

Introduction

1. CAD :

Computer aided Design (drafting) is a process of preparing a drawing of an object on the screen of a computer.

There are various types of drawing in different field engineering and science.

2. In the field of mechanical or Engineering the drawing of mechanic component and the layout of them are prepared.
3. In the field civil engineering and architector Plants and layouts of the building are prepared. In the field of electrical engineering the layout of power distribution system are prepared.
4. In all field of engineering use of computer is made for drawing and drafting.

* Use of CAD :

- (i) The use of CAD Process provides enhance graphic capability which allows any designer to conceptual these ideas.

- (ii) Modifying the design very easily.
- (iii) Perform animation
- (iv) Make design calculation
- (v) Use colours, fonts and other statics features.

* Reason for Implementing a CAD system :-

- Increase the productivity of the designer CAD improves the productivity of the designer to visualise the product and its components parts and reduces the time required in analysing and documenting the design.
- Improve the quality of design :-

CAD system improves the quality of the design a CAD system provides a more detailed engineering analysis a larger number of design alternative can be investigated.

The design error are also reduced because of the greater accuracy provided by the system.

- Improve Communication :-

It improves the communication in design the use of a CAD system provides better engineering drawings more standardization in the drawing and better documentation of design, few drawing errors and regenerative

- Improve the efficiency of the design :-

→ It improve the efficiency of design process and wastage at the design stage can be reduce.

- create database of manufacturing :-

→ In this process of creating the documentation for these products much of the required database the manufacture the product is also created.

- * Application of CAD :-

There are various process which can be performed by use of computer in the drafting process.

- Automated Drafting :-

This involves the creation of hard copy engineering drawing directly from CAD data base.

Drafting also includes teachers like automobile dimensioning generation of cross hatching areas, scaling of the drawing and the capabilities to develop section view and enlarge view details. It has ability to perform transformation of images and prepare theoretical drawing like isometric views perspective views.

* Geometric Modelling :

The concerned with the computer compatible mathematical description of the geometry of an object.

The mathematical description allow the image of an object to displayed and manipulated on a group terminal through signals from CPU from the CAD system.

The software that provide geometric modelling implies must be design for efficient use both by computer and human design.

* Building by laws :

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Building by laws are a set of legal regulation stabilized by local authorities or government

to insure Plan and systematic development of construction activities.

These laws covers the design, layout, height, size, use of space and safety standard for building.

They Aim to create uniformity and maintain harmony in the urban environment while insuring the safety comfort and health of equipment.

* Objectives of Building by laws :

- Regulate Development :

To insure and sustainable growth of urban and rural areas.

- Safety and Security :

Protect occupants and surrounding area from structural area or unsafe Practice.

- Promote health and hygiene :

Maintain adequate ventilation lighting and sanitation in buildings.

- statics appeal :

Maintain the visual consistency and appeal within locality or city.

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- Environmental Protection :
Encourage ecofriendly practices, such as rainwater harvesting and green spaces.

- Prevent over Prodding :
Regulate the population density in a given area through restriction of the size and number of building.

* Importance of building by laws :

i. Legal framework :

Provide a legal bases for construction activities, reducing disputes and insuring complines.

ii. safety standard :

Prevents structural collapse and hazards during natural disaster like earthquake or floods

iii. Efficient land use :

Optimize the use of land and resources through plant layout

IV. Infrastructure development :

Insure adequates provision for utilities like road, drainage, water supply and electricity.

V. Reservation of public interest :-

Safe guard the rides and interest of individuals and the community.

VI. Quality of life :

Improve the living condition for residents by promoting safety and well beings.

*. Importance terms by building laws in use :-(i) Set back line :

The minimum distance a building must be from the property line, Road or other structures to insure and ventilations.

(ii) Floor area ratio (FER) :-

The ratio of the total floor area of a building to the size of the total plot. It controls the density of construction.

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(iii) Building Height :- The vertical distance measured from the ground level to the highest point of the building.

(iv) Covered Area :- The portion of the floor covered by building, excluding open spaces, gardens and balconies.

(v) Plinth Area :- The built up area measured at the floor level of the building including walls.

(vi) Carpet Area :- The useable area of the building within the walls excluding thickness of wall and areas like balconies.

(vii) Occupancy Certificate :- A legal document satisfied that the building complies with all regulations.

(viii) Open Space :-

Uncovered area Plote for ventilation natural lights or landscape.

(ix) Basement :-

A part of the building that is below the ground level and used for parking, stores or other purposes.

(x) Zonic regulation :-

Laws that specified the type of construction allowed in specific areas (residential area, commercial and Industrial)

* Floor Area ratio (FAR) :-

It is quotient obtained by dividing total covered (Plinth area) on all floor divided by the area of the Plote and multiplying the quotient by hundred.

$$\text{i.e. FAR} = \frac{\text{Total covered area of all floors} \times 100}{\text{Area of Plote}}$$

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*. To erect building by local government the following

- i. Building frontage line
- ii. Built up Area of the building
- iii. Height of the building
- iv. Open space to be left on sides and back
- v. Size and roof height of rooms
- vi. Provision of opening in rooms, bathrooms, etc or proper light and ventilation.
- vii. Provision for water supply and disposal waste water.
- viii. Final structure design of the building for its safety.

*. Building line :-

Building line is also known as set back, or front building line. It is a line parallel to the plot boundaries beyond which no construction work is permitted. The building is restricted by local authorities keeping to the future prescribed widening of the road. The distance is taken from the central line of the road or lane.

For various types of roads gives the building line.

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Type of road	Building line
1. Village roads	9 metre
2. Other distric road	9 metre
3. Major distric road	15 metre
4. National state and highway	30 metre

*. Open space around buildings:

The national building code of our country as recommended following open space around building of varying height.

Description of Building	Front space (width in m)	Side space (width in m)	Back or rear space in m	Remarks
Building having height less than 10 m	3 in no case less than 1.8 m	3	3 in no case less than 1.8 m	minimum building line 7.5m
Building having height more than 10 m and less than 20 m	$3 + A$	$3 + A$	$3 + A$	The value of A in 1 m for every 3m beyond 10m height of building.

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Building having height more than 25m and less than 30m	10	10	10	
Building having height more than 30m.	$10 + B$	$10 + B$	$10 + B$	The value of B in 1m for every 5m beyond 30m.

* Delhi building by laws :-
 Their should be no construction layout beyond said back line.

↳ Canopy :-
 Cantilever ^{Projection} Position known as canopy of size limit 4.5 m (fifteen Feet) long and 2.4 m (8 feet) will not be consider as covered area.

↳ Balcony :-
 Open space of balcony which projects 0.9 metre (3 feet) beyond the said back line and is provided at the roof level should not be covered by more than 30%.

↳ Loft :-

Loft is define as subsidiary between two main roof or floor and is provided for keep unwanted household. its height should not be more than 25% of the roof.

↳ Mezzanine :-

mezzanine floor is provided between two main floors and its height should not be less than 2.0 m (7 feet 3 inch) and more than 2.7 m (9 feet). Area of mezzanine floor should not be more than 25% of the covered area of the building and it will not have no portion it must have window area at least 10% of its floor area for proper ventilation.

↳ Stair case :-

It all resolution building stair case will not be having width less than 0.9 m. (3 feet) and riser should not be more than 19 cm (7.5" inch) and treads less than 25 cm (10"). A spiral stair case should not be less than 75 cm (2' 6 inch) wide.

↳ Corridor and Passage :

In a residential building a corridor or passage and a Veranda will not be less than 1 m (3' 5 inch).

↳ Bathroom :

A bathroom in a residential building will not be having its floor area less than 1.8 square metre (19.37 sq. feet). The smaller dimension will not be less than 1.2 m (4' feet) if bathroom is combined with toilet then its floor area should not be less than 2.8 sq. metre (30.12 sq. feet) the roof height should not be less than 2.2 m (6' 0 feet 3 inch) and window less than 0.37 sq. metre (4 sq. feet).

↳ Latrine , Water Closets :

Water Closets will not be having floor area, smaller side and height less than 1.1 sq. m (11.84 sq. feet), 0.9 m (3 feet) and 2.2 m (7 feet 3") respectively. The walls will be having dado up to 1 m (3' 3 inch).

↳ Kitchen :

A floor area will not having size less than 4.5 sq. metre (48.42 sq. feet) and width will not be less than 1.5 metre (5 feet)

↳ Garage :

Personal garage will be having size not less than 2.75 metre ~~into~~ $\times 5.4 \text{ m}$ ($9' \times 18 \text{ feet}$) and height should not be less than 2.4 m (8 feet)

↳ Store :

Floor area of the store will not be less than 3 sq. m (32.28 sq. feet) if the store is having floor area more than 3 sq. m than opening of lights will be at least 10% of the floor area.

↳ Minimum size of a residential room :

A residential room will not be having floor area less than 9.5 sq. metre (22 sq. feet) and height of the roof should not be less than 2.75 metre (9 feet) and more than 4 metre ($13 \text{ feet } 5 \text{ inch}$) The width of the room will not be less than 2.4 m (8 feet)

↳ Provision of light and Air in the room :-

For external air and light every residential room should have one or more window, ventilator etc which should open in outside air for at least at veranda or balcony. The area of which should not be less than 1 room of floor.

↳ Basement :-

Basement should not be used for residential purposes. Inflammable materials are not stored in the basement. Minimum roof height of the basement (distance between floor of the basement and ceiling above) should not be less than 2.4 metre (8 feet). Basement should not have partition. Roof height above floor of the basement should not be less than 0.29 m (3 feet) and more than 1.0 m (4 feet) above surrounding level, outside the building.

↳ Shaft :-

Shaft if water closets and bathroom are not having direct line from outside of a building or through courtyard, then shaft are to be provided for air & light. Shaft should not be less than 15 sq.m (16.14 sq. feet).

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in area 1 m (3 feet 3 inch) in width. For building above 9 m (29 feet 6 inch) height, its minimum size should be 3 sq. metre (30.28 sq. feet) and minimum side of 1.0 m (4 feet).

* Built up Area for Residential building (NBC) :-

Area of Plot	Maximum Permissible all covered area of Plot
(i) More than 1 thousand sq. metre (m^2)	(i) 32.2 %
(ii) Between 500 to 1000 m^2 .	(ii) 40 %
(iii) Between 200 to 500 m^2 .	(iii) 50 %
(iv) Below 200 m^2 .	(iv) 60 %
(v)	

Above data is having an average value.

In fact maximum built area limitation are covered by the authorities depending on the

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type of construction, occupancy, width of lane for basic building, density of locality and parking facilities for example for bussension area maximum covered area ^{allowed} ~~about~~ is 75%.

* Building Permit :

A person or a society or an organisation who intends to erect or reconstruct a building or intends to make additional and alteration in an existing building has to apply to the concerned authority is prescribed fees along with plans in farrow print and statements in triplicate the permitting authorities are notified are community, a munciplitive, corporation or an area development authority depending upon the location of the land where the house or a building is to be erected.

* Plan :-

The plan should consist of the following :-

- 1. Side drawn to a scale not less than 1:800.
(1 cm = 8 m or 1 feet = 1 inch = 64 feet)
- 2. Showing boundaries of the site along with

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formation of details existing on all the four (4) sides of the Plot and north direction Preferably on right hand top corner of the drawing.

b.) Building Plan elevation and section drawn to a Scale not less than 1:10 (1 cm = 1 m or 1" = 8')

And all new Construction to be coloured Red.

The drainage and sea level line are to be shown in red dotted line. Structure (if any to be dissimulated are to be shown in yellow colour) location of W.C, sink, drains etc. to be shown clearly. Section drawing should show the size of footings, walls, roofs, slab beam etc. all plan are to be signed by owner and a qualified architect or an engineer.

The application should consist of specification giving kind and grade of material (bricks, flooring, reinforcement, doors, windows etc) and Portion (plaster, concrete, lime terracing etc).

The authority may accept or refused the application within 45 days if the authority fails to estimate the applicant any objection or refusal, The application and the Plans may be deemed San

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The duration mostly is for 3 years unless specified. If the construction is not started within a year of the sanction renewal of permit is required with a formal application.

While permitting the construction objective of the permitting authorities is to check where by laws of the area has been followed or not and design structurally safe. Which means that all structure, built and maintained such that stresses in material of construction should not exceed safe permissible stresses as let down by Indian standards.

* Minimum required recommended floor area and heights of rooms of residential building

Rooms	Minimum floor area (m ²)	Minimum height (m)
(i) Drawing room	9.5	2.75
(ii) Bed room	9.5	2.75
(iii) Living room	9.5	2.75
(iv) Dining room	7.5	2.75
(v) Kitchen	5.5	2.75
(vi) Bath and water closets	2.8	2.2
(vii) Bathroom	1.8	2.2

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(viii) Water closet	1.1	2.2
(ix) Servant's room	9.5	2.75
(x) Garage	12	2.5

#. Building by laws to be Practised :

(i) Off street Parking :-

Off street Parking refers to designated parking spaces provided within the boundaries of a property, away from public roads. This spaces are mandated to.

→ Minimum traffic congestion on streets.

→ Provide conveniences for building owner/occupants and visitor.

→ Follow specific dimension as prescribed (2.5m x 5m for cars).

→ Include provision for parking to ~~leaders~~ two wheeler, bicycles for differently abled person.

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→ allocate adequate space for maneuvering and entry / exit.

EX:- commercial complexes may require multilevel parking or basement parking to accommodate the expected vehicular load.

(ii) Fire protection :-

Fire safety measures are mandatory maintained to reduce this and insure the safety of occupants. These regulations cover

→ Provision of fire exit, escape escape routes and stair cases.

→ Installation fire detection of alarm system.

→ Uses of fire resistant materials for walls and doors.

→ Availability of fire fighting equipment such as extinguishers and sprinklers.

→ Addhernces to fire safety laws, codes, including a minimum distance between building to prevent fire spread.

EX:- High rise building must have a dedicated fire lift and refuge area on every alternate floor.

(iii) Minimum Plot Size :-

The minimum plot size is determined to maintain adequate open spaces, prevent over crowding and insure proper ventilation and lighting it varies based on land use

→ Residential : Minimum Plot sizes would range from 30 m² to 500 m², depending on the building type.

→ Commercial : Larger plots are required to handle higher foot falls and infrastructure needs.

Ex : In urban areas, group housing may require a minimum plot size of 1000 m².

(iv) Thickness of walls :-

Wall thickness is covered to insure structure stability, thermal insulation and noise reduction standards include

→ Load bearing walls (minimum thickness of 300 mm)

→ Non-bearing walls (minimum thickness of 150 mm)

→ Partitions wall (minimum thickness of 75 mm)

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ex :-

In multi storey building, thicker walls are needed on lower floor to support the weight above.

(vi) Plinths :-

The Plane Plinth is the portion of the building above ground level at below the floor level by laws specify

→ Minimum plinth height of 450 mm to protected against flooding.

→ Adequate ventilation and protection against moisture ingress

ex :-

Building in flood zone area flood prone area may require higher plinth levels to mitigate risk.

(vii) cellar :- (basement) :-

cellar are underground levels used for parking, storage, or utilities. regulation insure

→ Adequate ventilation and lighting

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- Proper Water Proofing to prevent seepage
- Use distraction (example not for residential purposes)
- Maintenance of structural stability at above ground levels.

eg :

In commercial ~~spaces~~ ^{spaces}, seller are primary used for parking and mechanical rooms

(vii) Height of floors :

Floor height is crucial for ventilation, lighting and aesthetic appeal, standards includes

- Residential building (minimum height of 2.75 m per floor).
- commercial buildings (minimum height of 3.5 m per floor).
- Adequate clearness for suspended ceiling and services like air conditioning.
ex :
Luxury apartments may have floor height exceeding 3 m for enhanced spaciousness.

(viii) Stairs :

Stair case dimensions and design insure safe and convenient movement

→ Minimum width 1 m (residential and 1.5 m) commercial

→ Maximum riser height 150 to 190 mm.

→ Minimum tread depth 250 to 300 mm.

→ Provision of hand rails on both sides

ex :

Emergency stair cases in high rises must meet specific fire safety standards, including fire resistance materials.

(ix) Lifts :

Lifts are essential for vertical movement in multistorey buildings. Regulation cover.

→ Minimum lift size (1.5 m x 1.5 m) for passenger lifts.

→ Installation of fire fighting lifts in high rises.

→ complies with safety and maintenance standards

→ provision of backup power supply

Ex :

Hospitals may require stretcher lifts to accommodate patients on stretchers.

(X) Lobbies and Corridors :-

Lobbies and corridors facilitate movement and connectivity within buildings by laws specify minimum to

→ minimum corridor width 1 m (residential) and 2 m commercial.

→ Adequate lighting and ventilation.

→ Use of slip resistance flooring material
eg :

Commercial building may have wider lobbies to handle high footfall and prevent congestion.

(X) Staircase Sanitary Accommodation :-

Sanitary facilities must meet hygiene and convenience requirements by laws maintain

→ minimum number of toilets based on occupancy. (1 toilet per 8 person in work place)

→ separate facilities for men, women and differentially abled individual.

→ Proper ventilation and drainage system

→ use of non porous material or easy to clean

Ex : School require a specific ratio of toilet to students, ensuring sufficient facilities.