A review of computer pedagogy in selected Western Region architecture schools and its relevancy to entry level employment in Las Vegas firms

Shelly Ann Hayden
University of Nevada, Las Vegas

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A REVIEW OF COMPUTER PEDAGOGY IN SELECTED WESTERN REGION ARCHITECTURE SCHOOLS AND ITS RELEVANCY TO ENTRY LEVEL EMPLOYMENT IN LAS VEGAS FIRMS

by

Shelly Ann Hayden, CSI, CDT

A thesis submitted in partial fulfillment of the requirements for the degree of

Masters Of Architecture

in

Architecture

College of Architecture
University of Nevada, Las Vegas
May 1995
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May 1995

ii
ABSTRACT

This study investigated the integration of computer education into architectural curricula in the Southwestern U.S. and the extent to which this education affects the ability of graduates to obtain entry-level positions in architectural firms in the Las Vegas, Nevada area. The study had three goals: (1) to provide university administration, faculty, and students with an understanding of how electronic technology and software can benefit architectural education; (2) to investigate the Southwest architectural computer curriculum structuring and offer any possible suggestions for change; and (3) to research local Las Vegas architectural firms and improve the chances for graduates to become more marketable in this computer age. This study presented research of literature concerning computer use in architecture and current thought on the subject of manual versus computer methods in architectural education. The study's methodology consisted of surveys of schools and firms, researching issues such as: (1) extent to which computers were taught in the Southwestern architecture schools; (2) the use of computers in Las Vegas architecture firms; (3) the hiring practices of these firms; and (4) the extent to which the skills taught in schools met the requirements sought by architects hiring new employees. The findings of the research showed that architecture schools were teaching primarily manual methods of architectural presentation, while firms in Las Vegas increasingly generated work by computer and required new hires to be able to use computers in architectural applications. From the research, recommendations were formulated regarding the integration of computers into architectural curricula.
## TABLE OF CONTENTS

### VOLUME I: WRITTEN THESIS

#### PART 1

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>APPROVAL SHEET</td>
<td>ii</td>
</tr>
<tr>
<td>ABSTRACT</td>
<td>iii</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>vii</td>
</tr>
<tr>
<td>LIST OF GRAPHS</td>
<td>viii</td>
</tr>
<tr>
<td>ACKNOWLEDGEMENTS</td>
<td>iv</td>
</tr>
<tr>
<td>CHAPTER 1: STATEMENT OF PROBLEM</td>
<td>1</td>
</tr>
<tr>
<td>Background Rationale Of The Study</td>
<td>1</td>
</tr>
<tr>
<td>Difference Between Academic Instruction And Architectural Practice</td>
<td>3</td>
</tr>
<tr>
<td>Computer Use In Firms</td>
<td>3</td>
</tr>
<tr>
<td>Computer Instruction In Architecture Schools</td>
<td>4</td>
</tr>
<tr>
<td>Response of The Profession</td>
<td>6</td>
</tr>
<tr>
<td>Goals Of This Study</td>
<td>9</td>
</tr>
<tr>
<td>Methodology</td>
<td>11</td>
</tr>
<tr>
<td>CHAPTER 2: REVIEW OF AVAILABLE LITERATURE</td>
<td>12</td>
</tr>
<tr>
<td>The Architectural Profession</td>
<td>13</td>
</tr>
<tr>
<td>Ethical Responsibilities In Architectural Practice</td>
<td>14</td>
</tr>
<tr>
<td>History Of Technological Training In Architecture</td>
<td>16</td>
</tr>
<tr>
<td>Current Architectural Training and Licensure</td>
<td>20</td>
</tr>
<tr>
<td>Professional Versus Technician Tasks</td>
<td>23</td>
</tr>
<tr>
<td>Computers In Society and In Architecture</td>
<td>25</td>
</tr>
<tr>
<td>Current Computer Use In The U.S.</td>
<td>25</td>
</tr>
<tr>
<td>Computer Use In Architecture</td>
<td>26</td>
</tr>
<tr>
<td>Benefits Of Computers</td>
<td>29</td>
</tr>
<tr>
<td>Future Considerations</td>
<td>31</td>
</tr>
<tr>
<td>Computer In Architectural Education</td>
<td>32</td>
</tr>
<tr>
<td>Critique Of Computerization In Schools</td>
<td>33</td>
</tr>
<tr>
<td>CHAPTER 3: METHODOLOGY</td>
<td>37</td>
</tr>
<tr>
<td>Scope Of The Study</td>
<td>37</td>
</tr>
<tr>
<td>School Delimitations</td>
<td>38</td>
</tr>
</tbody>
</table>
TABLE OF FIGURES

FIGURE 1: AIA Ethical Canons .................................................. 15

FIGURE 2: Ranking of Southwest Colleges With Emphasis on Computers ... 93
**TABLE OF GRAPHS**

<table>
<thead>
<tr>
<th>GRAPH 1: Computers In The United States</th>
<th>25</th>
</tr>
</thead>
<tbody>
<tr>
<td>GRAPH 2: Use Of Software Within Firms By Firm Size</td>
<td>28</td>
</tr>
<tr>
<td>GRAPH 3: Use Of CAD Software In Firms</td>
<td>29</td>
</tr>
<tr>
<td>GRAPH 4: Students Enrollment In Southwestern Architecture Schools</td>
<td>45</td>
</tr>
<tr>
<td>GRAPH 5: Population Of Universities Cities</td>
<td>45</td>
</tr>
<tr>
<td>GRAPH 6: Date Of College Establishment</td>
<td>46</td>
</tr>
<tr>
<td>GRAPH 7: Annual Tuition</td>
<td>46</td>
</tr>
<tr>
<td>GRAPH 8: Ranking Of Requirements For Recent Graduates</td>
<td>75</td>
</tr>
<tr>
<td>GRAPH 9: Firm Size Relating To Technical Staff</td>
<td>76</td>
</tr>
<tr>
<td>GRAPH 10: Number Of Graduates LV Firms Hired In The Past 5 Years</td>
<td>76</td>
</tr>
<tr>
<td>GRAPH 11: Computer Software Used By LV Firms For Design</td>
<td>77</td>
</tr>
<tr>
<td>GRAPH 12: Computer Software Used By LV Firms For Production</td>
<td>77</td>
</tr>
<tr>
<td>GRAPH 13: S.W. Architecture Schools Ranking Of Computer Emphasis</td>
<td>94</td>
</tr>
<tr>
<td>GRAPH 14: Percentage OF LV Firms Using Computers</td>
<td>96</td>
</tr>
</tbody>
</table>
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Shelly Ann Hayden
CHAPTER 1

STATEMENT OF THE PROBLEM

The use of computers in the United States has become universal in the fields of business, technology, and academic research. The architectural profession has also adopted the use of computers to a great extent, using them to produce construction documents and renderings, and also as tools in the design process. Computers are replacing the traditional manual methods of producing architectural documents. However, the education of architects has not kept up with the technology used in the profession. Some architecture schools are producing graduates without the skills needed to use these computerized tools, even though computers are becoming the standard in the profession. This study researched computer instruction in architectural schools, and the success of the schools in preparing graduates with the computer skills needed to obtain architectural jobs. This study specifically focused on computer education in architecture schools in the southwestern United States and how it affected employment opportunities in Las Vegas architectural firms.
BACKGROUND RATIONALE OF THE STUDY

The idea for this study came from the frequent references by professional architects in the Las Vegas valley to the lack of computer skills among recent architecture school graduates. At the time of the study, firms became ultimately computerized. Architects seeking graduates from entry-level jobs found that these graduates did not have the computer skills needed to become effective producers in their firms, which had become increasingly computerized. Because of the shortage of computer-literate local personnel, firms often needed to recruit workers from out of state, or had to train others who already had the technical knowledge of construction, such as senior draftsmen, in the use of computers. University faculty members in Las Vegas who were practicing architects and who used computers emphasized the need for computer skills. However, those faculty who did not use computers in their practice downplayed the need for computer education in architecture schools, with the general opinion that computer education took curricula away from the design skills essential to producing effective architects.

These observations brought out many questions about the use of computers in architecture. These questions addressed how computers should be used in architecture, how they will be used in the future, and whether architecture schools should teach computer skills. If it is appropriate for architecture schools to teach
computer skills, there are many questions about how computers should be integrated into architectural courses. These issues were the basis for this study.

Differences between academic instruction and architectural practice

Computer use in firms

The survey of Las Vegas architectural offices in this study showed a large range of computer use, from no use to complete computerization. The study showed that architects had very different views about the desirability of computers in architecture according to whether they used computers in their own practice. The information gathered showed that the trend in Las Vegas was toward more computer use and that offices using mostly hand drawing were becoming rare. This study focused on showing the full range of firms who used computers to different degrees, from little use to complete computerization.

Computers were used in the majority of Las Vegas firms surveyed. By keeping an informal log of classified advertisements in the Las Vegas Review-Journal, the author found that the most Las Vegas firms seeking graduates to hire looked for persons who had at least three years' experience in computer drafting.
As pointed out by the editors of *Architecture* magazine, firms wish to hire persons who can immediately contribute in terms of productivity and profit rather than people who need to be trained (Canty 1987, 29). This was the same view found by the survey of Las Vegas architects conducted in this study. Many of the architects stated that their main concern when hiring a potential employee is the candidate's computer drafting background, which was driven by the economics of having to train new personnel in computer usage. Some said that computer knowledge was more a requirement than design skills. This was a recurring comment, based on the fact that firms simply needed greater numbers of personnel in the production side of the operation than in the design side. These Las Vegas firms mostly hire their new employees from architecture schools in the southwestern region. For these students who decide to work in Las Vegas, success in finding a job depends on the kind of computer skills taught in the southwestern schools of architecture.

**COMPUTER INSTRUCTION IN ARCHITECTURE SCHOOLS**

The survey of firms showed that graduates need computer skills, but the survey of architecture schools in the southwest showed that schools do not emphasize computer use. Computer courses were available in most of the schools, but they were usually not a requirement for graduation. In most cases, students received
only a small amount of computer training - usually only an introductory course, as was verified by the surveys conducted in this study - which did not give them the proficiency needed to enter the workforce as a productive computer user in an architectural firm. These findings agree with nationwide trends identified by researchers such as the Association for Computer-Aided Design in Architecture (ACADIA) and commentators in the national professional journals such as *Architecture*, *Architectural Record*, and *Progressive Architecture*. A report published by ACADIA found that while most U.S. schools of architecture have computers and teach courses in CAD, the design studio has proven to be resistant to the integration of computers (Rogers 1989, 336). The design studio is considered to be the most important class in the architectural curriculum (Novitski Jan 1991, 103). David L. Mackey of Ball State University identified several factors leading to resistance to integrating computers into the design studio. Some faculty members trained in traditional manual methods fear that computerization threatens to push out traditional training in the studio, both in methods and course content (Mackey 1992, 65). Reasons cited for this often include the idea that computerization will focus education on the manipulation of the machine to the exclusion of more important architectural matters, while traditional methods develop hand-eye coordination and creative aesthetic skills. The cost of outfitting studios with computers has also been a barrier, although this may become less significant
as computer prices continue to drop (Rodgers 1989, 336). Other reasons are the difficulty of learning new methods for the faculty, the specific decisions that must be made on how to integrate computer use into courses.

Architectural education in the U.S. concentrates on design rather than production (Novitski Jan 1991, 103). However, this study found that beginning intern architects in Las Vegas are assigned mainly to production tasks, where computerization is used the most. The lack of computer training in the architecture schools therefore has resulted in the fact that graduates are not prepared for their first jobs. This study found that more integration of computers into architectural education would bring architects' training to a better match with current practice in the profession. Chapter 5 of this study discusses in more detail the factors that affected integration of computers in the curriculum. The last chapter lists recommendations for computer integration in architecture schools.

RESPONSE OF THE PROFESSION

The architectural profession has recognized that computers have become prevalent in practice, and that education has not kept up with this technology. *Progressive Architecture* (PA) has advocated increased computer training in architectural schools, but stated that instructors are mostly still biased toward
traditional manual methods. Mackey has advocated greater use of computers in the design studio, stating "educators need to accept, without judging it right or wrong, or better or worse, that ... the professional lives of today's students will be dominated by such electronic information/design technology" (Mackey 1992, 65). It is still most important that the studio be taught by designers who know computers, rather than computer experts (Neeley sept 1991, 59). Therefore, studio faculty members need to learn to use computers and the many diverse design programs available to encourage students to explore the multidisciplinary features the computer offers.

*Architecture* magazine published a profile of architectural education that showed a wide divergence between schools and practitioners in the way they view architecture. Schools tend to be deeply concerned with theory at the expense of practical issues, while the profession tends toward pragmatism. Because this gap exists, the students are not leaving the academic environment with the skills they need to be productive in the professional arena. The American Institute of Architects (AIA), which publishes *Architecture* and is the main professional organization of architecture in the U.S., suggests that a priority must be established in architectural education to bring it back to common ground with practitioners (Canty 1992 Aug, 29). However, a debate rages about how this can be accomplished. The current trend is for schools to introduce computer courses as
separate courses, but this will not prepare students or faculty for the coming state of the profession, and does not allow users to take full advantage of the possibilities of computerization. Educators who resist computerized instruction often feel that computerization fails to support the skills needed for advanced design education and can even serve as a barrier to teaching these skills. Computerization appears, as Mackey suggests, to "change the thinking, decision, and design process" such that "the changes are analogous to the differences in cultures, traditions, societal values, and architectural vocabulary observed in differing regions of the world and over time." But the view also exists that suggests architectural education in the future will be based on computer methods, and that educators should gain computer familiarity now in order to be able to deal with the changing curricula (Mackey 1992, 67-69).

The National Architectural Accreditation Board (NAAB), which accredits professional architectural degree programs, also endorses the importance of computers in the profession and requires universities to offer classes in automation. The NAAB’s "1991 Conditions and Procedures" requires schools to teach graphic communication skills and lists the criterion that students "be able to use computer technology in the display and use of information, images, and architectural design" (NAAB 1991, 20). However, this criterion apparently is not applied as a strong requirement, since many accredited architecture programs offer computer classes
as electives but do not require students to take them (see Chapter 4, A Review of Southwest Architecture Schools). Therefore, some Southwestern universities allow students to complete their academic career without once drawing with a computer. This fact shows throughout the Southwestern schools surveyed: all the schools offer computer courses, but only about 20 percent of them require those courses for graduation.

In summary, the professional organizations agree that education needs to be brought to some common ground with practitioners. Universities want students to be trained in theory, methods, history, skills and structured knowledge. Firms want to make a profit by employing students with these skills and with computer proficiency. The profession realizes that students must gain additional knowledge on the job that they did not learn in school, and has set up an Intern Development Program (IDP) by way of the National Council of Architectural Registration Boards (NCARB) to teach students the knowledge they need to be competent architects (AIA/NCARB 1993, 7). The problem is that schools are not teaching enough computer skills to allow graduates to obtain those first jobs. This was proven in the surveys conducted of the Southwestern schools, which showed that only eight of thirteen schools required computer courses, and in the survey of Las Vegas architectural firms' needs, which confirmed that Las Vegas firms wanted evidence of computer knowledge if they were to hire a recently graduated student. NCARB
will also be computerizing its architectural licensing exam in February 1997, which is another sign that it recognizes the importance of computers in architecture (James 1994).

This study showed there was a gap between the computer skills that Las Vegas architecture firms seek in hiring entry-level professional personnel and those provided by architectural schools in the southwestern U.S. Through the surveys conducted, Las Vegas firms sought students that were very skilled in 2-D CAD programs, and the Southwestern universities often required only one semester of introductory computer course work. The study found that this limited exposure to computers was insufficient to meet the needs of the prospective employers. Chapters 4 and 5 present in detail the research and surveys conducted and the conclusion drawn.

GOALS OF THIS STUDY

The first goal of this thesis was to provide university administration, faculty, and students with an understanding of how electronic technology and software can benefit architectural education. The second goal was to investigate the structuring of architectural computer curricula in the Southwestern schools and offer any possible suggestions for change. The final goal was to research Las Vegas
architectural firms and provide suggestions to improve the chances for graduates to become more marketable in this computer age.

**METHODOLOGY**

The author conducted an extensive review of literature that consisted of major journal articles and numerous books on the topic. The thirteen Southwestern universities with architecture programs were surveyed regarding their computer curriculum. Fourteen Las Vegas firms were surveyed and many interviewed in depth regarding their practical orientation, design philosophy, extent of computer use, and hiring procedures. The schools were rated numerically to identify the strengths and weaknesses of their computer instruction. The resulting information was tabulated to identify which factors may have a positive or detrimental effect on a school's ability and willingness to provide students with computer training within the architectural curriculum. (See the Appendix for questionnaires and lists of interview questions asked.) For more information on the methodology utilized for this thesis, see Chapter 3, Methodology and Analysis of Data.
CHAPTER 2

REVIEW OF AVAILABLE LITERATURE

Literature relating to the subject of computers in architectural education concerns three major topics. The first is the nature of the architectural profession, specifically the work tasks performed in the profession and the skills and technological training required to perform these tasks. This topic provides an explanation of how computers can be utilized in architectural tasks and how architects' training can incorporate computer training. The second area is the topic of computer technology and usage in contemporary society in general, in business, and in architecture, including historical use, current trends, and future projections. This is important because it indicates patterns of how tasks can be automated and how individuals' contact with computers in various settings can translate into their use in architectural tasks. The third topic is the specific application of computers in architectural education, including theoretical discussions and practical applications.
THE ARCHITECTURAL PROFESSION

An overview of the profession of architecture will help explain the role of computers in architecture, and will also explain some of the barriers that have obstructed the adoption of computerized instruction in architectural schools.

"Profession" versus "Occupation"

The importance of architecture as a profession, and the need for standards for its practice, was acknowledged in the U.S. with the establishment of the American Institute of Architects (AIA) in 1857, and with the adoption of the first state architectural licensing law in Illinois in 1897 (Cuff 1992, 5). Because architecture is considered a "profession" rather than just an occupation, there is a broad range of theoretical goals, responsibilities, and ethical obligations associated with the work of architecture. The profession and those within it must ascribe to the goal of improving mankind rather than seeking individual self-improvement, or personal beneficial gratification (Filson 1985, 59). Professionals are expected to conform to behavioral standards, which include rules of professional conduct and standards of ethical behavior (Haviland 1988, 1.5-1). Professionals have an ethical duty to
improve their communities, because they possess knowledge that is not accessible
to the general public. _AR_ defines the profession as follows:

First, that a profession is intellectual, and requires a professional to exercise
judgement and to deal with a long commitment to learning, and creates a
long and often arduous path towards becoming a professional... Second, the
profession must be practical - its knowledge needs to be applied to reality
and real concerns. Third, a profession has techniques and/or skills that can
be defined, taught, and that serve as mechanisms for transferring and
utilizing the knowledge of any particular profession... Fourth, a profession
must be organized into associations and/or groups of practitioners. (Filson,
1985, 59).

The theoretical orientation of the profession can make the practical aspects of the
work, including the technical work of producing documents, seem mundane or
unimportant. This study found that this theoretical orientation was sometimes a
barrier to serious interest in teaching computer skills in architecture schools.

ETHICAL RESPONSIBILITIES IN ARCHITECTURAL PRACTICE

An important aspect of the high standards required of architects as professionals
is a responsibility for certain ethical standards and conduct. As a registered
professional, the architect assumes responsibility for following ethical obligations
that are outlined by professional organizations and by government bodies having
authority for licensure. The American Institute of Architects (AIA) has issued a
Professional Code of Ethics that members of the association are obligated to follow.
This code is broken down into five canons that explain the professional responsibilities to the public, client, discipline, profession, and colleagues. These Canons are listed in Figure 1 (Harmon and Siena 1992, 5). Canon One, which urges members to advance in their knowledge of the "art and science" of the profession and contribute to its growth, can be applied to the computerization of architectural practice, recommending that architects acquire knowledge of the most up-to-date technology available for accomplishing their work.

As with architects in the profession, accredited architecture schools must also abide by ethical responsibilities according to the NAAB Conditions and

<table>
<thead>
<tr>
<th>Canon I: General Obligations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Members should maintain and advance their knowledge of the art and science of architecture, respect the body of architectural accomplishment and contribute to its growth; learned and uncompromised professional judgment should take precedence over any other motive in the pursuit of the art and science of architecture.</td>
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</table>

<table>
<thead>
<tr>
<th>Canon II: Obligations to the Public</th>
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<tr>
<td>Members should embrace the spirit and letter of the law governing their professional affairs and should thoughtfully consider the social and environmental impact of their professional activities.</td>
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<thead>
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<th>Canon III: Obligations to the Client</th>
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<tr>
<td>Members should serve their clients competently and in a professional manner, and should exercise unprejudiced and unbiased judgment on their behalf.</td>
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<th>Canon IV: Obligations to the Profession</th>
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<tr>
<td>Members should uphold the integrity and dignity of the profession.</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Canon V: Obligations to Colleagues</th>
</tr>
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<tbody>
<tr>
<td>Members should respect the rights and acknowledge the professional aspirations and contributions of their colleagues.</td>
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</table>

Figure 1: AIA Ethical Canons

Source: AIA Handbook
Procedures. Each institution must first provide the public with clear and accurate information regarding the school's accreditation status. Second, the program must provide evidence that every student has access to all the diverse educational environments provided. Finally, any evidence of plagiarism or falsifying information constitutes a breach of academic integrity (NAAB 1991, 12). To these official requirements may be added the ethical responsibility of schools to provide students with the skills necessary to enter the practice of architecture, which is the topic of this study.

HISTORY OF TECHNOLOGICAL TRAINING IN ARCHITECTURE

The incorporation of computers into architectural training is part of the larger issue of incorporating technological advances into the training of architects. While architecture has continually embraced technological advances throughout history, with technology and design being inseparable for centuries, the training of architects in modern times has tended to lag behind the advances being incorporated into architectural practice. A survey of how technological advances have been incorporated into architects' training in past times will shed light on the subject of integrating the advances of computerization into the training of modern architects.

Throughout history, advances in technology and architectural theory have
forced architects to learn new methods of construction, new forms of representation or style, and new ways of conveying their ideas. One of the most influential and earliest theorists on architectural technology and architects' training was Marcus Vitruvius Pollio. A Roman architect of the first century B.C. who had received his architectural training as a military engineer, he contributed greatly to the profession by writing a ten-volume book "De Architectura", which contained his experiences of Greek architecture, extensively covering historical, formal, and practical matters. The first volume discussed the training of architects and what processes he felt needed to be followed. Since no other books on architecture were written for many years, this book would be studied as a standard in the profession for centuries to come (Kostof 1977, 37).

In the Renaissance time a broad general education was the basis for architectural practice. This education allowed artisans to gain knowledge of perspective and mathematics and then that artisan could become an architect. The only formal training that Renaissance architects has in common was disegno, or drawing and perspective. This training was gained in a studio of another architect.

In the late seventeenth century, France opened the first official school of architecture, the Royal Academy of Architecture, which significantly altered architectural practice as it was known then. The French monarch, Francis, interested in the quality of education provided at this school, commissioned Serlio
to write several books on architecture that would be use by the school administration. This academy completely changed architects training in that they now learned abstract principles of design. This education concentrated on developing the beauty of architecture; technical matters were learned later through experience with the Royal Building Administration. The instruction in the Royal Academy influenced architectural training in the other European countries in the eighteenth and nineteenth centuries (Kostof 1977, 177).

In the early nineteenth century, a state-directed school was opened in Paris, known as L'Ecole des Beaux-Arts. This school was founded on the basis of setting a higher and more uniform standard for architectural training (Kostof 1977, 197). The ultimate role of the Beaux-Arts was to raise the status of the profession through a more rigid and formalized curriculum. Although it is imputed with reviving historical building styles, the philosophy of the Beaux-Arts was not to copy ancient buildings but to compose new styles through studying a wide variety of sources. The orientation of the Beaux-Arts was overwhelmingly with the aesthetics of architecture, dealing very little with the technological aspects of construction and marking the point at which modern architecture began to divorce aesthetics from technology. Many American architects would come to the school during the 1800's to receive their training because of the lack of schools of architecture in the United States.
An opposing theory concerning the integration of technological training into architectural education arose later in Germany with the Bauhaus, which was established in 1906. Bauhaus instruction focused on technology rather than historical aesthetics. Walter Gropius, its founder, believed that all artists (which included architects) were craftsmen, and that total design should be taught to students of these disciplines. Bauhaus instruction thus concentrated heavily on knowledge of materials and their manipulation. Chronologically situated in the early modern era of technology, the Bauhaus had an enthusiasm for industrial manufacturing processes and the products that came from them. Design of various kinds of practical objects incorporating the latest in modern technology was taught to students in all disciplines, including prospective architects. Aesthetic style was seen as deriving from efficient function, as with the machines and vehicles produced by modern technology; historical references were rejected as irrelevant to modern life (Fletcher 1987).

Comprehensive architectural training in the U.S. was unavailable until the establishment of an architecture school at the Massachusetts Institute of Technology (MIT) in 1897. U.S. architectural education in the twentieth century was influenced by both the Beaux-Arts and the Bauhaus. The teachers at MIT were trained at the Ecole des Beaux Arts and brought with them the Ecole's theories of architecture and its orientation of historical styles and aesthetics, which became the
standard in the U.S. Beginning in the 1930's, Gropius and many of his associates came to practice in the U.S. and to teach in American architecture schools, with the result that their theories overran the previous Beaux-Arts orientation. The Bauhaus model was used as the basis for structuring many U.S. curricula (Fletcher 1987).

This survey of how technology has been included in architectural education throughout history shows that technological training in architecture has needed to keep track with technological advances throughout the society of the day. This trend suggests that the general adoption of computer technology in contemporary society will and should be reflected in the practice of architecture and the education of architects.

CURRENT ARCHITECTURAL TRAINING AND LICENSURE

Modern societies in the developed world, including the U.S., require that their buildings not only meet acceptable standards for aesthetic appearance, but also are functional, safe and user friendly, and conform to numerous code requirements. To design these buildings, and to produce the detailed documents guiding their construction, architects must have a vast range of knowledge and training. To guarantee that architects have the required knowledge and ability needed to produce buildings that meet the standards, state governments and professional
organizations administer architectural testing and licensing programs. Requirements for an individual to become a licensed architect in the U.S. commonly include: (1) a professional degree in architecture, (2) a training or internship period (usually 3 years), and (3) passage of all sections of the Architect Registration Examination. (DOL 1994, 84).

The most well known characteristic of becoming an architect is a lengthy and sometimes arduous education (Cuff 1992, 2). This education allows the prospective architect to gain technical and theoretical knowledge required to practice architecture. Universities offer two professional degrees that provide students with the formal education required for licensure: the five-year Bachelor of Architecture (B.Arch.), the six-year Master of Architecture (M.Arch.). These degrees are usually recognized by the National Architectural Accrediting Board (NAAB), which is an independent organization formed to regulate educational requirements. The NAAB verifies that programs meet a minimum standard of requirements in design, technology, and practice as evaluated during review visits of schools by members of the board. (AIA-FB 1994, 52)

Upon receiving the professional degree the graduate enters the work force and is known as an intern-architect, one striving to become an architect in the future. The intern-architect registers with the National Council of Architectural Registration Boards (NCARB) in the Intern Development Program (IDP). This board
has its own set of standards for licensure, and the criteria vary according to the jurisdiction. Almost all state boards require architect candidates to complete IDP training to be eligible to take the licensing exams (AIA-FB 1994, 50). This internship period is approximately three years long and requires the candidate to show evidence of training in defined areas of the profession (see Appendix A).

When education and training are complete the candidate is eligible to apply to the state registration board for admission into the examination. The Architect Registration Examination (ARE) is prepared by NCARB, and was developed for nationwide usage. The candidate must pass all divisions of the ARE, which covers the following topics:

- predesign
- site design
- building design
- structural technology
- mechanical, electrical, plumbing, and acoustical systems
- materials and methods
- construction documents and services

(AIA-FB, 1994, 53). After the candidate passes all the sections of the examination the licensing board issues a license to practice architecture in the geographical area of its jurisdiction. The ARE will become computerized in February 1997, requiring that a candidate have at least basic computer skills to take the examination (James 1994).
"PROFESSIONAL" VERSUS "TECHNICIAN" TASKS

Modern architectural work may be broken into two major categories, drafting and designing. Drafting is a method of documenting building design, and requires a high level of accuracy and detail. Design is an activity that is creative, evaluative, and coordinative, which "brings into being something new and useful that had not existed previously" (Groninger and Kalisperis 1992, 27). This modern distinction between what many see as the "professional" work of designing versus the "technician" work of drafting is at the root of much opposition to the inclusion of computer training in architectural education.

Architectural offices in which new graduates will seek to begin their career are often organized so that the two types of work, designing buildings and developing the construction documents to erect those buildings, are separate processes performed by separate groups of employees. The separation can be seen in the different job titles used within firms; such as designer, draftsman (CAD operator), job-captain, senior draftsman, project manager and project architect. In small firms, all of these tasks must be accomplished with fewer employees, so each employee may have the opportunity to perform a greater range of design and documentation tasks. This greater opportunity also gives employees a greater responsibility to apply a broader range of knowledge and skills.
Firms generally assign recent graduates to work requiring a lesser range of knowledge and ability commensurate with their lesser experience, such as the "technician" work of drafting, graphic representation or rendering, or other small segments of the production of designs. The "professional" work of designing is usually assigned to the more experienced employees of a firm (DOL 1994, 85). As will be discussed in the next sections, architecture schools tend to concentrate on teaching the skills and knowledge needed for the "professional" aspect of the work, but new graduates tend to be assigned to the "technician" aspects of the work. Drafters traditionally have used pencil and paper to produce their drawings, they are increasingly turning to computer-aided design and drafting (CADD) technology to perform this task (DOL 1994, 84). While the design portion of architecture is generally performed by manual or computer methods at the worker's option, employers are requiring that the drafting part of the work be performed on computers. It follows that architectural school graduates who know CADD technology can be expected to find better entry-level opportunities in both the present and future job markets (DOL 1994, 85). The fact that architecture schools teach the "professional" design skills that do not require computer use in the contemporary architectural office, and that new graduates must have "technician" computer drafting skills to find their first jobs in Las Vegas, summarizes part of the conflict concerning the extent to which computer skills should be taught in
architecture schools.

COMPUTERS IN SOCIETY AND IN ARCHITECTURE

CURRENT COMPUTER USE IN THE U.S.

Computers today are found universally in many different forms in the fields of business, education, science, and home use. According to Colliers 1993 Encyclopedia, there are approximately 65 million personal computers in the United States, which include 4 million in schools, colleges, and universities and 29 million

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Graph 1: Computers In The United States

Source: 1993 Encyclopedia Britannica
in homes. These totals may increase 15 percent annually (Colliers, 1993). For a statistical calculation of personal computer usage from 1981 to 1991, refer to Graph 1 (Britannica, 1993). Computers in some form are present in almost all businesses (Colliers 1993). The benefit offered by computers has made them popular in office work, where large segments of the population become computer users, and retail sales, where computers are visible to almost all consumers. Perhaps this visibility has encouraged the public in general to accept new ideas of where computers may be useful. Computers are able to handle increasingly more sophisticated processes in all types of applications including architecture.

COMPANY USE IN ARCHITECTURE

Architectural applications for computers have been commercially available since the 1970’s but were not widely adopted because they were costly, difficult to use, inflexible in accomplishing the desired result, and slow. Architectural applications were not popularized until the 1980’s when microcomputers, which delivered sufficient power affordably, were combined with software that was reasonably easy to use. It is instructive to note that today's leading drafting software, AutoCAD, now used in more than half of architectural offices, was only introduced to the market in 1982 (Autodesk 1992, 647). Now as in the 1980’s,
architects use computers primarily to accomplish drafting. The idea of the "CAD operator" whose primary knowledge is of complicated computer equipment rather than architecture was abandoned along with the old-style computers and systems. The systems of the 1980's and beyond made computerized drafting and design intelligible enough that it was within reach of the person whose primary technical knowledge was in architecture. The profession soon agreed that persons performing drafting, even CAD drafters, still needed a technical knowledge of architecture as a primary requirement for producing architectural drawings. The "CAD Operator" has now been replaced by the draftsman skilled in the use of a computer as a drafting tool (DOL 1994).

Computer use in architectural firms has increased phenomenally. Reasons for this include the decreasing costs of computer hardware and software, as well as the increasing expectation in the business environment that architects produce their work in CAD format: for instance, state and federal governments increasingly require architects to submit computerized drawings upon completion of projects. Personal computers have revolutionized the way architectural services are accomplished in firms today. An estimated 47,000 personal computers were in use in architecture firms in 1991 (AIA-FS 1991). According to a 1994 AIA survey of firms, eighty-eight percent of architecture firms are now computerized; those firms that are not are mostly solo practitioners (AIA-FB 1994). Within these firms the
most commonly used software is word processing, followed by specification writing, and then CAD (Graph 2)(AIA-FB 1994). More than half of all architecture firms use CAD, including two-thirds of firms with computers (AIA-FB 1994). When only firms using computers are considered, these figures jump to 33 percent for conceptual design and 64 percent for construction documents (AIA-FB, 1994).

Computers working in the DOS environment (IBM compatible) are used by over 72 percent of firms with computers. Among CAD users, 65 percent of firms use AutoCAD software; all other packages trail significantly (Graph 3). Firms in the
U.S. have invested an estimated $537 million in computers in the past five years (AIA-FS 1991).

**BENEFITS OF COMPUTERS**

Computer software for architecture includes packages with three-dimensional graphics, photo-realistic renderings, animated walkthrough packages, and programs that help architects in the design stage. Software is available in other disciplines of
the profession such as specification writing, energy calculations, structural calculations, and load bearing factors. These types of software packages allow the architect or student to understand and visualize their projects better. As Professor Charles Rusch of University of Oregon stated, "...computer-aided design may not produce better designs, but the technology will produce better buildings because architects will understand them better" (Novitski 1993a, 151). Over the past few decades, the built environment is growing in complexity by requiring designs that are more energy efficient, healthier, conducive of productive work, and more responsive environmentally, socially, and culturally. As design solutions become more complex, the process requires a more demanding capacity for judgment and experience; it is imperative that designers use all means available to them, including the computer (Kalay 1993). The liability potentials of a design, including code compliance, accessibility issues, and other life safety factors make it imperative that a design be studied for all possible errors. The computer offers the designer a tool to investigate areas of the project that far exceed the capabilities of traditional means.

Aside from benefits concerning the technical aspects of design, computers offer the ability to construct computer models that allow clients a visualization of what their building will look like, inside and out, whether the observer is walking through or at rest (Kliment 1994, 9). Materials, textures, and design elements that
are in a photograph can be scanned into a computer file and integrated into the computer model (Thompson, 1991, 39). For example, if a client likes a particular carpet pattern, the designer can lay it out in the computer model of the building and allow the client to see the effect the carpet has on the space.

Furthermore, through the construction phase of a project, the computer allows constant and extensive professional supervision (Kalay 1993). With the difficulty of communicating increasingly complex matters in the field, architects can return to their offices and quickly generate additional information by computer, allowing contractors to lose less time in the construction of the building.

FUTURE CONSIDERATIONS

The success that CAD has shown in the architectural profession over the past decade demonstrates that architects are willing the replace traditional drafting media with computers (Marshall 1992, 39). According to a PA survey conducted in 1992, close to 90 percent of all architectural firms use computer, and over 50 percent are currently using CAD, while a majority of non-users expressed the intention of buying a system in the future (Rogers 1992, 336).
In contrast to the widespread adoption of computers in architectural practice, the integration of computers into architectural education has been slow. Mackey attributes this mainly to the resistance of traditionalist faculty members toward the integration of computers into the curriculum. This resistance, according to Mackey, is still common today. The basis of this resistance ranges from curricular issues, such as fear of computer training replacing architectural topics, to instructors' lack of familiarity with computers. In past years architecture schools commonly required only an introductory computer course, which merely taught the student how to use simple, general purpose computer applications. As CAD use became prevalent, schools generally started offering CAD courses in a separate studio or in a different classroom environment. Schools commonly did not allow architecture students to incorporate computer use into their studio projects or to use computers in reaching design solutions. The resulting situation has been a compromise in which the student is introduced to computer technology, such as computer graphics and design systems, in a classroom through a traditional course structure that is separate from the design studio (Mackey 1992).

The architectural studio still clings to methods that have been a tradition for generations. Students work at drawing boards cluttered with tracing paper and
soda cups; the professor visits with the students at their desks to critique their work (Novitski 1993a, 147). According to Ratensky, the major problem with this approach is that, in the privacy of the studio, teachers tend to formulate their own personal curriculum based on their individual beliefs as to what students need to learn, and may stray from the established curriculum of the school and its goals (Ratensky, 1992). This can translate into a traditional instructor ignoring a school's requirement to teach computer skills.

For computers to be integrated into the traditional design studio, teachers will need to be proficient in their use. The computerized studio may be seen as imposing a considerably higher knowledge requirement upon teachers, as they will need to answer often detailed questions about professional use of the computer software just as they must answer such questions about architecture and design (Hacker and Herman, 1989). However, an alternate view of this knowledge requirement is that it is merely a need to understand the current tools of architectural expression, and that it imposes no more of a burden than the proficiency using manual media has required.

CRITIQUE OF COMPUTERIZATION IN SCHOOLS

The fundamental mission of architectural education is to provide a quality,
high relevancy professional education. This mission, according to Mackey, is precisely the impetus that has pushed computers into the architectural studio. "Electronic technologies are not topics for courses, discussion and presentation, but rather form an environment in which all other architectural issues and topics are examined. The mission has not changed, only the context." Mackey foresees that the future curricula of schools will be based on computer methodologies (Mackey 1992). Until then, Mackey suggests that educators should be preparing themselves with the experience required for the future of the educational task (Mackey 1992).

Computerization of the architecture studio may prove to be a time-saver that allows students to gain more knowledge while they are in school. Hours formerly spent drawing perspectives and coloring presentations can be spent studying shadows falling across a proposed design, possibilities in construction, or countless other activities useful to students (Neeley 1991, 59). Computers allow students to visualize, analyze, and communicate hypothetical design solutions to a degree unprecedented by manual means. This allows students to comprehend better the implication of their design decisions (Kalay, 1993). A computer study model of a design project can be prepared by a student in only a few hours, while traditionally trained students might construct study models only after schematic design has been completed. The computer allows the student a more detailed look at the solution with a much smaller time investment than required by the traditional methods
As stated by Samuel Mockbee, a professor at Auburn University, "what's so wonderful about the computer is that you can go through several ideas in a couple of hours, where in the past it might have taken several days, and you might have gotten discouraged about trying to discover all the possibilities and maybe given up too easily" (Novitski 1994a, 107). The speed of computer generation of study models also allows students greater freedom to alter solutions before too great a time or emotional commitment is made to any particular design solution.

Computers in architecture schools of course are not an end in themselves but a tool. Mackey points out that computers cannot address the current and future issues that will impact students' professional lives; architecture programs must rely on a comprehensive curriculum content to provide a broad educational experience (Mackey 1992, 68). Courses should be modified to use the current technology and address design theories and methods from a computational point of view. Courses should still teach students how to use existing tools, and existing courses must be examined to see how they can benefit from integrating computers into their methods (Kalay 1993, 3). General introductory courses at the freshman level are important, but computer issues will be addressed most effectively when introduced into the studio (Mackey 1992, 67).

Professors Herman and Hacker at CalPoly Pomona believe that computers
will dramatically alter architectural education in three areas: (1) applications of graphic skills; (2) the application of information which comprises professional knowledge; and (3) the integration of skills and information in the design process. Hacker and Herman feel that architectural education is currently not working well, and that students are not well prepared to make a positive contribution to the state of "an environment undergoing severe stress." They theorize that computer use will actually increase students' awareness of the basic design issues that traditionalists fear will be trampled with computerization. Instead of focusing students only on the technical procedures of their use, computers will allow students to emphasize values on why and how buildings are designed (Hacker and Herman 1989).
CHAPTER 3
METHODOLOGY
SCOPE OF THE STUDY

The research for this study was conducted using various bibliographical resources, questionnaires, personal interviews, phone surveys, reference research, and a literature review. The literature review (Chapter 2) provided the background data supporting this study. Because computer use in architecture has only occurred to a significant degree over the past twelve years and is subject to rapid changes as technology advances, the background information was drawn mainly from architectural periodicals.

The survey was successful in collecting information from every architecture school in the Southwest region, for a response rate of 100%. For architecture firms in the Las Vegas metropolitan area, of which the 1994 telephone directory listed approximately 76 firms, a statistically significant sample size would require 63 responses (Krejcie and Morgan 1970, 607-10). The attempt of this study was not to provide statistically significant figures as to levels of computer use by Las Vegas firms, but to obtain a general overview of situations among the range of small, medium-sized, and large firms in Las Vegas.
SCHOOL DELIMITATIONS

The research conducted on architectural education programs had the following delimitations:

1. The universities and colleges surveyed were taken from the Southwestern region of the U.S. These schools were selected because they are the primary source of graduates seeking entry level architectural positions in the Las Vegas, Nevada metropolitan area.

2. The schools selected offered first professional degrees in architecture which were either accredited by NAAB or in candidacy for NAAB accreditation. One school, the New School of Architecture, has applied to NAAB for candidacy status. The University of Nevada, Las Vegas was not studied in order to maintain impartiality of the study.

FIRM DELIMITATIONS

Architecture firms studied for their hiring characteristics and computer usage were selected for their geographic location in Las Vegas, Nevada, a central site in
the Southwestern region of the U.S. The firm at which the researcher was employed was not surveyed in the interest in maintaining impartiality of the study. An attempt was made in this study to describe and investigate a range of situations in which computers were used to varying degrees in architectural offices. Because of this, the study focuses on the variety in firms responding rather than attempting to canvass and present a statistically significant sample.

ANALYSIS OF SCHOOLS

RESEARCH DESIGN

Through personal observation the researcher determined that architecture schools in the Southwestern region of the United States were the main source of architectural graduates available for hire by firms in Las Vegas. The study, therefore, was therefore conducted among these schools. A comprehensive listing of these schools was obtained from Architecture Schools of North America (1994). This book contains each school's address, phone numbers, statistical analysis of student body, accreditation status, and mission statement. Additional information was obtained from each school's catalog, including both general information on the architecture program and specific information on computer related education.

Each Southwestern school was sent an individualized questionnaire
requesting additional information concerning its curriculum structuring and course offerings (see Appendix B for sample questionnaire). Since the Southwestern region contains only twelve architecture schools, the researcher made several attempts to obtain a response from every school. Surveys were sent out up to three times until a response was obtained from all schools. After the final mailing the researcher contacted the remaining non-respondents by telephone and faxed the survey to encourage a response. Schools responding to questionnaires were later contacted by telephone for more detailed information.

ANALYZED FACTORS

Data on the schools was analyzed by the following factors to determine their relationship, if any, to the type and quality of computer education provided by the schools.

1. The type of architectural degree offered: The schools studied offered one or more of the following degree types: (a) five year Bachelor of Architecture; (b) six year Master of Architecture; (c) three year Master of Architecture for graduates from other disciplines.
2. The size of the student body: The size of the architecture program was determined by the number of students in the architecture program as follows: large (500 or more), medium (100-500), and small (100 or less). These categories were established at these levels for convenient reference.

3. The length of time the program has been in existence, determined by the date of establishment of the architecture program, including dates of any substantial program revamping.

4. The philosophy of architectural education: schools were generally noted as emphasizing such factors as theory, design, aesthetics, or technology based on their stated mission and on the analysis of their curriculum.

5. The organizational setting: Administrative location of the architecture school as a separate college, part of an engineering or art college, or independent educational organization. Also included in this factor is the type of school comprised by the larger organization: the university’s overall mission and its status as public or private.
6. The locality: Factors were noted concerning the community within which each school was located, including characteristics of the locality (large urban area, city, suburb, rural) and the state of the local/state economy.

7. The extent and methods of computer integration: Factors included (a) whether computer courses were offered or required; (b) setting of computer instruction in separate classes or integrated into design studios; (c) types of software used and taught; and (d) hardware types.

FIRMS

RESEARCH DESIGN

Firms approached for the survey were found through listings in the Las Vegas telephone directory. Firms were contacted by telephone to learn the name of the person in charge of hiring. The researcher faxed questionnaires along with individual cover letters to the hiring manager. Questionnaires were faxed to 22 firms, with 14 responding. These questionnaires asked for information regarding size and demographics of firm, hiring considerations, and computer usage (see Appendix C for sample questionnaire). Firms that did not initially respond were
telephoned again and asked to respond, and a second questionnaire was sent.

ANALYZED FACTORS

The following factors concerning firms were investigated and compiled:

1. Size of technical workforce within the firm.

2. Extent to which computers were used in (a) designing and rendering and (b) document preparation, and types of software used for each. This included the number of employees whose work was performed on computers.

3. Factors considered in hiring new employees including education, experience, personal characteristics, willingness to accept conditions of position, and skill in computer use. The respondent was asked to indicate each of these as being very important, somewhat important, or not important.

4. Types of positions for which new graduates were hired. Possibilities included such positions as architectural intern, part-time student drafter, midlevel or senior draftsman, designer, or specialized position such as renderer or CAD renderer.
CHAPTER 4

PROFILES OF SOUTHWESTERN ARCHITECTURE SCHOOLS

The architecture schools that provide most of the entry-level employees to Las Vegas architecture firms are the schools in the Southwestern region (including UNLV, which was not surveyed to maintain impartiality of the survey). The survey was successful in obtaining responses from every architecture school in the Southwest region. Schools were asked to provide information as to the computer courses they require, the elective courses they offer, the hardware and software they provide for student use, integration of computers into the design studio, and the direction they anticipate for future computerization. Additional information was collected concerning schools' enrollment size, geographic location, date of program establishment, tuition charged, and educational philosophy in order to determine if these factors correlated with the extent to which schools were integrating computers into their curriculum (see graphs 4-7). The survey found that levels of computer use varied over a wide range among the schools. No single factor was found to provide a primary explanation of a school's level of computer emphasis other than the NAAB's requirement that minimal computer skills must be taught to maintain accreditation.
Graph 4: Student Enrollment in Southwestern Architecture Schools In 1995.  
Source: Authors Investigation

Graph 5: Population of University Cities in 1995  
Source: 1995 U.S. Census Bureau Gopher
Graph 6: Date of College or Schools Establishment

Source: University Catalogs

Graph 7: Annual Tuition in 1994

Source: Architecture Schools of North America (1994)
ARIZONA STATE UNIVERSITY

Arizona State University (ASU) was the largest architecture school in the mountain desert southwest, with one of the oldest accredited programs in the region. Located within the Phoenix metropolitan area, it is situated as an independent college within a large university. The school offered a 4-year Bachelor of Science degree in design, with selective admission to upper division studies (junior and senior years), and an accredited 2-year Master of Architecture program. ASU sees its role as an architecture college as integrating the process of design with the technical, theoretical, and management aspects of practice, to provide graduates with a well rounded architectural education.

ASU had 40 Macintosh computers available to architecture students (located in a campus lab within the architecture building). The curriculum offered several elective courses in architectural computer applications, including graphics, computer-aided design, computer programming in architecture, and energy and experimental applications. The one required course involving computer use was Architectural Communications (301), a general communications course that covers manual graphic presentation, oral presentation techniques, and computer graphic applications. Software available for student use included energy simulation,
lighting, mapping, image manipulation, Internet access, and experimental evaluation programs in addition to drafting and both 3-D and 2-D design. The architecture building was also equipped with a computer network.

Although a range of applications were available for student use, computer skills were not emphasized within the architecture curriculum. Computer classes were taught within a computer lab environment. Although each design studio contained one computer, students were not required to use computers in their studio work. Professor Thomas Hartman, responding to this survey, indicated that there were enough machines to cover current use except at heavy use times (end of semester). However, with one computer in each design studio (approximately 15 students), and an overall ratio of about one computer for every 140 students, the situation indicated little possibility of allowing each student to apply computer use in a concentrated manner. This suggested that computer use in the program was not heavy. The most commonly used computer application was word processing, followed by graphic presentation (Photoshop, Pagemaker) and then design and drafting applications. The program was currently accelerating its emphasis on computer use - while computer survey courses were being offered to students in the lower levels, many of the graduate students had not been required to use a computer for anything other than word processing. The impetus for computerization had come from students' knowledge and previous use of computers as much as any
direction from the school administration.

Professor Hartman states that the curriculum was changing rapidly by the semester. He anticipated changes in the curriculum "at the level of 'making sense of it all.'" The curriculum was to become more defined, with classes structured to distinguish between basic computer competency and focused investigations and topics.

CAL POLY - POMONA

The California State Polytechnic University at Pomona (Cal Poly-P) was located on the outskirts of the Los Angeles metropolitan area. The Department of Architecture in Design was one of the four departments within the University, alongside the colleges of Art, Landscape Architecture, and Urban and Regional Planning. The school offered an accredited 5-year Bachelor of Architecture degree and an accredited 2-year Master of Architecture program. Like Cal Poly-SLO, the university stated that it "specializes in career oriented professional and liberal education," with its first goal "to provide career-oriented educational opportunities of excellent quality to students" (Cal Poly-P 1994, 14). The architecture school stated its goal as "producing students who will be able to conduct a thoughtful, socially responsible professional practice." The architecture school's educational
strategy was to begin students with exercises in drawing, graphics, and visual communication and progress toward comprehensive architectural projects that employed creative and analytical skills. (AIA 1994, 16-17.)

Cal Poly was equipped with a computer-aided instruction laboratory which contains both Macintosh and PC Compatible computers. The program required one semester computer course, Introduction to CAD in Architecture (474). This course was designed to give students a working knowledge of the AutoCAD program. The introductory course was required at the third year. The school offered only one additional elective, Advanced Computer-aided Design, which was an extension of the one required course. Other software available for student use included structural analysis, energy simulation, and specification writing programs. Professor Paul Tran, in his response to this survey, ranked the college's use of computer applications in the following order: 3-d modeling was most commonly used, followed by two-dimensional drafting, simple three-dimensional design programs, dos applications, and at the bottom of the list, virtual reality.

Although Cal Poly-P considers itself a practice-oriented university, computer use was not specifically emphasized within the architecture curriculum. Computer classes were taught within a computer lab environment and not integrated into the design studio. This fact and the small number of courses available suggested that computer use in the program was not heavy.
Professor Tran stated that the college was to start implementing animation and virtual space programs in the design studio eventually, but that no target date has been set for this to occur.

CAL POLY-SAN LUIS OBISPO

California Polytechnic State University (Cal Poly-SLO) was the largest architecture school in the southwest region, with a department that offered degrees not only in Design, but also in Landscape Architecture, Architectural Engineering, City and Regional Planning, and Construction Management. Located within the San Luis Obispo area, it was a state college that enrolled approximately 1,500 students. The school offers an accredited 5-year Bachelor of Architecture degree, and an unaccredited 1-year Master of Science in Architecture degree. The university stated its goal as offering a practice-oriented education in professional and technical fields, with an educational approach in which students could "get their hands dirty" (CalPoly 1994, 5). The architecture school's stated objective was to develop the design and technical skills necessary to pursue a career in the field of architecture. The philosophical base of the school was associated with the human
basis of architecture: because architecture was concerned with man-made surroundings and the people who use them, the architect must develop a sensitivity to human needs (AIA 1994, 14-15.)

Cal Poly had a Macintosh computer lab available to students. The upper division courses provided a limited number of computers for common use in the design studios, but the number of computers apparently was insufficient to cover demand during heavy use times (such as end of semester). The curriculum offered several elective courses in architectural computer applications, including graphics, advanced graphics, and computer-aided design. Cal Poly required its students to take one course in Computer Applications (250), which was an introductory course in architectural computer applications, operating systems, and graphics. One other software course offered was in the use of energy simulation programs. The most commonly used computer application was word processing, followed by drafting applications (ArchiCad), graphic presentation (Photoshop, Pagemaker), and design (DinoPerspective).

The requirement of an introductory course, the availability of electives and the evidence of heavy computer use at certain times during the semester indicated that computer use within the program was at a moderate level.

The respondent, Professor John Cotton, felt that the school would increase its computer usage in professional practice topics, which included specification
writing and energy analysis. The college anticipated that it planned to move toward more network communications and more sophisticated usage of three-dimensional programs.

NEW SCHOOL OF ARCHITECTURE

The Newschool of Architecture was a new (founded in 1980), small private college in downtown San Diego offering an 2-year Associate of Arts degree and an accredited B.Arch. degree, with a 5-year program for first time college students and an accelerated 3-year program for students with prior schooling. The program was begun in 1992 and had 95 students. The emphasis was a hands on approach to architecture, and the school "takes great pride in providing students an architectural education for the real world" (AIA 1994, 80). The instructors were leading practitioners in Southern California; with night classes that allowed most students to work in architectural firms by day. The school also supported a Design Clinic, a working office in which students, supervised by faculty, produced "real-life" projects, which included historic preservation, pro bono community service and new developments.

The Newschool required an Introduction to Computers course which did not include CAD, and an Intermediate CADD course. Optional courses included further
survey courses in computer applications and advanced CADD. Computers were located in a lab that was separate from the design studios. Software for 2-D CAD was the primary computer application used, followed by 3-D conceptual modeling, complex 3-D modeling, and word processing.

With its orientation toward "real-life" projects and the architectural business environment, the school's computer instruction ensured that students had at least some of the computer skills required for employment. The Newschool also taught construction documents. Hand drawing was still used in design classes, although both hand drawing and computer drawing were taught simultaneously, and the school encouraged computer use in preliminary design. The Newschool anticipated that computers would be incorporated into the design studio in coming years, although the survey response did not indicate when this would be implemented. Overall, the Newschool was committed to providing students with the computer skills needed for entry-level employment, but appeared to be in the preliminary stages of implementing this goal.

SOUTHERN CALIFORNIA INSTITUTE OF ARCHITECTURE

The Southern California Institute of Architecture (SCI-Arc) was a private independent college located in Los Angeles. SCI-Arc was a fairly young school,
founded in 1972, but was one of the southwest’s leading design colleges. The school offered an accredited 5-year Bachelor of Architecture and an accredited 2-year Master of Architecture degree. SCI-Arc saw its mission as advancing the field of architecture by producing students who were truly artists working constantly to redefine what had been overlooked, and to shape the future. The work produced was to be open-ended, expansive and inclusive in the way our minds assimilate and incorporate the issues and ideas of the day (AIA 1994, 114-115.)

SCI-Arc had a computer lab available to students that housed both Macintosh and PC compatible computers. The curriculum did not require students to take any computer courses. However, the school did offer four elective courses in architectural computer applications, including introduction to computers, imaging, and computer theory. The only other computer course available to students was a course that concentrated on the business end of professional practice aspects. The most commonly used computer application was word processing, followed by drafting applications, then design, and finally virtual reality applications.

With these programs available for student use, the school offered opportunities for students to explore the main categories of architectural computer applications. But without requiring computer classes or integrating computers into design studios, computer skills were not developed within the architecture curriculum. The elective courses that were taught had be separated from the studio
and were taught within a laboratory environment. Professor Tim Durfee saw that computers were to become fully integrated into the college in the future, with computer facilities in the design studio and computers included in the rest of the curriculum. However, the lack of computer usage now and the lack of a firm time-frame for their integration suggested that computer education was not a high priority.

Professor Durfee states that SCI-Arc was promoting the use of the computer as an explorational design tool, along with others traditionally used in the field of architecture. There was less emphasis on a strictly vocational aspect of the computer in practice, though students left the institution with a feeling that they should learn a CAD program and understand the possibilities that these programs may offer. SCI-Arc therefore did not ensure that graduates leave with the computer skills needed to gain an entry-level job in a market like Las Vegas, as was shown in the survey of firms (see Chapter 5).

UNIVERSITY OF ARIZONA

University of Arizona (UofA) was located in the civic center of Tucson. The school was ranked 14th among public universities in the amount of research and development funding awarded. The College of Architecture was organized as an
independent college of the university. The school offered an accredited 5-year Bachelor of Architecture and an unaccredited Master of Architecture degree. UofA sought to provide an academic program with a human orientation that encouraged an optimistic, ethical, nonstylistic attitude toward the built environment. The program was structured to encourage a diverse and balanced education. Upon graduation, students were expected to have cultivated well-developed abilities in analysis, evaluation, critical thinking, synthesis and communication (AiA 1994, 136).

The University of Arizona had several computers available to the students in a computer lab that offered both Macintosh and PC compatible machines. The curriculum offered several elective courses in architectural computer applications, including graphics, design applications, and energy analysis. UofA required students to take three computer courses. The Introduction to Architectural Computing (270) was a course which emphasizes hardware, software, and programming techniques in architecture. Topics in Architectural Design (402) was a computer-aided design course which included studio work emphasizing large buildings and building complexes. The Emphasis Area in Architecture (451) was a computer-aided design course which was a continuation of the 402 course, with emphasis on desert architecture, community design, and design communication. Software available for student use included energy simulation, structural evaluation, drafting, and both 3-D and 2-D design. The most commonly used computer
applications were AutoCAD, Photoshop, Pagemaker, Macromind, and Stratovision.

Computer skills were stressed in the architecture curriculum by exposing students to the computer in their sophomore year. Computer skills were, however, taught within their own computer design course and not incorporated into the regular design studios. Professor Rob Dvorak indicated that within the coming years all students would be required to buy their own computers (laptop) and software; the college would furnish a network and peripherals. This would allow students to become more involved in computer use and not have to compete over computers in the common use laboratory. The curriculum structuring and required courses suggested that the program was going in the direction of more computer usage now and in the future.

Professor Dvorak stated that the school was planning on strong computer usage in the future, with school facilities becoming a 'service station' supporting the students' own workstations and software. The computer courses of the future were planned to change to provide support for the design studio.

UNIVERSITY OF CALIFORNIA, BERKELEY

The University of California, Berkeley (UCB) was the second largest
architecture school in the southwest region, with one of the oldest programs of architecture in the United States. Located across the bay from San Francisco, it was situated as an independent college on a large university campus. The school offered a pre-professional 4-year Bachelor of Arts degree, from which students continued to the accredited 2-year Master of Architecture program. UCB was one of the few colleges that offered the extended 3-year Doctoral degree in Architecture. Berkeley stated that the mission of its program was to prepare students for either entry-level employment or for admission with advanced standing to graduate study in this field, in addition to providing a general education in preparation for a wide variety of study and career opportunities in business, government, and other professions (AIA 1994, 144-145.) UCB’s approach to architectural education made technical subjects available for students who wished to concentrate on them but encouraged a broader approach not focusing strictly on the comprehensive range of work done in the profession of architecture. As stated in the school’s catalog, "although ability in building design is often considered to be the goal of our educational system and our graduates, knowledge about how people can affect environments and manage human, financial, and natural resources in the creation of that environment is our major emphasis" (1994, 128.)

UCB had both Macintosh and PC compatible computers available to its students. The bulk of the computers were located in a lab, with a limited number
located in the upper division design studios. There were no required computer courses at Berkeley. However, there were five elective courses offered in design methods, applications in architecture, design theories, and computer-assisted design. Software available included computer-aided design, structural analysis, energy simulation, and professional practice management. The software was available for the student use through a university-wide computer network, including MicroVax and Sun systems.

Computer instruction in the UCB program was in the same state as other topics related to the work of developing real buildings that were intended to be built - the school offered a good variety of classes for those interested but did not stress these skills. Computer classes offered to undergraduates were taught within a computer lab environment, and although some computers were physically located within design studios, there was no requirement for students to use them in studio work. There was no requirement that Berkeley students ever used computers during their education. Professor Yehuda Kalay, in providing information for this survey, stated that computer applications such as word processing, graphic presentation (Photoshop), design, and drafting applications (AutoCAD) all were introduced to the students in one course. This exposed the student to the vast capabilities the programs offered and allowed students to select those which they found most useful. Professor Kalay added that the architecture program did not
teach construction documents. Since production of construction documents was the activity in which computers were used most often in architecture, Berkeley's elimination of this subject from its curriculum also eliminated a major inducement for computer use in the architecture school.

UNIVERSITY OF CALIFORNIA, LOS ANGELES

The University of California, at Los Angeles (UCLA) was one of the nine campuses with the University of California system. Located within the Los Angeles metropolitan area, it was situated as an independent college within a large university. The school offered only graduate degrees in architecture, urban design, and urban planning. The program offered an accredited 3-year Master of Architecture degree and a 3-year Doctor of Architecture degree. UCLA was founded in 1966 as an architecture college having faith in the future of architecture and its chance to serve humankind if theoretical advances in academic disciplines and technical capabilities of the computer could be incorporated into an architectural education. UCLA's mission statement maintained that the only way to keep abreast of the frequent changes in today's architectural field was to revise and clarify the curriculum throughout the years (AIA 1994, 146-147).

UCLA had a sophisticated PC compatible computer laboratory with two
networks (an IBM token ring network and a TCP/IP Ethernet network that was connected to the university networking system via high-speed fiber optic link), two primary and several secondary file servers, laser plotters, a thermostatic plotter, and several gigabytes of disk storage space. The curriculum offered several elective courses in architectural computer applications, including graphics, computer programming, design, computer modeling, production drawings, urban planning, geometric modeling, and energy modeling. The school however only required one course involving computer use, Construction Documents (437), which concentrated on design of simple structure and creation of working drawings and specifications. Software available for student use included energy simulation and structural applications. The most commonly used computer application was drafting (AutoCAD), followed by graphic presentation (PhotoShop, PageMaker), then design and virtual reality (QuatroPro, Paradox). Through the network architecture students had access to rendering and animation systems including TDI, Silicon Graphics, Visual Software, Renderize, and Alisa Sonata.

Despite the wide variety of applications that were available for student use, students were not required to develop computer skills beyond the one introductory class. Computer courses were taught in a laboratory, and students was not required to use computers in design studio projects. With forty-five machines available for student use and a student body of 230, the resulting ratio of one
computer for every five students did not seem to offer opportunity for students to use computers to a great extent in their design projects. This fact, combined with the availability of good computer lab facilities and a wide range of software, suggested that the student interested in computers had opportunity to do so independently but that the school did not pursue the goal of ensuring students are competent computer users.

Professor Bill Jepson states that the curriculum was changing yearly with regard to computerization. The curriculum was constantly being revised to introduce new courses, for example last year they introduced the virtual reality course and this year was the lighting simulation course.

UNIVERSITY OF COLORADO, DENVER

The University of Colorado in Denver (UofC) was a new school of architecture whose classes were physically divided between two different campuses. Graduate architecture programs, landscape architecture, urban design, and urban and regional planning were taught on the Denver campus, and the undergraduate programs were taught at the Boulder campus. The architecture college of the UofC was therefore strictly a graduate college. It offered a 3-year accredited Master of Architecture degree. The UofC’s stated mission was to lead
in the discovery, communication and application of knowledge in the discipline of architecture. The program was rooted in the creation of an academic environment which was both intellectually stimulating and educationally challenging (AIA 1994, 150-151).

The UofC had a state-of-the-art computer laboratory which housed both Macintosh and PC compatible computers. The curriculum did not require that computer courses needed to be taken to fulfill the graduation requirements. The school did, however, offer a number of elective courses in architectural computer applications, including graphics, design with Macintosh, computer-aided design, and advanced design in DOS. Within the elective courses offered, the school emphasized graphic presentation (PhotoShop), followed by design (Form Z), and drafting applications (AutoCAD). Other courses which included secondary computer use were historical analysis, structural analysis, environmental concerns, and planning.

Even though many different kinds of software applications were available for student use, computer skills were not emphasized within the architecture curriculum. Computer classes were taught in a computer lab environment and were not integrated into the design studios. The program was moving towards accelerating its computer use and the options that would be offered to students.

Professor Robert Flanagan, responding to this survey, stated that he feels
the computer would be the basis of design at the college and would become the standard within ten years. In his response Prof. Flanagan stated "software choice was critical, drafting was time poorly spent," which suggested an inclination toward more design and analysis-type software programs rather than drafting programs.

UNIVERSITY OF NEW MEXICO

The University of New Mexico (UNM), located in the Albuquerque area, was an architecture school that also offered degrees in planning and environmental design as well as architectural design. The architecture college was an independent college within a large university. The school offered a pre-professional 4-year Bachelor of Art in Architecture, and an accredited 2-year Master of Architecture program. UNM saw its mission as providing a broad range of knowledge and skills needed for the creation of a humane and responsible physical environment. These socially oriented concerns were balanced with the development of students' own areas of interest (AIA 1994, 188-189).

UNM had a Macintosh laboratory available for student use that was housed within the architecture building. The program however did not require its students to take any computer courses. It did offer five elective courses in architectural computer applications, including graphics, spreadsheet applications in architecture,
computer orientation, and computer-aided design. For additional computer exposure students were allowed to take a three-credit course at the local vocational school in computer-aided design (AutoCAD). Additional courses which included secondary computer use were structural applications, energy simulation, drafting, and both 3-D and 2-D graphic representation. The most commonly used computer application was word processing, followed by drafting (MiniCad), design (PhotoShop, Design Shop), and design presentation (Form Z).

A good range of computer applications were available for those students who were interested, but computer skills were not required or emphasized within the architecture curriculum. Computer classes were taught within a computer lab environment and are not introduced into the studio. The program staff was currently looking at many options for greater computer integration but had not yet decided on a specific direction.

The staff member who provided the survey information felt that the use of the computer was important, however more important was the principles of "how to do architecture." The respondent repeated a view often heard in the discussion of computers in architecture: "The use of the tool must be taught, but the use of the brain is the most important! The two skills enhance each other."
The University of Southern California, a large university of 27,000 students, housed the only private school of architecture in the U.S. associated with a major research university. The university was located near the central business district of Los Angeles. The School of Architecture, founded in 1914, had a medium sized student body of 450. The School of Architecture and its faculty regularly win national awards recognizing their accomplishments. The faculty included four Fellows of the AIA and two ACSA Distinguished Professors.

USC offered an accredited Bachelor of Architecture degree and several master's programs including the Master of Architecture, Master of Building Science, Master of Landscape Architecture, and dual degrees that combined the M.Arch. or MLA with a Master of Planning degree from the School of Urban and Regional Planning (AIA 1994, 203).

The foundations of undergraduate architectural instruction at USC included the principles of a recognition of the interdependence of theory and practice; an understanding of architecture as a response to the human condition and to human experience; and a respect for disciplines involving visual form and technology as means for creating architecture. The three graduate programs also emphasized the humanistic contribution of the design disciplines (AIA 1994, 204).
The School of Architecture had three computer labs available to students, with software for 2-D drawing, 3-D modeling, structural computations, and solar analysis. Equipment included Macintosches which were furnished with AutoCAD, Stratovision, and Photoshop. Students also had computers available in their studios. Five classes relating to architectural computer applications were offered. These classes began with general applications of computers to architecture, and covered advanced applications, theories and techniques of computer use related to architecture. None of the computer courses were required for graduation. Computer use until now had been integrated into the design studio beginning in the fourth year course, but was now being implemented in the first and second year studios as of 1995.

The survey response stated that all computer instruction in the School of Architecture was related to building design rather than production drawings. The survey also stated that the primary computer application taught was word processing, with 2-D drawing ranked second. The fact that computers were now integrated into design classes at all levels, and that computers were available both in labs and studios, showed that USC was committed to exposing students to computers even though it did not require them to take computer classes. The specific computer classes offered, which dealt with indepth investigation of issues in architectural computing, also showed a commitment to include computers in the
students' educational experience. With the types of software available to students, the emphasis of computer use was in conceptualization and communication of design rather than development of marketable skills in computer drafting.

UNIVERSITY OF UTAH

The University of Utah (UofU) was located in the Salt Lake City area, the center of the Intermountain West. The architecture school was an independent college within a medium sized university campus. The college had a small number of students and fostered a close relationship with faculty and students. Degrees offered were: a pre-professional 4-year Bachelor of Science in Architecture Studies, and an accredited 2-year Master of Architecture degree. The college's stated mission was to focus on the development, maintenance, and analysis of the built environment while expanding the student's perception of our multifaceted world context (AIA 1994, 216).

UofU had computers located in two laboratories available for student use. It also had computers located within the design studio for the use of upper division students. The curriculum offered several elective courses in architectural computer applications, including graphics, computer programming, modeling, production drawings, professional practice, rendering, and analytical tools. The one required
course involving computer use was Introduction to Computer in Architecture (350), which taught computer literacy to students to help them understand and use computers in general. Software available for student use included energy simulation, lighting, structural applications, mechanical simulation, building economics and specification writing. The most commonly used computer application was word processing, followed by drafting, graphic presentation, and design.

Software offered for student use covers a full range of professional architectural applications, but computers were not thoroughly integrated into the architecture curriculum. The lower level courses required students to use a laboratory; the upper division students must compete for use of a small number of computers within the studio. Professor Ted Smith had indicated that there was difficulty incorporating the computer into the design studio because faculty members did not have the skills to help students computer use. One fact that indicated a strong commitment to computer education was that UofU offered a Master of Architecture degree with emphasis in computing. Because there was some integration of computers into the studio, a range of software was available for students, and a graduate level area of emphasis on computers, UofU's computer use ranked at a moderate level. The program was currently accelerating its emphasis on computer use, and recognized the importance of the computer, many
students had purchased their own computer hardware and software. Professor Smith stated that the changes at UofU are ongoing, and that he foresaw that faculty would be forced to become more involved with the use of computer's.

WOODBURY UNIVERSITY

Woodbury University was a fairly new architecture school located in the Burbank a suburb of Los Angeles area. An independent college of architecture, it was small in size with only 220 students enrolled. The school offered only the accredited 5-year Bachelor of Architecture degree. Woodbury prided itself on allowing a great deal of student-faculty interaction. The school's catalog stated an emphasis in its professional courses of relating theory to practice (WU 1994, 4). Woodbury saw the study of architecture as concerned with the environment achieved by things built and reflecting the ancient need to give significance to the physical setting. Architecture was "a fusion of art and science...demanding both creativity and logic." The design and theory courses, integrated with technical and engineering subjects, computers, business, art and science provided a foundation for the student's future personal and professional growth (AIA 1994, 234-235.)

Woodbury had two computer laboratories available to architecture students. One was a Macintosh lab which runs two different CADD programs and several
graphic programs. The other lab was equipped with PC compatible computers loaded with AutoCAD for advanced CAD use. The three computer courses offered by the college were all required courses to fulfill graduation requirements. The Computer-Aided Drafting (211) course was an introductory course in computer-aided design and drafting in which students learned the basics of generating two-dimensional and working drawings. The Fourth-year CAD Design Studio (481) allowed computer use in design studies and graphic representation of concepts. The final course, Fifth-year CAD Design Studio (483), was an extension of the 481 course in that it allowed computer use in the design and presentation process alongside traditional methods. The program also allowed team projects to be done via Internet. This potentially allowed students the experience of working at home instead of in the studio environment, returning to the classroom only for presentations. Software available for student use included lighting engineering, specification writing, and cost estimating programs.

With a full range of software available, four required computer classes, Internet access, and integration of computer use into the design studio, computer emphasis was heavy at Woodbury.

Professor Raymond Arcilla, who responded to the survey, indicated that the college was still increasing its commitment to computerization. The school was currently working toward incorporating computerization earlier in the curriculum, in
a second-year design classroom. Professor Arcilla stated that the curriculum had difficulty changing because the average studio instructor was too much into old notions of presentation. "The average studio instructor had yet to understand that a 'fly-through' of a building should be considered part of the final presentation. They had no problems with photorenderings, but put a fly-through on an overhead on a wall and WWIII breaks out." Professor Arcilla felt that these faculty members should look at their peers in medicine and law to see how other professionals have embraced technology and enhanced their own professions.
CHAPTER 5

PROFILES OF LAS VEGAS ARCHITECTURE FIRMS SURVEYED

The Las Vegas valley is one of the fastest growing metropolitan areas on the U.S., with what is perhaps one of the country's highest rates of building construction. Along with the rapid growth of the building industry has come a rapid rate of computerization among companies involved with this industry. The public works agencies of the state, city and county have encouraged computerization by making it mandatory for firms producing state work to submit their projects on electronic media. The firms in the Las Vegas valley that responded to this survey showed similarities with regard to computer usage, software packages used and qualifications required of new hires (see graphs 8-12). The responses received indicate that many traditional hiring factors that seemed so important just a few years ago have now been replaced by the requirement for computer knowledge and experience.

The following information was gained from 14 architecture firms responding to the survey, out of 25 approached. The questionnaire asked firms to identify selected factors, including computer competence, as to their importance in the selection of entry-level employees. A successful attempt was made to hear from
firms of all sizes, from one-architect firms to some of the largest in Las Vegas. The results were not intended to provide a statistical analysis of the probability of graduates' gaining entry-level positions as related to their computer skills, but to show the range of hiring practices found and provide a qualitative analysis of the Las Vegas entry-level job market essentially, the work climate new graduates may expect to find when seeking positions within Las Vegas firms.

HOLMES SABATINI ASSOCIATES ARCHITECTS

Holmes Sabatini is a medium sized firm with 5-10 employees engaged in

Graph 8: Ranking Of Requirements Las Vegas Firms Sought In Recent Graduates In 1995. Source: Authors Investigation
Graph 9: Firm Size Related To Technical Staff In 1995. 
Source: Firm Survey

Graph 10: Number of Graduates Las Vegas Firms Hired In The Past 5 Years (1990-1995). 
Source: Firm Survey
Graph 11: Computer Software Used By Las Vegas Firms For Design. Source: Firm Survey

Graph 12: Computer Software Used By Las Vegas Firms For Production Source: Firm Survey
drafting technical work and with a high degree of computer use. Over the past 5 years the firm has hired over 6 recent graduates of architectural schools. Both experience and a professional degree are important qualifications sought by this firm when hiring. This firm ranked a college degree, computer knowledge, attitude, willingness to work, and personality as the most important factors in new hires, followed by drafting and design experience, personal goals, references, and acceptance of wage and benefit packages offered. The factor named as not important was appearance. The principals of the firm were listed as having a high degree of computer literacy.

Software packages used in the office for design are AutoCAD 12, Accurender, and PACAD 2.5. Software packages used for production drawings is AutoCAD, with word processor programs (Microsoft Word, Wordstar) used for text. Familiarity with 2-D AutoCAD was the most important computer skill needed from new hires. Knowledge of 3-D CAD, computer modeling, virtual reality and computer programming was of secondary importance. Knowledge of managerial software (word processing, spreadsheets) was listed as not important.
David Harris is a small one-architect firm with 1-4 employees engaged in drafting technical work. The technical employees have recently converted in the last year from hand drafting to computer drafting (AutoCAD). Over the past 5 years they have hired only 0-2 recent graduates from schools of architecture. The most important qualification that the firm looks for when hiring a graduate is technical experience. According to the survey the principal ranked drafting experience, computer knowledge, meeting job requirements, attitude, skills, willingness to work and personality as the most important factors he looks for when hiring a graduate, followed by appearance, personal goals, references, and acceptance of wage and benefit packages offered. The factor named as not an important requirement was having a college degree. The principal of the firm was listed as having a high degree of computer familiarity.

Software packages used in the office for design and production drawings are the same packages, AutoCAD 12 and AutoArchitect. Having 2-D AutoCAD experience was listed as the most important computer skill needed for new hires, followed by computer programming. The firm listed managerial software knowledge, computer modeling, 3-D AutoCAD, and virtual reality as not important computer skills.
WELLES-PUGSLEY ARCHITECTS

Welles-Pugsley is a medium sized firm that currently has 10-15 employees engaged in the technical aspects of architecture, producing the majority of their work on the computer. Over the past 5 years they have hired 3-4 graduates of architecture schools. They state that the most important qualifications when interviewing a potential employee are experience and a professional degree. As stated in their survey they categorized having a degree, drafting experience, attitude, personal goals, and willingness to work as the most important factors, followed by computer knowledge, meeting job requirements, architectural skills, appearance, personality, and acceptance of wage offered. The one item they found not important in a new hire was the benefit package. The principals of the firm were listed as having a moderate degree of computer literacy.

Software packages used in the office for design are AutoCAD with ARE and Corel Draw. The software package used for production drawings is AutoCAD release 12. This firm did not rank the importance of knowing the different aspects of the computer.
Lucchesi Galati is a medium sized firm with 10-15 employees engaged in drafting technical work. In the past 3 years the firm has converted to a high degree of computer usage. In the past 5 years they have hire 3-4 recent graduates of architecture schools. Both experience and a professional degree are important qualifications they require when they hire a new employee. They state in their survey that the most important qualities in a new hire are personal goals, meeting job requirements, attitude, and willingness to work. They state the secondary prerequisites are a professional degree, drafting experience, computer knowledge, appearance, references, personality and acceptance of wage and benefits package. The principals within the firm state that they are moderately familiar with the use of computers.

The firm is currently using two different computer software packages for the design end of the projects, Accurender and 3-D Studio. Like most of the Las Vegas firms, Lucchesi & Galati are utilizing AutoCAD release 12 for generating their production drawings. They state in their survey that familiarity with 2-D AutoCAD is the most important computer skill needed, followed by managerial software (word processing). They listed computer modeling, virtual reality, and 3-D AutoCAD as skills they do not require in a new hire.
Kittrell/Garlock is one of the largest firms in the Las Vegas valley, employing over 15 technical personnel, with the vast majority of them engaged in a high degree of computer usage. Throughout the past 5 years they have hired over 6 architectural graduates. They stated in their survey that they primarily look for a candidate with drafting experience and a professional degree. In their survey response they ranked computer knowledge, professional degree, drafting experience, meeting job requirements, architectural skills, personality, attitude, and willingness to work as important qualifications when hiring a recent graduate. Appearance, personal goals, references, and acceptance of wage and benefit packages were of secondary importance. The principals of the firm were listed as having a fair knowledge of computer familiarity; although they may not personally use computers they are aware of the potentials of computers.

KGA is currently using AutoCAD release 11 both for design and to generate production drawings. When hiring a recent graduate the firm seeks a candidate with 2-D AutoCAD computer knowledge, followed by managerial software, basic 3-D AutoCAD, and computer modeling. They state that having virtual reality and programming knowledge was know an important factor when evaluating a recent graduate.
HARRIS SHARP AND ASSOCIATES

Harris Sharp is a small sized firm with only 1-4 personnel who are engaged in drafting technical work. This firm employs computers to generate a majority of their work. Throughout the past 5 years HSA has hired 3-4 recent architecture school graduates. According to their survey response they ranked a college degree, computer knowledge, meeting job requirements, personality, architectural skills, and willingness to work as the most important qualifications they look for when hiring a new employee. They ranked appearance, drafting experience, attitude, personal goals, references, and acceptance of wage and benefits packages as secondary factors. They feel that a graduate must have both a college degree and drafting experience as important qualifications in applying for a job in the firm. The principals of the firm are listed as being moderately computer literate.

HSA is currently not using any software programs to perform design work. They are however utilizing AutoCAD and AutoArchitect to produce the construction documents within the office. Having computer knowledge in 2-D AutoCAD was ranked the most important computer talent, followed by 3-D AutoCAD and managerial software packages. The use of computer modeling, virtual reality, and programming were ranked as not important among computer skills.
JMA is a medium sized firm that has 5-10 employees who work in the drafting technical area of the office. They are engaged in a high degree of computer usage from design through the construction phases of a project. In the past 5 years JMA has hired more than 6 graduates from architecture colleges. The principal responding to the survey considers having both a professional degree and drafting knowledge as important qualifications they seek when they hire a new graduate. As stated in their survey they consider a college degree, meeting requirements, personality, computer knowledge, experience and attitude as the most significant qualifications they are looking for in a new hire, followed by architectural skills, appearance, willingness to work, personal goals, references, and acceptance of the wage and benefit packages offered by the firm. The principals within the firm have a moderate degree of computer familiarity.

JMA is currently using AutoCAD release 12 and 3-D Studio for the design phase of projects, with AutoCAD also their software of choice for construction documents. The computer skills they find most important in a potential new hire are knowledge of 2-D AutoCAD and managerial software, followed by 3-D AutoCAD and computer modeling. The computer skills seen as least important in their hiring decisions are virtual reality and computer programming.
Massanari Bemis is a medium sized firm of 5-10 drafting technical staff employees using computers to produce drawings. Over the last 5 years they have hired 5-6 recently graduated architecture students into their firm. As stated in their survey response, drafting experience is the primary qualification they are seeking in a new hire, followed by computer knowledge, attitude, willingness to work, architectural skills, requirements, and personality. Ranked as secondary in importance were college degree, personal goals, references, appearance, and acceptance of wage and benefit packages offered by the firm. The principals in the firm were identified as being moderately computer literate.

Massanari and Bemis use the software package AutoCAD release 12 for both the design phase and the generation of production drawings. Familiarity with 2-D AutoCAD was the most important computer skill required for a new hire. Massanari and Bemis see the profession of any other computer skills as non-essential when they are considering hiring a new employee.
DOMINGO CAMBEIRO CORPORATION

Domingo Cambeiro is one of the largest firms in Las Vegas, with over 15 employees engaged in drafting technical work. The firm uses computers to a high degree in its daily operations. Throughout the past 5 years they have hired 3-4 architecture graduates. As stated in their survey response, they look for college graduates who have drafting experience when seeking new hires. According to their survey they ranked drafting experience, attitude, willingness to work, computer knowledge, personal goals, and personality as the most important factors in new hires, followed by a college degree, meeting job requirements, references, and architectural skills as secondary requirements. The factor listed as not important was willingness to accept the wage and benefit packages offered by the firm. The principal of the firm was noted as having a high degree of computer familiarity.

The firm uses the software package 3-D Studio in the design phase, and AutoCAD release 12 for the creation of production drawings. In their survey response they ranked familiarity with 2-D and 3-D AutoCAD as the most important computer skills required, followed by managerial computing skills, computer modeling/fly-throughs, and virtual reality. The computer skill named as not an important factor was programming.
Gary Guy Wilson is a medium sized firm with 5-10 employees involved in drafting technical work. Over the last 5 years they have hired 5-6 recent graduates of architecture schools. In recruiting these graduates they looked for both drafting experience and a professional degree. In response to the survey they ranked a college degree, architectural skills, computer knowledge, attitude, willingness to work and personal goals as the most important qualifications they seek in a new hire, followed by job requirements, appearance, personality, drafting experience, references, and acceptance of wage and benefits packages as secondary factors. The principal stated in the survey that he has a high degree of computer knowledge.

Software packages used in the office for design are AutoCAD 12 with Productivity Tools. Software packages used for production of drawings are AutoCAD 12, with managerial software (Lotus, Total World) used for text and for management applications. Knowledge of 2-D AutoCAD and managerial software were ranked the most important computer skills needed in a new hire, with 3-D AutoCAD ranked second. The least important computer skills were computer modeling, virtual reality and programming.
Architectural Design Concepts Incorporated is one of the smallest firms in the Las Vegas valley, with 1-4 technical staff employees. They are, however, the only firm responding to the survey that does not use computers in design or drafting production. The most important qualification they seek when hiring a new employee is experience in an architectural office. They have however hired two or fewer recent graduates in the past five years. As stated in their response they ranked architectural skills, personality, experience, and attitude as the most important factors when they hire a new employee, followed by wage requirements. The items they identified as least important were a college degree, job requirements, appearance, computer knowledge, personal goals, and references. The principal, Joe Koehm, does state however that he is somewhat literate in computer usage.

Mr. Koehm notes in his survey response, "Ask small firms around town how they feel about being screwed out of public works jobs because they don't have a computer." He continues to say that firms are being 'force-fed' computers, causing a standard to be set that the 'old-fashioned' firms cannot compete with. He states that hands-on experience and construction knowledge are the most important qualifications he looks for in a new hire. He feels that one employee must have the ability to do a wide range of tasks in order to cut down on overhead and make the
firm successful by being 'lean and mean.'

HARRY CAMPBELL AND ASSOCIATES

Harry Campbell is a large firm in Las Vegas with over 15 employees engaged in drafting technical work using computers to a high degree. In the last 5 years, HCA has hired 3-4 graduates from architecture schools. Both drafting experience and a professional degree are qualifications they seek in a new hire. Their response ranked the following as important factors when hiring a new employee: appearance, computer knowledge, personal goals, attitude, and willingness to work. They then ranked secondly a college degree, meeting job requirements, personality, and experience, followed by references and acceptance of wage and benefit options. The principal in the firm is ranked as having a moderate degree of computer knowledge.

HCA is currently using a number of computer software packages for design, specifically AutoCAD release 12, AME, AutoShade, and Renderman. The software package used for the production of construction documents is AutoCAD release 12 with the ASG package. According to their survey they ranked familiarity with 2-D AutoCAD as the important computer skill needed for a new hire, followed by skill with managerial software, 3-D, modeling, virtual reality, and computer programming.
MORRIS & BROWN ARCHITECTS

Morris & Brown is a fairly large firm in Las Vegas, currently employing over 15 drafting technical personnel. The firm uses computers to a high degree. Throughout the past 5 years the firm has hired 3-4 recent architecture graduates. Their response identified the most important qualifications needed in a new hire as possession of a professional degree and drafting experience. They currently ranked a college degree, drafting experience, computer knowledge, attitude, willingness to work, architectural skills, appearance and personality as the most important factors in a new hire, followed only by acceptance of wages offered. The principals in the firm are identified as having a moderate degree of computer literacy.

AutoCAD release 12 is used in the office for both design and the generation of production drawings. The most important computer skill required in the office is knowledge of basic 2-D AutoCAD, followed by 3-D AutoCAD and computer modeling. Knowledge of computer programming was listed as not important.

MARNELL CORRAO ASSOCIATES

Marnell Corrao is the largest firm in Las Vegas and has over 15 technical staff employees engaged in drafting and computer usage. However, they have only
hired 3-4 recent graduates of architecture schools in the past few years. The most important qualification they seek when recruiting potential hire is architectural experience. They ranked a college degree, meeting job requirements, architectural skills, personality, experience, attitude, willingness to work and personal goals as the most important qualifications for new hires, followed by computer knowledge, appearance, reference, and acceptance of wages and benefits. As stated in the survey response, the principals within the firm are knowledgeable in computer applications, however they do not participate in the daily operations.

The software package utilized in Marnell Corrao's office for design and generation of production drawings is Mountain Top. Mountain Top is a Unix based CAD program. The computer skills they seek when considering a new hire are knowledge of 2-D AutoCAD and programming, followed by 3-D AutoCAD, computer modeling, and virtual reality. Knowledge of managerial software (word processing, spreadsheets) and programming was listed as not important.
CHAPTER 6
ANALYSIS OF FINDINGS

COMPUTER EMPHASIS IN SCHOOLS

Through the research conducted by the investigator, it appeared that southwest universities had not required students to develop as much skill in architectural computer applications as Las Vegas firms were demanding. All the universities offered computer courses in their curriculum; however, only three schools required more than one course, an additional five required one semester of basic introduction to computers, and the other five did not require their students to take any computer courses. Since NAAB required schools to demonstrate that their graduates were "able to use computer technology in the display and use of information, images, and architectural design" (NAAB 1991, 20), it appeared that some accredited schools were not meeting NAAB requirements. A possible explanation could be that some schools have not had a recent accreditation visit and would be found deficient in this factor if their programs were reviewed. Another possibility is that some schools were able to produce computer-generated student work despite the fact that formal computer instruction was not offered, suggesting that students had learned computer skills from a source other than the architecture curriculum.
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<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
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</table>

A = Availability of computer lab for student use.  
   2 points

B = Availability of computers within design studio classrooms.  
   4 points

C = Required use of computer in design studio work.  
   7 points

D = Required computer courses.  
   7 points each.

E = Optional computer courses offered.  
   2 points each

F = Major categories or types of software offered  
   1 point each

Note: Ranking of elements was weighted from 7 (very important) to 1 (least important) to account for (a) their significance in providing skills required for professional computer use, and (b) the breadth of their impact among all students within a program, based on research conducted.

Figure 2: Ranking of Southwest Universities With Emphasis On Computers In 1995.  
Source: Authors' Investigation
Figure 2 contains a numerical ranking of schools in which the investigator attempted to demonstrate a schools' emphasis of computers by giving reasonable weight to the various computer-related elements. This ranking served as a guideline to determine which factors of school organization, size, and funding status might correlate with computer emphasis in schools. The intent of this analysis was to identify factors which might either be barriers or be conducive to computer emphasis within schools, so that recommendations could be developed to enhance computer integration (See graph 13).

The study examined the possibility of correlations between a schools' commitment to provide students with computer skills with a number of other factors,
including length of time the architectural program had been in existence, size of university/architecture program, public or private status, size of town in which schools were located, and tuition charged. The correlation between these factors and schools’ computer emphasis was found to be small in most cases. The schools at the top of the list tended to be smaller, newer, charge higher tuition, located in large cities, and more willing to emphasize practice.

The schools that concentrated most heavily on computer usage were Woodbury University, University of Utah, and the University of Arizona. Woodbury, the most computer oriented, was a fairly new school. The fact that it was established in the era of the PC may be one reason for its acceptance of automation. Of the four newest schools, all stressed computer use or expressed this as a goal toward which they were working.

The only university to address computer usage in its philosophy statement was Woodbury University. The view taken at Woodbury was the integration of technical education, including computer skills, into the design and theory courses, and the overall knowledge of architecture. Woodbury University was the only school at which all of the computer courses offered were required. Of those courses, the last two classes were CAD for the design studio. With its required courses and use of the computer in the studio, Woodbury represented the highest level of computer integration into the architectural curriculum in the Southwest.
COMPUTER USE IN FIRMS

Of the fourteen firms that answered the survey in the Las Vegas valley only one firm was not using computers in the production of their drawings (see graph 14). Although the sample size was small and would have had a large repeatedly margin of error if it was considered purely for its statistical merits, the responses reinforced the notion among the Las Vegas architectural community that practically all firms in this city were computerized, and that computer literacy was the primary skill these firms sought in hiring entry-level personnel. The survey also reinforced the idea that Las Vegas firms overwhelmingly hired entry-level personnel to perform

Graph 14: Percentage Of Las Vegas Firms Using Computer In 1995. Source: Authors Investigation
production tasks rather than more "artistic" tasks, such as designing the concepts for buildings.

The single firm that was not using computers in their operations was a small firm that seemed to despise the use of the computer. They were appalled at the fact that state work was only awarded to firms that produced their drawings on the computer. This survey respondent stated his view that good architects were made not by computer proficiency but by a culmination of skills and knowledge from a wide variety of experiences and understanding. However, none of the survey respondents indicated views that would conflict with this statement. Proponents of computer education in architectural schools agreed that the practice of architecture was much more than proficiency in computer use. Their responses pointed out the view often viewed among both academic architects and some practitioners that the use of a computer somehow negates or opposes all other aspects of architectural education and practice. This particular firm specialized in small residential jobs and did not produce major public or commercial projects which, as, required by State policy, that architects submit computer-generated drawings and files.

GAP BETWEEN SKILLS TAUGHT IN SCHOOLS AND REQUIREMENTS OF FIRMS

The research conducted through this thesis demonstrated that a gap existed
between the computer skills that southwest schools were providing and those skills sought by Las Vegas firms in employing entry-level candidates. Of the fourteen firms surveyed, thirteen stated it was a requirement of the firm that their new hires have basic 2-D drafting skills and CAD knowledge. However, only three schools were requiring students to take a concentration of computer courses, and five schools required only one semester of basic computer survey, which was not sufficient to develop proficiency. All the schools, however, offered computer courses and some had a variety of options from which to choose. The schools which offered many elective computer courses allowed interested students to develop computer proficiency but did not prepare their graduates for the types of entry-level jobs found in an architectural market environment found in such locations as Las Vegas.
CHAPTER 7
RECOMMENDATIONS

It was logical to assume that persons who had completed five or more years of especially difficult college study in the field of architecture would have left school with the intent of finding work in the architectural marketplace and ultimately becoming a architect. Both the lay person and the prospective student assumed that architecture schools should and do prepare students to enter the architectural workplace. The gap between education and the workforce found in this study showed that this was not true. If schools were to live up to their commitment to the students, they needed to somehow close the gap between the skills taught and those needed for initial employment. The investigator had personally observed many architecturally qualified graduates enter an office and apply for position. One of the first questions that was asked concerned their level of computer knowledge. Applicants who were not computer literate were politely told that someone with computer skills was needed, and that they would not be considered for a position with the firm.
ATTITUDES WITHIN THE ACADEMIC COMMUNITY

A major issue that needed to be corrected in architectural education was its ambivalent attitudes towards utilization of computers and the realities of their use in the practice of architecture. From the surveys and literature research conducted there seemed to be little argument regarding the ubiquitous requirement for design and production of professional documents through the means of computer hardware and software in present day media. They were used to and will continue to be used. Some schools seemed to have little interest in training students for production-oriented entry-level jobs, but most entry-level jobs in Las Vegas were in the production section which required computer skills. This showed that those Southwest schools who produced the graduates without necessary computer skills for employment in cities such as Las Vegas failed students in their obligation to prepare them with the computer skills needed for the profession they were entering.

Students did not graduate with all the technical knowledge needed to be architects, or there would have been no need for a three-year internship before graduates were eligible to be licensed. Production-oriented initial jobs provided young intern-architects with the technical experience they needed to design buildings that were cost-effective, structurally efficient, and buildable. Preparing students for their first job was not the supreme goal of Southwest architectural school. However, without that first job the recent graduate would never have been
able to become a registered architect. Production positions may not have enforced the glamorous view of architecture that was popularized in Ayn Rand’s novel The Fountainhead, but they were and continued to be a necessary step in educating students with a more comprehensive knowledge of the discipline of architecture. It was only with this comprehensive knowledge that a practitioner was truly able to be called a professional. Being able to produce a building design that was competent in all aspects, technically as well as in its broader social, aesthetic, and economic aspects, and follow it through to completion was and has continued to be the essence of professionalism in architecture. Architects, as professionals, were required to produce a product that gave a tangible benefit to society. This was what separated professional architects from artists, dilettantes and draftspersons.

An elitist attitude was still found frequently in architectural education that suggested it was somehow beneath the dignity of schools to teach practical skills that were required in a production position. The old view of the gentleman dilettante architects, who practiced architecture as a genteel pastime rather than sole supporting themselves by providing a professional, tangible benefit to society, seemed to persist in many schools by their reluctance to teach necessary skills and knowledge related to production documents and technical subjects. The analysis of Las Vegas market done has demonstrated perhaps that more than many, architecture was first and foremost an economic activity. It consisted of the erection
of buildings for human use, paid for by building owners who wanted the best value for their money and who provided a living wage only for those who were able to produce a product efficiently and competently, whether they were architects or graduates who aspired to become architects. No other profession school generated graduates without providing them with the skills to fully prepare them for entry-level jobs in their chosen field, or without the knowledge of the nuts-and-bolts of their profession needed to deliver their basic services to the client. This investigation found no overwhelming philosophical or practical reason why schools could not have taught skills applicable at all levels of experience in the profession, and have fulfilled their commitment to students by providing them with the ability to enter the field for which they had studied for five or more years.

A persistent attitude among some academicians with dated skills and educations, who were unfamiliar with computers, was the curious view that using a computer to explore and communicate design ideas somehow prevented students from learning the "real" focus of architecture, such as aesthetics, spatial relationships, environmental responses, and societal impacts. The suggestion was that computers and technical proficiency were somehow in conflict with these loftier topics and goals of architectural education. On the other end of the spectrum, educators competent in the use of computers tended to believe computers enhanced and freed students from time and energy consuming assignments in the
instruction of practically all topics in architecture.

Apparently, a fundamental reason why some traditional educators rejected computers were the association of computers strictly with drafting, and the idea that the use of computers in the studio would turn architecture schools toward "vocational" or trade school education. The suggestion was that education will concentrate on teaching the particular commands used to manipulate the computer, to the exclusion of most everything else. Computer advocates saw computers as little different from traditional drawing media - they all took well developed skills to use them effectively - and that persons who wanted to enter the profession needed to learn to use the tools that were the industry standard. As an architecture student, a job captain and a proficient computer user, the investigator held the view that using a computer daily, until the motions became reflex, was precisely the way to develop the computer skills that were needed when students wished to enter the workforce. Older educators may not have realized that students who grew up with computers had a much better intuition for their use, and that for these students, learning computer skills was not an overwhelming task that left no time for the study of other aspects of architecture curricula. The view of computers as complex drafting machines was also a narrow-minded view that ignored the more sophisticated applications that were constantly developing in areas such as structural analysis, environmental modeling, and graphic representation.
Las Vegas firms were using computers to draw construction documents and were utilizing various programs in the design phase of projects. All the firms surveyed that used computers were using PC compatible, in either the DOS or Windows environment. Schools, however, continued to teach CAD and other related software on Macintosh computers. Students would have benefited if they were taught on the systems they would utilize after graduation. Therefore, it was the writer's recommendation that schools convert from Macintosh computers to PC computers. This would allow students to familiarize themselves at an early stage with the machinery most commonly used in the profession, and would have avoided students' confusion with two different environments. One barrier to wider use of PC's over Macintosh was that Apple provided greater price incentives to educational institutions, making Macs more economical for schools to acquire. Schools needed to weigh the benefits of having a lower number of computers that met the workplace standard versus a higher number of computers that differed from those most commonly used in the profession.

Of the fourteen firms surveyed, twelve were using AutoCAD Release 12 to produce their construction documents, and of those twelve, nine of the firms were also utilizing it for the design of their projects. However, of the thirteen schools
surveyed only six taught AutoCAD. Schools should have kept in touch with the professional environment concerning computer use and taught the products commonly used so that students may have been able to transfer their skills directly from school to the workplace. Again, economic factors promoted use of other, less expensive CAD programs than AutoCAD, which provides little in the way of discounts to educational institutions. Schools should have been aware that choosing to buy more licensed copies of a cheaper CAD software, instead of fewer copies of the most widely used package, may have adversely impacted the school's ability to produce employable graduates.

As technology advanced rapidly, software and hardware technology also advanced, with considerable developments introduced into the market each year. For schools to have kept on top of these rapid changes, funds should have been budgeted annually for computer-related purchases for architectural curricula. These purchases may have been in the form of computer software upgrades, hardware or motherboard advances, networking, and plotting medium devices.

CURRICULUM

If universities were to provide architecture students with an education that will make them competitive in the job market, they should have required more computer
use within the curriculum. These courses should have started early in the student's career and progressed annually as the student advanced. Making computer courses mandatory would have required students to face and conquer the often times intimidating prospect of developing computer competency.

As with any skill, computer use took a few months of constant operation for the user to become proficient. It would have taken more than just one introductory course for students to have gained a level of skill that would have been useful in the design and drawing of an actual project. Introductory classes that covered basic principles of graphic representation (first or second year) should therefore have included both traditional and computer methods, teaching students principles that applied equally in either medium. Students would have thus learned the basics of both methods, and the early exposure to computers would have translated into greater efficiency in the following years of their professional education. At the start of third year, when design training began in earnest, students who were equipped with enough computer knowledge would have been able to utilize the computer in their third year design studio projects. By the final year of their curriculum, students would have gained enough computer proficiency to have met the demands for initial employment in professional office of practicing architects.

Two barriers to computer integration in Southwestern architecture schools related to the location of computers and the type of instructors hired to teach
computer skills. With regard to location, computers were often placed in a lab that is physically separated from the studio environment. For teaching, instructors of computer courses are often generalized experts in computer programming usage rather than specialized on applications for architectural professionals. Therefore, many students’ computer experience is often separated from the design process and directed by a professor who may have little knowledge of design applications. Such situations could lead to computer instruction that was only vaguely related to professional use of computers in architecture, and that may have been of little use in the design process. For computers to be used to their fullest benefit, they should have been physically located in the studio environment and taught by design professors who understood their use in professional practice. Thus, students would have not only gained computer proficiency, but also would have seen how their computer proficiency was incorporated into an actual project. Students’ experiences have shown that copying an elevation from a book as an exercise, is not as valuable a learning experience as formulating and representing that elevation from one's own design decisions.

The computer could have been used in the studio not only to produce finished drawings, but also to have helped the student in the design of three-dimensional studies, virtual reality renderings, light and shadow studies, calculations of loads (wind, structural, energy), color selections, and imaging. Incorporation into
the studio would therefore have allowed students to explore design issues to a
larger degree and more efficiently than was possible with traditional methods. This
was especially significant since design had much become more sophisticated and
complex.

**STUDIO**

Usually, the location of computers in laboratories rather than in design
studios was found to have been a matter of budgetary efficiency. Schools could
afford shared computer resources more easily than they could provide a computer
for each student. However, shared computers caused a problem in at least two
ways. One was that the computer was physically separated from the environment
where the design work was being done, which discouraged the computer's use in
design. The other problem was that shared computers were in high demand at
peak periods, such as the end of the semester, which decreased students' opportunity to use them in completing projects. Therefore, the ideal situation would
have been to place a computer for every student in the design studio. This was the
most effective means to integrate computers effectively, and architecture programs
should have striven to achieve this ideal situation. The expense of hardware and
software was, of course, the main barrier. One alternative was to require students
to buy their own machine, as proposed at the University of Arizona and other programs. This may have had the undesirable consequence of limiting architectural education only to those with sufficient financial resources, unless schools were able to make arrangements with computer manufacturers to arrange loans, grants, or other payment plans for this requirement. Apple, the leader in the educational segment of the computer industry, was marketing their goods to students and schools and offered such financing arrangements. Requiring students to provide their own hardware would have also allowed schools to have concentrated their resources on providing software and networking capabilities.

It was important that universities be selective in their purchase of computer software programs. Programs such as AutoCAD were expensive, even when special educational pricing was available, but many CAD and modeling programs were on the market that cost far less and had similar capabilities. Software development was an extremely active industry; new packages were continually introduced into the market, and competition was high. Schools had the opportunity to investigate and purchase programs that were less expensive and relatively easy to learn by students in developing schematic design solutions for a project. A major consideration was that schools should have purchased CAD packages most used by local architects in the schools' region so that students could have had the opportunity to prepare themselves for employment. Although architecture schools
often had objected to the idea of offering "vocational" or "computer operation" courses, they should have investigated the feasibility of offering such courses outside of the normal program and marketed these offerings toward local professionals and their staffs. Revenue from these courses could have helped defray costs of providing expensive software for the use of full-time students in the program.

Another possibility for reducing a schools' financial burden in purchasing expensive software such as AutoCAD is to offer courses in cooperation with a local technical school or community college that taught the desired software package. This arrangement was in place at the Newschool of Architecture. By this means architecture schools could save money by granting students credit for classes completed using other school's resources.

To integrate computers effectively into the studio, professors must be competent computer users. Computer proficiency should have been a hiring criterion for new faculty, and current design faculty should have been required to achieve computer proficiency. Computer proficiency should also have been established as one of the requirements for attaining tenure, and continuing technical proficiency established as a performance criterion. Only when studio professors have understood the professional use of computers in architecture will students leave school with the proficiency to use this tool to their best advantage.
Computer use in the studio also could have created a convenient opportunity for group projects. With networks, students could have easily shared drawings and other information on different phases of the same project. This would have allowed familiarization with another type of computer use they would probably have encountered if they worked for a larger firm. It would have given them experience in team design and production, which they would probably have encounter in positions they were likely to hold after graduation.

In summary, the use of computers in design studios created new physical demands for architecture program facilities. Computers required sufficient electrical and communications outlets as well as physical space for printers, servers, terminals, and plotters. Also, important were static protection and an environment relatively free of airborne particles, such as cutting wood with power saws within the studio. Individual work spaces had to be arranged to accommodate the computer, drawing space, and layout space. Securing this valuable equipment involved physically attaching the equipment to an immovable surface, or limiting the physical means of access with keys, keycards, or combination locks, or by limiting the hours in which access was allowed. Computers also produced eyestrain, especially with the long hours architecture students spent on their projects, and an appropriate level of non-glare lighting had to be achieved. Finally, the use of computers and computer networks were expected to develop operational problems,
especially when operated by persons who were not completely familiar with the machines. The presence of a computer technician or system manager, whether a separate full-time position or a staff member's collateral duty, was necessary to ensure that equipment functioned properly. This reduced the potential time loss of that studio professors and students attempting to correct system problems beyond their expertise.

SUMMARY

This analysis has shown that schools of architecture in the Southwestern region needed to ensure that quality computer instruction was included in their curricula. The research showed that architectural firms in a job market such as that found in Las Vegas demanded entry-level employees who are effective computer users, and that architecture schools could produce such graduates if proper emphasis was given to integrating computers into the curriculum. With the benefits provided by computers, architectural education would be able to reach new levels of excellence to keep pace with the advances within the profession.
APPENDIX A

IDP TRAINING REQUIREMENTS
You must acquire 700 value units (465 are required and 235 are elective) to satisfy the IDP requirements. One value unit equals eight hours of work in that specific category.

CATEGORY A: DESIGN AND CONSTRUCTION DOCUMENTS
1. Programming ................................................................. 10
2. Site and Environmental Analysis .................................................. 10
3. Schematic Design .............................................................. 15
4. Building Cost Analysis ......................................................... 10
5. Code Research ........................................................................ 15
6. Design Development ............................................................. 40
7. Construction Documents .......................................................... 145
8. Specification and Materials Research ......................................... 15
9. Document Checking and Coordination ...................................... 15
Total Units Required .................................................................. 350

CATEGORY B: CONSTRUCTION ADMINISTRATION
10. Bidding and Contract Negotiation .............................................. 10
11. Construction phase-Office ...................................................... 15
12. Construction phase-Observation .............................................. 15
Total Units Required .................................................................. 70

CATEGORY C: MANAGEMENT
13. Project Management .............................................................. 15
14. Office Management .............................................................. 10
Total Units Required .................................................................. 35

CATEGORY D: RELATED ACTIVITIES
15. Professional and Community Service ......................................... 10
16. Other Related Activities .......................................................... 0
Total Units Required .................................................................. 10

The difference between the total units required and the sum of the categories is that the candidate must earn a certain number of units within the same category.
APPENDIX B
SAMPLE SCHOOL SURVEY

CAL POLY-SAN LUIS OBISPO SCHOOL SURVEY

Each school was surveyed individually because of their different computer class requirements. This is a sample of one of the thirteen different questionnaires that were sent out.

1. Please check which computer classes are required and which are optional?

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<th>Required</th>
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<td>Computer Application</td>
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<tr>
<td>350</td>
<td>Computer Application To Arch.</td>
</tr>
<tr>
<td>357</td>
<td>Computer Graphics In Arch.</td>
</tr>
<tr>
<td>461</td>
<td>Adv. Comp. CAD Arch.</td>
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2. If you require an application in computer architectural class, how is it taught? (check which applies)

   ___ In a lab
   ___ In the studio
   ___ It is not required

3. Do you develop hand drawing skills before drawing on the computer?
   Yes  or  No

4. Do you encourage preliminary sketching on the computer?
   Yes  or  No

5. If you incorporate the use of a computer in the design studio, at what year in the curriculum do you do this? (circle one)
   1st  2nd  3rd  4th  5th  or  6th

6. In what ranked order do you teach the computer? Number with 1,2,3,4,5- with 1 being first and 5 being last.

   ___ 3-D Modeling
   ___ 2-D
   ___ Virtual Reality
   ___ 3-D Simple
   ___ Wordprocessing/Dos
7. Which of the following applies to computer usage in your curriculum? (check one)
   ___ Each student has a computer at their desk
   ___ Studios have a fixed number of computers for common use
   ___ Computers are in lab separated from the studio

8. Do you require team projects?  
   Yes  ___  No

9. Are you using the computer for other applications besides design (ex: structures, energy, pro-practice, specifications, construction documents, mechanical) List all that apply.

10. Of the computer classes you offer, what classes relate to building design and which relate to construction documents?
    DESIGN  ___  CONSTRUCTION DOCUMENTS

11. With the increasing trend towards computer utilization, do you anticipate any curriculum changes in the future to compensate for this trend? If yes, what changes will be made and when?

12. Any other suggestions or comments relating to computers in the curriculum that you are currently using, will be appreciated. Please list your comments below:

In addition to this survey that was mailed out to the different schools a telephone survey was conducted in December, 1994. The following questions were asked to the different schools.

a. What type of computer hardware are you currently running?

b. What computer software are you currently running for your different functions, such as 3-D, 2-D, design, etc.?

c. At what time was your college established as a independent entity?
APPENDIX C

SAMPLE FIRM SURVEY

FIRM SURVEY

1. How many of your employees are classified as architects, intern-architects, or drafting personnel?
   ___ 1-4                      ___ 5-10
   ___ 10-15                    ___ Over 15

2. Evaluate the importance of the following qualifications when you hire a recent graduate, by filling in the blank with the most appropriate responses—VI, SW, or NI (Very Important, Some-What Important, or Not Important. List any additional items you feel are important attributes when hiring a graduate.
   ___ College Degree          ___ Willing to Work
   ___ Draft/Design Experience ___ References
   ___ Computer Knowledge      ___ Appearance
   ___ Meet Job Requirements   ___ Wage
   ___ Attitude                ___ Benefits
   ___ Personal Goals          ___ Personality
   ___ Skills
   Others:____________________

3. Approximately how many recent graduates have your hired in the past 5 years?
   ___ 0-2                      ___ 3-4
   ___ 5-6                      ___ Over 6

4. When you employ a person, what do you look for? (check the one that applies)
   ___ 1. Someone with a professional degree
   ___ 2. Someone with experience
   ___ 3. All the above
5. When you hire someone new do they have to be computer literate? If yes, check all that apply.
   VL  SWL  NL  Managerial computer (W.P., Spreadsheets)
   VL  SWL  NL  CAD-Basic Drafting
   VL  SWL  NL  CAD-3-D
   VL  SWL  NL  Computer Modeling w/Fly-Through
   VL  SWL  NL  Virtual Reality
   VL  SWL  NL  Programming Their Own Systems
   Others:________________________

6. What software programs are you currently utilizing for your production and design departments?

   DESIGN   PRODUCTION
   __________  __________
   __________  __________
   __________  __________

7. In general, how responsive are the principals in your firm toward computers i.e. - very literate, some-what literate, or not literate at all? (circle the one that applies)
   VL   SW   NL

   Firm Name:_____________________________________________________

   Any Additional Comments would be appreciated, please list below:
WORKS CITED


Bennett, Tom. 1993. 'Old-fashioned' architects leap to the cutting edge. Architectural Record, June, 75-77.


Novitski, B.J. 1994b. From drawing board to CAD. Architecture, April, 127-29.


Ross, Steven S. 1994. 'Virtual office' is set to lure architects into 21st century. Architectural Record, October, 56-69.


PART 2

APPLIED THESIS

A PROTOTYPICAL ARCHITECTURE SCHOOL
PROGRAMMING DOCUMENT
PROGRAMMING

PROTOTYPE

COLLEGE

OF

ARCHITECTURE

by: SHELLY ANN HAYDEN
MASTER OF ARCHITECTURE
UNLV
MAY 1995
### Library
- 4100 A1 General Shelving
- 1000 A2 Bound Periodicals
- 300 A3 Reference/Text Books
- 300 A4 Syllabus/Sec/Pub/Display
- 450 A5 Current Periodicals/Informal Reading
- 150 A6 Microforms
- 150 A7 Catalog Card Area
- 150 A8 Overdue Policies
- 150 A9 Copy Area
- 150 X5 Typing/Computer Area
- **Total:** 64460

### Classrooms
- 3100 B1 Audio/Computer
- 100 B1 Projection Room
- 100 B1 Platform/Stage
- 100 B1 Storage Room 1
- 100 B1 Storage Room 2
- 100 B1 Lobby/Entry
- **Total:** 6650

### Administration
- 300 C1 Dean's Office
- 140 C2 Dean's Secretary
- 140 C3 Assistant Dean's Office
- 05 C4 Undergraduate
- 20 C5 Graduate Program Coordinators
- 140 C6 Administrative Assistant
- 100 C13 Secretary/Clerical Staff
- 140 C14 Office
- **Total:** 6650

### Studio
- 1400 D11 First Year Studio
- 1400 D12 First Year Studio
- 1400 D13 First Year Studio
- 1400 D14 First Year Studio
- 150 D15 Faculty Office
- 150 D16 Faculty Office
- **Total:** 6650

### Shop Zone
- 200 E1 General Work Area
- 200 E2 Plastic Power Tool Area
- 200 E3 Wood Power Tool Area
- 200 E4 Tool Storage
- 100 E5 Clean-Up
- **Total:** 6650

### Commons
- 100 F1 Vending Area
- 100 F2 Concession Area
- 150 F3 Gifts
- 100 F4 Kitchentte
- 100 F5 Display Storage
- **Total:** 6650

### Gallery
- 100 G1 Permanent Display
- 100 G2 Temporary Display
- 100 G3 Lobby/Entry/Desk
- 100 G4 Kitchenette
- 100 G5 Display Storage
- 100 G6 Janitor Room
- **Total:** 6650

### Research Lab
- 100 H1 Graphic Production
- 100 H2 Copy Center
- 100 H3 Student Archive/Store
- 100 H4 Computer Laboratory
- 100 H5 Copy/Teach's Office
- 100 H6 Boro/Shop Area
- 100 H7 Construction
- 100 H8 Display Area
- **Total:** 6650

### Approximate Usable Area
- 64460 S.F.

### Support Area (40%)
- Restrooms, Structural, Mechanical, Lobby, and Circulation
- **Total:** 12892 S.F.

### Total Building Gross Square Feet
- **Total:** 77352 S.F.

### Space Considerations
SPACE RELATIONSHIP
OUTDOOR COMMONS

F1.1 VENDING AREA

F1.3 INDOOR COMMONS

F1.2 CONCESSION/KITCHENETTE

COMMONS
ADMIN.

KITCHENETTE

TEMPORARY DISPLAY

PERMANENT DISPLAY

JURY ROOM

PUBLIC ENTRY

GALLERY
GENERAL SHELVING AND BOUND PERIODICALS

Shelving for general books and bound periodicals will be on a standard shelving system in 3'-0" modular shelves with approximately five shelves per module. The collection should be grouped in two or three areas for easy organization of call numbers. Spacing between modules should be a minimum of 3'-6" to accommodate for book trucks and convenient patron use. Leave top two shelves empty to accommodate for projected future growth.

<table>
<thead>
<tr>
<th>SHELVES</th>
<th>BOOKS/SHELF</th>
<th>BOOKS/MODULE</th>
<th># OF MODULES</th>
<th># OF VOLUMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOOKS</td>
<td>5</td>
<td>25</td>
<td>15 APPROX.</td>
<td>212</td>
</tr>
<tr>
<td>PERIODICALS</td>
<td>5</td>
<td>25</td>
<td>15 APPROX.</td>
<td>100</td>
</tr>
</tbody>
</table>

PLAN

A. 36x18x92h BOOKSHELVES (434)
GENERAL READING AREA (SEAT 62)

Architecture books tend to be larger than standard books so areas should be provided to open several books at one time. Reading areas should be dispersed throughout the general shelving. Avoid getting clustered together. This will generate a noisy atmosphere. Reading area should be away from other noisy areas such as entrance, reference, computer catalog, typing area. Natural lighting supplemented by artificial lighting is recommended. Approximately 50% individual carrels (e.g., with a desk surface approx. 3'-0" long x 2'-0" deep). 40% should be be table seating (6'-0" x 4'-0" EZ seating 4 persons) and the remaining to be lounge.

PLAN

EQUIPMENT

A. 36x24 INDIVIDUAL CARRELS
B. 3-SEAT COUCH
C. CHAIRS
D. 12x48 WORKTABLE
REFERENCE/INDEX BOOKS

The reference collection should not be far from the circulation desk, that way they can be seen by library users since they are non-circulating volumes. Located near a on-line catalog computer, adjacent to a seating area to serve eight people. Reference shelving should be alternating with every other shelf being waist high to allow the tops to serve as consulting area. Leave top two shelves empty for future growth.

<table>
<thead>
<tr>
<th>SHELVES</th>
<th>BOOKS/SHELF</th>
<th>BOOKS/MODULE</th>
<th># OF MODULES</th>
<th># OF VOLUMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>25</td>
<td>50</td>
<td>4</td>
<td>400</td>
</tr>
<tr>
<td>5</td>
<td>25</td>
<td>125</td>
<td>8</td>
<td>600</td>
</tr>
</tbody>
</table>

PLAN

A. 12x48 WORKTABLE
B. 36x24 INDIVIDUAL CARRELS
C. 36x12x47 BOOKCASE (4)
D. 36x12x30 BOOKCASE (2)
E. CHAIR (2)

ROOM A1.3 SCALE: 3/16"=1'-0"
ENTRANCE/SECURITY/DISPLAY

There should be one public entrance/exit for the library. All patrons exiting will pass through a security detector system, except in an emergency. The circulation desk should be visible from the entry for security and check-out reasons. The reserved books should be visible from the entrance. Display area should be provided allowing enclosed displayed a open bulletin/tackboard. The entrance should be inviting.

PLANT

EQUIPMENT
A. 48x36 table model display
B. 48x48 tackboard
C. Security detector
CURRENT PERIODICALS & INFORMAL READING (15)

Current issues should be located relatively close to the entrance, it is assumed that patrons will come in for short periods of time to browse quickly through the new periodicals. This area will probably be a social area, promote casual conversations, with furniture being of lounge type, low tables, with an exterior view. Separate from noise reasons but locate to permit staff to monitor it. Shelving is the sloped which allow covers to be displayed. Some to be a two-shelf modules to create open area.

<table>
<thead>
<tr>
<th>SHELVES</th>
<th>BOOKS SHELF</th>
<th>BOOKS MODULE</th>
<th># OF MODULES</th>
<th># OF VOLUMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>3' x 0&quot;</td>
<td>2</td>
<td>3</td>
<td>6</td>
<td>36</td>
</tr>
<tr>
<td>1' x 0&quot;</td>
<td>5</td>
<td>5</td>
<td>15</td>
<td>6</td>
</tr>
</tbody>
</table>

PLAN

EQUIPMENT

A. 72 x 48 TABLE
B. CHAIR (2)
C. 3-SEAT COUCH
D. END TABLE
E. 36 x 12 x 64 BOOKCASE (2)
F. 36 x 12 x 64 BOOKCASE (2)
G. LOUNGE CHAIR (2)
H. COFFEE TABLE
ROOM #: A16
TITLE: MICROFORMS
CAPACITY: SIX
FUNCTION: LIBRARY
AREA: 150 SF.

MICROFORMS

MICROFORMS WILL BE PART OF THE COLLECTION: BACK ISSUES OF PERIODICALS, SPECIAL COLLECTION MATERIAL, ETC. MICROFORMS ARE EITHER 35MM REEL MICROFILMS OR 4"x6" MICROFICHE. EACH MICROFORM REQUIRES STORAGE AND SPECIAL EQUIPMENT FOR VIEWING AND REPRODUCTION. SIX READER STATIONS SHOULD BE PROVIDED WITH APPROXIMATELY 15 S.F. FOR EACH, AND PROVIDE CABINETS FOR STORAGE APPROXIMATELY 3'-0" WIDE BY 2'-0" DEEP BY 4'-0" HIGH. PROVIDE ONE FOR FUTURE USE.

PLAN

EQUIPMENT
A. READER STATION
B. CHAIR (6)
C. 36x24x48" STORAGE CABINET

ROOM A16 SCALE: ¼"=1'-0"

◊ ◊ ◊ ◊ ◊ ◊ LIBRARY
ROOM #: A17

TITLE: CATALOG AREA

CAPACITY: SIX

FUNCTION: LIBRARY

AREA: 150 SF.

CATALOG AREA

Approximately 150 SF will be required to accommodate (4) computer terminals to reference not only the Architecture Library but also the University Library. This area should be located near the circulation desk, reference area, and readily accessible to the general stacks. They should not be clustered but dispersed throughout the stacks.

PLAN

EQUIPMENT

A. 36"x24" P.C. TABLE
B. CHAIR (4)
C. COMPUTER TERMINAL
D. NETWORK COMPUTER OUTLET
E. CARD CATALOG CABINETS

ROOM A17  SCALE: 1/4" = 1'-0"
OVERSIZED FOLIOS

OVERSIZED BOOKS REQUIRE SPECIAL SHELVING AND ARE GENERALLY KEPT SEPARATE FROM THE GENERAL STACKS, BUT HOWEVER IS LOCATED NEAR THEM. OVERSIZED BOOKS ARE STORED IN TWO DIFFERENT FASHIONS: FLAT IN CUSTOM SHELVES WITH DEEPER STORAGE OR VERTICALLY IN STANDARD SHELVES WITH FEWER SHELVES. LOCATE GENERAL READING TABLES CLOSE TO THIS AREA FOR PATRONS EASY ACCESS

<table>
<thead>
<tr>
<th>SHELVES</th>
<th>BOOKS/SHELF</th>
<th>BOOKS/MODULE</th>
<th># OF MODULES</th>
<th># OF VOLUMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>VERTICAL</td>
<td>4</td>
<td>16</td>
<td>12</td>
<td>900</td>
</tr>
<tr>
<td>FLAT</td>
<td>10</td>
<td>30</td>
<td>0</td>
<td>250</td>
</tr>
</tbody>
</table>

PLAN

ROOM A1B

EQUIPMENT
A. 36x12x30h BOOKCASE (12)
B. 36x18x30h BOOKCASE (6) FLAT

ROOM A1B SCALE: 1/4" = 1'-0"
COPY AREA

There should be provided both black-and-white and color copier. Each copier should have a work space located nearby for holding material to be copied. It should be located near the entrance, as students often bring non-library material in to be copied. It should be contained in a separated area or room because the noise they generate; provide acoustical control. It should be convenient to the current periodicals and reserve books as they are not allowed to leave the library. It should be visible from circulation desk. Glazing maybe required.

PLAN

EQUIPMENT

A. Sorting Table
B. Copy Machine
ROOM #: A110

TITLE: TYPING/COMPUTER AREA

CAPACITY: SIX

FUNCTION: LIBRARY

AREA: 230 SF.

TYPING/COMPUTER AREA

This room should be acoustically separated from the rest of the library. It should provide a minimum of (4) typing stations and (6) computer terminals for word processing functions. Provide one community printer.

PLAN

EQUIPMENT

A. 60x36 P.C. WORKTABLE
B. 48x24 WORKTABLE
C. SECRETARIAL CHAIRS (10)
D. COMPUTER TERMINAL
E. PRINTER
F. TYPEWRITER
G. COMPUTER NETWORK OUTLET
H. WORKTABLE

ROOM A110  SCALE: 1/2"=1'-0"

◊ ◊ ◊ ◊ ◊ ◊ ◊ LIBRARY
ROOM #: A2.1

TITLE: SPECIAL COLLECTION

CAPACITY: EIGHT

FUNCTION: LIBRARY

AREA: 200 SF.

SPECIAL COLLECTION

Each 'SPECIAL' collection shall show its separation by the decor and furnishing in each room. They will have conference tables (for B) within. This will allow meetings. Library staff will control access to these rooms, appointments necessary. Books will be locked in glass shelving, and retrieved by library staff. Provide large storage of oversized folios. Provide special humidity & environmental controls for the preservation of the collection. Allow natural lighting as long as it does not come into contact with the collection. It shall be located near the special collection rooms & the rare books collection. Special collection include non-typical library materials such as drawings, tapes, catalogs, photographs.

<table>
<thead>
<tr>
<th>SHELVES</th>
<th>BOOKS/ SHELF</th>
<th>BOOKS/ MODULE</th>
<th># OF MODULES</th>
<th># OF VOLUMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>25</td>
<td>125</td>
<td>2</td>
<td>250</td>
</tr>
</tbody>
</table>

EQUIPMENT

A. BOAT-SHAPED CONF. TABLE
B. CONFERENCE CHAIR (8)
C. 36x14x30H BOOKSHELF (2)

PLAN

ROOM A2.1 SCALE: 1/4"x1'-0"
ROOM #: A22

TITLE: RARE BOOK COLLECTION

CAPACITY: SIX

FUNCTION: LIBRARY

AREA: 300 S.F.

RARE BOOKS

The staff will control access to this room. Monographs, photographs, drawings and miscellaneous papers will be kept locked in shelves and files. Provide appropriate humidity and climate control for the preservation of the collection. Provide a conference table for six. Little natural light.

<table>
<thead>
<tr>
<th>SHELVES</th>
<th>BOOKS/SHELF</th>
<th>BOOKS/MODULE</th>
<th># OF MODULES</th>
<th># OF VOLUMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>125</td>
<td>25</td>
<td>125</td>
<td>10</td>
<td>1250</td>
</tr>
<tr>
<td>4'-0&quot; FLAT FILES</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

PLAN

EQUIPMENT

A. BOAT-SHAPE CONF. TABLE
B. CONFERENCE TABLE (6)
C. 36''x48'' SHELVES (10)
D. FLAT FILES (5)

ROOM A22 SCALE: 3/16" = 1'-0"
SLIDE COLLECTION

SLIDE COLLECTION SHALL BE OPEN THE SAME HOURS AS THE LIBRARY. IT WILL HAVE A LOCKED ENTRANCE. PATRONS WILL BE ALLOWED TO ACCESS IT EVEN WHEN A STAFF MEMBER IS NOT PRESENT. PUBLIC SPACE WILL INCLUDE STORAGE CABINETS, STUDY AND VIEWING CARRELS AND A CATALOG COMPUTER. STUDY CARRELS HAVE LIGHT TABLES FOR VIEWING IMAGES. TRAYS WILL BE AVAILABLE FOR VIEWING SLIDES IF A STUDENT MISSES A CLASS. STAFF AREA WILL INCLUDE A COMPUTER WORKSTATION, SLIDE MOUNTING, AND LABELING AREA AND STORAGE FOR EQUIPMENT. DARKROOM FACILITIES ARE LOCATED IN SHOP ZONE.

PLAN

EQUIPMENT

A. 36"x24" WORKTABLE
B. 24"x48" VIEWING CARRELS
C. 24"x18"x60" SLIDE FILE CABINET
D. COMPUTER TERMINAL
E. NETWORK COMPUTER OUTLET
F. SECRETARY CHAIR
G. TYPEWRITER
H. 60"x36" DESK w/RETURN
J. CHAIR (6)
K. STORAGE CLOSET
SEMINAR/MEETING ROOM

This seminar room is a multi-use room for viewing media, and holding meetings, seminars, class presentation. It will be equipped with a conference table for 10. It shall be equipped with a projection and slide projection equipment. Equipment will be secured for security.

PLAN

EQUIPMENT
A. Conference Table
B. Conference Chair
C. Projection Screen
D. Built-in Counter
E. Slide Projector

ROOM A2.4

SCALE: 1/4" = 1'-0"

LIBRARY
DOCUMENT CENTER

THE DOCUMENT CENTER IS A PLACE FOR OBTAINING DOCUMENTS AND DRAWINGS. AIA SUPPLY LARGE DRAWINGS AND CONTRACT DOCUMENTS WHICH CAN BE OBTAINED HERE. INSTEAD OF ARCHITECTS SENDING OUT FOR DOCUMENTS THEY CAN GO HERE AND PURCHASE THEIR REQUIRED MATERIALS. IT SHALL BE EQUIPPED WITH FILES AND SHELVES FOR STORAGE.

PLAN

EQUIPMENT

A. BUILT-IN COUNTER
B. VERTICAL FILES (6)
C. FLAT FILES (2)
D. 36X18X50IN BOOKCASE (2)
E. SECRETARIAL CHAIR
F. COMPUTER TERMINAL
G. TYPEWRITER
H. LOUNGE CHAIR
J. END TABLE
LIBRARIAN’S OFFICE

THE LIBRARIAN IS RESPONSIBLE FOR ACTIVITIES THAT OCCUR WITHIN THE LIBRARY, WHICH DO NOT REQUIRE DIRECT CONTACT WITH USERS AND STAFF. THIS OFFICE WILL BE THE PLACE OF UNSCHEDULED MEETINGS, CONSULTING WITH FACULTY AND STUDENTS ON THEIR RESEARCH NEEDS, AND MEETING WITH STAFF. LIBRARIAN IS USUALLY ENGAGED IN RESEARCH, PROVIDE LAY-OUT SPACE AND SHELF STORAGE. OFFICE LAY-OUT SHALL PROVIDE MOVEABLE ITEMS WITH ERGONOMIC FURNISHINGS. A VIEW TO THE EXTERIOR IS ESSENTIAL.

PLAN

EQUIPMENT

A. 66x30 DESK WITH RETURN
B. 66x18 CREDENZA
C. 36x44x42h BOOKSHELF (2)
D. SWIVEL CHAIR
E. WASTEBASKET
F. CONFERENCE CHAIRS (1)
G. FILING CABINET (2)
H. NETWORK COMPUTER OUTLET
I. COMPUTER TERMINAL
J. WORK TABLE w/(2) CHAIRS

ROOM A3.1  SCALE: 1/4"=1'-0"
CIRCULATION DESK/STAFF WORK STATION

The Circulation Desk or Check-out Desk is the point of maximum control of the materials in the library. This area will be located near the entrance/exit for security reasons. This area will be staffed by 2-3 personnel, accepting returns, checking out material. When staff is low, this area also becomes the reference desk. Work stations should provide seated staff member with an unobstructed view of the library. This area will be provided with computer terminals and the automated equipment for library use.

PLAN

EQUIPMENT
A. 60x30 DESK WITH RETURN
B. BUILT-IN COUNTER
C. SWIVEL CHAIR
D. WASTEBASKET
E. FILE CABINET (2)
F. NETWORK COMPUTER OUTLET
G. COMPUTER TERMINAL

ROOM A3.2  SCALE: 1/4" = 1'-0"

◊ ◊ ◊ ◊ ◊ ◊ ◊ LIBRARY
STAFF AREA

THE STAFF AREA PROVIDES SPACE FOR A VARIETY OF NEEDS AND ACTIVITIES. IT SHOULD BE FLEXIBLE TO ACCOMMODATE CHANGING SERVICES, WORK HABITS, INNOVATIONS, STAFF GROWTH, AND RE-ORGANIZATION. IT SHOULD BE AJACENT TO THE CIRCULATION DESK. PROVIDE A COMBINATION OF NATURAL LIGHT AND ARTIFICIAL LIGHTING. PROVIDE COMPUTER TERMINALS, TELEPHONE EQUIPMENT, AND CATALOG COMPUTERS. PROVIDE SPACE FOR MAIL, PROCESSING, OFFICE MATERIALS, PREPARATION OF BINDERY MATERIALS, TYPING AND STORAGE FOR PUBLISHERS CATALOGS, AND BOOK REPAIR (SINK REQUIRED).

EQUIPMENT

A. 60x30 DESK WITH RETURN
B. WORK TABLE w/(1) CHAIR
C. 36x14x48 SHELVES (4)
D. SWIVEL CHAIR
E. WASTEBASKET
F. COMPUTER TERMINAL
G. TYPEWRITER
H. NETWORK COMPUTER OUTLET
I. WORK SINK

PLAN

ROOM A33

SCALE: 3/16" = 1'-0'

LIBRARY
SHELVING/CIRCULATION TITLES/RECEIVING

This is an area next to the circulation desk. When a book is returned it goes to this area. It will be checked back in with the computer and put on a shelf for later re-circulation back to the general stacks. Provide a computer catalog terminal and (3) 3'-0" module shelves. Provide exterior door for receiving new equipment and books.

PLAN

EQUIPMENT
A. 66x30 Desk with Return
B. 60x30 Worktable
C. 36x14x42h Bookshelf (3)
D. Swivel Chair
E. Wastebasket
F. Secretary Chair
G. Computer Terminal
H. Network Computer Outlet

ROOM A3.4 SCALE: 1/4"=1'-0"

Library
RESERVE BOOKS

This space is near the entrance and circulation desk. Due to the fact you must obtain a reserved book from a staff member, this area will provide clear separation from the books and the reading area. Provide seating adjacent to the reserve books.

<table>
<thead>
<tr>
<th>SHELVES</th>
<th>BOOKS/SHELF</th>
<th>BOOKS/MODULE</th>
<th># OF MODULES</th>
<th># OF VOLUMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>25</td>
<td>125</td>
<td>2</td>
<td>250</td>
</tr>
</tbody>
</table>

EQUIPMENT

A. 72"x48 TABLE
B. CHAIR
C. 36"x14"x18" BOOKSHELF (3)
D. BUILT-IN COUNTER

PLAN

ROOM A3.5  SCALE: 1/4"=1'-0"
ROOM #: A3.6

TITLE: STORAGE

CAPACITY: NONE

FUNCTION: ADMINISTRATION

AREA: 50 SF.

STORAGE

PROVIDE STORAGE FOR EXTRA BOOKENDS, FILES, PAPER SUPPLIES, HARDWARE MANUALS, BACK-UP EQUIPMENT, BROKEN EQUIPMENT, AND EQUIPMENT.

PLAN

EQUIPMENT

A. 36x14x70h BOOKSHELF
B. SHELVES

ROOM A3.6 SCALE: 1/4"=1'-0"
ROOM B11-B16

TITLE: AUDITORIUM
CAPACITY: 250
FUNCTION: LECTURE
AREA: 4650 SF.

AUDITORIUM (250 SEAT)
LARGE LECTURE ROOM PROVIDES AUDITORIUM STYLE SEATING WITH MOVEABLE TABLET ARMS FOR 250 PEOPLE. THIS LECTURE ROOM WILL BE USED FOR CLASSES, WILL BE UTILIZED FOR LECTURES, VISITING AND LOCAL. ACOUSTICAL CONSIDERATIONS NEED TO BE TAKEN. THE AUDITORIUM SHOULD BE LOCATED ON GROUND FLOOR FOR EASE OF SLOPED FLOOR. LOBBY AREA IS USED AS ENTRANCE TO THE AUDITORIUM. A PLACE WHERE CEREMONIES WILL BE HELD. STAGE AREA SHOULD BE RAISED. PROVIDE HANDICAP SEATING AT A VARIETY OF SPACES. PLACED AT THE REAR OF AUDITORIUM WITH ENTRANCE FROM LECTURE ROOM. PROVIDE WINDOW WALL FOR VIEWING. RAISED PLATFORM APPROX. 1'-0" TO 1'-6" IN HEIGHT. PROVIDE A HANDICAP RAMP FOR ACCESSIBILITY TO STAGE. PROVIDE (2) SEPARATE STORAGE AREAS FOR EQUIPMENT STORAGE.

EQUIPMENT
A. MOVE TABLET ARM DESK (250)
B. PODIUM & LIGHTS
C. OVERHEAD PROJECTOR
D. SOUND SYSTEMS
E. VIDEO MONITOR
F. SLIDING CHALKBOARD
G. TACKBOARD
H. DOUBLE PROJECTOR SCREEN
J. LECTURE TABLE/ELECTRIFIED
K. SLIDE PROJECTOR

PLAN

CLASSROOM
CLASSROOM (70 SEAT)

This room will be used for regularly held classes. It will be equipped with fixed tables with swing-out seats. The floor shall be slightly sloped for sight lines. Exterior lighting would be nice but not views that would distract from lectures.

PLANT

EQUIPMENT

A. Fix table w/swing-out seats
B. Worktable
C. Stool
D. Chalkboard
E. Wastebasket
F. Tackboard
G. Projection screen

ROOM B2.1 SCALE: 1/16"=1'-0"
CLASSROOM (50 SEAT)

This room will be used for regularly held classes. It will be equipped with fixed tables with swing-out seats. The floor shall be slightly sloped for sight lines. Exterior lighting would be nice but not views that would distract from lectures.

**Plan**

- A. Fix Table w/Swing-out Seats
- B. Worktable
- C. Stool
- D. Chalkboard
- E. Wastebasket
- F. Tackboard
- G. Projection Screen

**Equipment**

**Room B2.2**

Scale: $\frac{1}{8''} = 1' - 0''$

Classroom
ROOM #: B23

TITLE: CLASSROOM

CAPACITY: THIRTY-FIVE

FUNCTION: LECTURE

AREA: 140 SF.

CLASSROOM (35 SEAT)

This room will be used for regularly held classes. It will be equipped with fixed tables with swing-out seats. The floor shall be slightly sloped for sight lines. Exterior lighting would be nice but not views that would distract from lectures.

PLAN

EQUIPMENT

A. FIXED TABLE w/SWING-OUT SEATS
B. WORKTABLE
C. STOOL
D. CHALKBOARD
E. WASTEBASKET
F. TACKBOARD
G. PROJECTION SCREEN

CLASSROOM (35 SEAT) SCALE: 1/6" = 1'-0"
DEAN’S OFFICE

The Dean is responsible for coordinating the faculty, meeting with students, meeting with community members to advance the quality of education at the School of Architecture. The Dean will use his office for meetings involving three to four people. Access to the office to be controlled by passing by a secretary. The office will be equipped with an excellent view of the exterior. The Dean’s secretary will be located immediately adjacent to the office.

EQUIPMENT

A. 66x36 EXECUTIVE DESK
B. 66x18 EXECUTIVE CREDENZA
C. 36x12x60 BOOKCASE (2)
D. EXECUTIVE CHAIR
E. WASTEBASKET
F. 30x36 P.C. WORKTABLE
G. LATERAL FILE CABINET
H. NETWORK COMPUTER OUTLET
J. COMPUTER TERMINAL
K. WORKTABLE w/4 CHAIRS
L. GUEST CHAIRS (2)
DEAN'S SECRETARY

THE DEAN'S SECRETARY SHOULD BE LOCATED NEXT TO THE DEAN'S OFFICE AND NEAR THE GENERAL ADMINISTRATIVE AREAS. VISITORS WILL USUALLY WAIT IN THIS AREA WHEN THEY ARE TO VISIT THE DEAN. A VIEW TO THE EXTERIOR IS PREFERRED BUT NOT ESSENTIAL.

PLAN

EQUIPMENT

A. 60x30 Desk w/Return
B. 48x16 P.C. Worktable
C. 36x12x60h Bookcase
D. Faculty Chair
E. Wastebasket
F. Guest Chair (2)
G. Lateral File Cabinet
H. Network Computer Outlet
J. Computer Terminal
K. Typewriter

ROOM C1.2

SCALE: 1/16"=1'-0"
ASSISTANT DEAN'S OFFICE

THE ASSISTANT DEAN IS A FACULTY MEMBER WITH A PART-TIME ADMINISTRATIVE APPOINTMENT. THE ASSISTANT ASSISTS IN DAY-TO-DAY OPERATIONS OF THE SCHOOL. THEY HANDLE FACULTY AND ADMINISTRATIVE PROBLEMS ON AN INDIVIDUAL NATURE. WORKS CLOSELY WITH THE DEAN. CONVENIENTLY LOCATED NEAR THE DEAN'S OFFICE AND THE ADMINISTRATIVE ASSISTANT. LOCATE NEAR THE ASSISTANT DEAN'S SECRETARY. PROVIDE EXTERIOR VIEW.

PLAN

EQUIPMENT

A. 60x30 DESK WITH RETURN
B. 60x18 CREDENZA
C. 36x12x60h BOOKCASE (2)
D. FACULTY CHAIR
E. WASTEBASKET
F. COMPUTER TERMINAL
G. NETWORK COMPUTER OUTLET
H. LATERAL FILE CABINET
J. WORKTABLE
K. 30x26 P.C. TABLE
L. GUEST CHAIRS (2)
M. TACKBOARD

ROOM CI3 SCALE: 1/4"=1'-0"
PROGRAM COORDINATOR

The Program Coordinator is a faculty member with a part-time administrative appointment. This office will serve as both a faculty office and an administrative office. The primary use will be to counsel students. They are also responsible for recruiting new students, admissions, and review transfer students. It shall be located near the lobby and be provided with an exterior view.

PLAN

ROOM CI.4 & CI.5

EQUIPMENT

A. 60x30 DESK
B. 52x26 P.C. TABLE
C. 36x12x60 BOOKCASE
D. FACULTY CHAIR
E. WASTEBASKET
F. VERTICAL FILE CABINET
G. 48x24 WORKTABLE
H. NETWORK COMPUTER OUTLET
J. COMPUTER TERMINAL
K. SECRETARIAL CHAIR
L. GUEST CHAIRS (2)

ROOM CI.4 & CI.5 SCALE: 1/4" = 1'-0"

◇ ◇ ◇ ◇ ◇ ADMINISTRATION
**ROOM C16**

**TITLE:** ADMINISTRATIVE ASSIST.

**CAPACITY:** ONE

**FUNCTION:** ADMINISTRATION

**AREA:** 140 SF.

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**ADMINISTRATIVE ASSISTANT**

The Administrative Assistant is in charge of the secretarial/clerical staff and oversees all activities. Also serves as Office Manager. This person is in charge of personnel records, recruitment forms, accounting and statistics. The Administrative Assistant’s office must be adjacent to the secretarial/clerical area and convenient for the Dean’s area to access. Provide an exterior view.

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**PLAN**

**EQUIMENT**

A. 60x30 desk with return
B. 52x26 P.C. table
C. 36x12x60 bookcase (2)
D. Secretarial chair
E. Wastebasket
F. Vertical file cabinet
G. Lateral file cabinet
H. Network computer outlet
J. Computer terminal
K. Typewriter
L. Guest chairs (2)
SECRETARIAL/CLERICAL AREA (2 STATIONS)

The secretarial pool needs to be in a centralized area for access from all administrative staff. This area will be in charge of word processing, school administration, editing, materials of research and typing. The record vault should be located adjacent to this area. This area should be adjacent to the reception/waiting area to assist receptionist. Provide exterior view.

EQUIPMENT

A. 60x30 Desk with return
B. 52x26 P.C. Table
C. 36x12x60h Bookcase (2)
D. Secretarial Chair
E. Wastebasket
F. Vertical File Cabinet
G. Computer Terminal
H. Network Computer Outlet
J. 24x20 Printer Stand
K. Computer Printer
L. Typewriter

PLAN

ROOM C1.1

SCALE: 3/16" = 1' - 0"

ROOM #: C1.1

TITLE: SECRETARIAL/CLERICAL AREA

CAPACITY: Two

FUNCTION: Administration

AREA: 180 SF.
MISC. OFFICE

These offices will serve as overflow offices. They could be used by part-time faculty as shared common space, by visiting lectures, by visiting professors. It will be equipped with the same amenities as a faculty office. Provide exterior view.

PLAN

EQUIPMENT

A. 60x30 desk with return
B. 48x16 P.C. table
C. 36x12x60 bookcase
D. Secretarial chair
E. Wastebasket
F. Guest chair (2)
G. Vertical file cabinet
H. Network computer outlet
J. Computer terminal
RECEPTION/WAITING AREA

This area must be very important. It is the first and lasting image of visitors and prospective students. This area serves as a check-point for the faculty members, so they receive the least disruptions. Students will pick-up forms and leave messages for faculty mailboxes with the receptionist. The receptionist also answers the telephones, located near the secretarial/clerical staff. Exterior views in waiting area is a must.

PLAN

EQUIPMENT

A. 60x30 DESK
B. 24x20 TYPEWRITER STAND
C. 36x12x60 BOOKCASE
D. SECRETARIAL CHAIR
E. WASTEBASKET
F. VERTICAL FILE CABINET
G. TYPEWRITER
H. NETWORK COMPUTER OUTLET
J. COMPUTER TERMINAL
K. END TABLE
L. LOUNGE CHAIR (4)
COPY CENTER

The copy center should be centralized for easy use by all members of the faculty. The copy center will include a large copy machine w/collator, a smaller back-up, binding equipment, and a black-line machine for larger prints. The center should be located so faculty can easily drop-off and pick-up materials without disturbing other faculty. This area should have acoustical considerations. Should be provided with a built-in counter for lay-out area and work counter, shelves for storage of paper and copy supplies.

EQUIPMENT

A. Large Copier w/Collator
B. Small Copier
C. Large Black-Line Machine
D. Tackboard
E. Built-in Counter
F. Counter w/Upper Cabinets
MAIL ROOM

This room provides a central location for faculty mail. The mailboxes will be a "pigeonhole" style so all slots will be open. With this openness only faculty and authorized personnel will be allowed to enter the mail room. Provide a counter in close proximity so faculty members will have an area to sort out the mail. Provide a bulletin board to serve as official communication for faculty members. This room should be located to accommodate convenient trips to receive mail. This mailbox slots should be generous in size (14"x12"x6") provide for 40 full-time, 50 part-time, and 6 graduate assistants. Provide for additional growth.

PLAN

EQUIPMENT
A. Mail Slots
B. Stool
C. Built-in Counter
D. Tackboard

ROOM C2.2 SCALE: $\frac{\frac{1}{4}}{=}$1'-0"
**CONFERENCE ROOM**

This room will be used for faculty meetings and administrative committees. Visitors and departmental personnel will use this room for seminars and meetings. This room should be conveniently located near the faculty/administrative areas, near the entrance/reception area. A view to the exterior is desirable. Provide a rail on the wall for use to display boards on. Provide a projection screen, slide projector, video system.

**EQUIPMENT**

A. Conference Table  
B. Conference Chair  
C. Wall Rails  
D. Projection Screen  
E. Slide Projector  
F. Video System

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**PLAN**

ROOM C2.3  
SCALE: 3/16" = 1'-0"
BREAKE ROOM

This room will be a quiet retreat for faculty members. It will not be designed as a lunch room, because faculty members will use the commons area. This room will be used for short breaks and informal faculty communications. It will be equipped with a small round table and (5) chairs, a refrigerator, sink, counter area with storage cabinets, microwave space, and a place for a coffee machine. An exterior view is preferred for this space.

PLAN

ROOM C2.4 SCALE: 1/4"=1'-0"

EQUIPMENT

A. 4' ROUND TABLE
B. CHAIRS (5)
C. REFRIGERATOR
D. SINK
E. BUILT-IN CABINET
F. TACKBOARD

◊ ◊ ◊ ◊ ◊ ADMINISTRATION
ROOM: C2.5

TITLE: SPECIAL PROJECT/RESEARCH WORKROOM

CAPACITY: FOUR

FUNCTION: ADMINISTRATION

AREA: 300 SF.

SPECIAL PROJECT/RESEARCH WORKROOM

This room will be used for special projects which occur at various times during a semester. This room will be equipped for a broad range of possible research topics. The room will be equipped for drafting table, lay-out space, worktable, desk, P.C. workstation with a computer terminal. An exterior view is a priority.

PLAN

EQUIPMENT
A. 60x30 Desk with Return
B. 32x16 P.C. Table
C. 36x12x60 Bookcase
D. Secretarial Chair
E. Wastebasket
F. Typewriter
G. Computer Printer w/Stand
H. Network Computer Outlet
J. Computer Terminal
K. 36x60 Drafting Table
L. Drafting Stool
M. Lay-Out Counter

ROOM C2.5 SCALE: 1/16"=1'-0"

◊ ◇ ◇ ◇ ◇ ADMINISTRATION
FILE ROOM/VAULT

This room will be built with fire-resistant structure to insure the contents. It will have vertical and lateral file cabinets for storage of archive files and current student folders. It should be located near the clerical staff for easy access to the files.

PLAN

EQUIPMENT

A. LATERAL FILE CABINET

ROOM C2.6 SCALE: 1/4"=1'-0"
Graduate Assistant Office

This room will be an open office to house five graduate assistants. Since they are considered part-time faculty members, they do not require much room. This office will be equipped with 5 desks, community bookcase, community file cabinets. An exterior view would be nice.

Plan

Equipment

A. 48x30 desk with return
B. 52x26 P.C. workstation
C. 36x12x60 bookcase
D. Secretarial chair
E. wastebasket
F. Typewriter
G. Vertical file cabinet
H. Network computer outlet
J. Computer terminal
K. Printer w/stand

Room C2.1

Scale: 3/16" = 1'-0"
ROOM C2B

TITLE: AIAS OFFICE
CAPACITY: TWO
FUNCTION: ADMINISTRATION
AREA: 200 S.F.

AIAS OFFICE

This office will be in a central location of all AIAS activities. It will be equipped to be open most of the day for student questions and administrative activities. It will be equipped with (2) desks, bookshelves, bulletin boards, file cabinets. It will be located near the administrative area but not necessarily within the same pod.

PLAN

EQUIPMENT
A. 60x30 desk
B. 60x30 desk with return
C. 36x12x60 bookcase
D. Faculty chair
E. Wastebasket
F. Lateral file cabinet
G. Tackboard
H. Network computer outlet
J. Computer terminal
K. Guest chair (2)

ROOM C2B SCALE: 1/4"=1'-0"

◊ ◊ ◊ ◊ ◊ ADMINISTRATION
FIRST YEAR STUDIO

STUDIOS SHOULD BE LOCATED SO THAT IT REQUIRES STUDENTS TO WALK PAST OTHER ACTIVITIES AND AREAS. INTERACTION BETWEEN THE DIFFERENT STUDIOS HAS SIGNIFICANT BENEFITS FOR THE STUDENTS, BUT OBTAIN ACOUSTICAL PRIVACY. STUDIOS SHOULD BE VISIBLE FROM THE HALLWAY SO THAT PASSERSBY CAN VIEW ACTIVITIES INSIDE THE STUDIO. PROVIDE A SMALL SINK, VIEWS TO THE EXTERIOR ARE REQUIRED. WALLS WILL BE HEAVY DUTY DURABLE TACK SURFACE, A RAIL WILL BE PROVIDED FOR PRESENTATION BOARDS.

PLAN

EQUIPMENT

A. 36x12 DRAFTING TABLE
B. LAY-CUT w/STORAGE
C. 36x14x36h BOOKSHELF
D. DRAFTING CHAIR
E. CONFERENCE TABLE
F. CONFERENCE CHAIRS
G. WALL RAILS
H. CHALKBOARD
J. FLAT-FILE
K. STORAGE CABINETS
L. LIGHT TABLE
M. CUTTING TABLE
N. UNDER COUNTER REFRIG
P. SINK
FACULTY OFFICE

Faculty offices provide quiet private spaces for the faculty to create. Offices should provide a pleasant environment to house faculty for long periods of time. Offices are used for lecture preparation, grading, research, student advising, and reading manuscripts. Faculty requires drafting space for the development of student assignments or sponsored research. Faculty offices will be directly adjacent or within their studios they are teaching.

PLAN

EQUIPMENT

A. 66x30 desk with return
B. P.C. worktable
C. Drafting table
D. Drafting chair
E. Faculty chair
F. Guest chair
G. 36x12x12 bookcase
H. File cabinet
J. Wastebasket
K. Computer terminal
L. Computer network outlet

ROOM D12, D22, D32, D42, D52, D62
SCALE: ¼"=1'-0"
SECOND YEAR STUDIO

Studios should be located so that it requires students to walk past other activities and areas. Interaction between the different studios has significant benefits for the students, but obtain acoustical privacy. Studios should be visible from the hallway so that passersby can view activities inside the studio. Provide a small sink. Views to the exterior are required. Walls will be heavy duty durable tack surface. A rail will be provided for presentation boards.

PLAN

EQUIPMENT
A. 36x12 DRAFTING TABLE
B. LAY-OUT w/STORAGE
C. 36x14x36h BOOKSHELF
D. DRAFTING CHAIR
E. CONFERENCE TABLE
F. CONFERENCE CHAIRS
G. WALL RAILS
H. CHALKBOARD
J. FLAT-FILE
K. STORAGE CABINETS
L. LIGHT TABLE
M. CUTTING TABLE
N. UNDER COUNTER REFRIG
P. SINK

ROOM D2.1 SCALE: 1/16"=1'-0"
THIRD YEAR STUDIO

STUDIOS SHOULD BE LOCATED SO THAT IT REQUIRES STUDENTS TO WALK PAST OTHER ACTIVITIES AND AREAS. INTERACTION BETWEEN THE DIFFERENT STUDIOS HAS SIGNIFICANT BENEFITS FOR THE STUDENTS, BUT OBTAIN ACOUSTICAL PRIVACY. STUDIOS SHOULD BE VISIBLE FROM THE HALLWAY SO THAT PASSERSBYS CAN VIEW ACTIVITIES INSIDE THE STUDIO. PROVIDE A SMALL SINK, VIEWS TO THE EXTERIOR ARE REQUIRED. WALLS WILL BE HEAVY DUTY DURABLE TACK SURFACE. A RAIL WILL BE PROVIDED FOR PRESENTATION BOARDS. PROVIDE (4) DUPLEX OUTLETS PER STUDENT WORK AREA. PROVIDE AMBIENT LIGHT LEVELS FOR WORK SPACE. LOW LIGHT FOR COMPUTER USAGE. HVAC DESIGNED TO ACCOMMODATE THE COMPUTERS.

EQUIPMENT

A. 36x12 DRAFTING TABLE
B. LAY-OUT w/ STORAGE
C. 36x14x36h BOOKSHELF
D. DRAFTING CHAIR
E. CONFERENCE TABLE
F. CONFERENCE CHAIRS
G. WALL RAILS
H. CHALKBOARD
J. FLAT-FILE
K. PROJECTION SCREEN
L. LIGHT TABLE
M. CUTTING TABLE
N. UNDER COUNTER REFRIG
P. SINK
Q. COMPUTER STATION
R. COMPUTER NETWORK OUTLET
S. PLOTTER
FOURTH YEAR STUDIO

STUDIOS SHOULD BE LOCATED SO THAT IT REQUIRES STUDENTS TO WALK PAST OTHER ACTIVITIES AND AREAS. INTERACTION BETWEEN THE DIFFERENT STUDIOS HAS SIGNIFICANT BENEFITS FOR THE STUDENTS, BUT OBTAIN ACOUSTICAL PRIVACY. STUDIOS SHOULD BE VISIBLE FROM THE HALLWAY SO THAT PASSERSBY CAN VIEW ACTIVITIES INSIDE THE STUDIO. PROVIDE A SMALL SINK. VIEWS TO THE EXTERIOR ARE REQUIRED. WALLS WILL BE HEAVY DUTY DURABLE TACK SURFACE. A RAIL WILL BE PROVIDED FOR PRESENTATION BOARDS. PROVIDE (4) DUPLEX OUTLETS PER STUDENT WORK AREA. PROVIDE AMBIENT LIGHT LEVELS FOR WORK SPACE. LOW LIGHT FOR COMPUTER USAGE. HVAC DESIGNED TO ACCOMMODATE THE COMPUTERS.

EQUIPMENT

A. 36x12 DRAFTING TABLE
B. LAY-OUT w/ STORAGE
C. 36x14x36h BOOKSHELF
D. DRAFTING CHAIR
E. CONFERENCE TABLE
F. CONFERENCE CHAIRS
G. WALL RAILS
H. CHALKBOARD
J. FLAT-FILE
K. PROJECTION SCREEN
L. LIGHT TABLE
M. CUTTING TABLE
N. UNDER COUNTER REFRIG
P. SINK
Q. COMPUTER STATION
R. COMPUTER NETWORK OUTLET
S. PLOTTER
FIFTH YEAR STUDIO

STUDIOS SHOULD BE LOCATED SO THAT IT REQUIRES STUDENTS TO WALK PAST OTHER ACTIVITIES AND AREAS. INTERACTION BETWEEN THE DIFFERENT STUDIOS HAS SIGNIFICANT BENEFITS FOR THE STUDENTS, BUT OBTAIN ACOUSTICAL PRIVACY. STUDIOS SHOULD BE VISIBLE FROM THE HALLWAY SO THAT PASSERSBYS CAN VIEW ACTIVITIES INSIDE THE STUDIO. PROVIDE A SMALL SINK. VIEWS TO THE EXTERIOR ARE REQUIRED. WALLS WILL BE HEAVY DUTY DURABLE TACK SURFACE. A RAIL WILL BE PROVIDED FOR PRESENTATION BOARDS. PROVIDE (4) DUPLEX OUTLETS PER STUDENT WORK AREA. PROVIDE AMBIENT LIGHT LEVELS FOR WORK SPACE. LOW LIGHT FOR COMPUTER USAGE. HVAC DESIGNED TO ACCOMMODATE THE COMPUTERS.

**PLAN**

**EQUIPMENT**

A. 36x72 DRAFTING TABLE
B. LAY-OUT w/STORAGE
C. 36x14x36h BOOKSHELF
D. DRAFTING CHAIR
E. CONFERENCE TABLE
F. CONFERENCE CHAIRS
G. WALL RAILS
H. CHALKBOARD
J. FLAT-FILE
K. STORAGE CABINET
L. LIGHT TABLE
M. CUTTING TABLE
N. UNDER COUNTER REFRIG
P. SINK
Q. COMPUTER STATION
R. COMPUTER NETWORK OUTLET
S. PLOTTER

**ROOM D5.1**

SCALE: 1/16"=1'-0"
SIXTH YEAR STUDIO

STUDIOS SHOULD BE LOCATED SO THAT IT REQUIRES STUDENTS TO WALK PAST OTHER ACTIVITIES AND AREAS. INTERACTION BETWEEN THE DIFFERENT STUDIOS HAS SIGNIFICANT BENEFITS FOR THE STUDENTS, BUT OBTAIN ACOUSTICAL PRIVACY. STUDIOS SHOULD BE VISIBLE FROM THE HALLWAY SO THAT PASSERSBY CAN VIEW ACTIVITIES INSIDE THE STUDIO. PROVIDE A SMALL SINK. VIEWS TO THE EXTERIOR ARE REQUIRED. WALLS WILL BE HEAVY DUTY DURABLE TACK SURFACE. A RAIL WILL BE PROVIDED FOR PRESENTATION BOARDS. PROVIDE (4) DUPLEX OUTLETS PER STUDENT WORK AREA. PROVIDE AMBIENT LIGHT LEVELS FOR WORK SPACE. LOW LIGHT FOR COMPUTER USAGE. HVAC DESIGNED TO ACCOMMODATE THE COMPUTERS.

EQUIPMENT

A. 36x12 DRAFTING TABLE
B. LAY-CUT w/STORAGE
C. 36x14x36h BOOKSHELF
D. DRAFTING CHAIR
E. CONFERENCE TABLE
F. CONFERENCE CHAIRS
G. WALL RAILS
H. CHALKBOARD
J. FLAT-FILE
K. PROJECTION SCREEN
L. LIGHT TABLE
M. CUTTING TABLE
N. UNDER COUNTER REFRIG
P. SINK
Q. COMPUTER STATION
R. COMPUTER NETWORK OUTLET
S. PLOTTER
ROOM E11

TITLE: GENERAL WORK AREA

CAPACITY: EIGHT

FUNCTION: SHOP ZONE

AREA: 200 SF.

GENERAL WORK AREA

This space is a separate area from the tools which provides space for students to work on projects. It provides the tool areas not to be crowded. Provide durable surface worktables. This area should be immediately accessible to the plastic tool, wood tools and shop coordinator's office. Provide general shop equipment.

EQUIPMENT

A. 48"x72" WORKTABLE
B. 30" WORK COUNTER
C. WORK STOOL

PLAN

ROOM E11

SCALE: \( \frac{1}{4} \)" = 1'-0"
ROOM E12

TITLE: PLASTIC POWER TOOL AREA

CAPACITY: FOUR

FUNCTION: SHOP ZONE

AREA: 200 SF.

PLASTIC POWER TOOL AREA

This space is a separate space to house power tools for cutting and molding plastics. This area will provide limited space for assembly due to the fact assembly will be done in the general work area. This area should be visible from the shop coordinator's office.

EQUIPMENT

A. BAND-SAW
B. JIG-SAW
C. DRILL PRESS
D. SANDER
E. MITER-SAW
F. STORAGE CABINET
G. WORK STOOL
H. HOT WIRE CUTTER

PLAN

ROOM E1.2 SCALE: 1/4" = 1'-0"

SHOP ZONE
WOOD POWER TOOL AREA

THE SPACE IS A SEPARATE SPACE TO HOUSE POWER TOOLS FOR CUTTING AND FINISHING WOOD. THIS AREA WILL PROVIDE LIMITED SPACE FOR ASSEMBLY DUE TO THE FACT ASSEMBLY WILL BE DONE IN THE GENERAL WORK AREA. THIS AREA SHOULD BE VISIBLE FROM THE SHOP COORDINATOR'S OFFICE. PROVIDE AIR LINES FOR POWER TOOLS. PROVIDE ENOUGH AREA FOR GROWING AND IMPROVING EQUIPMENT.

PLAN

EQUIPMENT
A. TABLE SAW & SIDE TABLE
B. RADIAL SAW & LONG BENCH
C. PANEL SAW
D. BAND SAW
E. JIG SAW
F. DRILL PRESS
G. SANDER
H. JOINER
J. PLANER
K. GRINDER
L. MITER SAW
M. WORK STOOL

SHOP ZONE
**TOOL STORAGE**

Provide a separate area for cabinets required to secure and store the various hand tools and hand power tools and miscellaneous supplies. Visible from the shop coordinator's office and opens directly onto the general work area. Some cabinets should be open directly in the general work area.

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**PLAN**

**EQUIPMENT**

A. STORAGE CABINET

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ROOM E1.4

SCALE: 1/4"=1'-0"
CLEAN-UP

Provide in this area a utility sink for projects and a clean-up sink for the shop. Provide an emergency shower. Locate convenient to be used by all areas in the shop zone. Provide a floor drain and a grease trap. Provide a few lockers for aprons and overhauls.

PLAN

EQUIPMENT

A. Utility Sink
B. Floor Sink & Grease Trap
C. Emergency Shower
D. Lockers
E. Counter

ROOM E15

SCALE: 1/4" = 1'-0"

Shop Zone
PROVIDE A SEPARATE ROOM FOR PAINTING AND DRYING STUDENT PROJECTS. THIS ROOM SHOULD BE LOCATED NEAR THE PAINT STORAGE ROOM. SHOULD HAVE SEPARATE ENTRANCE SO IT IS ACCESSIBLE AFTER SHOP HOURS, SO STUDENTS CAN SPRAY PROJECTS AND MOUNT WORK IN A VENTED SPACE. PROVIDE PROPER OSHA VENTILATION STANDARDS. PROVIDE A UTILITY SINK FOR CLEAN-UP AND A WORK COUNTER.

PLAN

EQUIPMENT
A. SPRAY TABLE WITH HOOD
B. DRYING TABLE
C. PORTABLE DRYING LAMPS
D. CLEAN-UP SINK
E. DRYING SHELVES
F. WORK STOOL
G. VENTILATION
PAINT STORAGE/INFLAMMABLES

This room will provide a safe and secure storage area for paints and hazardous materials. Should open adjacent to the paint booth. Should meet OSHA standards.

PLAN

EQUIPMENT
A. STORAGE CABINET

ROOM E2.2
SCALE: 1/4"=1'-0"
SHOP COORDINATOR’S OFFICE

This office provides a private work area for the shop coordinator, and a central location to overview the activities of shop. The major shop zones should be visible and accessible to this office. Provide a large window to view the activities. It should have acoustical privacy so when the door is closed the noise of the machines will not disturb a normal telephone conversation. Provide storage cabinets for special equipment, storage for publishers catalogs, and book repair (sink required).

PLAN

EQUIPMENT
A. 66x30 Desk with return
B. Faculty Chair
C. Storage Cabinets
D. Guest Chair
E. Vertical File Cabinet

ROOM E2.3 SCALE: 1/4"=1'-0"
RECEIVING/STORAGE/LOADING DOCK

THIS SPACE PROVIDES AN AREA FOR RECEIVING AND STORING OF MATERIALS FOR THE SHOP ZONE AND OTHER AREAS OF THE COLLEGE. PROVIDE A 8'x8' ROLL-UP DOOR, BIG ENOUGH FOR A FORKLIFT. PROVIDE AN AREA FOR SHELVES FOR STORAGE OF NEUFLY RECEIVED MERCHANDISE UNTIL DISTRIBUTION CAN BE MADE.

PLAN

EQUIPMENT

A. 8'x8' ROLL-UP DOOR
B. STORAGE SHELVES

RECEIVING/STORAGE/LOADING DOCK

THIS SPACE PROVIDES AN AREA FOR RECEIVING AND STORING OF MATERIALS FOR THE SHOP ZONE AND OTHER AREAS OF THE COLLEGE. PROVIDE A 8'x8' ROLL-UP DOOR, BIG ENOUGH FOR A FORKLIFT. PROVIDE AN AREA FOR SHELVES FOR STORAGE OF NEUFLY RECEIVED MERCHANDISE UNTIL DISTRIBUTION CAN BE MADE.

PLAN

EQUIPMENT

A. 8'x8' ROLL-UP DOOR
B. STORAGE SHELVES

ROOM E2.4 SCALE: 1/4" = 1'-0"
ENTRY/CONTROL

Provide a vestibule for the entry to control the noise that escapes into the corridor. The shop coordinator's office should be off the entrance. There should be an area to view student work.

PLAN

EQUIPMENT

A. Vestibule
B. Tackable wall surface
C. Counter for display

ROOM E2.5
SCALE: ¼"=1'-0"
STUDENT ASSEMBLY

This room provides a separate space for use by groups of students under the supervision of a professor. Provides a space for assembling and finalization of projects. This room takes congestion away from the general work area and provides a secure place for projects in progress. Access to this room will be through the shop to locate it next to the tools.
TITLE: VENDING AREA
CAPACITY: TWO
FUNCTION: COMMONS
AREA: 100 SF.

VENDING AREA

Provide a space for six large vending machines to be accessible 24-hours a day by the students. Vending machines should be in a separate room near the Commons but not directly visible. Service access should be convenient for restocking the machines. This area should be located near the outdoor Commons. Include in the room a VCT or tile floor with a floor drain, large trash bin, counter for books, and a tackboard.

PLAN

EQUIPMENT
A. VENDING MACHINES
B. BULLETIN BOARD
C. BOOK COUNTER
D. WASTEBASKET

ROOM Fl.1
SCALE: 1/4"=1'-0"
CONCESSION AREA/KITCHENETTE

Provide a small concession stand for specialty coffees, teas and maybe a small menu. This area will house a cater's serving events in the Commons and perhaps the Lobby of the Auditorium. Should have two separate accesses. Provide a sales counter, preparation counter and cabinets, sink, refrigerator, and microwave.

PLAN

EQUIPMENT
A. Sink
B. Built-in Cabinet
C. Sales Counter
D. Range
E. Refrigerator
F. Microwave

ROOM F1.2

SCALE: 1/4" = 1'-0"

COMMONS
ROOM #: FI.3

TITLE: COMMONS AREA

CAPACITY: SEVENTY-FIVE

FUNCTION: COMMONS

AREA: 1200 S.F.

COMMONS (SEATING FOR 75)

THE COMMONS IS A PLACE INTENDED TO JOIN TOGETHER AND CREATE COMMUNICATION BETWEEN STUDENTS, FACULTY, PROFESSIONALS, AND THE PUBLIC. THIS AREA IS A MULTI-USE SPACE THAT PROVIDES TABLES FOR EATING AND CONVERSATION AND A SPACE TO DISPLAY STUDENT AND FACULTY WORK. THIS AREA CAN BE USED FOR INFORMAL STUDYING AND EATING LUNCHES. PROVIDE A SINK AND MICROWAVE IN THIS AREA FOR STUDENT/FACULTY LUNCHES. PROVIDE A COMMUNITY REFRIGERATORS. PROVIDE BULLETIN BOARD AREA AND A STORAGE ROOM FOR CHAIRS NOT BEING USED.

PLAN

EQUIPMENT

A. 36x36 TABLES
B. STACKABLE CHAIRS
C. GANG TABLE
D. BULLETIN BOARD

ROOM FI.3 SCALE: 1/16"=1'-0"
PERMANENT DISPLAY

The permanent gallery will become the 'entrance' of the college of architecture. The permanent gallery is similar to that of a museum, where the exhibition is on permanent display only to be changed for restoration or updating technology. This should be immediately adjacent to temporary gallery. This room(s) will be the location of events and exhibits held by the college. A kitchenette will be located adjacent to accommodate the catering need of exhibits. The gallery should be located on the ground floor and in close proximity to the lobby of the auditorium. Be able to be open during evening for public events.

PLAN

EQUIPMENT
A. MOVEABLE PARTITIONS

ROOM G1.1 SCALE: 1/16" = 1'-0"

GALLERY
TEMPORARY DISPLAY

THE TEMPORARY GALLERY SERVES THE SAME FUNCTION AS THE PERMANENT GALLERY. EXCEPT THE TEMPORARY MEANS JUST THAT. IT WILL DISPLAY TRAVELING EXHIBITS, STUDENT WORK, AND WORK OF VISITING LECTURES. THIS ROOM SHOULD BE IMMEDIATELY ADJACENT TO THE PERMANENT GALLERY AND THE KITCHENETTE. REVIEW THE PERMANENT GALLERY FOR SIMILAR CHARACTERISTICS.

PLAN

EQUIPMENT

A. MOVEABLE PARTITION

ROOM G1.2

SCALE 1/8" = 1'-0"
ROOM #: G13

TITLE: LOBBY/ENTRY/DESK

CAPACITY: FIVE

FUNCTION: GALLERY

AREA: 150 SF.

LOBBY/ENTRY/DESK

This space should create a lobby for the permanent and temporary gallery spaces. It will have a desk for reception of guests to the exhibit. This space should also house a coat rack to accommodate the guest coats.

PLAN

EQUIPMENT

A. BUILT-IN DESK
B. COAT RACK

ROOM G1.3 SCALE: ¹⁄₄"=1'-0"
KITCHENETTE

The kitchenette will be used by the caterers to accommodate the food preparation for the exhibits. The kitchenette will be immediately adjacent to the gallery spaces. It will be furnished with a sink, range, microwave, and a refrigerator to provide preparation counters.

PLAN

EQUIPMENT
A. Sink
B. Built-in cabinet
C. Microwave
D. Refrigerator
E. Range/Oven

GALLERY
**WORKSHOP**

This room provides an area for assembly of exhibit materials and a place to restore damaged displays. This room is also where crates are made to move displays that are traveling. This room should be equipped with worktables and small tools and equipment to fix displays. If too big then assemble objects in the shop zone.

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**EQUIPMENT**

A. 72 x 48" table
B. Work tool
C. Built-in counter

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**PLAN**

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**SCALE: 1/4"=1'-0"**
DISPLAY STORAGE

This room is a place to store traveling exhibits until they are ready to display and while they are waiting to be shipped out. It will also be a general storage for items used in the gallery such as tables.
ROOM #: G1.7
TITLE: JURY ROOM
CAPACITY: FIFTY
FUNCTION: GALLERY
AREA: 850 SF

JURY ROOM

This room will be the formal room student juries of their projects. The front wall will be equipped with rails to be used for projects display. It shall be equipped with table and chairs for jury members and comfortable chairs for the audience. This room will have spot lighting on the display wall.

PLAN

EQUIPMENT

A. JURY TABLES
B. GUEST CHAIR
C. MODEL TABLE
D. JURY WALL

ROOM G1.7 SCALE: 1/8"=1'-0"
ROOM H1.1

TITLE: GRAPHIC PRODUCTION
CAPACITY: TWO
FUNCTION: RESEARCH LAB.
AREA: 200 SF.

GRAPHIC PRODUCTION

This is a room where graphic presentations for the college are created. It will be equipped with drafting tables and lay-out area for cut and paste projects. This room will design and create brochures, bulletins and help in preparation of portfolios. It should be located near the audio-visual core, for work involving photography.

PLAN

EQUIPMENT
A. 66x30 desk with return
B. Faculty chair
C. 36x12x60h bookshelf
D. Drafting table
E. Drafting stool
F. Lay-out counter
G. Computer terminal
H. Network computer outlet

ROOM H1.1 SCALE: 1/4"=1'-0"
COPY CENTER

This room will be the reproduction core for the student body. This room will be equipped with a normal coin operated copy machine, blueprint machine, and a flat-bed machine. The flat-bed will help students mount drawings on foam core. All machines will be coin operated to assist in the cost of supplies and maintenance.

PLAN

EQUIPMENT

A. COPY MACHINE
B. BLUEPRINT MACHINE
C. FLAT-BED MACHINE
D. BASE COUNTER w/PAPER STORAGE
STUDENT ARCHIVE STORAGE

This room is where past student projects, drawings and models, will be stored. This room should be a 2-hour assembly. It will be equipped with shelves for models and flat files for original drawings. This room stores specific requirements for accreditation reviews.

ROOM:  H1.3
TITLE:  STUDENT ARCHIVE
CAPACITY:  NONE
FUNCTION:  RESEARCH LAB.
AREA:  400 S.F.

PLAN

EQUIPMENT
A. FLAT FILE DRAWERS
B. STORAGE SHELVES FOR MODELS

ROOM H1.3  SCALE:  3/16" = 1'-0"  LABORATORY
COMMUNITY RESEARCH/OUTREACH LABORATORY

This area is an open plan, multi-use space to serve both funded research projects and community services. The purpose is on service-oriented projects that focus on broad environmental, urban design issues. This use of the computer to plan designs will be emphasized on most projects. Maximum of nine work stations plus a conference table, bookshelves and file cabinets. For special assignments project have available for possible use secretarial work stations, drafting tables, computers. Locate immediately adjacent of this room is a faculty office.

PLAN

EQUIPMENT
A. 66 x 30 Desk with return
B. 30 x 30 P.C. Table
C. 36 x 12 x 60 Bookshelf
D. Faculty Chair
E. Drafting Table
F. Drafting Stool
G. Computer Terminal
H. Network Computer Outlet
J. Lay-out Counter
K. Conference Table
L. Conference Chair

ROOM H2.1
SCALE: 1/8" = 1'-0"
FACULTY OFFICE

The faculty office should be immediately be adjacent or within the laboratory it serves. The close knit provides a relationship between the faculty and the users. These offices provide a private/quiet work area and should be semi-private. They will be equipped with a desk, P.C. worktable, computer, bookcase, file cabinets.

EQUIPMENT

A. 60x30 desk with return
B. P.C. table
C. 36x14x78 bookshelf
D. Faculty chair
E. Wastebasket
F. File cabinet
G. Guest chair
H. Computer terminal
J. Network computer outlet

PLAN

ROOM H2.2, H2.4, H2.6, H2.8

SCALE: 1/4" = 1' - 0"

LABORATORY
SOLAR RESEARCH LABORATORY/TESTING (ROOFTOP)

This is an outdoor work and testing area provided for further research in solar activity. This outdoor rooftop test area will consist of a metal grate base raised 3 feet above the roof. Activities that will occur in this area include hooking up experiments with instruments, mounting and dismounting instruments, and some experiments. This area should be immediately adjacent to an elevator lobby barriers must be built to limit activity to testing area and not the rest of the roof. Provide faculty office adjacent to space to help monitor activity.

PLAN

ROOM H2.3

EQUIPMENT

A. Raised metal grate floor

LABORATORY
STUDENT/FACULTY RESEARCH/SPECIAL PROJECTS

This area provides a laboratory for non-funded projects of a collaborative nature that involve both faculty and students. Teams entering national design competitions would use this area. Upper division students are invited to participate with faculty in the development and execution of projects. Provide the faculty office adjacent or within the laboratory. Provide drafting table with lay-out space, computer stations and conference table. Open area for flexible arrangement.

PLAN

EQUIPMENT

A. 60x30 desk with return
B. 30x30 p.c. table
C. Faculty chair
D. Drafting stool
E. Drafting table
F. Lay-out counter
G. Computer terminal
H. Network computer outlet
J. Conference chair
K. Conference table

ROOM #. H2.5

SCALE: 1/8" = 1'-0"

LABORATORY
ROOM #: H2.1

TITLE: COMP. LABORATORY

CAPACITY: SEVENTEEN

FUNCTION: RESEARCH LAB.

AREA: 1200 SF.

COMPUTER LABORATORY

This area will be the central core for the computer network. With each upper division and graduate student equipped with computers their use will be limited in this area. This laboratory will mainly be used by lower division students to learn the operation of the computer and the use of computer aided design. It will be utilized by local practitioners to learn the use of computer to stay updated on technology. It will be used by students to learn new programs and updated three-dimensional software. The computer technician's office will be within the laboratory to assist in class time or study time activities. This room will house the server for the rest of the college.

PLAN

A. PC WORKTABLE
B. SECRETARIAL CHAIR
C. COMPUTER TERMINAL W/PAD
D. NETWORK COMPUTER OUTLET
E. PRINTER STAND
F. PRINTER
G. PLOTTER

EQUIPMENT

PLAN

SCALE: 1/16" = 1'-0"

LABORATORY
DARKROOM

The darkroom will be equipped for the development of photos. It will be equipped with a development sink and table with area for drying. The darkroom will be equipped with special doors.

PLAN

EQUIPMENT
A. Built-in base counter
B. Double sink
C. Single sink
D. Stool
E. Worktable
F. Darkroom door

ROOM H3.1
SCALE: ¼"=1'-0"

LABORATORY
PHOTO LAB

This area will be a photo studio. It will be equipped with a lay-out table and backdrops. It will have track-lighting and portable lights for photography.

PLAN

EQUIPMENT

A. Drafting Table
B. Lay-out Counter
C. Drafting Stool
D. Worktable
E. Portable Lights
F. Network Computer Outlet
G. Computer Terminal
H. Back Drops

ROOM H3.2 SCALE: ¼"=1'-0"
FACULTY OFFICE

This faculty office will be equipped as all the others with a desk, P.C., workstation, file cabinet, bookcase. The professor will be in charge of the audio-visual center. Locate the office in a central location to assist all the areas.

PLAN

EQUIPMENT

A. 66x30 desk with return
B. P.C. Worktable
C. 36x44x72 shelves
D. Faculty Chair
E. Waste Basket
F. Computer terminal
G. Network Computer outlet
H. File cabinet
J. Guest chair

LABORATORY
CLASSROOM/WORKSPACE

This room will be used to teach students how to take pictures, the use of specialized equipment to photograph models. This room will also be used as a workspace for photography projects.

PLAN

- A. Built-in counter
- B. 60x30 worktable
- C. Stool
- D. Chalkboard

EQUIPMENT

ROOM 3.4

SCALE: \(\frac{1}{8}" = 1' - 0"

LABORATORY
ROOM #: H3.5

TITLE: STORAGE

CAPACITY: NONE

FUNCTION: RESEARCH LAB.

AREA: 80 S.F.

AUDIO/VISUAL STORAGE

This room will be used as general storage for audio-visual equipment. Provide shelves and a lockable cabinet. Besides photography equipment, this room will be used to store overhead projectors, extra slide projectors, and video equipment.

PLAN

EQUIPMENT

A. SHELVES
B. STORAGE CABINETS

ROOM H3.5

SCALE: 1/4" = 1' - 0"

LABORATORY
PART 3

APPLIED THESIS

CONCEPTS
CONCEPTS

LIBRARY
The library stands alone for security reasons. Security needed to be established to allow only one entrance. Glass block provided for natural light without heat intake and security reasons. The library is an open area space with exposed structural trusses and mechanical systems. A second story space slices through the middle of the building and has high window to allow natural light to filter down to the second and first story spaces. The library has a grand lobby space which provides a visual access from the circulation desk to all major areas for security reasons.

AUDITORIUM
The auditorium stands alone to provide building awareness. It sits out towards the pedestrian mall in case the university allows other classes besides architecture to use it. It also is located adjacent to the gallery space for night time functions. The auditoriums basic shape slopes towards the stage both on the floor and on the roof, this helps the acoustical properties in the room, with sound vibration.

STUDIO
The building was designed with jogs in the walls both in the floor plan and the wall plane. The juxtaposed structure allows for sun orientation and indirect natural lighting. The 'dark' functions (restrooms, mechanical) were placed on the south side because they require no natural light. The fifth and sixth year studios are located on the third floor for hierarchy. They will have exposed structures and clerestories to allow natural light indirectly into the space. The shop zone is located on the first floor for students easy use for project preparation. The studios are designed like an architects office, with the faculty members being the supervisor. The building is separated for easy 24 hour access and each room will be individually licked for privacy among students.
ADMINISTRATION
This building houses a number of functions: classrooms, gallery, administration, commons, and laboratories. It was designed to represent the studios in a smaller mirrored version. The gallery is a free formed shape that stands out from the rest of the building allowing visitors to distinguish this as the main entrance. The administration sits on the second floor. Visitors must travel through the gallery to get to the schools receptionist. This forces visitors, students, and faculty to view the art. The first floor has a commons with an exterior commons directly located. This exterior commons is surrounded by trees, covered with a shade fabric and is housed with water misters to help control the exterior environment. The classrooms are located on the first floor with two separate entrances to allow student access easily without traveling through the gallery. The laboratories are housed on the third floor and will have exposed structures and clerestories to allow indirect natural light into the spaces. The studio and administration are connected at the third floor via bridge.
PART 4

APPLIED THESIS

BASIS FOR DESIGN
BASIS FOR DESIGN

PROJECT
This project is a prototype architecture school which will serve best usage when used in a southwest environment. It will service 250 students; no other disciplines.

SCOPE
To provide a 77,000 square foot facility equipped with state of the art equipment and furnishings to teach architecture with innovative technology. Basic design concepts to allow a cost efficient construction.

SITE
Since this project as no 'set' site, because it is a prototype. A site analysis can not be preformed. However, a site size of 600 x 350 feet was determined from basic university plots. An arbitrary north was given to help design with sun conditions in mind.

DESIGN THEORY
The project has four major elements of the program, the library, the auditorium, the studios, and administration which has been separated to improve their identity and circulation. The four elements are organized around a central courtyard. This area will be a gathering place for students and faculty, and function as the main circulation.

ENVIRONMENTAL IMPACT
It is anticipated that this project will have no significant impact on the environment and will not provide any significant air or water pollution.

PEDESTRIAN MALL
This project was designed to connect off a major university mall on the south side. The walkway leading into and around the central courtyard will be accented with scored patterns.
TYPE OF CONSTRUCTION
Type II one hour construction with automatic sprinkler system.

OCCUPANCY
Mixed occupancy according to 1991 UBC. A-2.1 for Auditorium and B-2 for all other areas.

DESCRIPTION OF MATERIALS
Exterior walls- Masonry block covered with synthetic stucco on the Library and Auditorium. Synthetic stucco backed up to structural steel studs in the Studios and Administration.
Interior walls- Gypsum wall board finish throughout.
Windows- 1\" insulating units. Glass block in Library. Insulating glass in the clerestories in the Studio and Administration.
Roof- Single-ply EPDM and metal standing seam.
Ceiling- Gypsum board finish in corridor. Suspended acoustical tile throughout.
Floor- Carpet and VCT in selected areas.
PART 5

APPLIED THESIS

STRUCTURAL
STRUCTURAL

PRIMARY LOAD
The Library and Auditorium will be masonry load bearing wall system which also resist the lateral loads. Using architectural materials as part of the structure reduces cost and provides a very efficient system. The Studio and Administration will be designed as a gravity load carrying steel frame system with a moment resisting frame to resist the lateral loads. This system provides flexibility without shear walls or braced frames.

FLOOR SYSTEM
Composite normal weight concrete on steel deck.

ROOF SYSTEM
Typically the roof assembly will consist of a layer of light weight insulating concrete over rigid insulation board over 1-1/2" deck. The deck will span over open web joists, steel beams and load bearing masonry walls.

FOUNDATION SYSTEM
At the base the building is supported on continuous footings, under walls, and isolated pad footing under columns.

DESIGN LOADS
Roof live load- 20 psf
Floor live load- 100 psf
Roof dead load- 29 psf
Floor dead load- 98 psf
Wind- UBC Exposure B, 75 mph
Seismic load- .20, Seismic zone 2B

MATERIAL PROPERTIES
Foundation- f'c = 3000 psi
Slab on Grade- f'c = 4000 psi
Slab on Metal deck- f'c = 3500 psi
Reinforcing steel- Fy = 60,000 psi
Concrete Masonry unit- f'm = 1500 psi
Structural steel- A36
PART 6

APPLIED THESIS

MECHANICAL/ELECTRICAL
MECHANICAL

GENERAL
The mechanical disciplines for this project consist of HVAC, plumbing and fire protection sections.

DESIGN CONDITIONS

<table>
<thead>
<tr>
<th>MODE</th>
<th>OUTDOOR</th>
<th>INDOOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooling</td>
<td>106 FDB</td>
<td>78 FDB</td>
</tr>
<tr>
<td></td>
<td>68 (mean coincident)</td>
<td>45% RH</td>
</tr>
<tr>
<td></td>
<td>70 F (design)</td>
<td></td>
</tr>
<tr>
<td>Heating</td>
<td>28 FDB</td>
<td>72 FDB</td>
</tr>
</tbody>
</table>

The proposed design heat transmission coefficients will be 0.05 Btuh/ft² F and .08 Btuf/Ft² F for roof and wall construction, respectively. 76 FWB will be used to select cooling towers in order to address possible recirculation.

HVAC SYSTEM
Central plant located in the Studio consisting of (2) water chillers, (2) boilers, heat exchangers, cooling towers and support pump system. Air handling systems (except Auditorium) will be variable volume type with adjustable frequency drives on both supply and return-exhaust fans. The Auditorium will be constant volume type with roof mounted exhaust fans. It will be a 4 pipe system with individual fan coils to allow for variable air.

PLUMBING
The plumbing systems will be conventional in all respects, consisting primarily of cast iron soil, waste, vent, and storm drain systems and type L copper domestic hot and cold water piping system.

FIRE PROTECTION SYSTEM
Each building will be served by an independent fire line form the on-site water distribution system. Each building will be fully protected by an automatic wet-pipe sprinkler system. Standpipes will not be required.
**ELECTRICAL**

A diesel-fire engine generator will be provided to power life safety system, in the event of power failure.

General lighting within the facility will be provided with energy efficient fluorescent fixtures and incandescent and indirect fixtures. Exterior lights will be high sodium fixtures.

A combination fire alarm system will be provided with automatic smoke detectors, manual pull stations and water flow switches.

A conduit for the telephone system provided.

Raceways will be provided in Studio and Administration for the ability to network computer systems.
PART 7

APPLIED THESIS

SKETCHES
Entrance Sequence
Circulation
Auditorium Plan to Section
Studio Plan to Section
Library Plan to Section
PART 8

APPLIED THESIS

OUTLINE SPECIFICATION
OUTLINE SPECIFICATION

DIVISION 0 - BIDDING REQUIREMENTS

00200 Information Available to Bidders
00700 General Conditions

DIVISION 1 - GENERAL REQUIREMENTS

01010 Summary of Work
01027 Applications for Payment
01035 Change Order Procedures
01040 Coordination
01045 Cutting and Patching
01090 Reference Standards
01300 Submittals
01310 Progress Schedules
01340 Shop Drawings, Product Data, and Samples
01380 Construction Photographs
01400 Quality Control
01410 Testing Laboratory/Agency Services
01500 Construction Facilities and Temporary Controls
01560 Construction Cleaning
01580 Project Identification and Signs
01590 Field Offices and Sheds
01600 Material and Equipment
01630 Product Substitutions
01650 Starting of Systems
01660 Testing, Adjusting, and Balancing of Systems
01670 Systems Demonstration
01700 Contract Closeout Procedures
01730 Operational and Maintenance Data
01750 Spare Parts and Maintenance Materials

DIVISION 2 - SITE WORK

02110 Site Clearing
02202 Rock Removal
02211 Rough Grading
02222 Excavation
02223 Backfilling
02225 Trenching
02510 Asphaltic Concrete Paving
02550 Water Distribution System
02675 Disinfection of Water Distribution System
02730 Site Sanitary Sewage Systems
02811 Landscape Irrigation
02831 Chain Link Fences and Gates
02870 Site Furnishings
02923 Landscape Grading
02938 Sodding
02950 Trees, Plants, and Ground Cover

DIVISION 3 - CONCRETE

03200 Concrete Reinforcement
03300 Cast-In-Place Concrete
03370 Concrete Curing

DIVISION 4 - MASONRY

04100 Mortar and Grout
04270 Glass Block Masonry
04300 Reinforced Unit Masonry System

DIVISION 5 - METALS

05120 Structural Steel
05210 Steel Joist
05311 Steel Roof Deck
05313 Steel Floor Deck
05400 Cold Formed Metal Framing
05500 Metal Fabrications and Misc. Products
05510 Metal Stairs
05520 Handrails and Railing
05720 Ornamental Handrail Systems

DIVISION 6 - WOOD AND PLASTIC

06200 Finish Carpentry
06410 Custom Casework

DIVISION 7 - THERMAL AND MOISTURE PROTECTION

07110 Sheet Membrane Waterproofing
07212 Board Insulation
07213 Batt and Rigid Insulation
07240 Coated Insulation System (EIFS)
07255 Cementitious Fireproofing
07270 Firestopping
07533 Elastomeric Sheet Roofing
07600  Sheet Metal Flashing
07610  Metal Roofing System
07724  Roof Hatches
07900  Joint Sealers

DIVISION 8 - DOORS AND WINDOWS

08111  Steel Doors, Windows and Frames
08210  Wood Doors
08305  Access Doors
08331  Overhead Coiling Doors
08410  Aluminum Entrances and Storefronts
08712  Door Hardware
08721  Automatic Door Equipment
08800  Glazing

DIVISION 9 - FINISHES

09220  Portland Cement Plaster
09260  Gypsum Board Systems
09300  Ceramic Tile
09331  Quarry Tile
09510  Suspended Acoustical Ceilings
09520  Acoustical Wall Panels
09650  Resilient Flooring
09688  Carpet
09900  Paint
09955  Fabric Wall Covering

DIVISION 10 - SPECIALTIES

10100  Chalkboards, Markerboards, and Tackboards
10165  Plastic Toilet Compartments
10210  Metal Wall Louvers
10250  Wall Clocks
10270  Access Flooring
10440  Interior Signage
10522  Fire Protection Specialties
10800  Toilet and Bath Accessories
DIVISION 11 - EQUIPMENT

11050 Library Equipment
11120 Vending Equipment
11130 Audio Systems
11132 Projection Screen and Equipment
11476 Revolving Darkroom Doors

DIVISION 12 - FURNISHINGS

12500 Window Treatment
12620 Furniture/Furniture Schedules
12710 Fixed Tablet Arm Seating
12775 Fixed Table and Seat System

DIVISION 13 - SPECIAL CONSTRUCTION

13650 Photovoltaic Collectors

DIVISION 14 - CONVEYING SYSTEMS

14245 Hydraulic Elevators-Passenger
14420 Wheelchair Lift

DIVISION 15 - MECHANICAL

15010 Basic Mechanical Requirements
15100 Valves
15140 Supports and Anchors
15153 Reciprocating Air Compressor
15170 Motor and Adjustable Frequency Controllers
15190 Mechanical Identification
15260 Piping Insulation
15280 Equipment Insulation
15290 Ductwork Insulation
15310 Fire Protection Piping
15330 Sprinkler Systems
15410 Plumbing Piping
15430 Plumbing Specialties
15440 Plumbing Fixtures
15450 Plumbing Equipment
15510 Hydronic Piping
15515 Hydronic Specialties
15540 HVAC Pumps
15545 Chemical (Water) Treatment
15559 Flexible Water Tube Boilers
15712 Induced Draft Cooling Tower
15755 Heat Exchangers
15855 Air Handling Unit with Coils
15860 Fans
15870 Power Ventilators
15885 Air Cleaning
15890 Ductwork
15910 Ductwork Accessories
15930 Air Terminal Units
15936 Air Outlets and Inlets
15973 Pneumatic Control Systems
15980 Instrumentation
15990 Testing, Adjusting and Balancing

DIVISION 16 - ELECTRICAL

16010 Basic Electrical Requirements
16110 Conduit
16112 Surface Raceways
16120 Wire and Cable
16130 Boxes
16141 Wiring Devices
16160 Cabinets and Enclosures
16180 Electrical Connections
16190 Supporting Devices
16195 Electrical Identification
16421 Utility Service Entrance
16425 Switchboards
16440 Disconnect Switches
16450 Secondary Grounding
16461 Dry Type Transformers
16470 Panelboards
16480 Motor Control
16485 Contactors
16495 Transfer Switch
16510 Lighting Fixtures
16530 Site Lighting
16622 Packaged Engine Generator Systems
16700 Audio Systems Electrical
16721 Fire Alarm and Smoke Detection System
16741 Telephone Fiberoptic & Broadband Coaxial Service
16745 Broadband Cable System
16950 Testing
PART 9

APPLIED THESIS

SQUARE FOOTAGE ANALYSIS
COST ESTIMATE
## COST ESTIMATE

**PROTOTYPICAL ARCHITECTURE SCHOOL**  
90,470 Square Feet

<table>
<thead>
<tr>
<th>CSI DIVISIONS</th>
<th>COST</th>
<th>%OF COST</th>
<th>SQ.FT COSTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bidding Requirements</td>
<td>419,780</td>
<td>4.94</td>
<td>4.64</td>
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<tr>
<td>1. General Requirements</td>
<td>341,977</td>
<td>4.03</td>
<td>3.78</td>
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<tr>
<td>3. Concrete</td>
<td>556,390</td>
<td>6.54</td>
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<tr>
<td>4. Masonry</td>
<td>197,224</td>
<td>2.32</td>
<td>2.18</td>
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<tr>
<td>5. Metals</td>
<td>539,202</td>
<td>6.34</td>
<td>5.96</td>
</tr>
<tr>
<td>6. Wood &amp; Plastic</td>
<td>200,844</td>
<td>2.36</td>
<td>2.22</td>
</tr>
<tr>
<td>7. Thermal &amp; Moist. Protect.</td>
<td>450,541</td>
<td>5.30</td>
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</tr>
<tr>
<td>8. Doors &amp; Windows</td>
<td>423,399</td>
<td>4.98</td>
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<tr>
<td>10. Specialties</td>
<td>332,930</td>
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<tr>
<td>11. Equipment</td>
<td>358,261</td>
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<td>12. Furnishings</td>
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<td>13. Special Construction</td>
<td>211,699</td>
<td>2.49</td>
<td>2.34</td>
</tr>
<tr>
<td>14. Conveying Systems</td>
<td>192,701</td>
<td>2.27</td>
<td>2.13</td>
</tr>
<tr>
<td>15. Mechanical</td>
<td>1,244,868</td>
<td>14.64</td>
<td>13.76</td>
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<tr>
<td>16. Electrical</td>
<td>838,657</td>
<td>9.86</td>
<td>9.27</td>
</tr>
</tbody>
</table>

**TOTAL BUILDING COST**  
8,502,370  
100%  
93.98

2. Site Work  
826,475  
Landscaping & Offsite  
69,271

**TOTAL PROJECT COST**  
9,398,116
PART 10

APPLIED THESIS

DRAWINGS OF PROTOTYPICAL ARCHITECTURE SCHOOL
PHOTOS OF PROTOTYPICAL ARCHITECTURE SCHOOL
AUDITORIUM WING
1. LOBBY
2. AUDITORIUM/CLASSROOM
3. STAGE
4. STAGE
5. PROJECTION ROOM

LIBRARY WING - SECOND LEVEL
1. ENTRY/SECURITY
2. CIRCULATION DESK
3. RESEARCH LIBRARY
4. RESERVE BOOKS
5. CURRENT PERIODICALS
6. ANNA DOCUMENT CENTER
7. BOOK/Shelving
8. OVERSEAS FIELDS
9. COPY CENTER
10. REFERENCE
11. LECTURE ROOM
12. STACKS/RAILWAY
13. RARE BOOKS
14. STUDIO/COMPUTER
15. SPECIAL COLLECTIONS

LIBRARY WING - FIRST LEVEL

AUDITORIUM NORTH ELEVATION

AUDITORIUM WEST ELEVATION

AUDITORIUM SOUTH ELEVATION

AUDITORIUM EAST ELEVATION

PROTOTYPE ARCHITECT
ARCHITECTURE STUDIES 1993-1994
DESIGNER: SHELY ANN HAYDEN
MASTER OF ARCHITECTURE CANDIDATE

UNIVERSITY OF NEVADA, LAS VEGAS
STUDIO ROOF FRAMING

STUDIO SECOND FLOOR FRAMING

STUDIO FIRST FLOOR FRAMING

ARCHITECTURE SCHOOL
NEVADA, LAS VEGAS

EXAMING COMMITTEE:
RICHARD BECKMAN, AIA
MICHAEL ALCORN, AIA
HUGH BURGESS, AIA
ANTHONY SAVILLE

KEY PLAN
NORTH