
UNIT 7

REALISATION OF ARCHITECTURAL PROJECTS

Structure

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7.0 INTRODUCTION

We know that an architect while designing a building, goes through a process of finding solutions to problems which are both, functional and aesthetic. But preparing the design of a building is only a small part of duties and responsibilities of an architect. Broadly speaking, an architect acts as a coordinator between the client and the contractor; between many technical consultants such as for air conditioning, electricity, mechanical equipment, structural water supply and sanitation and so on. All buildings; houses, flats, offices or factories in towns or elsewhere have to follow certain regulations. An architect is supposed to follow such regulations and ensure that the buildings he designs, are constructed in accordance with such regulations. Like in any other profession computers are an important tool in architectural as well. An architect can make intelligent use of Computers in various aspects of his work.

7.1 OBJECTIVES

After studying this unit, you should be able to

- know how an architect functions as a professional,
- familiarize yourself with the rules and regulations that buildings have to follow before the buildings are built and occupied,
- appreciate that construction of a building is a team-work and there are ways of managing it efficiently, and
- finally, learn what is the role of computers in architectural profession.

7.2 ROLE OF AN ARCHITECT

Like doctors, lawyers, and other professionals, the architect and engineer provide only their qualified and professional services to the client in exchange of professional fees. The owner - a client may not have knowledge of building drawings and the process of execution of a building. They may not have ideas about the various clearances and no-objection certificates that have to be obtained before the plans are approved as well as the formalities to be complied during the course of construction. They look upon architect or engineer to guide them from the assignment of project till its completion, because he possesses the requisite knowledge and expertise in the field of building design and construction.

Some of the important tasks of an architect arising out of agreement with the owner are given in subsequent paragraphs.

7.2.1 Plans and Specifications

The architects and engineers are required to prepare drawings in accordance with the instruction of the clients complying with all rules and regulations of the statutory/local authorities. If the plans are not in conformity with the rules and regulations, the architect may be held responsible for not guiding his client correctly and may lose his fees or be subjected to legal action. The architect is given the freedom to design the building in his own way but he has to comply with the idea, convenience and requirements of the owner. The drawings prepared by the architect are an important instrument in the tender. They should be carefully prepared so as not to cause faulty construction or extra items during construction. They should clearly show what the contractor is required to do. It is the duty of the architect to supply the drawings to the contractor in time.

Specifications

The design ideas of an architect are translated into actual reality through specifications of the work, they should therefore be clear and without ambiguity. Specification tells the type of materials (brand names if necessary), their proportions, the kind of workmanship required and the method of execution etc.

7.2.2 Estimate of the Work

After having designed a building and having prepared the drawings and specifications, it is necessary to obtain some idea about the cost of the building. A client has a right to know how much his building will cost. It is important that the estimates are prepared with care and attention so as to give a realistic forecast of actual cost. It may vary a margins of 10% to 15% provided the scope of work and material prices have not changed.

Estimate is a word where range varies from forecasting value without actually measuring to approximate judgement based on actual data supplied including measured drawings and specifications. This ascertains the financial implications involved and decides the feasibility of the work. It is useful in framing tenders for work and check contractor's work during and after execution for purpose of interim and final certificate. Also it helps in ascertaining requirements of controlled materials like cement and steel and to make applications to the controlling authorities.

While preparing an estimate, it is likely that a few items might have been overlooked. Hence a certain allowance, 10%-15% of the total cost is made in the estimate which will take care of all these contingencies

The methods of estimating are as follows:

- a. Detailed or item-wise estimate
- b. Estimate on area basis
- c. Estimate on cubic contents basis
- d. Estimate on unit basis
- e. Estimate on building cost index

Every method of estimating has got its own basis ingredients, one of which is the correct computation of areas or quantities.

7.2.3 Tenders

The architect or the engineer has to invite tenders for the works within a reasonable time, upon receiving instructions from his client.

A tender is an offer made by one party to another for execution of specified work at a specified cost, in keeping with all the terms and conditions stated therein. Prior to inviting tenders, the architect must ensure that all plans, details, specifications etc. are correct and without ambiguity, the bill of quantities is accurate.

Prior to filling in the tenders, the contractor should study the drawings and specifications carefully, analyze the site properly and account for the number and types of manpower required, in order to work out establishment charges, cost of material and labor etc. correctly.

Tenders may be invited in any of the following manners:

- i) **by invitation** - suitable for private works wherein contractors from a panel maintained by architect are invited to quote,
- ii) **by public notice** - public works are advertised in newspapers and any contractor possessing the qualifications stated, can quote,
- iii) **by negotiations**-in this case the architect possesses some base or datum for negotiations such as limit of cost of construction per unit plinth area, or so.

The nature of tender can be classified as under:

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| (i) Category I | (a) Item rate tender
(b) Schedule of rates with percentage up or down |
| (ii) Category II | (a) Lump-sum tender
Lump-sum percentage tender |
| (iii) Category III | (a) Cost plus percentage or 'cost plus fee' tender
(b) Cost plus fixed fee tender
(c) Cost plus fixed fee with bonus/penalty
(iv) Labor tender
(v) Tender for demolition work |

7.2.4 Duties and Liabilities in Profession

The duties and liabilities in the profession arising out of contract (express or implied) with the owner are that when he is employed to prepare the drawings, the architect has not only to supervise the work but he is also held responsible for the failure of the work. He is to prepare clear specifications which elaborate about the type of materials, their proportion, the kind of labor required and the method of execution etc. The estimates prepared should be a realistic forecast of the actual cost. It may vary 10%-15% provided the plans, prices of materials and labor remain unaltered.

The architect has to invite tenders for the works. He should also make inquiries about the site with respect to the position in the development plan and also to check the soil condition of the plot before construction to prevent unequal settlement and hence failure of the building.

Express and Implied Authority of Architect

Express authority is indicated in the contract and allows the architect to modify the design as long as it does not change the whole scheme. He can alter the quantity and quality of work but not the specifications. He can order removal of defective material from site, dismiss any person employed by the contractor. He can certify part payments to various people and issue the final certificate of completion.

The architect has no implied authority to obtain the tender or enter into contract with the contractors on client's behalf. He cannot vary the building contract or dismiss the contractor without client's permission. He cannot appoint consultants/specialists without the consent of the client.

Architect has rights to extend the time of completion under a set of circumstances given therein but he has no authority to issue acceleration instructions as this involves financial liabilities.

Supervision and Delegation

It is the duty of the architect to give proper supervision on the work and issue all the details from time to time so that the work does not stop. If the work is found to be defective or materials used are found to be of substandard quality, they should be rejected.

Delegation of Duties

Though the clerk of works is described as the eyes and ears of the architect yet the overall responsibility remains with the architect, but his liabilities are reduced to 80% with rest 20% borne by the clerk of works.

7.2.5 Code of Professional Conduct

The Council of architecture has been constituted as per Section 3(1) of the Architects Act, 1972. Section 45 provides for the said powers of the council to make regulations for architectural education, standards of professional conduct and etiquette and code of ethics which will have a binding force on all the registered architects.

The Architects' (Professional Conduct) Regulations, 1989, published by the COA is a comprehensive code pinpointing the extent of duties of the architect to the society, client, fellow brothers etc. and sets out architects' behavior/approach to various problems.

Architect should let the client know about the conditions of engagement and scale of charges. He cannot sub-commission another architect without the client's concern. He cannot advertise his professional services and not let his name be used in public advertisements. But he can publish a notice of change of his address, exhibit his name outside his office and on building construction sites under his supervision, provided the lettering does not exceed 10 cm in height. He may also allow his name to appear in professional/telephone directory.

If an architect is employed for a job previously handled by another architect, then he has to give him a notice and obtain his no objection certificate.

7.2.6 Conditions of Engagement and Scale of Fees

When an architect undertakes a job, his fees are usually agreed in advance. If not, then after completion of work, he is entitled to reasonable remuneration based on Quantum Merit.

The architect shall provide services such as:

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|---|------------------------|
| (a) Site evaluation and analysis | (g) Electrical work |
| (b) Environmental impact assessment | (h) Acoustical work |
| (c) Architectural work and site development | (i) Landscape work |
| (d) Structural engineering work | (j) Interior designing |
| (e) Sanitary, water supply, drainage work | (k) Graphic signage |
| (f) Heating, ventilation, air conditioning | |

The architect will also prepare drawings necessary for submission to statutory bodies for sanction certificates and prepare estimates of cost to invite tenders. He is also required to provide periodic site supervision.

The fee is based on the tendered cost of the total project (above mentioned points). Where part or whole project is not executed, the fee will be on the cost calculated on the prevailing rates, i.e. market rates or scheduled rates plus current tender percentage.

Architectural Drawings

- a. Site plan -showing all major site features, building location, levels, surrounds roads north point etc.-scale 1: 200
- b. All floor and roof plans-scale 1: 100
- c. All elevations-scale 1: 100
- d. Sections through all major spaces-scale 1: 100
- e. Details/sections of special features -scale 1: 50
- f. Plans of stairs, ramps, lifts-scale 1: 50
- g. Toilet, kitchen/pantry details-scale 1: 50
- h. Schedule of doors and windows
- i. Reflected ailing plan if required

7.3 BUILDING REGULATIONS

Man is a social animal. When we live in a society we have to observe certain rules and regulations. These rules have been evolved in course of time for the safety and well-being of the individual as well as the community. These rules are sometimes called the customs. Similarly, houses and buildings in a city or town or a village must observe some 'customs' or regulations. If you were to build a house in a jungle or a farm, no one would be bothered much as to how you build it but in a town some rules must be followed to ensure the order and well-being of the town. There are regulatory administrative bodies in towns, cities and village who ensure that no one builds haphazardly, unsafely and in a way that will spoil the order of things. But the most important things for us to understand is that these rules and regulations are made for our own good and for the good of the society and it is in our own interest that we should observe these rules.

Primary set of rules and regulations are formulated and regulated by the municipal corporation or municipalities. They are generally in the form of Building Bye-laws or Development Control Regulations. In other cases, it may be the Taluka Authorities or a Village Panchayat that might administer such regulations.

In every town or a city, before you construct a building, you are required to submit the building drawing to the relevant authorities and seek an approval. Generally, in the municipal office there is a department, Town Development Office (TDO) or such where the plans are to be submitted for approval. All such authorities who give approval for construction of a building, have a printed book of regulations and building bye-laws.

The Development Control Rules for Greater Bombay, for instance, are framed under the Maharashtra Regional and Town Planning Act, 1966 (Maharashtra. Act No. XXXVII of 1966).

In some cases, depending on the nature, height and location of a building, special and additional clearances of building proposal are required from authorities such as Airport Authority, Fire Department, Defense Authorities etc.

Every person who intends to carry out development or redevelopment, erect or re-erect a building or alter any building or part of a building is required to give a notice, in writing to the Commissioner in a prescribed form accompanied by plans and statements in required number. One set is retained by Commissioner's office for record after the issue permission or refusal. The exact nature of information required to be included in the application is mentioned in the book of regulations.

The information given along with the notice is found satisfactory, a commencement certificate or development permission is given to the applicant. This permission is valid for a limited period, say four years which may be extended further by application before the expiry date.

Procedure during the Construction

- a) Construction should conform with the regulations.
- b) The owner is required to serve a notice to the commissioner informing about starting of work at least 7 days before the commencement of work.

- c) Certain documents related to test results, development permission with relevant drawings are required to be kept in a suitable place on site for inspection by the authorities.
- d) When the work is completed to the plinth level the owner has to give notice to the commissioner through his architect or engineer so that he may have the work inspected to verify if it is being carried out according to the permission given.
- e) If during the construction of a building any departure of substantial nature from the sanctioned plan is made, the permission of the authorities is required. A revised plan in prescribed manner should be submitted for approval. Any work which is not covered by such approval will be deemed as unauthorized construction and shall be liable to legal action and demolition.
- f) **Completion Certificate** - The owner through his licensed plumber will submit a drainage completion certificate to the commission. The owner through his architect or structural engineer or surveyor, who has supervised the construction, shall furnish a building completion certificate in prescribed form along with completion plan. The Authorities may inspect the site and after satisfying themselves about the compliance of work with the permission given, issue a certificate of acceptance of the completion of work.
- g) **Occupancy Certificate**-On receipt of the completion certificate, the owner through his architect or engineer submits a development completion certificate. Upon inspection the commissioner issues occupancy certificate. Only then the building is available for occupancy.

For all the procedures and regulations regarding buildings as mentioned above, all the responsibility and liability is on the owner. However, since the owner is not a technical person he has no knowledge of the procedures. Therefore, in actual sense all the responsibility rests with the architect and engineer. It is, therefore, very important that the architect and the engineer responsible for the project should be thoroughly conversant with all the building regulations and the formalities during the construction. Under the provision of appointment, the architect is morally responsible to guide his client, the owner of the building in carrying out all the formalities.

8.4 CONSTRUCTION MANAGEMENT

We have seen earlier that the role of an architect is not just to design the building and prepare drawings. In most of the cases he is involved in the process of realizing the project. Let us examine the various stages of involvement of architect in a building project after the building design is completed and until the building is handed over to the owner for occupancy.

Constructing a building on the basis of the architectural design is a complex process requiring a coordinated effort of many agencies, experts/consultants and trades. The job of managing a building construction is somewhat like that of conductor conducting a classical musical orchestra. If it is not done properly, (i) it is likely that the building may not get built as per the design, (ii) the materials, finishes and services in the building may not be good enough, (iii) the building may get delayed, and (iv) cost more. Since it requires a variety of inputs, an architect has to depend upon various consultants, experts, suppliers and so on. Usually, he would have a project engineer for this purpose. It is essentially the project engineer who helps architect coordinate and manage a project.

The main objective of good construction management is to get a building constructed exactly as per the design, in sound construction with good finishes, in reasonable time and in the most economical cost.

Tendering

Having prepared working drawings, specifications and quantities, an architect prepares a tender document to invite tenders from various prospective contractors. Tendering and selection of the right contractor is the first most important task in construction. An architect may invite tenders from selected list of contractors whose quality of work he is familiar with or in case of larger projects contractors may be invited through advertisement. Out of the many contractors who submit the tenders, one is selected after careful scrutiny of the rates quoted, the services offered, resource mobilizing capabilities and professional credibility.

7.5 COMPUTERS IN ARCHITECTURE

Virtually everyone involved in architectural design is affected by the arrival of computers the profession. Very soon most of us will be using computers daily, so it is vital that the concepts and techniques of computer-aided architecture are widely understood.

The design professions are now being transformed; an architect's office is no longer a clutter of drawings boards and scaled models of buildings. Computers have replaced all that. There is a remarkable range of computers and programs that are useful to architects. There are enough similarities in graphics programs, in particular, that we can conduct a generalized discussion, that is applicable to many different systems. This section will be most useful if you are starting out, and it may contain some interesting information if you have some previous knowledge or experience.

The design professions have never been quick to change and it is a major step to begin using a new tool like a computer. These tools have the potential to make labor of an architect more productive, but more importantly the promise to transform the way one designs.

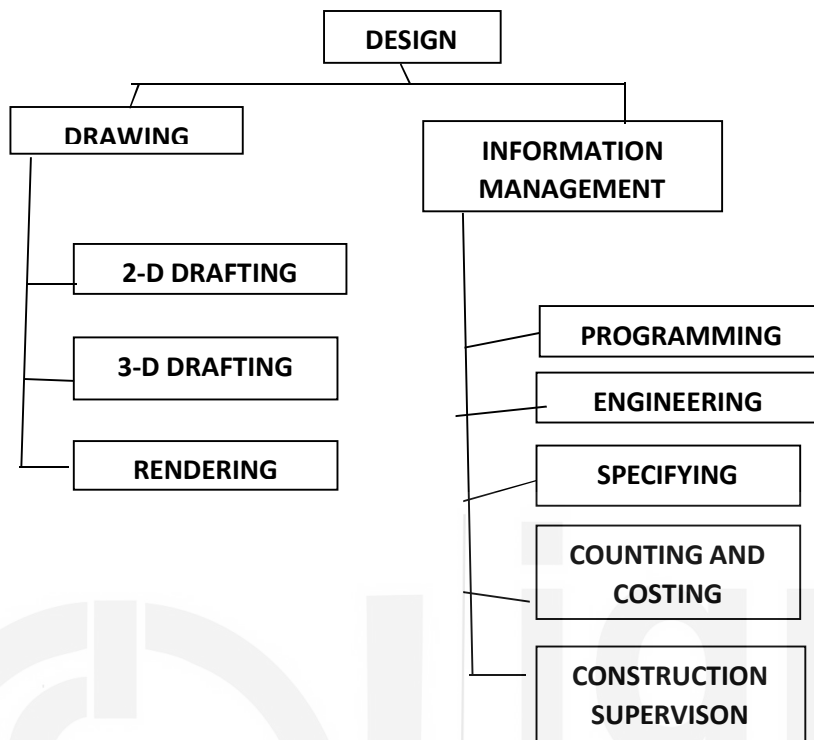
Computer Aided Drawing (CAD) and Information Management Systems (MIS) are now within reach of virtually every designer and drafter. Sophisticated computer (hardware) and (software) can now be purchased by even small firms.

CAD vs Traditional Methods

It is possible to use computer aided drawing without really taking fullest advantage of its capabilities. Even some experienced CAD users have simply transferred all their manual drawing habits over their computer.

It is like buying an airplane and driving it down the highway, rather than learning how to fly. It requires an effort to learn to fly, but if you don't bother, you might as well stick with your car.

Computer aided design programs offer a wide variety of features, in many different combinations as shown in figure. Some of these are common to most sophisticated, architecturally oriented programs. It is particularly important that you take full advantage of the particular features of your software.



Hardware

In order to use a computer, you need to know very little about the machine itself. Your biggest concern, is how to turn it on and adjust the video display. However, the more you know about what goes on inside, the more you can optimise it to get the most out of your software. As time passes you may wish to add new hardware to your existing system. Since only certain combinations of computers and add-on peripheral equipment will work together, it is very important to be familiar with different types of computers and peripherals.

Information Processors

Before proceeding with understanding of the chip, it is necessary to understand how characters are represented in the computer. The computer being electronic machines work better with just two signals (on/off), thus giving them only two distinct digits 1 (for on) and 0 (for off) to work with. Hence, in the binary system used by computers, each number or character is represented in terms of the binary digits 1 and 0. Each of these binary digits is called a bit (binary digit). 8 bits make a-byte. 8 bits or a byte is used to represent a character in a computer.

The size of the memory is measured in the units of “kilobytes” (kB) where each represents about (1024 to be precise) bytes. 1 megabyte (mB) contains 1024 kB and 1 gigabyte (gB) contains 1024mB of memory.

Microcomputers or personal computers have silicon chips as well as numerous other specialized chips. These "microprocessors"- pocket size process and store information. The size-capacity of the processor determines the speed and the power of the computer.

Remembering and Storing Information

Most computers use two primary ways of storing information

- on silicon chips, which reside within the computer
- on media disks which in some cases can be removed from the computer

Internal-chip based memory called "Random Access Memory"(RAM) due to its quick accessible nature, depends on uninterrupted electric power. It is used primarily for working memory when the machine is turned off, it loses its information.

Permanent storage media, such as CSs, diskettes and hard disks can be used to save your work periodically as you work, in case of power failure, and to archive drawing indefinitely.

Diskettes are an inexpensive, easily transportable medium. They can be carried one computer to another, and they can be erased and used repeatedly. These floppy disks or micro disks come in several sizes and capacities, varying with the computer model.

Mass storage media such as hard disks are a necessity for computer aided drawing. They are faster and have a greater capacity -10 to 100 times greater than diskettes. A hard disk is a complete mechanism, not a removable medium.

Typically, a single hard disk can contain CAD programs, your drawings, various "utility" programs and additional software for cost estimating, and word processing. Since they hold so much information, they must be organized very carefully. Groups of files (drawings, programs and other data) can be organized into DIRECTORIES and SUBDIRECTORIES, so that it can be managed them more easily.

Computer Disk - Read Only Memory (CD-ROM) systems offer vast amount of storage capacity but cannot be written on directly.

Drawing

Drawing is a manual activity. Just as a straight edge/T-square guides a pencil, the computer assists in putting lines where they belong.

There are several different kinds of user interface available for computer aided drawing. Each uses a particular type of hardware.

Typing and Cursoring

A keyboard is one of the most common and widely used input devices. Other than a few additional keys, it follows the same layout as that of a conventional typewriter.

Since a keyboard can be used to write drawings' notations and perform numeric calculations, it is more than a means to enter commands. The arrow keys can also be used to move the on-screen drawing cursor or cross-hairs, more precisely over short distances than a hand-held pointing device.

Voice Recognition system

An alternative to typing commands is speaking them for which voice recognition systems are available that enables you to talk to your computer Instead of typing to it. They consist of a

microphone, an electronic board that usually be placed the computer and some special software that translate voice patterns into words.

These systems are far from foolproof arrangement - a chance remark may have unpredictable consequences - but the idea of drawing without manually entering commands is certainly attractive.

Mouse

Several kinds of devices can be used as electronic pencils. A 'mouse' is a hand-held box with several buttons and a tail linking it to the computer. By sliding it around on a pad or on the desktop you can move the cursor or even pick items from the on-screen menus. There are two types of electronic mouse: optical and mechanical.

Joystick

The evolutionary ancestor of the mouse is the stationary directional pointer called a 'Joystick'. This stationary device can be pointed in any direction and the moves in that direction. Since it is difficult to control the speed of movement, a joystick is not a comfortable drawing tool.

Screen Pointing

It is carried out with the help of a light A light pen. A light pen is a pen-sized pointer that is held to the display screen to pick menu items and move the cross-hair around a drawing. In theory, it is the most direct device, but in practice, it has some several serious disadvantages. Light pens may become more popular when more mobile, less eye-straining screen become available. High resolution, low-flicker video screens and other alternatives make this possible.

Digitizing

The mice are relative pointers. They indicate direction but do not measure distance accurately, hence, they cannot be used for tracing. In order to copy a paper drawing, you need a digitizing tablet, an absolute pointing device.

A digitizing tablet is used with either an electronic stylus or a box with buttons (and a tail) that looks like a mouse. This box, called a cursor, has a pair of cross-hairs that travel over the drawing surface, as does the point of stylus.

They can be used, however, to trace with a very high level of accuracy as well as to pick commands and symbols from a menu that is overlaid on the tablet.

Output Device

Once you create an electronic drawing, you usually need to find a way to get it find a way to get it onto paper. In architectural practice, one needs to be able to reproduce one's drawings at large scale. For all this, you need to have an output device.

Printing

Graphic printers-an output device - are the quickest way to produce a drawing. Images are produced by printing very small and very close dots together onto paper by one of the three ways. Firstly, a print-head with 8 to 24 pins can be used to strike a ribbon, secondly, an inkjet a squirt

patterns onto the paper directly, or thirdly, electrostatic process, using a laser or a LCDs can produce images in a manner similar to photocopies.

Pin impact printer are limited in resolution by the mechanics of the tiny pins. When you need a quick record of any drawing and are not concerned with other details, a mechanical dot matrix printer suffices.

Inkjet printers share most of the advantages and problems of pin impact printers. They are generally used for text and medium resolution graphics, However, inkjet printers have the potential of producing higher resolution drawing at larger size and they can find a greater role in architectural graphics than they currently play.

Electrostatic dot-matrix printer is relatively expensive but they are both fast and accurate. Small desktop laser printers have sufficient resolution to produce good architectural details and small presentation drawings while doubling the letter-quality of the text.

Plotting

Pen plotters are the kind of tool that gives the output as that of drafting. The quality of line is far superior to any dot matrix media.

Large plotters move a sheet of paper under the pen in one direction, while the pen is moved in the other direction. Smaller plotters move the pen on a bar in both directions.

Low cost plotters often move the pen in short visible "jumps" making diagonal lines into "star steps" just like a dot matrix printer.

A good plotter produces smooth diagonals and curves. Multi-pen plotter will automatically change pens according to your instructions, although single-pen plotters will stop to let you change pens manually. Technical pens or inexpensive felt-tip pens can be used for this purpose.

Software

Architectural computer programs provide you with a set of tools that help you to perform repetitions and other tasks to organize your work. Each of these tools can help you in carrying out complex operations in a few steps. You can draw with multiple lines, copy elements that are repeated, then edit your work and enhance it with other multiple task tools.

Computers are ideally suited to carrying out sequence of tasks. Indeed, a well-designed program allows you to give a command, then let the machine do the dirty work. To the architect, this means freedom from many repetitive drawing, lettering, and reporting operations. The tools available for multiple operations can be classified as drawing, editing, enhancing and data-handling aids.

Drawing with a computer is like learning to draw again. You once mastered the Skill, it can have a lot of advantages. Furthermore, drawing with a computer can be mindlessly accurate. A plan can be developed at "full scale" by zooming (enlarging the screen display) on a detail.

Editing Tools

One of the most difficult aspect of manual drawing habits is to copy or edit an existing drawing. Computers provide tool that often make it easier to copy and adjust a previously drawn element rather than to draw a new one. Even a simple line should be copied when you want to repeat the exact length of the original.

Enhancing Your Drawing

A set of tools available in the device helps you to enhance a drawing by adding information, making it more readable or more attractive. These aids include different line types and colors, hatching patterns, solid fills, text and dimensions.

Custom Tools

With many CAD programs, you can create your own drawing tools. Some CAD software are open, allowing users to make modifications or additions to the program itself, while other software is closed and do not allow customization.

Handling Information

Some of the most helpful tools for computer-aided architecture are not only drawing tools, but accessories for linking drawings to non-graphic information. These data management tools can help you in keeping track of the numbers and types of objects you place in your drawing. This enables you to make lists in tabular form, automating a process that is otherwise time consuming and error-prone.

7.6 SUMMARY

Architecture is a profession involving not only designing a building but also coordinating. The works of many disciplines and contractors in order that a building project is realized Well. An architect has to understand the requirements of a client and 'design' a building. Which will not only satisfy these requirements but also give him a building which is aesthetically pleasing. Architectural design is not just an artistic work but it deals with many functional and technical aspects of a building. Many disciplines and professionals have to work in order to make a good building. It is the job duty of an architect to coordinate the works for various consultants, contractors etc. An architect has to be conversant with the rules and regulations related to buildings. He is a professional responsible for regulating correct construction.

Computers have made an architect's life easy by creating better visualizations, quicker and accurate technical drawings and keeping track of various data, figures and correspondences in the profession. An architect should be able to make good use of the facilities provided by the computers.

FURTHER READING

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