

The Design Process

The design process is made up of the following steps:

1. **Problem Analysis and Definition:** This involves determining the causes, needs, and goals. One should use a notebook to organize his/her ideas, take notes, record data, and document activities.

The following are ways of examining a problem that help in understanding its real causes:

- **Describe history of conditions:** Sequence of events preceding a situation can be established through personal experience, interview, or experiment. For example, Road networks, black spots
- **Investigate its magnitude:** Determine the frequency of occurrence and widespread of effect. For example, how many people, how big an area is, etc.
- **Identify subproblems:** Identify conditions for subproblems which contribute to its real problem. For example, leakage in a sewage system in a house causes weakening of walls.
- **Identify human effect:** Everything designed has a final interaction with people and must have satisfactory effect on them. Therefore, check for attractiveness, safety, comfort, efficiency, etc.
- **Consider the consequences:** The effect the new device/construction will have on workforce. i.e., need for training, displacement, etc.

2. **Research on the Problem:** This is a continuous part of the design process. It is the acquisition of knowledge necessary for project completion.

The following is important when you are researching on the problem

- Decide what kind of research can be accomplished
- Formulate a plan and record all sources and results in a notebook

Research can be accomplished through:

- Reading existing books, manuals, and journals in a certain area
- Interviews with dealers, users, owners, etc.

3. **Specify Design Parameters:** The specific traits (characteristics) that the design should possess are called parameters. Parameters include things such as cost, user characteristics, simplicity, weight, materials, etc.

For example, the parameters of a jetfighter might include: maximum takeoff distance, speed, distance between refueling, minimum climb rate, maximum landing distance, etc.

The traits are performance specifications that do not describe the plane or jet.

The following should be determined by parameters:

- User characteristics- age, strength, skills, and education.
- Market price
- Useful life
- Size limitations
- Power requirements
- Safety requirements

4. Generate Ideas: It is important to have many ideas to choose from. Designers get many ideas while analyzing and researching the problem. Methods of idea generation include: brainstorming, and consulting peers/professionals

5. Develop Concepts: Some of the collected ideas represent attainable solutions. The better ideas should be developed by good sketches accompanied by notes to adequately describe the outstanding features and operations of the design. The sketches must be complete and clear.

6. Finalization and Reporting: The design process ends with finalization and reporting. A good report should be:

- Clear
- Complete
- Accurate

The report should contain:

- Design steps and consideration
- Design team involved
- Testing mechanisms
- The design structure
- Dimensions and further information

CAD Modeling

CAD modeling is the process of designing and developing a model. A model is a three dimensional (3D) representation of a possible design. It is often smaller than its real thing (scaled down), or may be the actual size.

Types of Models

1. **Exploratory models:** Used to investigate an idea. They are used to visualize an idea and help reach a solution and one can several models before reaching a solution.
2. **Prototype models:** Made before manufacturing or constructing an item. A prototype model resembles the final object and it is made to confirm that the best solution has been achieved. It is made with great care and accuracy.
3. **Demonstration models:** Used to explain an idea or principle to prove that the final product will work. They may be simplified or scaled down or even two dimensional (2D). They must operate in a similar way as the final product. They are used to demonstrate how a system operates e.g. flow of cars in a car park, arrangement of furniture, etc.

Basic Requirements of a CAD System

- Computer hardware
- Software: i.e., operating system to create/establish appropriate environment, avail necessary programs, data files and communication facilities, which are collectively called the CAD system itself, and application software/design package
- Person/Designer
- Certain type of problem, need, or challenge

Fields in which CAD is applied

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|--------------------------------|-----------------------|
| • Advertisement | • Architecture |
| • Movies and film production | • Engineering |
| • Cartography- Drawing of Maps | • Product designs |
| • Geography | • Landscaping |
| • Artistic design | • Manufacturing, etc. |

CAD Standards

Standards are principles that guide designers in the design work, enabling them to produce a product that is acceptable and fit for use and the user.

The main benefit of standards is that they enforce a uniform behaviour, facilitate communication between people, stabilize the production process, and make it easier to add new people to an ongoing project. They also enhance the ability of the clients to assess the progress and quality of the results.

Process-Oriented and Product-Oriented Standards

Process-Oriented standards specify the procedures and processes to be followed in product design and development.

Product-Oriented standards deal with the ability of the product, and they are seen as an independent contribution to design quality.

Importance of CAD Standards to Designers

- Brings greater accuracy
- Establishment and use of common terminology enhances communication
- Facilitates more effective data exchange with clients and collaborating firms
- Reduction of necessity for training, whereby knowledge acquired in one project can be used in the next
- An in-house or industry standard for display style or screen layout ensures that all systems have the same look and are easily recognizable
- Improves the process of exchanging data electronically

Organizations that Develop CAD Standards

- Governments
- National and International organizations, e.g. ISO
- Professional bodies
- Individual or group of related or collaborating industries