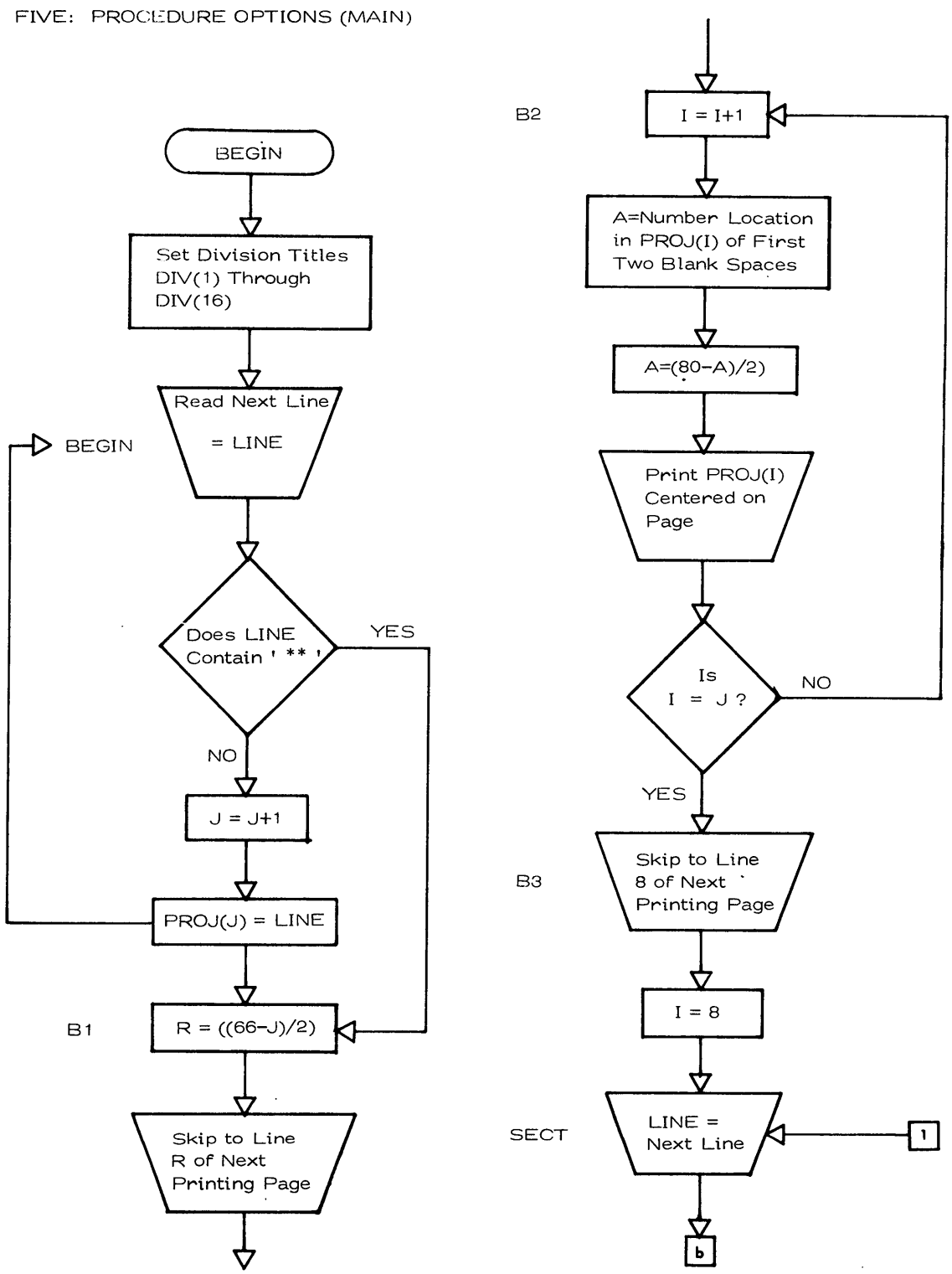


Figure 3-5(a). Flow Chart - Five Procedure Option(main)

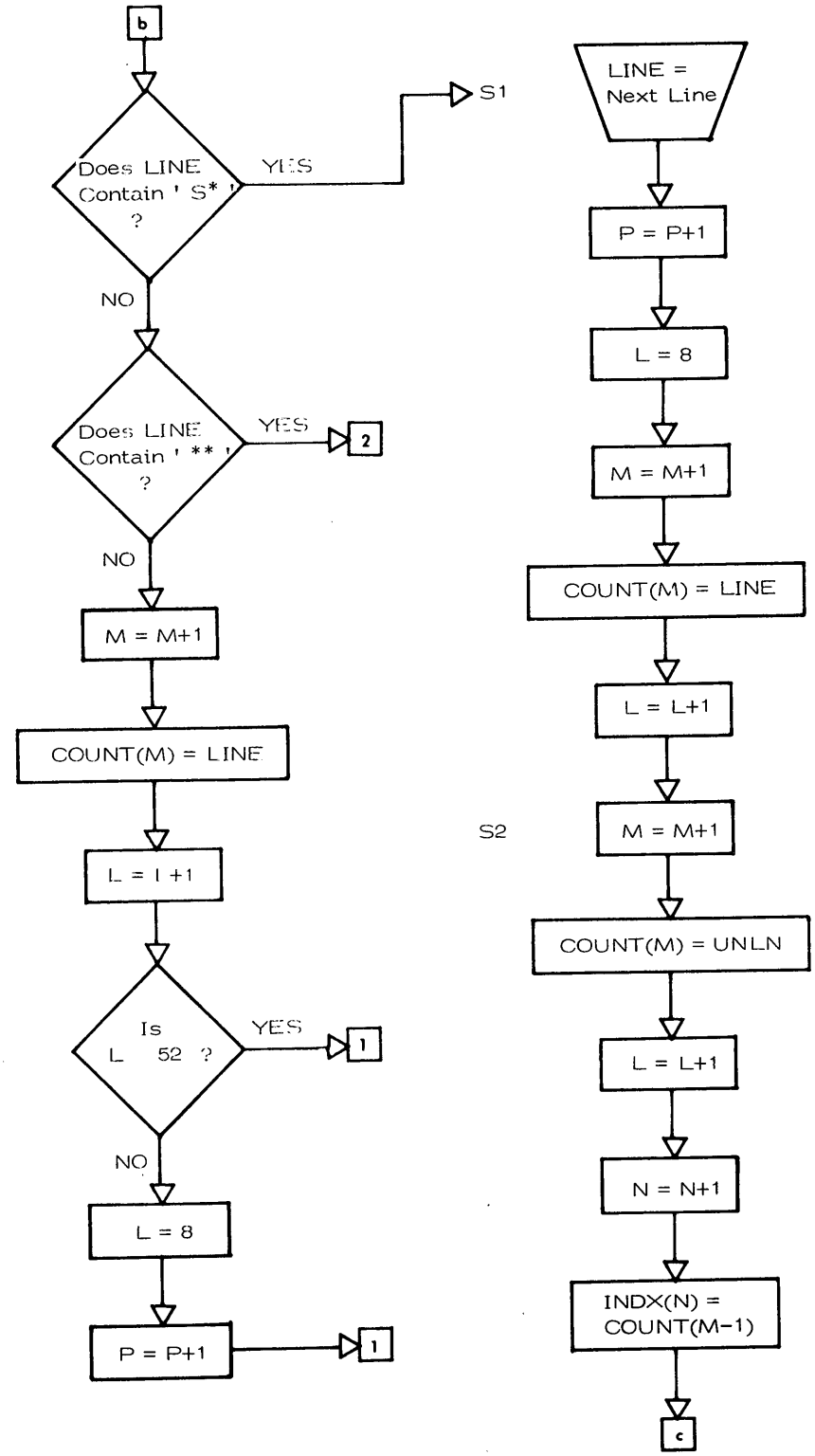


Figure 3-5(b). Flow Chart - Five Procedure Options(main)

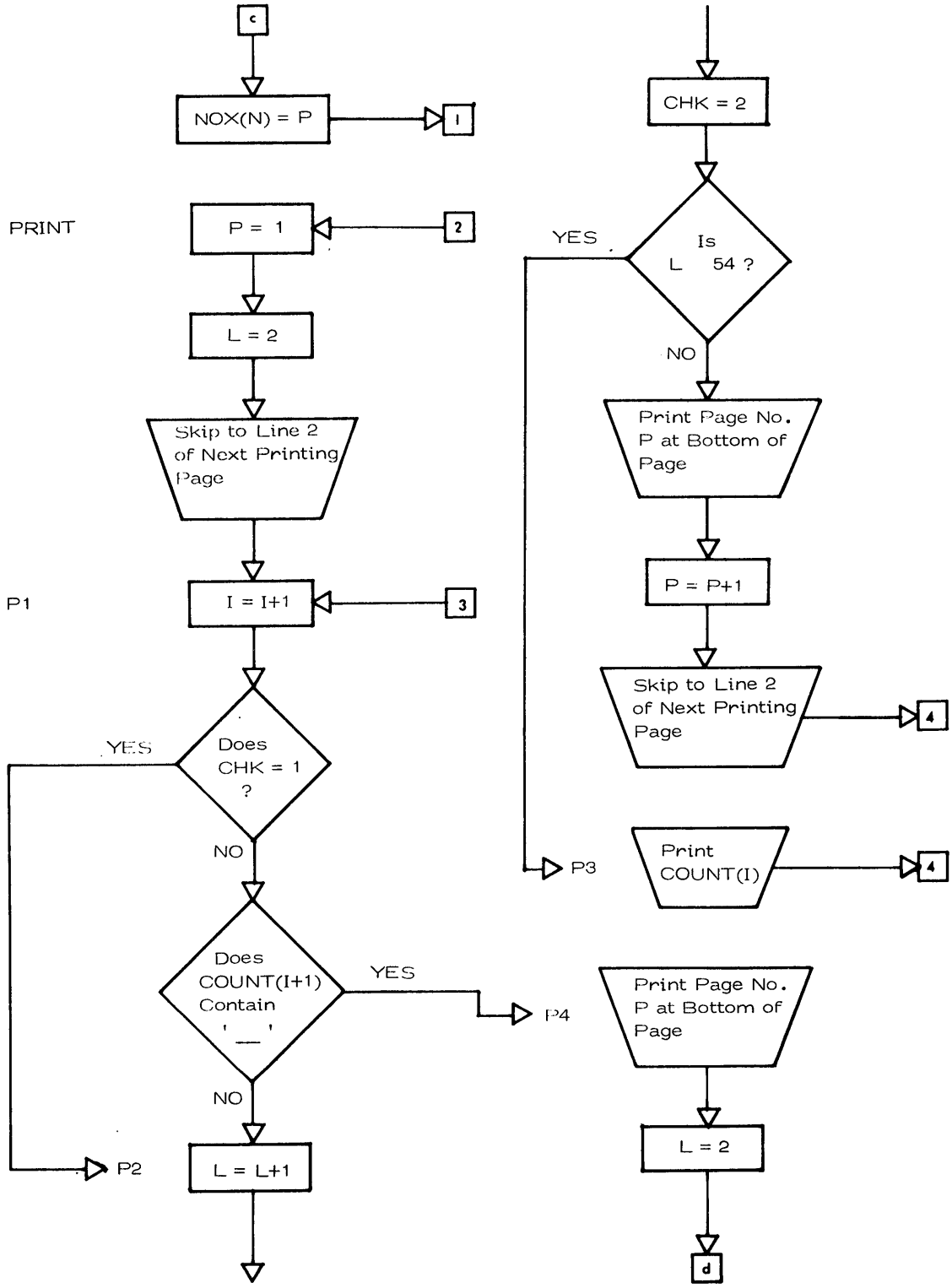


Figure 3-5(c). Flow Chart - Five Procedure Options(main)

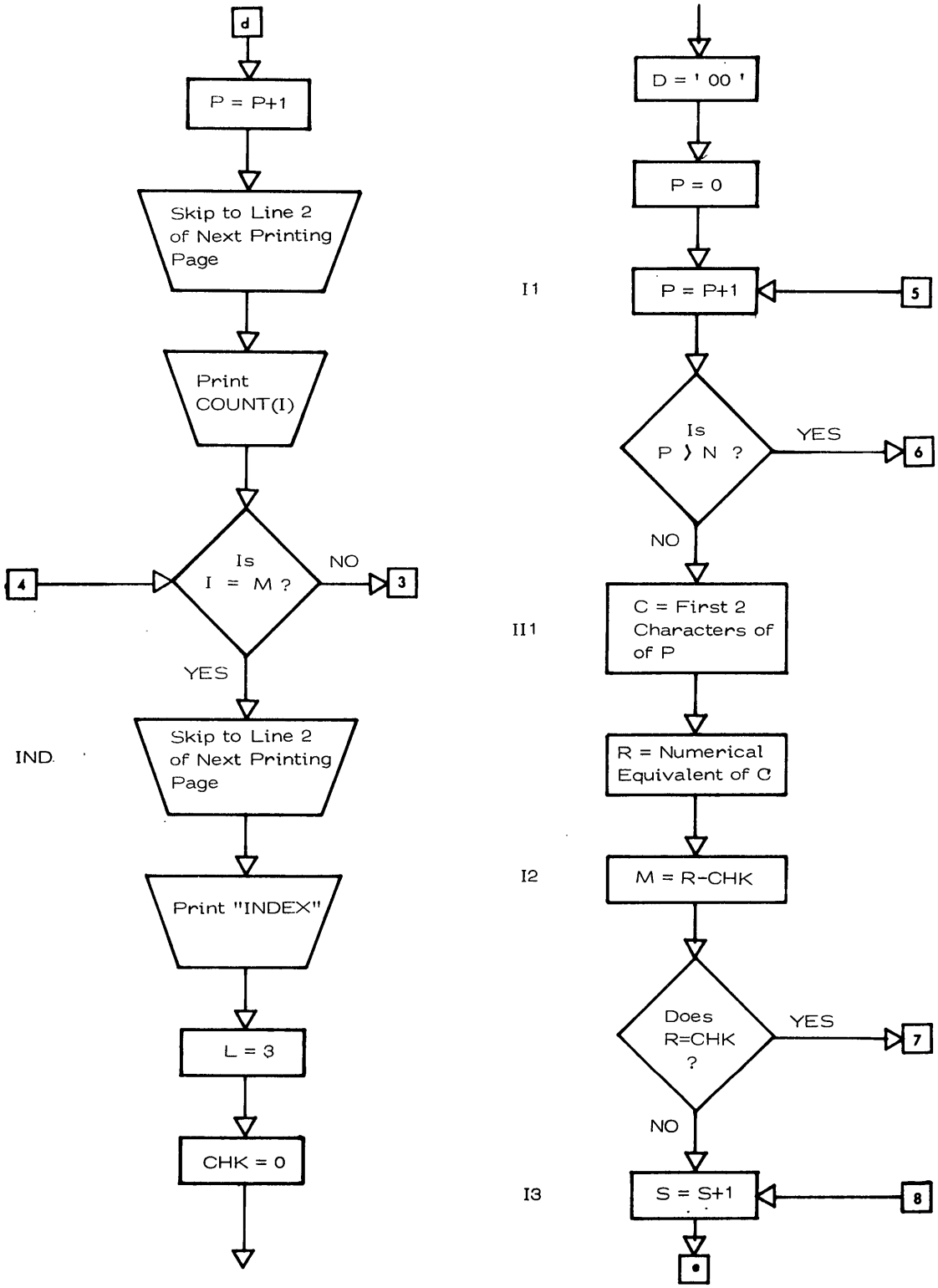


Figure 3-5(d). Flow Chart - Five Procedure Options(main)

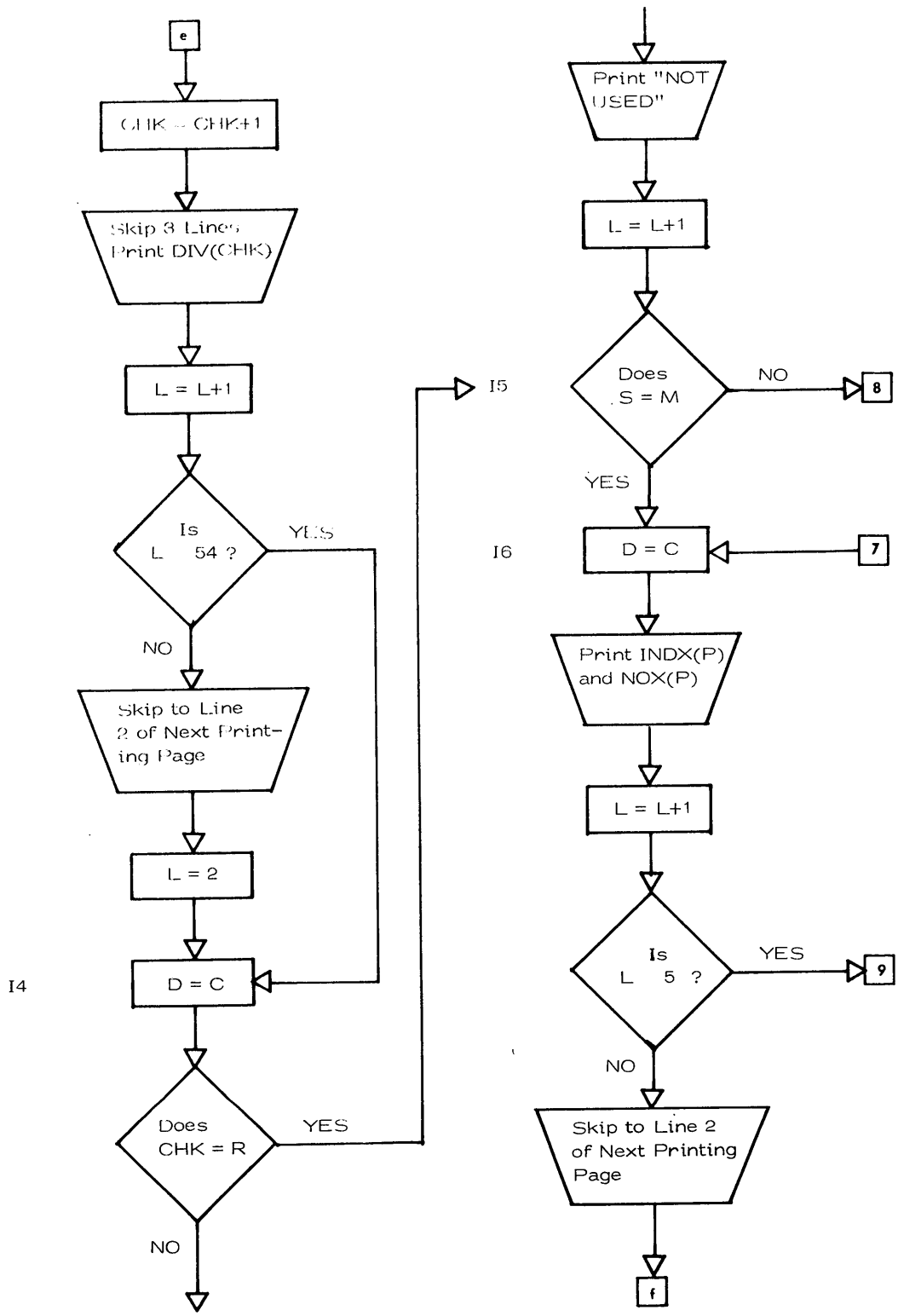


Figure 3-5(e). Flow Chart - Five Procedure Options(main)

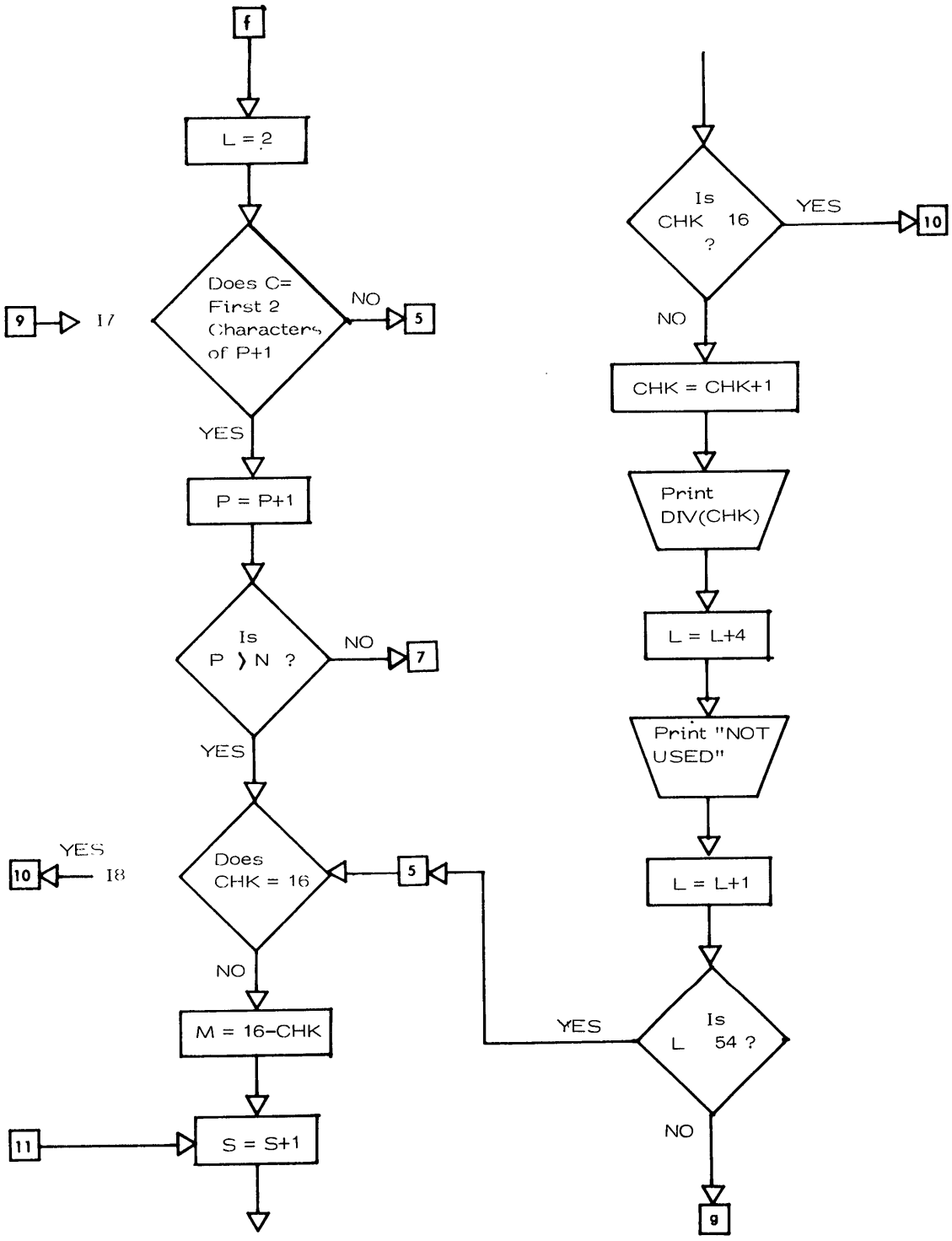
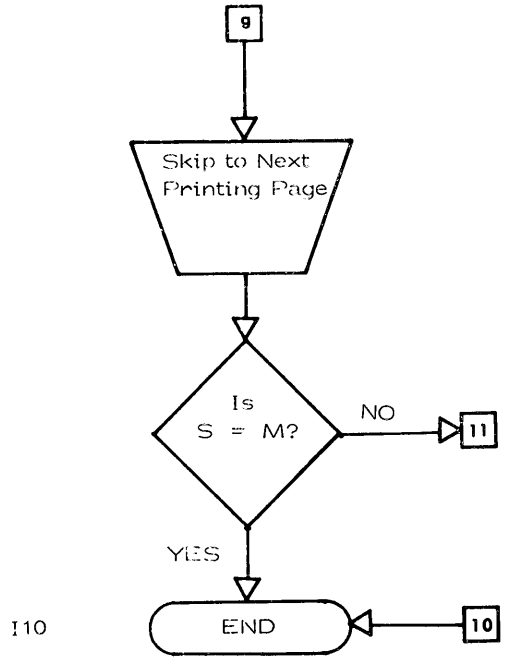


Figure 3-5(f). Flow Chart - Five Procedure Options(main)



I10

Figure 3-5(g). Flow Chart - Five Procedure Options(main)

IBM

Quotation for Rental/Purchase of IBM Machines *

Type	Model/ Special Feature	Description	Qty.	Monthly Availability Charge (Per Unit)	Purchase Price (Per Unit)	Minimum Monthly Maintenance Charge (Per Unit)
3275	2	Display Station (Displays 1,920 Characters)	1	$145.00	$ 6,500.00	$13.00
	4630	66 Key Typewriter Keyboard	1	15.00	600.00	4.50
	3441	Dial	1	10.00	450.00	1.00
	5550	Printer Adapter	1	N/C	N/C	N/C
	7820	Transmission Speed (1200 Bits/Second)	1	N/C	N/C	N/C
3284	3	Printer (40 Characters/Second)	1	165.00	7,095.00	27.00
NOTE:	Customer must supply a 1200 bit/second modem for communication with the central computing facility. The central computing facility must have a compatible modem and capabilities to communicate with the 3275 on a dial-up basis.					
		EXTENDED TOTALS		$335.00	$14,645.00	$45.50

* Quotation obtained from the Marketing Division of International Business Machine Corp.

Figure 3-6. Hardware Cost for MSPEC/TSO

increases.

The second costs, operational costs, will increase as the useage goes up. Expenses that will be incorporated in this group are as follows:

1. Connect Charges
2. Computer Resource Charges
3. Storage Charges
4. Printing (When performed on remote printer)
5. File Dumps and Restores
6. Tape Input and Output

These charge are illustrated in figure 3-7 and 3-8. The operational costs are the result of billings for useage by a time-sharing company who owns the main computer. One is charged only for the actual time used; but, is restricted by minimum charges.

A typical costs accounting for operation of the MSPEC/TSO System can be made based on the data illustrated in Figure 3-7 and 3-8. It could be reasonably assumed that a complete master specification would consists of 1000 pages. Assuming 60 lines per page and 70 characters per line the master specification would consist of 4,320,000 characters. The master specification would be stored on-line for a maximum of 10 minutes in the development of the project specification. The costs for this on-line storage would be $86.40. The complete operation of the MSPEC/TSO in the development of the project specification would be

CAC/3600 SCHEDULE OF CHARGES *

CONNECT CHARGES:

Minimum Charges	0.1 Connect Unit / Sign-on
10/15 CPS Terminals	1.0 Connect Unit / Actual Hour
30 CPS Terminals	1.3 Connect Unit / Actual Hour

	PRIME TIME			
Number of Connect Units	Unit Cost	Incremental Cost	Cumulative Cost	Non-Prime Time Unit Cost
1 - 60	$ 10.00	$ 600.00	$ 600.00	$ 4.00
61 - 120	9.00	540.00	1140.00	4.00
121 - 180	8.00	480.00	1620.00	4.00
181 - 240	7.00	420.00	2040.00	4.00
241 - 300	6.00	360.00	2400.00	4.00
301 - 360	5.00	300.00	2700.00	4.00
361 - OVER	4.00			4.00

Prime Time Connect charges are incremental, resulting in cumulative charges.
For Example: 100 hours of connect results in charges of 60 x $10.00 plus 40 x $9.00 or $960.00.

COMPUTER RESOURCE CHARGES:

Computer Resource Unit (CRU) $ 0.21 Prime Time $ 0.07 Non-Prime Time

8k Fortran / Basic	1.0 CRU / Actual CPU Second
16k Fortran / Basic	1.6 CRU / Actual CPU Second
32k Fortran / Basic	3.0 CRU / Actual CPU Second
File Usage	1.1 CRU / 1000 File Usage Units
COGO	1.6 CRU / Actual CPU Second
CONFORM	2.6 CRU / Actual CPU Second
EDITOR	1.5 CRU / Actual CPU Second
INFORM	1.8 CRU / Actual CPU Second

STORAGE CHARGES:

Thousands of Characters *	Cost per 1,000	Incremental Cost	Cumulative Cost
1 - 200	$ 0.70	$ 140.00	$ 140.00
201 - 500	0.60	180.00	320.00
501 - 1,000	0.48	240.00	560.00
1,001 - 2,000	0.36	360.00	920.00
2,001 - 4,000	0.22	440.00	1360.00
4,001 - 10,000	0.18	1080.00	2440.00
10,001 - 20,000	0.16	1600.00	4040.00
20,001 - 40,000	0.14	2800.00	6840.00
40,001 - 60,000	0.12	2400.00	9240.00
60,001 - OVER	0.10		

* Prices obtained from Call-A-Computer, Occidental Life Insurance Building, Raleigh, North Carolina

Figure 3-7. Time Sharing Schedule of Charges

CAC SUPPORT SERVICES
PRICING SCHEDULE *

PRINTING

$2.00 / 1000 lines, 1 part
$3.00 / 1000 lines, 2 part
$4.00 / 1000 lines, 4 part

FILE DUMPS & RESTORES

$1.00 / file

CARD READING

$5.00 / 1000 cards

CARD PUNCHING

$10.00 / 1000 cards

TAPE INPUT & OUTPUT

$1.00 / 1000 records

STORAGE

Tape Rental	$5.00 / tape / month
Tape Purchase	$20.00 / tape
Tape Storage	$5.00 / tape / month
Forms Storage	$5.00 / box / month

BATCH TIME

$375.00 / hour

PERSONNEL

Senior Analyst †.	$30.00 / hour
Junior Analyst †.	$20.00 / hour
Operator	$10.00 / hour

†. four hour minimum

Minimum Charge:	$8.00 per transaction
Priority Charge:	Double normal charge

* Prices obtained from Call-A-Computer, Occidental Life Insurance Building, Raleigh, North Carolina

Figure 3-8. Time Sharing Support Services Pricing Schedule

	Access to Master Specification	Ease of Retrieval of Pertinent Sections	Editing and Updating Capabilities of Master	Editing and Updating Capabilities of Project Specification	Speed of the Output
MSPEC/TSO	Excellent	Excellent	Excellent	Excellent	500 words/min
MT/ST	Excellent	Good	Good	Fair	160 words/min
Cut and Patch	None	Poor	Poor	Poor	60 words/min

	Source of Output	Estimated Time in Minutes of 40 pages of Output	Monthly Costs of Hardware	Operation Costs per Specification	
MSPEC/TSO	Medium Speed Printer	67.2 min.	$ 380.50	$ 211.66	• Use of a high speed printer is recommended. This could be accomplished at a low cost by dumping output onto the main computing center's printer. The output would be 100 to 1000 lines/min.
MT/ST	Low Speed Automatic Typewriter	210 min.	$ 280.75	none	
Cut and Patch	Manual	560 min.	none	none	

Figure 3-9. Comparison of Production Methods

one hour. Therefore, the connect time would be $10.00. The project specification would consists of approximately 40 pages (these are not the final pages of output as they would be a greater number). The on-line storage costs would be $114.46, assuming the full hour was taken for the process of developing the project specification. Therefore, the costs of developing the project specification was $211.66. This would be a final copy, with index and title page ready for printing.

A comparison to the MT/ST and Cut and Patch Method is illustrated in figure 3-9. Advantages of the MSPEC/TSO System should be taken into account when making the decision to implement such a system. It is recognized that there is a significant increase in costs over other methods; but, this increase in costs is offset by the speed and the use of the system in the solution of other management problems.

CHAPTER FOUR

EDUCATION USES OF MSPEC/TSO

The teaching of specification writing in architectural school has traditionally been combined with Professional Practice courses. Specification writing requires a thorough knowledge of building materials, construction law and the mechanics of specification writing itself. Most courses concentrate on the later of the three, mechanics of specifications. The traditional method of teaching specifications keeps the instruction in a vaccum, remote from building material and methods courses and construction law instruction which form an important part of the specification.

MSPEC/TSO can satisfy the needs of traditional methods of instruction; but, it can serve a better function in a new system of instruction presented in this chapter. The educational approach to specification writing encompases the three areas presented. To properly train the student, the instructor should concentrate on several pre-instruction changes in traditional methods. (See figures 4-1)

1. The traditional instructional "course" should be removed and incorporated with material and method "laboratories".

2. Construction law instruction combined with the professional practices "laboratory" for a quarter or more should preceed the laboratory.

3. Instruction should run parallel to material and method instruction to allow the student an immediate source for research.

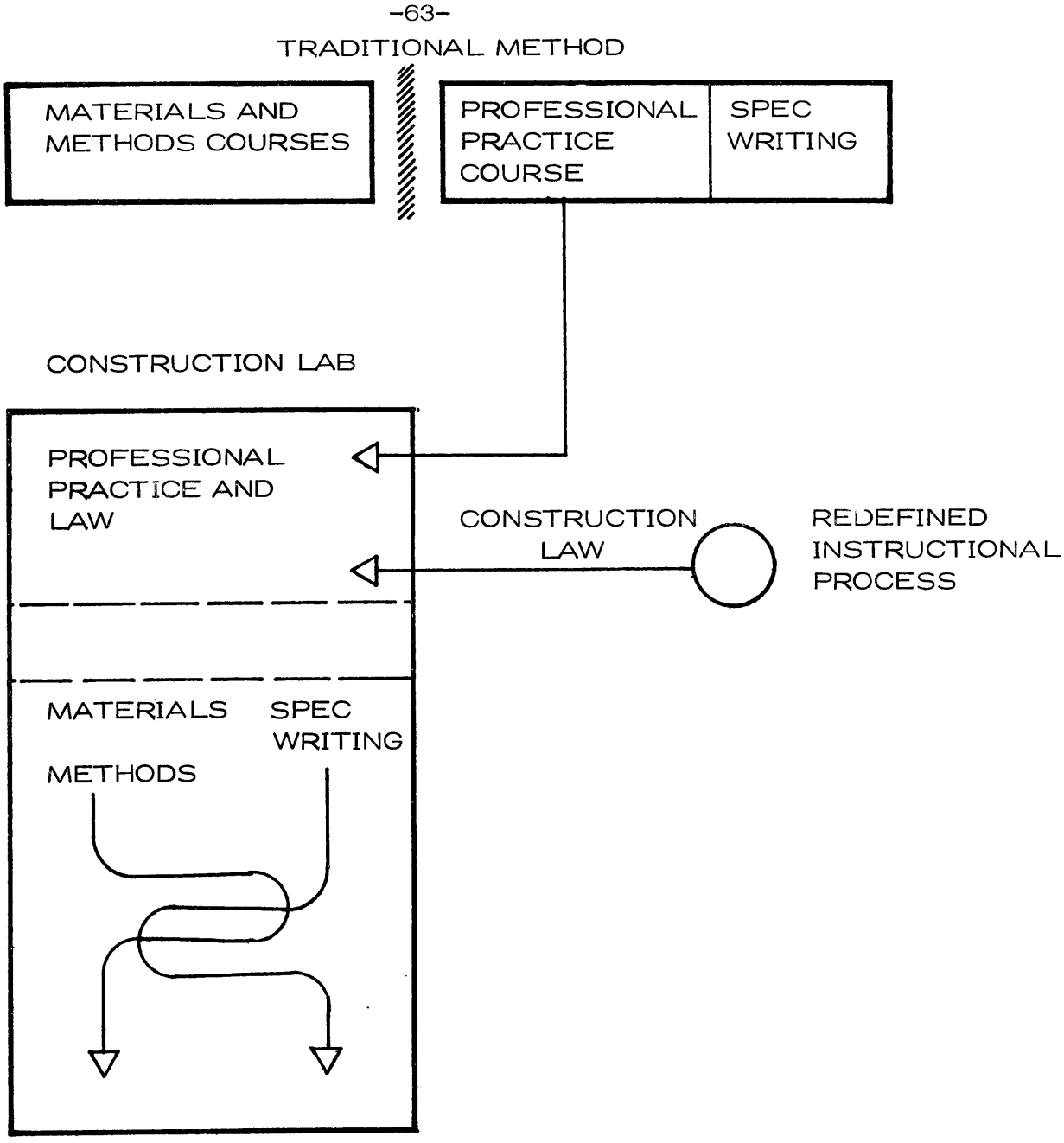


Figure 4-1. Preinstructional Reorganization

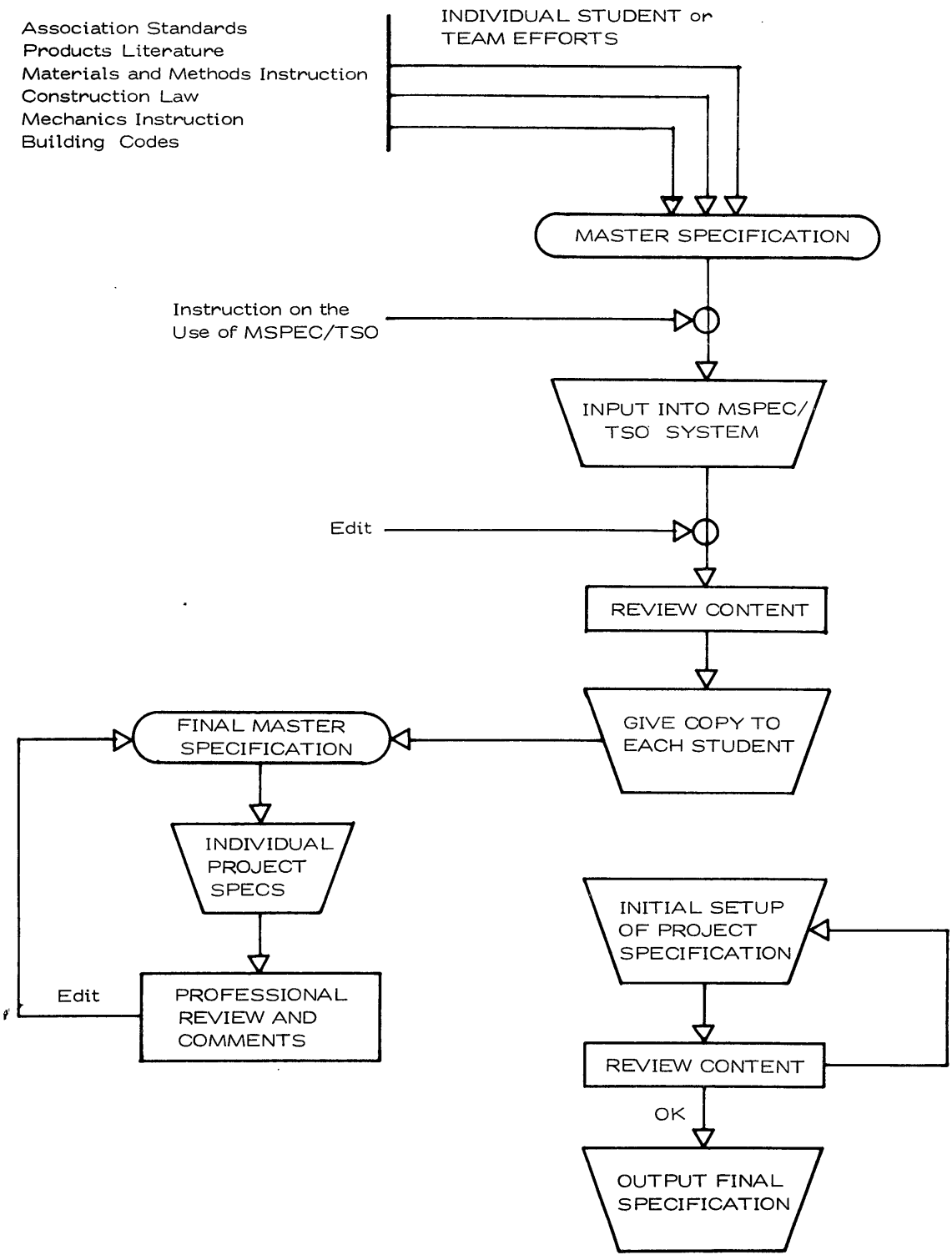


Figure 4-2. Educational Use of MSPEC/TSO

4. The total process should be termed a construction laboratory which would be a more descriptive title.

The specification instructor should concentrate this efforts on instruction containing the following parameters:

1. Development of a master specification based on thorough research of products, methods of installation, and construction standards.

2. Proper mechanics of specification writing including language and legal consequences of the language used.

3. Methods and purpose of updating and editing the master specification for inclusion of up-to-date materials and new techniques for installation.

4. Development of a project specification including review, editing and final copying.

5. Field testing of the project specification for updating the master.

Development of the Master Specification

The development of a master specification should be assigned by the instructor on a team basis. Each team would investigate one material or division such as Division 6-Carpentry. If the instructor feels this may be burdensome to the student he may assign a particular section such as 0610.0-Rough Carpentry to each student. Emphasis should be placed on the development of a complete master specification as this will be used in further assignments.

The student should research thoroughly all applicable standards, codes and associated agencies that control the quality of the product. For

example, wood products such as millwork would be governed by the American Woodwork Institute (AWI) or plywood by the American Plywood Association. In the case of particular species the student should concentrate on associations such as Southern Pine Assoication or Western Wood Products. Also recommended standards for installation can be found in these sources.

During the period of research the instructor could take class room time for presentation of the outline procedure of MSPEC/TSO, the Uniform Construction Index and CSI Format and specification writing mechanics.

As one may see, the obvious advantage of the combination of materials courses and specification writing can be found in the dual purpose of instruction in both areas through products research. This also will enable the student to readily understand the importance of products research in the development of a specification. The total class involvement will remove the burden of research for a complete master specification from the individual student.

Upon completion of the master specification information should be shared and final copies given to each student for future use in the instructional process. In lieu of the development of the master specification a stock master specification such as MASTERSPEC could be used.

Installation of the Master Specification

At this point instruction should be on a class basis since one master specification can serve the entire class. Instruction should be given in the basic operation of the terminal as well as the installation of the master specification on the system. For reference, the instructor can refer to Appendix A-MSPEC/TSO Users Guide. After installation the instructor should obtain a copy of the master of each student. The individual teams should review their respective sections in detail for typographical errors and errors in the specification itself. A general review of the sections of other teams should be made and errors brought to their attention.

Instruction should now be made in the editing procedure of the master. The procedure utilizes the facilities of the IBM/System 360 Time Sharing Option. Each team should edit his respective section at the terminal. After another review and correction of errors the master is ready for individual project specifications.

Creating the Project Specification

The project specification is created by the retrieval and editing of pertinent sections from the master. In the classroom situation the teams should use a project familiar to them. The obvious choice would be the design project from the design laboratory. This would enable the student to create a project specification from a familiar project and would also

instruct the class on how one master specification can serve several projects, thus, emphasizing the importance of a complete master specification.

It should be recognized that a good master will serve approximately 80% of the needs of the project specification. Once again the interplay between the material and methods instruction and the specification writing comes into the process. The individual student or team should research and write the remaining needed sections and introduce them for inclusion in the master.

The instructor at this point may wish to introduce the importance of updating the master by feedback from the project specification. Also the project specification should be reviewed and edited to suit the individual nature of the project. Upon completion of the necessary reviews the project specification can be printed.

Field Testing of the Project Specification

No system can be successful without the testing and feedback of viable information into the system. MSPEC/TSO is no different. Built into the process is the means by which the master and project specifications can be updated through the use of editing capabilities offered by the Time Sharing Option.

In the construction sequence of events the testing of the project specification and, thus, the master specification is made. When errors or new techniques are found the master should be changed to reflect the results of testing. In the classroom situation this is not easily accomplished.

In lieu of this, the instructor can bring to light, through student envolvement, problems that are foreseen in the project specifications presented. The faculty and also guest professionals can review several of the project specifications and present their experienced viewpoint on the consequences that may result from errors found. This would prove to be a direct feedback to the students efforts and contribute to the educational process.

APPENDIX A

MSPEC/TSO USER'S GUIDE

MSPEC/TSO is a computerized specification package utilizing the IBM System 360/Time Sharing Option. The basic principles of time sharing were discussed in Chapter Two and Three.

The format of this chapter will be one of introduction and explanation of the following procedure for use:

1. The computer hardware necessary for use of the package
2. Creating the master specification
3. Updating and editing the master specification
4. Listing the contents of the master specification
5. Creating the project specification
6. Editing and updating the project specification
7. Printing a proof copy at the terminal
8. Printing a proof or hard copy at the printer

The command procedures for use with MSPEC were written for use on the IBM 360/370 computer located at Virginia Polytechnic Institute and State University. The programs used to execute the specifications were written in Programming Language One (PL/1). If use of this program is desired on other systems, it will be necessary to change the command procedures listed in Appendix C.

Hardware Necessary for Operation

The minimum hardware for use with MSPEC/TSO is a visual display or typewriter terminal. Since they are similar, the typewriter terminals

use will be explained; since, it generally enjoys more widespread use. On the V.P.I.S.U. campus two types of terminals exist, the IBM Selectric Typewriter Terminal and the Datel Terminal. The Datel's use will be explained here.

The reader is requested to have access to the Datel or IBM terminal as he proceeds through the explanation of this procedure. For those who do not have access to a terminal, the input and output of data from the terminal and printer are listed in Appendix B.

The Coupler

For those terminals that do not have direct hookup a coupler is installed from the rear of the terminal. The coupler is a shoe box sized device used to transmit and receive communication messages between the terminal and the computer over existing telephone lines. Located on the front of the coupler is the power switch. Turn this switch to ON. A red light should be burning indicating the computer is operating. Most IBM terminals on campus have direct hookup with the computer.

The Terminal

The terminal appears and operates much like an ordinary typewriter. A few special keys are noted below.

Located at the upper left of the terminal keyboard there are two lights, one marked READY and the other marked PROCEED. The IBM terminal

does not have these lights. When the READY light is burning, the terminal is connected with the computer. When the PROCEED light is burning, the terminal can transmit information to the computer. Otherwise, the keyboard will be locked.

Located on the upper right is the ATTENTION key. It's main function is to erase lines. The user is advised not to press this key haphazardly, as this can cause erasure of the input. The ATTENTION key's use will be explained later.

At the middle right is the RETURN key. It's use is very similar to that of an electric typewriter. When pressed it returns the line to the beginning of the next line. One additional function is that the line typed is not transmitted to the computer until the RETURN key is pressed. This allows for erasures which also will be discussed next.

The POWER switch is located on the bottom right of the terminal keyboard. At this time the user might wish to familiarize himself with the location of the keys. If additional information is desired consult the owner's manual of the terminal being used.

The following is a procedure for use of the terminal with MSPEC/TSO. It serves as a users' guide and may be referred to by the novice for useage of MSPEC/TSO.

LOGON/LOGOFF

"Logging on" is the procedure to connect the computer to the terminal. "Logging off" is the procedure to disconnect the computer from the terminal. The first step is the "LOGON". It is done as follows:

1. Turn the computer to ON.
2. Turn the terminal to ON.
3. Dial (9) 951-3230.
4. When a high pitched tone is heard, place the phone in the coupler. The READY and PROCEED lights should come on.
5. ENTER logon (userid/password). Note: the userid and password represents your computer account number. It will be assigned to you by the computer center. For use of the program in the School of Architecture at V.P.I.S.U. consult your advisor.

   The computer will return READY.
   The terminal is now connected.

To "logoff" you need only enter"LOGOFF". The system will return accounting information.

There are three modes for operation of the terminal: the READY mode, the EDIT mode and the INPUT mode. The last statement returned from the computer, represents the mode in which the terminal is operating. As an example, after "logon", "READY" is returned. This indicates the READY mode. The other two, edit and input, will be discussed.

Creating the Master Specification

There are many sources for content material to develop a master

specification; MASTERSPEC, one installed in the user's office, etc. The only criteria that must be followed in using a master specification with MSPEC/TSO is that it be written in the CSI section numbering format and that the conventions unique to MSPEC/TSO be used.

Publication reference that may aid in the development of a master specification can be obtained from the following:

MASTERSPEC
Production Systems for Architects and Engineers
1785 Massachusetts Avenue, NW
Washington, D. C. 20036

The Construction Specification Institute
Suite 300, 1150 Seventeenth Street, NW
Washington, D. C. 20036

Assuming that you have obtained a master specification to be inputed, the following procedure will be used to enter, edit, update and store your master specification.

Entering the Master Specification

To enter the master specification, do the following:

1. LOGON (See LOGON/LOGOFF)

2. Enter: edit mspec data new
   the computer will return:
   EDIT
   (the terminal is in the edit mode) and
   INPUT
   00010
   (the terminal is in the input mode)

3. You can now proceed to enter the specification. To do so do the following:

   (a) on the line before each new section enter 'S*'. This must be done before each section.
   (b) at the end of your input enter '**'.
   (c) enter each section number in the first column after the computer supplied line number (00010 above).
   (d) after section numbers enter line and character spaces as desired for formating.

4. See "Correction of Errors" and "UPDATING" for respective information.

5. When completed, hit the RETURN key without hitting the space bar. This will place you into the EDIT mode.

Correction of Errors

Correction of errors can be in the two modes: EDIT and INPUT. Correction of errors in the INPUT mode can only be done before the line is returned. To erase merely backspace over the characters. Note that all characters backspaced over are erased. If characters are to remain they must be reentered. If it is desired to reenter the entire line, hit the ATTENTION key once. If it is pressed haphazardly (several times) it can send the terminal into the ready mode causing loss of all input.

To correct errors in the EDIT mode, do one of the following:

1. Correction of a Single Word

   enter

   C the line number/word to be changed/to what word

   example

   C 00010/STRUCTURRES/STRUCTURES

2. Correction of a Line

enter

line number and line

example

00010 ALL STRUCTURES etc.

3. Deletion of a Line or Series of Lines

enter

d begin line number / end line number

example to delete line 10 enter

d 10

to delete line 10 through 100 enter

d 10 100

Save and End

At the end of each input session, you must save your specification. To do this enter "save". The computer will return "SAVED".

To end enter the word "end". This will place you in the READY mode.

Updating the Master Specification

To update the master specification, the terminal must be in the EDIT mode. To do this enter:

edit MSPEC data

If a word is changed on a line deleted or changed, refer to the previous section. "Correction of Errors". The "change" and "delete" subcommands can be used.

At some time, you may wish to insert a section between two other sections. It will be necessary to first move the lower section down in line number. This is done by the "renum" subcommand. As an example, suppose the user wants to insert section 0130.0 between section 0120.0 and 0140.0.

```
00050  S*
00060  0120.0
00070
00080
00090  S*
00100  0140.0

enter renum 100   10   90
```

This will renumber line 90 to 100. Beginning with 100 all other line numbers will be incremented by 10.

then to insert section number 0130.0

```
enter   input 90 1
```

This says that input lines beginning at line 90 will be incremented by 1. The computer will return

```
INPUT
00090
```

Enter "S*" at line 90 and the section number, "0130.0", at line 00091 Continue entering information.

Find

If the user cannot find the section number in the master specification because of renumbering, etc., the user can have the computer find it for him. As an example, suppose you wanted to find section 0130.0.

Enter the following:

```
top
f '0130.0'
1*
```

The computer will return

```
00090   0130.0 etc.
```

Listing the Master Specification

To list the content of the master specification enter

```
(if in the READY mode)   l mspec. data
(if in the EDIT mode)    l
```

Listing the Section Numbers and Titles of the Master Specification

To list the CSI section numbers and titles which the user has as headings in his master specification, type:

```
exec listmspc
```

The computer will print at the terminal, a complete list of the CSI numbers and titles. This serves as a checklist of the updated version of the specification and can be used to check off the sections the user wishes to be used on the project specification. (See Appendix B for example).

Creating the Project Specification

Creating a project specification from the contents of the master specification is a simple operation. The user must have first saved a master

specification. He then obtains a list using "exec listmspc" of the CSI titles that are stored in the master.

After checking off the titles needed, the user types the following command:

exec spec

The computer will return

ENTER THE PROJECT INFORMATION

The project information consists of information pertinent to the project such as the project name, location, project number, etc.

You should input this information and when completed, type "**". The computer will return:

THANK YOU -- NOW ENTER THE SECTION NUMBERS

The user enters the CSI section numbers that make up the project specification. When completed, enter "**". If an error is made or the section number is not located, the computer will return:

***THE FOLLOWING SECTION NUMBERS ARE NOT FOUND ***

it will then list the numbers and the following:

REENTER YOUR INPUT

You should review your list. Reenter the CSI numbers, which are located in the master specification. The remaining sections can be entered through the "edit" mode of the project specification.

If an error has been made in the procedure, the computer will inform you of this. You must begin again. It may take time to reevaluate the error. Therefore, in some cases it would be economical to log off. At any rate, you must begin again.

If the section numbers are found, a listing will be made including the location of the section in the master specification, the CSI number and the title.

Listing and Editing the Project Specification

To list or edit the project specification, the terminal must be in the EDIT mode. To do this type:

edit project.data

The computer will return

EDIT

The use follows the same conventions as outlined in the section "Editing and Updating the Master Specification". To list the project specifications, enter: "l" or "l project.data".

Hard or Proof Copy From the Printer

Once the project specification has been edited and the additional material necessary for the specification to be complete has been added the user can obtain the hard copy. It is advised that all extensive printout be obtained from the main printer because of its speed and economy. To do this enter the following:

submit printer

The computer will return

PRINTER SUBMITTED
READY

The user can now logoff or create another specification. The project specification will be printed out, page numbered with a title page and an index included. It can be picked up at the computing center in Bin 12.

Text Master Specification

For those users who wish to obtain practice on the procedure set forth above without inputting his own master specification, he may use a test copy in the place of his own specification. To set up this enter the following:

exec testspc

The user is now ready to proceed. There are several intentional errors in the test master specification. The user can gain practice in editing procedures by correcting these.

APPENDIX B

MSPEC/TSO INPUT AND OUTPUT EXAMPLES

Included in this appendix is a typical example of the development of a project specification. The master specification is incomplete and is used only to demostrate the procedure outlined in Appendix A. The procedure will follow that defined in Appendix A.

Examples that follow demostrate the use of the following procedures:

1. Listing the contents of the masterspec using "edit mspec.data" and the list (l) subcommand of TSO.

2. Listing the section numbers and titles using "exec listmspc". Note that the location numbers on the far right of the output correspond to the location number in mspec listed above.

3. Creating a project specification using "exec spec.".

4. Editing the project specification using "edit project data." Note the listing and error corrections using the correction (c) subcommand of TSO.

5. The output from the printer which came from the use of the command "exec printer." The specification is only an example. In reality each section listed would contain a complete specification.

```
edit mspc.data
EDIT
L
00010 S*
00020 0010.0      SUMMARY OF THE WORK
00030 S*
00040 0110.0      SCHEDULES AND REPORTS
00050 S*
00060 0120.0      SHOP DRAWINGS, SAMPLES AND SUBMITTALS
00070 S*
00080 0130.0      TEMPORARY FACILITIES
00090 S*
00100 0140.0      CLEANING UP
00110 S*
00120 0160.0      ALLOWANCES
00130 S*
00140 0170.0      ALTERNATES
00150 S*
00160 0180.0      SPECIAL CONDITIONS
00170 S*
00180 0190.0      DEFINITION OF TERMS
00190 S*
00200 0201.0      SCOPE
00210 S*
00220 0210.0      CLEARING OF SITE
00230 S*
00240 0220.0      EARTHWORK
00250 S*
00260 0230.0      PILING FOUNDATION
00270 S*
00280 0250.0      SITE DRAINAGE
00290 S*
00300 0255.0      SITE UTILITIES
00310 S*
00320 0260.0      ROADS AND WALKS
00330 S*
00340 0270.0      SITE IMPROVEMENTS
00350 S*
00360 0280.0      LAWN AND PLANTING
00370 S*
00380 0290.0      LAKES AND RESEVOIRS
00390 S*
00400 0310.1      CONCRETE FORMWORK
00410 S*
00420 0320.0      CONCRETE REINFORCEMENT
00430 GENERAL     1.  STEEL BARS, WELDED WIRE FABRIC, SUPPORTS AND
00440                 OTHER INCIDENTALS FOR THE PLACING OF REIN
00450                 FORCING FOR CONCRETE WORK.
00460             2.  WORK NOT INCLUDED: MASONRY REINFORCING.
```

```
00470                3.  PRIOR TO THE PLACEMENT OF ANY CONCRETE, THE
00480                    ARCHITECT AND/OR ENGINEER SHALL BE NOTIFIED
00490                    OF POURING SCHEDULE IN ADVANCE.
00500                4.  DETAILING AND SHOP DRAWINGS:  REINFORCING
00510                    STEEL DETAILED IN ACCORDANCE WITH ACI MANUAL
00520                    OF STANDARD PRACTICE FOR DETAILING REINFORCED
00530                    CONCRETE STRUCTURRES, ACI-315.
00540
00550 PRODUCTS       1.  SIZE OF MESH AND BARS AS SHOWN ON DRAWINGS.
00560                2.  REINFORCING BARS SHALL BE ROLLED FROM INTER
00570                    MEDIATE GRADE NEW BILLET STEEL CONFROMING TO
00580                    ASTM DESIGNATION A615 WITH MINIMUM YIELD POINT
00590                    OF 60,000 PSI.
00600                3.  WELDED WIRE FABRIC:  MESH REINFORCING SHALL BE
00610                    ELECTRIC WELDED WIRE FABRIC AND CONFORM TO
00620                    ASTM DESIGNATION A-82.
00630                4.  COLD-DRAWN STEEL WIRE -- WIRE SHALL CONFROM
00640                    TO ASTM A615.
00650                5.  METAL ACCESSORIES - SPACERS, CHAIRS, TIES AND
00660                    OTHER DEVICES NECESSARY EOR THE PROPER ASSEM
00670                    BLING, PLACING, SPACING, AND SUPPORTING ALL
00680                    REINFORCEMENT IN PLACE SHALL BE PROVIDED.
00690
00700 EXECUTION      1.  REINFORCING STEEL HANDLED AND PLACED IN ACCOR
00710                    DANCE WITH ACI-318.
00720                2.  CLEANING AND BENDING REINFORCEMENT:  METAL
00730                    REINFORCEMENT AT THE TIME CONCRETE IS PLACED
00740                    SHALL BE FREE FROM SCALE, OIL, AND STRUCTURAL
00750                    DEFECTS (CRACKS EXCESSIVE RUST AND PITTING),
00760                    OR OTHER ƒPPROVED SUPPORTS.  UNLESS OTHERWISE
00770                    SPECIFIED SUPPORTS SHALL CONFORM TO THE ACI
00780                    DETAILING MANUAL (ACI-315).
00790                3.  ETC.
00800 S*
00810 0330.0         CAST IN PLACE CONCRETE
00820 S*
00830 0340.0         PRECAST CONCRETE
00840 S*
00850 0350.0         CEMENTITIOUS DECKS
00860 S*
00870 0360.0         EXPANSION AND CONTRACTION JOINTS
00880 S*
00890 0410.0         MORTAR
00900 S*
00910 0420.0         UNIT MASONRY
00920 S*
00930 0430.0         WIRE TIE SYSTEMS
00940 S*
00950 0440.0         STONE
00960 X*
```

```
exec listmspc


0010.0      SUMMARY OF THE WORK                                  00000020
0110.0      SCHEDULES AND REPORTS                                00000040
0120.0      SHOP DRAWINGS, SAMPLES AND SUBMITTALS                00000060
0130.0      TEMPORARY FACILITIES                                 00000080
0140.0      CLEANING UP                                          00000100
0160.0      ALLOWANCES                                           00000120
0170.0      ALTERNATES                                           00000140
0180.0      SPECIAL CONDITIONS                                   00000160
0190.0      DEFINITION OF TERMS                                  00000180
0201.0      SCOPE                                                00000200
0210.0      CLEARING OF SITE                                     00000220
0220.0      EARTHWORK                                            00000240
0230.0      PILING FOUNDATION                                    00000260
0250.0      SITE DRAINAGE                                        00000280
0255.0      SITE UTILITIES                                       00000300
0260.0      ROADS AND WALKS                                      00000320
0270.0      SITE IMPROVEMENTS                                    00000340
0280.0      LAWN AND PLANTING                                    00000360
0290.0      LAKES AND RESEVOIRS                                  00000380
0310.1      CONCRETE FORMWORK                                    00000400
0320.0      CONCRETE REINFORCEMENT                               00000420
0330.0      CAST IN PLACE CONCRETE                               00000810
0340.0      PRECAST CONCRETE                                     00000830
0350.0      CEMENTITIOUS DECKS                                   00000850
0360.0      EXPANSION AND CONTRACTION JOINTS                     00000870
0410.0      MORTAR                                               00000890
0420.0      UNIT MASONRY                                         00000910
0430.0      WIRE TIE SYSTEMS                                     00000930
0440.0      STONE                                                00000950
0450.0      MASONRY RESTORATION                                  00000970
```

0460.0	ANCHORS AND ACCESSORIES	00000990
0510.0	STRUCTURAL METAL	00001010
0520.0	OPEN-WEB JOISTS	00001030
0530.0	METAL DECKING	00001050
0570.0	MISCELLANEOUS METAL	00001070
0580.0	SPECIAL FORMED METAL	00001090
0610.0	ROUGH CARPENTRY	00001110
0620.0	FINISH CARPENTRY	00001130
0630.0	GLUE-LAMINATED WOOD	00001150
0640.0	CUSTOM WOODWORK	00001170
0660.0	WOOD TREATMENTS	00001190
0670.0	FASTENING	00001210
0710.0	WATERPROOFING	00001230
0715.0	DAMPPROOFING	00001250
0720.0	BUILDING INSULATION	00001270
0730.0	SHINGLES AND ROOFING TILES	00001290
0740.0	PREFORMED ROOFING AND SIDING	00001310
0750.0	MEMBRANE ROOFING	00001330
0760.0	SHEET METAL WORK	00001350
0770.0	WALL FLASHING	00001370
0780.0	ROOF ACCESSORIES	00001390
0790.0	CAULKING AND SEALANTS	00001410
0810.0	METAL DOORS AND FRAMES	00001430
0820.0	WOOD DOORS	00001450
0830.0	SPECIAL DOORS	00001470
0840.0	FLEXIBLE DOORS	00001490
0850.0	METAL WINDOWS	00001510

0860.0	WOOD WINDOWS	00001530
0870.0	FINISH HARDWARE	00001550
0880.0	WEATHERSTRIPPING	00001570
0885.0	GLASS AND GLAZING	00001590
0890.0	CURTAINWALL SYSTEM	00001610
0910.0	LATH AND PLASTER	00001630
0925.0	GYPSUM DRYWALL	00001650
0930.0	TILE WORK	00001670
0940.0	TERRAZZO	00001690
0995.0	WALL COVERING	00001710
1010.0	CHALKBOARD AND TACKBOARD	00001730
1015.0	COMPARTMENTS AND CUBICLES	00001750
1020.0	DEMOUNTABLE PARTITIONS	00001770
1025.0	DISAPPEARING STAIRS	00001790
1030.0	FIREPLACE EQUIPMENT	00001810
1035.0	FLAGPOLES	00001830
1037.0	FOLDING GATES	00001850
1040.0	IDENTIFYING DEVICES	00001870
1050.0	LOCKERS	00001890
1055.0	POSTAL SPECIALTIES	00001910
1060.0	RETRACTABLE PARTITIONS	00001930
1065.0	SCALES	00001950
1067.0	STORAGE SHELVING	00001970
1070.0	SUN CONTROL DEVICES	00001990
1075.0	TELEPHONE BOOTHS	00002010
1080.0	TOILET AND BATH ACCESSORIES	00002030
1085.0	VENDING MACHINES	00002050

1090.0	WARDROBE SPECIALTIES	00002070
1095.0	WASTE DISPOSAL UNITS	00002090
1110.0	BANK EQUIPMENT	00002110
1115.0	GYMNASIUM EQUIPMENT	00002130
1118.0	DARKROOM EQUIPMENT	00002150
1120.0	ECCLESIASTICAL EQUIPMENT	00002170
1130.0	EDUCATIONAL EQUIPMENT	00002190
1140.0	FOOD SERVICE EQUIPMENT	00002210
1150.0	GYMNASIUM EQUIPMENT	00002230
1150.5	SHIPYARD EQUIPMENT	00002250
1151.0	SWIMMING POOL EQUIPMENT	00002270
1151.5	CHLORINATION EQUIPMENT	00002290
1152.0	SEWAGE TREATMENT PLANT EQUIPMENT	00002310
1210.0	ARTWORK	00002330
1220.0	BLINDS AND SHADES	00002350
1230.0	CABINETS AND FIXTURES	00002370
1240.0	CARPETS AND MATS	00002390
1250.0	DRAPERY AND CURTAINS	00002410
1260.0	FURNITURE	00002430
1270.0	SEATING	00002450

READY

```
exec spec
UTILITY DATA SET NOT FREED, IS NOT ALLOCATED
TEMPNAME ASSUMED AS A MEMBER NAME

***  ENTER THE PROJECT INFORMATION  ***

american defender life insurance company
corporate headquarters
raleigh, north carolina

specifications

ronald l. collier, a.i.a. / architect
**

*** THANK YOU.   NOW ENTER THE SECTION NUMBERS ***

0010.0
0110.0
0120.0
0130.0
0160.0
0320.0
**

AMERICAN DEFENDER LIFE INSURANCE COMPANY
CORPORATE HEADQUARTERS
RALEIGH, NORTH CAROLINA

SPECIFICATIONS

RONALD L. COLLIER, A.I.A. / ARCHITECT
**
```

```
THE FOLLOWING SECTIONS MAKE UP THE PROJECT SPEC:
0010.0      SUMMARY OF THE WORK                                  00000020
0110.0      SCHEDULES AND REPORTS                                00000040
0120.0      SHOP DRAWINGS, SAMPLES AND SUBMITTALS                00000060
0130.0      TEMPORARY FACILITIES                                 00000080
0160.0      ALLOWANCES                                           00000120
0320.0      CONCRETE REINFORCEMENT                               00000420

DATA SET PROJECT.DATA NOT LINE NUMBERED, USING NONUM
SAVED
READY
```

```
edit project.data
EDIT
L

00010 AMERICAN DEFENDER LIFE INSURANCE COMPANY
00020 CORPORATE HEADQUARTERS
00030 RALEIGH, NORTH CAROLINA
00040
00050 SPECIFICATIONS
00060
00070 RONALD L. COLLIER, A.I.A. / ARCHITECT
00080 **
00090 S*
00100 0010.0      SUMMARY OF THE WORK
00110 S*
00120 0110.0      SCHEDULES AND REPORTS
00130 S*
00140 0120.0      SHOP DRAWINGS, SAMPLES AND SUBMITTALS
00150 S*
00160 0130.0      TEMPORARY FACILITIES
00170 S*
00180 0160.0      ALLOWANCES
00190 S*
00200 0320.0      CONCRETE REINFORCEMENT
00210 GENERAL     1.  STEEL BARS, WELDED WIRE FABRIC, SUPPORTS AND
00220                 OTHER INCIDENTALS FOR THE PLACING OF REIN
00230                 FORCING FOR CONCRETE WORK.
00240             2.  WORK NOT INCLUDED: MASONRY REINFORCING.
00250             3.  PRIOR TO THE PLACEMENT OF ANY CONCRETE, THE
00260                 ARCHITECT AND/OR ENGINEER SHALL BE NOTIFIED
00270                 OF POURING SCHEDULE IN ADVANCE.
00280             4.  DETAILING AND SHOP DRAWINGS:  REINFORCING
00290                 STEEL DETAILED IN ACCORDANCE WITH ACI MANUAL
00300                 OF STANDARD PRACTICE FOR DETAILING REINFORCED
00310                 CONCRETE STRUCTURRES, ACI-315.
00320
00330 PRODUCTS    1.  SIZE OF MESH AND BARS AS SHOWN ON DRAWINGS.
00340             2.  REINFORCING BARS SHALL BE ROLLED FROM INTER
00350                 MEDIATE GRADE NEW BILLET STEEL CONFROMING TO
00360                 ASTM DESIGNATION A615 WITH MINIMUM YIELD POINT
00370                 OF 60,000 PSI.
00380             3.  WELDED WIRE FABRIC:  MESH REINFORCING SHALL BE
00390                 ELECTRIC WELDED WIRE FABRIC AND CONFORM TO
00400                 ASTM DESIGNATION A-82.
00410             4.  COLD-DRAWN STEEL WIRE -- WIRE SHALL CONFROM
00420                 TO ASTM A615.
00430             5.  METAL ACCESSORIES - SPACERS, CHAIRS, TIES AND
00440                 OTHER DEVICES NECESSARY FOR THE PROPER ASSEM
00450                 BLING, PLACING, SPACING, AND SUPPORTING ALL
00460                 REINFORCEMENT IN PLACE SHALL BE PROVIDED.
```

```
00470
00480 EXECUTION  1.  REINFORCING STEEL HANDLED AND PLACED IN ACCOR
00490                DANCE WITH ACI-318.
00500            2.  CLEANING AND BENDING REINFORCEMENT:  METAL
00510                REINFORCEMENT AT THE TIME CONCRETE IS PLACED
00520                SHALL BE FREE FROM SCALE, OIL, AND STRUCTURAL
00530                DEFECTS (CRACKS EXCESSIVE RUST AND PITTING),
00540                OR OTHER APPROVED SUPPORTS.  UNLESS OTHERWISE
00550                SPECIFIED SUPPORTS SHALL CONFORM TO THE ACI
00560                DETAILING MANUAL (ACI-315).
00570            3.  ETC.
00580 **
END OF DATA


c 310 /structurres/structures/

1 310
00310                CONCRETE STRUCTURES, ACI-315.

s
SAVED

end
READY
```

AMERICAN DEFENDER LIFE INSURANCE COMPANY
CORPORATE HEADQUARTERS
RALEIGH, NORTH CAROLINA

SPECIFICATIONS

RONALD L. COLLIER, A.I.A. / ARCHITECT

INDEX

0010.0	SUMMARY OF THE WORK	1
DIVISION 1	GENERAL REQUIREMENTS	
0110.0	SCHEDULES AND REPORTS	2
0120.0	SHOP DRAWINGS, SAMPLES AND SUBMITTALS	3
0130.0	TEMPORARY FACILITIES	4
0160.0	ALLOWANCES	5
DIVISION 2	SITE WORK	
NOT USED		
DIVISION 3	CONCRETE	
0320.0	CONCRETE REINFORCEMENT	6
DIVISION 4	MASONRY	
NOT USED		
DIVISION 5	METALS	
NOT USED		
DIVISION 6	CARPENTRY	
NOT USED		
DIVISION 7	MOISTURE CONTROL	
NOT USED		
DIVISION 8	DOORS, WINDOWS, AND GLASS	
NOT USED		
DIVISION 9	FINISHES	
NOT USED		
DIVISION 10	SPECIALTIES	
NOT USED		

DIVISION 11 EQUIPMENT
NOT USED

DIVISION 12 FURNISHINGS
NOT USED

DIVISION 13 SPECIAL CONSTRUCTION
NOT USED

DIVISION 14 CONVEYING SYSTEMS
NOT USED

DIVISION 15 MECHANICAL
NOT USED

DIVISION 16 ELECTRICAL
NOT USED

0010.0 SUMMARY OF THE WORK

0110.0 SCHEDULES AND REPORTS

0120.0 SHOP DRAWINGS, SAMPLES AND SUBMITTALS

0130.0 TEMPORARY FACILITIES

0160.0 ALLOWANCES

0320.0 CONCRETE REINFORCEMENT

GENERAL
1. STEEL BARS, WELDED WIRE FABRIC, SUPPORTS AND OTHER INCIDENTALS FOR THE PLACING OF REIN FORCING FOR CONCRETE WORK.
2. WORK NOT INCLUDED: MASONRY REINFORCING.
3. PRIOR TO THE PLACEMENT OF ANY CONCRETE, THE ARCHITECT AND/OR ENGINEER SHALL BE NOTIFIED OF POURING SCHEDULE IN ADVANCE.
4. DETAILING AND SHOP DRAWINGS: REINFORCING STEEL DETAILED IN ACCORDANCE WITH ACI MANUAL OF STANDARD PRACTICE FOR DETAILING REINFORCED CONCRETE STRUCTURES, ACI-315.

PRODUCTS
1. SIZE OF MESH AND BARS AS SHOWN ON DRAWINGS.
2. REINFORCING BARS SHALL BE ROLLED FROM INTER MEDIATE GRADE NEW BILLET STEEL CONFROMING TO ASTM DESIGNATION A615 WITH MINIMUM YIELD POINT OF 60,000 PSI.
3. WELDED WIRE FABRIC: MESH REINFORCING SHALL BE ELECTRIC WELDED WIRE FABRIC AND CONFORM TO ASTM DESIGNATION A-82.
4. COLD-DRAWN STEEL WIRE -- WIRE SHALL CONFROM TO ASTM A615.
5. METAL ACCESSORIES - SPACERS, CHAIRS, TIES AND OTHER DEVICES NECESSARY FOR THE PROPER ASSEM BLING, PLACING, SPACING, AND SUPPORTING ALL REINFORCEMENT IN PLACE SHALL BE PROVIDED.

EXECUTION
1. REINFORCING STEEL HANDLED AND PLACED IN ACCOR DANCE WITH ACI-318.
2. CLEANING AND BENDING REINFORCEMENT: METAL REINFORCEMENT AT THE TIME CONCRETE IS PLACED SHALL BE FREE FROM SCALE, OIL, AND STRUCTURAL DEFECTS (CRACKS EXCESSIVE RUST AND PITTING), OR OTHER APPROVED SUPPORTS. UNLESS OTHERWISE SPECIFIED SUPPORTS SHALL CONFORM TO THE ACI DETAILING MANUAL (ACI-315).
3. ETC.

APPENDIX C

MSPEC/TSO SOFTWARE

Included in this appendix is the software necessary for the operation of MSPEC/TSO. The command procedures are original procedures unique to MSPEC/TSO and written according to the criteria set forth by the IBM System/360 Time Sharing Option. The software programs are written in the Program Language One (PL/1) computer language.

The following command procedures are listed in this appendix:

1. LISTMSPC.CLIST (EXEC LISTMSPC)
2. PRINTER.CNTL (SUBMIT PRINTER)
3. SPEC.CLIST (EXEC SPEC)
4. TERMPRNT.CLIST (EXEC TERMPRNT)

The following programs follow the command procedures listed:

1. One Procedure Options(main)
2. Four Procedure Options(main)
3. Five Procedure Options(main)

LISTMSPC.CLIST

```
00010   PROC 0
00020   XEQ COLLIER.LOAD(LIST) DSIN(MSPEC.DATA)
00030   END
READY
```

PRINTER.CNTL

```
00010 //BIN12SPC JOB 30722,ARCHITECT,MSGLEVEL=1,NOTIFY=BERGY
00020 /*MAIN TIME=5,REGION=200
00030 //   EXEC   PL1LFCLG
00040 //PL1L.SYSIN DD DSN=BERGY.COLLIER.FIVE.PL1,DISP=SHR
00050 /*
00060 //GO.SYSIN DD DSN=BERGY.PROJECT.DATA,DISP=SHR
00070 /*
00080 //
READY
```

SPEC.CLIST

```
00010 PROC 0
00020 D PROJECT.DATA
00030 FREE F(TOUT)
00040 FREE F(POUT)
00050 FREE ATTRLIST(PPP)
00060 ATTRIB PPP LRECL(80) RECFM(F B)
00070 ALLOC DA(PROJECT.DATA) F(POUT) SP(3,1) BLOCK(1680) USING(PPP)
00080 ALLOC DA(MSPEC.DATA) F(TOUT)
00090 XEQ COLLIER.LOAD(PROJECT)
00100 EDIT PROJECT.DATA
00110 RENUM
00120 SAVE
00130 END
00140 END
READY
```

TERMPRNT.CLIST

```
00010   PROC 0
00020   XEQ COLLIER.PRINTER.LOAD DSIN(PROJECT.DATA)
00030   END
READY
```

```
00010   ONE: PROCEDURE OPTIONS (MAIN);
00020   DECLARE (SPCLN(500),MUT(500)) CHAR(80) VARYING;
00030  DECLARE DLINE CHAR(80);
00040
00050     ON ENDFILE(TOUT) GO TO CHECK;
00060
00070   DECLARE      (J,K,L,M,G,P,R,S) FIXED(3) INITIAL(0),
00080          (NUMB(100),PROJ(10), SCTN(100),  ERR(20))
00090          CHARACTER(80),
00100          VARYING, STAR CHARACTER(2) INITIAL('**'),
00110          A FIXED(2),
00120          DUM CHARACTER(80) VARYING,
00130          SECNL CHARACTER(2) INITIAL('S*'),
00140          (T,V) CHARACTER(6),
00150          (W,I) FIXED(4) INITIAL(0),
00160          POUT FILE RECORD,
00170          TOUT FILE RECORD;
00180
00190          PUT EDIT('***  ENTER THE PROJECT INFORMATION  ***')
00200          (COLUMN(1),A) SKIP;
00210          PUT SKIP; PUT SKIP;
00220   BEGIN: M=M+1;
00230          GET EDIT(PROJ(M)) (COLUMN(1),A(72));
00240          A=INDEX(PROJ(M),'**');
00250          IF A>0 THEN GO TO SECT;
00260          GO TO BEGIN;
00270
00280   SECT:    PUT EDIT('*** THANK YOU.   NOW ENTER THE SECTION
00290           NUMBERS ***') (COLUMN(1),A) SKIP;
00300          K=0;
00310          PUT SKIP; PUT SKIP;
00320
00330   S1:    K=K+1;
00340          GET EDIT(SCTN(K)) (COLUMN(1),A(80));
00350          A=INDEX(SCTN(K),'**');
00360          IF A>0 THEN GO TO SEQNC;
00370          GO TO S1;
00380   SEQNC: DO I=2 TO (K-1);
00390          IF SCTN(I-1)<SCTN(I) THEN GO TO SEQ1;
00400          DUM=SCTN(I);
00410          SCTN(I)=SCTN(I-1);
00420          SCTN(I-1)=DUM;
00430  SEQ1:   END SEQNC;
00440
00450          OPEN FILE(TOUT) INPUT;
00460  SEARCH: I=I+1;
00470          READ FILE(TOUT) INTO(DLINE);
00480          MUT(I)=DLINE;
00490          A=INDEX(MUT(I),'**');
00500          IF A>0 THEN GO TO CHECK;
```

```
00510           GO TO SEARCH;
00520
00530   CHECK:  CLOSE FILE(TOUT);
00540    CCC:   DO J=1 TO K;
00550           T=SUBSTR(SCTN(J),1,6);
00560           A=INDEX(SCTN(J),'**');
00570           IF A>0 THEN GO TO S2;
00580
00590    C1:    DO G=1 TO I;
00600           V=SUBSTR(MUT(G),1,6);
00610           IF T=V THEN GO TO RECRD;
00620           IF G=(I-1) THEN GO TO ERROR;
00630           GO TO C2;
00640
00650    RECRD: L=L+1;
00660           NUMB(L)=MUT(G);
00670           GO TO C3;
00680
00690    ERROR: S=S+1;
00700           ERR(S)=SCTN(J);
00710           GO TO C3;
00720
00730    C2:    END C1;
00740    C3:    END CCC;
00750
00760    S2:    IF S=0 THEN GO TO S3;
00770           PUT SKIP; PUT SKIP;
00780           PUT EDIT('THE FOLLOWING SECTION NUMBERS NOT
00790           FOUND:') (COLUMN(1),A);
00800           PUT SKIP; PUT SKIP;
00810           DO W=1 TO S;
00820           PUT EDIT(ERR(W)) (COLUMN(1),A);
00830           END;
00840
00850           PUT EDIT('*****  REENTER THE SECTION NUMBERS
00860           CORRECTLY  *****') (COLUMN(1),A);
00870           PUT SKIP; PUT SKIP;
00880           GO TO ENDAL;
00890    S3:    PUT SKIP;
00900           DO W=1 TO M;
00910           PUT EDIT(PROJ(W)) (COLUMN(1),A);
00920           END;
00930           PUT SKIP;  PUT SKIP;
00940           PUT EDIT('THE FOLLOWING SECTIONS MAKE UP THE
00950           PROJECT SPEC:') (COLUMN(1),A);
00960           DO W=1 TO L;
00970           PUT EDIT(NUMB(W)) (COLUMN(1),A);
00980           END;
00990
01000   MSPEC: DO J=1 TO K;
```

```
01010             A=INDEX(SCTN(J),'**');
01020             IF A>0 THEN GO TO OUT;
01030
01040     M1:     P=P+1;
01050             T=SUBSTR(SCTN(J),1,6);
01060             IF T=SUBSTR(MUT(P),1,6) THEN GO TO SECT1;
01070             A=INDEX(MUT(P),'**');
01080             IF A>0 THEN GO TO OUT;
01090             GO TO M1;
01100
01110   SECT1:    R=R+1;
01120             SPCLN(R)=MUT(P);
01130
01140   SS1:      P=P+1;
01150             R=R+1;
01160             SPCLN(R)=MUT(P);
01170             A=INDEX(MUT(P),'S*');
01180             IF A>0 THEN GO TO M2;
01190             GO TO SS1;
01200
01210     M2:     END MSPEC;
01220
01230     OUT:    OPEN FILE(POUT) OUTPUT;
01240             DLINE='S*';
01250             WRITE FILE(POUT) FROM(DLINE);
01260     O1:     DO S=1 TO M;
01270             DLINE=PROJ(S);
01280             WRITE FILE(POUT) FROM(DLINE);
01290             END O1;
01300
01310     PSPEC:  DO W=1 TO R;
01320             DLINE=SPCLN(W);
01330             WRITE FILE(POUT) FROM(DLINE);
01340             END PSPEC;
01350             DLINE='**';
01360             WRITE FILE(POUT) FROM(DLINE);
01370             CLOSE FILE(POUT);
01380   ENDAL:    END ONE;
END OF DATA
```

```
00010    FOUR: PROCEDURE OPTIONS (MAIN);
00020
00030    DECLARE (N,J,K,I) FIXED(3) INITIAL(0),
00040      (PROJ(10),LINE,CHK(500)) CHAR(80) VARYING,
00050      P FIXED(2) INITIAL(0),
00060      R CHAR(1),SCTN(500) CHARACTER(80) VARYING,
00070      PERIOD CHAR(1) INITIAL('.'),
00080      NUM CHARACTER(10) INITIAL('0123456789'),
00090      STAR CHAR(2) INITIAL('**');
00100
00110    ON ENDFILE(SYSIN) GO TO END;
00120
00130
00140    MSPEC: K=0;
00150           GET EDIT(LINE) (COLUMN(1),A(80));
00160           IF STAR=SUBSTR(LINE,1,2) THEN GO TO END;
00170
00180    JAY:   K=K+1;
00190           IF K=5 THEN GO TO PERID;
00200           IF K=7 THEN GO TO OUT;
00210           R=SUBSTR(LINE,K);
00220           P=INDEX(NUM,R);
00230           IF P=0 THEN GO TO MSPEC;
00240           GO TO JAY;
00250
00260    PERID:  R=SUBSTR(LINE,K);
00270           IF PERIOD=R THEN GO TO MSPEC;
00280           GO TO JAY;
00290    OUT:   I=I+1;
00300           CHK(I)=LINE;
00310           GO TO MSPEC;
00320
00330    END:   DO N=1 TO I;
00340           PUT EDIT(CHK(N)) (COLUMN(1),A);
00350           PUT SKIP;
00360           P=P+2;
00370           IF P>60 THEN GO TO E1;
00380           GO TO E2;
00390
00400    E1:    PUT PAGE LINE(8);
00410           P=8;
00420           GO TO E2;
00430
00440    E2:    END END;
00450
00460
00470    END FOUR;
END OF DATA
```

```
00010      FIVE: PROCEDURE OPTIONS (MAIN);
00020      DECLARE  (LINE, PROJ(10), COUNT(1000), DIV(16))  CHAR(72)
00030      VARYING,
00040      INDX(200) CHAR(50),
00050      (J,I,A,L,S) FIXED(2) INITIAL(0),
00060      I FIXED(4) INITIAL(0),
00070      CHK FIXED(2) INITIAL(1),
00080      M FIXED(4) INITIAL(0),
00090      (P,N) FIXED(3) INITIAL(0),
00100      NOX(200) FIXED(3) INITIAL(0),
00110      UNLN CHAR(65) INITIAL((65)'_'),
00120      (C,D) CHAR(2);
00130
00140      DIV(1)='DIVISION 1      GENERAL REQUIREMENTS';
00150      DIV(2)='DIVISION 2      SITE WORK';
00160      DIV(3)='DIVISION 3      CONCRETE';
00170      DIV(4)='DIVISION 4      MASONRY';
00180      DIV(5)='DIVISION 5      METALS';
00190      DIV(6)='DIVISION 6      CARPENTRY';
00200      DIV(7)='DIVISION 7      MOISTURE CONTROL';
00210      DIV(8)='DIVISION 8      DOORS, WINDOWS, AND GLASS';
00220      DIV(9)='DIVISION 9      FINISHES';
00230      DIV(10)='DIVISION 10     SPECIALTIES';
00240      DIV(11)='DIVISION 11     EQUIPMENT';
00250      DIV(12)='DIVISION 12     FURNISHINGS';
00260      DIV(13)='DIVISION 13     SPECIAL CONSTRUCTION';
00270      DIV(14)='DIVISION 14     CONVEYING SYSTEMS';
00280      DIV(15)='DIVISION 15      MECHANICAL';
00290      DIV(16)='DIVISION 16      ELECTRICAL';
00300
00310      ON ENDFILE(SYSIN) GO TO PRINT;
00320
00330    BEGIN: GET EDIT(LINE) (COLUMN(1),A(72));
00340           A=INDEX(LINE,'**');
00350           IF A>0 THEN GO TO B1;
00360           J=J+1;
00370           PROJ(J)=LINE;
00380           GO TO BEGIN;
00390
00400    B1:     R=((66-J)/2);
00410           PUT PAGE;
00420           PUT LINE(R);
00430
00440    B2:    DO I=1 TO J;
00450           A=INDEX(PROJ(I),'   ');
00460           A=((80-A)/2);
00470           PUT EDIT(PROJ(I)) (COLUMN(1),X(A),A);
00480           END B2;
00490
00500    B3:     PUT PAGE LINE(8);
```

```
00510             I=8;
00520   SECT:     GET EDIT(LINE) (COLUMN(1),A(72));
00530             A=INDEX(LINE,'S*');
00540             IF A>0 THEN GO TO S1;
00550             A=INDEX(LINE,'**');
00560             IF A>0 THEN GO TO PRINT;
00570             M=M+1;
00580             COUNT(M)=LINE;
00590             L=L+1;
00600             IF L<52 THEN GO TO SECT;
00610             L=8;
00620             P=P+1;
00630             GO TO SECT;
00640    S1:      GET EDIT(LINE) (COLUMN(1),A(72));
00650             P=P+1;
00660             L=8;
00670             M=M+1;
00680             COUNT(M)=LINE;
00690             L=L+1;
00700
00710    S2:      M=M+1;
00720             COUNT(M)=UNLN;
00730             L=L+1;
00740
00750    S3:      N=N+1;
00760             INDX(N)=COUNT(M-1);
00770             NOX(N)=P;
00780             GO TO SECT;
00790    PRINT:    P=1;
00800             L=2;
00810             PUT PAGE LINE(2);
00820             CHK=1;
00830
00840    P1:      DO I=1 TO M;
00850             IF CHK=1 THEN GO TO P2;
00860             A=INDEX(COUNT(I+1),'__');
00870             IF A>0 THEN GO TO P4;
00880    P2:      L=L+1;
00890             CHK=2;
00900             IF L<54 THEN GO TO P3;
00910             PUT LINE(58);
00920             PUT EDIT(P) (COLUMN(40),F(3));
00930             L=2;
00940             P=P+1;
00950             PUT PAGE LINE(2);
00960             GO TO P5;
00970
00980    P3:      PUT EDIT(COUNT(I)) (COLUMN(10),A);
00990             GO TO P5;
01000
```

```
01010    P4:     PUT LINE(58);
01020            PUT EDIT(P) (COLUMN(40),F(3));
01030            L=2;
01040            P=P+1;
01050            PUT PAGE LINE(2);
01060            PUT EDIT(COUNT(I)) (COLUMN(10),A);
01070
01080    P5:     END P1;
01090
01100            PUT LINE(58) EDIT(P) (COLUMN(30),A);
01110    IND:    PUT PAGE LINE(2);
01120            PUT EDIT('INDEX') (COLUMN(38), A);
01130            PUT SKIP;
01140            L=3;
01150            CHK=0;
01160            D='00';
01170            P=0;
01180    I1:     P=P+1;
01190            IF P>N THEN GO TO I8;
01200    I11:    C=SUBSTR(INDX(P),1,2);
01210
01220            IF C=D THEN GO TO I6;
01230            IF C='01' THEN R=1;
01240            IF C='02' THEN R=2;
01250            IF C='03' THEN R=3;
01260            IF C='04' THEN R=4;
01270            IF C='05' THEN R=5;
01280            IF C='06' THEN R=6;
01290            IF C='07' THEN R=7;
01300            IF C='08' THEN R=8;
01310            IF C='09' THEN R=9;
01320            IF C='10' THEN R=10;
01330            IF C='11' THEN R=11;
01340            IF C='12' THEN R=12;
01350            IF C='13' THEN R=13;
01360            IF C='14' THEN R=14;
01370            IF C='15' THEN R=15;
01380            IF C='16' THEN R=16;
01390
01400    I2:     M=R-CHK;
01410             IF R=CHK THEN GO TO I6;
01420    I3:     DO S=1 TO M;
01430            CHK=CHK+1;
01440            PUT SKIP(3);
01450            PUT EDIT(DIV(CHK)) (COLUMN(10),A);
01460            L=L+4;
01470            IF L<54 THEN GO TO I4;
01480            PUT PAGE LINE(2);
01490            L=2;
01500
```

```
01510    I4:     D=C;
01520            IF CHK=R THEN GO TO I5;
01530            PUT EDIT('NOT USED') (COLUMN(15),A);
01540            L=L+1;
01550
01560    I5:     END I3;
01570
01580     I6:    D=C;
01590            PUT EDIT(INDX(P),NOX(P)) (COLUMN(15),A,COLUMN(65),A);
01600            L=L+1;
01610            IF L<54 THEN GO TO I7;
01620            PUT PAGE LINE(2);
01630            L=2;
01640     I7:    IF C¬=SUBSTR((P+1),1,2) THEN GO TO I1;
01650            P=P+1;
01660            IF P>N THEN GO TO I8;
01670            GO TO I6;
01680            L=L+1;
01690            IF L<54 THEN GO TO I7;
01700            PUT PAGE LINE(2);
01710            L=2;
01720
01730    I8:     IF CHK=16 THEN GO TO I10;
01740            M=16-CHK;
01750            DO S=1 TO M;
01760            IF CHK>16 THEN GO TO I10;
01770            CHK=CHK+1;
01780            PUT SKIP(3);
01790            PUT EDIT(DIV(CHK)) (COLUMN(10),A);
01800            L=L+4;
01810            PUT EDIT('NOT USED') (COLUMN(15),A);
01820            L=L+1;
01830            IF L<54 THEN GO TO I8;
01840            PUT PAGE LINE(2);
01850            L=2;
01860    I9:     END;
01870
01880    I10:     END FIVE;
END OF DATA
```

REFERENCES CITED

1. Victor O. Schinnerer and Company, "Quality Control in the preparation of Specification" (Washington, D. C.: By Author, 1972), p. 1.

2. C. Herbert Wheeler, Jr., et. al., Emerging Techniques of Architectural Practice (Washington, D. C.: The American Institute of Architects, April 1966), P. V.

3. G. Neil Harper, Computer Applications in Architecture and Engineering (New York: McGraw-Hill Company, 1968) p. 32.

4. IBID., p. 33.

5. Arthur W. Brown, "CSI-Beyond 'the Domain', "The Construction Specifier (August 1973), p. 43.

6. The Construction Specification Institute, "CSI Format - Master List of Specification Section Titles," Manual of Practice (Washington, D. C.: By Author, September 1972), p. 5.

7. IBID, p. 5.

8. The Construction Specification Institute, "Methods of Specifying the 'General' Section Part," Manual of Practice (Washington, D. C.: By Author, October 1970), p. 3.

9. The Construction Specification Institute, "Methods of Specifying Products: A Comparison," Manual of Practice (Washington, D. C.: By Author, August 1970), p. 3.

10. The Construction Specification Institute, "Methods of Specifying the 'Execution' Section Part," Manual of Practice (Washington, D. C.: By Author, October 1970), p. 3.

11. The Construction Specification Institute, "Methods of Specifying the General Section Part," p. 3.

12. The Construction Specification Institute, et. al., Uniform Construction Index (Washington, D. C.: By Authors, 1973), p. 0.3.

13. The Construction Specification Institute, "Using a Master Specification," Manual of Practice (Washington, D. C.: By Author, July 1973), p. 3.

14. Brown, "The CSI - Beyond 'the Domain'," p. 43.

15. The Construction Specification Institute, "Using a Master Specification," pp. 7-8.

16. "Automated Specification Processes Save Time," Architectural Record (January 1968), p. 93.

17. International Business Machine Corporation, "The IBM Magnetic Tape Selectric Typewriter," (Marketing brochure printed by the author, location unknown, 1973), p. 2.

18. Frank L. Cordella, "Specifications Quicker and Easier," AIA Journal (Vol. LII, October 1969), p. 42.

19. International Business Machine Corporation, "The IBM Mag Card II".

20. PSAE, "MASTERSPEC - the Automated Master Specification System," (Marketing brochure printed by the Author, 343 South Dearborn Street, Chicago Ill.), p. 3.

BIBLIOGRAPHY

Ackoff, Russell L. and Maurice W. Sasieni, Fundamentals of Operations Research, New York: John Wiley and Sons, Inc., 1968.

Alpert, D. and Bitzer, D. L., "Advances in Computer-based Education," Science, Vol. 167 (March 20, 1970), pp. 1582-1590.

The American Institute of Architects, ed., "Specifications," Architects Handbook of Professional Practice. Washington, D. C.: By Author, 1735 New York Avenue, H. W., 1969.

"Automated Specification Processes Save Time." Architectural Record, January 1968, pp. 93-94.

Barnett, Jonathan, "Will the Computer Change the Practice of Architecture?," Architectural Record, January 1965, pp. 143-150.

Barron, Maurice, "Computers: New Decision Making Tool for Managing the Professional Office," Progressive Architecture, July 1971, pp. 76-77.

Bates, Frank and Mary L. Douglas, Program Language One. 2nd ed., Englewood Cliffs, New Jersey: Prentice-Hall, Inc.,

Bernholtz, Allen, "Systematic Design by Computer," Architectural and Engineering News, March 1968, p. 42-43.

Brown, Arthur W., "CSI-Beyond the Domain," The Construction Specifier, Vol. 26, August 1973, pp. 43-47.

Cameron, Tom, "At the Crossroads", The Construction Specifier, Vol. 26 (August 1973) p. 170-72.

Campbell, Jr., Carl M., "The Machine Takes Command: A Forecast," Architectural and Engineering' News, March 1968, p. 44-45.

Codella, Frank L. "Specs Quicker and Easier", AIA Journal, Vol. LII, (October 1969), p. 42.

Collier, Ronald L., Interoffice Critical Path Scheduling of Projects in an Architectural Firm (Blacksburg, Va.: unpublished paper, March 1972).

"Computer Programs to Share," AIA Journal, XLIX (April 1968), p. 94.

The Construction Specification Institute, et. al., Uniform Construction Index. Washington, D. C.: By the Authors, 1150 17th Street, N. W., 1973.

The Construction Specification Institute, Manual of Practice, Washington, D. C.: By Author, 1717 Massachusettes Avenue, N. W., (individual Chapters have varying publishing dates).

Creamer, John M., "Reducing Specification Rewriting," Architectural and Engineering News, September 1966, pp. 33-34.

Donnelly, Jr., James H.; Gibson, James L.; Ivancevich, John M. Fundamentals of Management - Functions, Behavior, Models, Austin, Texas: Business Publications, Inc., 1971.

Ebert, Carl J., "The Specification Writer - Then and Now," The Construction Specifier, Vol. 26, May 1973, p. 40.

Forte, Allen, SNOBOL 3 Primer - An Introduction to the Computer Programming Language, Cambridge: The MIT Press, June 1968.

Harper, G. Neil, Computer Applications in Architecture and Engineering, New York: McGraw Hill Company, 1968.

Hattis, David B. and Thomas E. Ware, The PBS Performance Specification for Office Buildings. Report to the Office of Construction Management, Public Building Service, General Services Administration, Washington, D. C., January 1971 (revised September 1971). Washington, D. C.: Government Printing Office, 1971.

"Information Retrieval for Design and Specification." Architectural Record, May 1970, pp. 65-66.

"Information Please," Architectural and Engineering News, pp. 34-36.

International Business Machine Corp., Computing Systems Fundamentals Text - Unit I. Endicott, New York: By the Author, IBM DPD Educational Development, Educational Center, 1967.

International Business Machine Corporation, The IBM 3270 Information Display System --- More Than Meets the Eye, White Plains, New York: By Author, Data Processing Division, 1133 Westchester Avenue, April 1971.

International Business Machine Corporation, "The IBM Communicating Magnetic Card Selectric Typewriter" (marketing brochure printed by author, location unknown, 1973).

International Business Machine Corporation, "The IBM Magnetic Tape Selectric Typewriter" (marketing brochure printed by Author, location unknown, 1973).

International Business Machine Corporation, IBM System/360 Operating System: Time Sharing Option Command Language Reference, (File No. S360-36, Order No. GC28-6732-2), White Plains, New York: By Author, Data Processing Division, 1133 Westchester Avenue, 1972.

International Business Machines Corporation, IBM System/360 Operating System: Time Sharing Option Terminal User's Guide, (File No. S360-36, Order No. GC28-6763-0), White Plains, New York: By Author, Data Processing Division, 1133 Westchester Avenue, 1971.

International Business Machine Corporation, IBM System/360 PL/1 Subset Reference Manual, (Form No. C28-8202-0, File No. S360-29), White Plains, New York: By Author, Data Processing Division, 112 East Post Road, 1967.

International Business Machine Corporation, "May Card II Typewriter" (marketing brochure printed by Author, location unknown, 1973).

International Business Machine Corporation, "Word Processing Equipment" (marketing brochure printed by Author, location unknown, 1973).

McCracken, Daniel D. and William S. Dorn, Numerical Methods and Fortran Programming with Application in Engineering and Science, New York: John Wiley and Sons, Inc., 1964.

McGuire, Joseph J., "Learning Specifications as a Design Tool," The Construction Specifier, Vol. 26, May 1973, p. 62-65.

Meir, Hans W., "In-House Specification Systems," The Construction Specifier, Vol. 26 (October 1973) p. 12.

Meier, Hans W., "Plain Language Specifications," The Construction Specifier, Vol. 26 (April 1973) p. 46.

Meir, Hans W., "Plug-in Specification," The Construction Specifier, Vol. 26 (September 1973) p. 22.

Milne, Murray, "From Pencil Points to Computer Graphics, "Progressive Architecture, June 1970, pp. 168-177.

Monk, Kenneth W., "Cost Consulting with the Computer," Architectural and Engineering News, March 1968, p. 38-41.

Production Systems for Architects and Engineers, "This is Masterspec," Washington, D. C.: By Author, 1785 Massachusettes Avenue, H. W. November 15, 1972.

PSAE, "Masterspec - the Automated Specification System," Marketing brochure printed by the Author, 343 South Dearborn Street, Chicago, Ill..

Riggs, Benard Dean, "Language Fundamentals: A Basic Tool," The Construction Specifier, Vol. 26 (July 1973) p. 14-15.

Rosen, Harold J., Specification Guide Stanford, Conn.: Reinhold Publishing Corporation, 1972.

Schruben, A.I.A., John H. "Here is Masterspec." AIA Journal Vol. 54, No. 4 (October 1970), pp. 45-49.

Schruben, John H., "Information Memorandum," (Informational letter on the MASTERSPEC System, from Production Systems for Architects and Engineers, Inc., 343 South Dearborn Street, Chicago, Illinois, July 1, 1970).

Schruben, John H., AIA, CSI and Harper, G. Neil, "Computer Controls Costs," Architectural and Engineering News, March 1968, p. 37.

Schruben, John H., A.I.A., CSI and Harper, G. Neil, "Specifications On Tape", Architectural and Engineering News, March 1968, p. 30-31.

Schinnerer, Victor O. and Company, "Quality Control in the Preparation of Specifications," Location Unknown: By Author, pp.1-3.

Stewart, Clifford D. and Kaiman Lee, "Can a 54-year-old architectural firm find romance and happiness with an interactive computer system?," Progressive Architecture, July 1971, pp. 64-73.

Taha, Hamdy A., Operations Research, New York: The MacMillan Company, 1971.

Tomson, Bernard and Norman Coplan, It's the Law, Stanford, Conn: Reinhold Publishing Corporation, 1972.

Virginia Tech Computing Center, TSO User's Guide - Computing Center Publication for System User, Blacksburg, Va.: Systems Information Division, August 15, 1972.

VPI & SU Student Chapter of the ACM, Computers in Communication (Selected papers from Virginia Computer User's Conference, Blacksburg, Virginia, March 1972).

Wheeler, Jr., C. Herbert, et.al., Emerging Techniques of Architectural Practice, Washington, D. C.: The American Institute of Architects, April 1966.

The two page vita has been removed from the scanned document. Page 1 of 2

The two page vita has been removed from the scanned document. Page 2 of 2

MSPEC/TSO:
ARCHITECTURAL SPECIFICATION MANAGEMENT UTILIZING THE IBM TIME SHARING OPTION

by

Ronald Lee Collier

(Abstract)

In view of the shift of emphasis of the architectural practicioner's responsibility from environmental design for which he was trained to that of business management, especially in areas of contract document production, the possibility of relieving the practicioner from one time consuming activity, that of specification production, was investigated. Specifically, the possibility of automation of the task was a major consideration.

A procedure for the incorporation of the computer was developed. This procedure, entitled MSPEC/TSO, includes several recent developments in construction communication; namely, the CSI Format and the Uniform Construction Index. MSPEC/TSO consists of several original computer programs used in combination with the IBM System/360 Time Sharing Option for use with remote computer terminals. The procedure for operation was designed to be conversational with the operator, so as to be capable of operation by a clerical staff member.