**PRINCIPLES OF ORGANISATION**

An organisation is a groupof people working together to achieve an established goal.It is the relationship which exists between people taking part in a group activity. It defines the responsibilities and authoriy of individuals in relation to men, materials, money and machinery which constitute the resources of an organisation. An organisation is needed because a manager at any level can effectively manage the function of only a limited number of persons working directly under him.

The setting up of a suitable organisation for various civil engineering works is all the more necessary because the construction industry is competitive field of endeavour which is susceptible to many risks, variable labour conditions and diverse construction problems. In order to be effective, an organisation has to follow certain basic principles given below:

**(i) Principle of Objectives:** The organisational objectives should be clearly defined. The structure of the organisation should be geared to achieve these objectives at minimum cost and effort.

**(ii) The Scalar Principle:** An organisational structure consists of different levels of authority arranged in a hierarchical manner. The line of authority should be clearly defined from the chief executive at the top to the first line supervisor at the bottom. This is known as scalar principle. The importance of scalar principle lies in the fact that the understanding of authority relationships within an organisation becomes easier. It also throws light on how different parts of an organisation are created and held together.

**(iii) Principle of Balance Between Authority and Responsibility:** In order to perform work properly, it is essential that everyone knows his duty, responsibility and authority or powers. Authority means right to act, decide and command. The delegate will not be able to perform his task properly unless he is given necessary powers (i.e. authority). So, whenever a task is assigned to a person, he must be given sufficient powers to exercise control in order to achieve desired objectives.

Responsibility is the obligation of a subordinate to perform any job allotted to him by his superiors. A person, who is assigned responsibility to do a certain job, must be given appropriate authority to achieve the same. Thus, authority and responsibility go hand in hand and must be balanced rationally to produce best results. For example, if a civil engineer in a construction firm is asked to carry out construction of different structures, and is not given corresponding authority to procure the various resources, responsibility given to the civil engineer would be illogical and unbalanced.

**(iv) Principle of Unity of Command:** Each person in an organisation must know to whom he has to report and from whom he should receive orders. He should also know the persons both upwards and downwards whom he is to consult. The principle that each subordinate should report to only one superior is called the ‘Unity of Command’. This not only avoids confusion but also helps in maintaining a definite line of command. In order to avoid indiscipline, delay,

disorder and undermining of authority, a subordinate should receive orders from only one superior and not from a number of superiors.

**(v) Principle of Span of Control**: According to this principle, there is a limit to the number of subordinates an executive can effectively supervise. There are many factors on which the span of control depends, such as the type of work, whether routine or repetitive, level in the organisation, type of problems encountered and abilities of the persons involved. The optimum span of control varies from person to person and job to job. Sometimes the number six is taken as the effective span of control.

**(vi) Principle of Departmentation:** Departmentation means the division of an organisation into several distinct departments or sections. This helps in increasing the efficiency and facilitates the execution of work. In order to obtain optimum results, the functions and scope of each department must be clearly defined.

**(vii) Principle of Specialisation:** According to this principle, activities of the organisation should be grouped as per the functions and assigned to individuals according to their specialisation.

**(viii) Principle of Communication:** The number of supervisory levels in an organisation must be kept as small as possible. This helps in shortening the line of communication for passing on information, instructions and suggestions from the chief executive level to the first line supervisor. The temptation to go too far in either direction (i.e., horizontal and vertical) means increased lines of Communication which may result in lower overall efficiency and profit.

**(ix) Principle of Flexibility and Stability:** Flexibility and stability in an Organization are closely inter-related. On the one hand, an organization should be flexible enough to assess the changes which often become necessary because of internal and external situations. While on the other hand, the organization must be stable enough to withstand any organizational change

which becomes necessary for the accomplishment of its objectives.

**(x) Principle of Motivation and Professional Growth:** The organizational structure should be such that it provides enough opportunities to its personnel for their professional growth and upward or lateral mobility. Job roles should be such that each member of an organization achieves professional satisfaction and is motivated towards loyalty for the organisation.

**(xi) Principle of Continuity**: The organisational structure should be dynamic so that it not only provides for the activities necessary to achieve its objectives but also for the continuation of such activities in the future. This maintains a link between the past and the future.

**COMMUNICATION, LEADERSHIP AND HUMAN RELATIONS**

**(i) Communication:** Communication means sharing of ideas in a condition of mutual understanding. The message conveyed by the initiator may be verbal, written or visual and the receiver may listen, see or examine and react in other ways.

In the absence of proper communication between the various groups and within group members working on a construction site, the desired progress of Work would not take place. In some cases, the construction work may not even start due to a communication gap between the planners and implementors. To safeguard against this, efforts should be made to use better communication styles and techniques to promote a congenial atmosphere at construction site.

**(ii) Leadership:** Leadership is needed for every project or organisation at different levels for various reasons given below:

To help in defining the mission of the group;

* To create an environment in which group members become committed to the objectives of the group;
* To serve as an interpreter of messages and behavior of other groups and individuals who may have some influence on the group;
* To co-ordinate the activities of group members to ensure compatible and consistent efforts towards the organisational goal achievement;
* To provide needed resources for the group.

Thus, heads of different groups working on the project should provide appropriate leadership to achieve the established objectives.

(iii) **Human Relations*:*** The term human relations applies to all interactions, good and bad, among people. The behaviour of people at work and how various elements of the workplace affect the people are important to the study of human relations in an organisation or project. Someone may be irregular at work due to health problems arising out of adverse site conditions,

while another might be inefficient because of family problems. Human behaviour in the work environment includes the interaction between superiors and subordinates, the interaction amongst peers, and the way in which individuals interact with each other in formal and non-formal groups. Human behaviour in the work environment covers more than just the activities involved with the actual work itself.

**ORGANISATION**

An organisation structure specifies the various job tasks and shows how the same are formally divided, grouped, and coordinated. It provides an appropriate framework for authority relationship. It indicates the hierarchy of authority and the reporting relationships. It is a means to help the management to achieve the organisational objectives.

There is considerable evidence to indicate that choice of an organisation’s strategy (stability strategy/growth strategy) is determined by three basic factors (contingency factors): (i) the organisation’s size, (ii) technology used by the organisation (for converting the financial, human and physical resources into products and services), and (iii) environmental uncertainty (external environment).

**LINE ORGANISATION**

Line organisation is the simplest form of organisation structure. The line structure is based on the scalar principle, which states that authority and responsibility should flow in a direct line vertically from the highest level of the organisation to the lowest level. The primary emphasis in the line organisation is upon the superior-subordinate relationship. Every person in the organisation is in the direct chain of command. (Figure 1).

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**Finance**

**Deputy Manager**

**Marketing**

**Foreman**

**Accountants**

**Officers**

**Workers**

**Assistants**

**Salesman**

One of the advantages of the line organisation is that it facilitates decision making and execution because there is a definite authority at each level of the hierarchy. However, the disadvantage is that if a wrong decision is made at the top level, the same is carried out simply without anybody down the line venturing to point out its deficiencies.

**LINE AND STAFF ORGANISATION**

Most business organisations, except the very small, have this type of structure. As the organisations have grown complex, the problems of line executives have become sufficiently complicated. The line executives being generalists, need the advice of personnel with specialised knowledge and functions to tackle these problems. For this purpose, the staff positions are created in the organisation. In line and staff organisation, the line authority remains the same as it does in the line organisation i.e. the authority flows from top to bottom; and the line executives perform the major functions; the staff functionaries support and advise the line executives. For example, for sound management of human resources, the line managers are provided specialised assistance through personnel/Human Resource managers. As staff functionaries are employed to perform supportive role, they do not have any power of command in the organisation (Figure 2).

The main advantage of line and staff organisation is that the staff specialists relieve the line executives of the botheration of concentrating on specialised functions like selection, training, development, wage and salary administration, accounting, public relations etc. However, the disadvantage of this structure is that since functionaries are not accountable for the results, they may not be performing their duties effectively.



## FUNCTIONAL ORGANISATION STRUCTURE

This is the most widely used form of organisation structure because of its simple logic and common sense appeal. Here the tasks are grouped together on the basis of common functions. So, all production activities or all financial activities are grouped into a single function which undertakes all the tasks required of that function. A typical chart of a functional organisation is presented in Figure 3.

The functional structure suits best to the small to medium organisations producing one or a few products, where the goals of the organisation emphasise functional specialisation, efficiency and quality

The main advantages of this type of structure are that by grouping people together on the basis of their specialist expertise, the organisation can facilitate both their utilisation and their coordination in the service of the whole organisation. The functional grouping also provides opportunities for promotion and career development. One of the major disadvantages of this form of organisation is the growth of sectional interest which may conflict with the needs of the organisation as a whole. For example, the members of the production department will see their activities from the narrow perspective of their own department rather than viewing the same from the broader perspective of the entire organisation.



**PRODUCT ORGANISATION STRUCTURE / DIVISIONAL STRUCTURE**

This form of organisation structure is adopted by large companies producing a wide range of products. Here, the activities are grouped on the basis of the individual products manufactured by the company. Thus, one finds autonomous “little companies within the company” adopting this type of organisation structure. As such, within each of these little independent units, we find all important functions viz. production, marketing, finance and human resources. The organisation structure of a large multi-product pharmaceutical company is illustrated.

One of the advantages of the product organisation is that it enables diversification of the products to take place with minimal effort. Another advantage is that it can cope better with technological change by grouping people with expertise and their specialised equipment in one major unit. The main disadvantage of the product organisation is that each product division may promote its own product group in a way that creates problems to other product divisions of the company.



**ORGANISATION FOR A CONSTRUCTION FIRM**

The organisation for a construction firm has to be developed taking into account the general principles of organisation and the special characteristics of the construction industry. It is difficult to lay down specific rules for organizing the structure of a construction company. Any organisational structure proposed for a construction firm should take into consideration the nature of activities, scope and type of project work and the area(s) of operation of the company.

The type of organisation suitable for a small construction firm is a simple line or line and staff type of organization. The engineer incharge at the site exercises full authority and is responsible for the execution and progress of work. Under him are a few section officers or foremen who get

the work executed. In very small works such as construction of a private residential house, the contractor has to himself perform the functions of the engineer. In the case of medium to large sized construction companies, a line and staff type of organisation is preferred.

**TEMPORARY SERVICES**

Every site, whether large or small, requires temporary services which are designed and provided by the contractor. On a small site, the temporary services consist of access roads, water supply, electric supply, sewer connections etc. On a large construction site, temporary services include a

number of facilities such as telephone connection, batching plant, tube-wells, service roads, repair and construction yards, material storage yards, canteen and medical facilities etc. There is

no specific or fixed pattern for the type of temporary services required at a site. These services depend on the following factors:

* Size and nature of the project
* Location of the project
* Project cost
* Specific needs
* Number of working shifts per day.

Varioustemporary services required at the site are briefly described below:

**(a) Water Supply**

Water supply is essential for all construction sites. For large construction sites, tubewells may be bored which could be later used on a permanent basis.

Water supply is required for industrial and drinking purposes. Industrial water Supply is required for rock drilling, pile driving, feed water for boiler plant and transporting materials by pipe lines etc. Drinking water supply is required for the work areas, offices, canteen etc. To obtain water supply connections, the contractor or project manager has to apply to the public Health Engineering Department stating the purpose and quality of water required.

**(b) Electricity connection**

It is required for both large as well as small projects. In order to obtain an electricity connection, the contractor or project manager has to apply to the Electricity Board/Department stating the quantity of electricity required and the place where the transformer is to be installed. From the transformer, the contractor has to make his own arrangements for supply of power to various locations on the site.

**(c) Repair and Construction Yards**

Such type of yards are essential for repair and maintenance of equipment and machinery and as a working area for bar benders, carpenters, welders etc. These yards are set up on the construction site for smooth and unobstructed construction activity.

**(d) Material Stores**

Such stores are usually constructed with brick walls and G.I. sheet roofing. G.I. sheets are preferred for roofing purposes because of their high reusability. The stores are used for the storage of cement, electrical materials, hardware, paints, tools, spare parts, stationery etc. Sometimes A.C. sheets are also used for roofing purposes.

**(e) Approach and Service Roads**

Approach and service roads are provide for trucks to transport construction materials such as sand, aggregate, cement etc. to the site. These roads are usually provided on the periphery of the construction site. In large projects, these roads may also run through the construction site so that

materials may be dumped at the required locations avoiding re-handling/ shifting of materials.

**(f) Sewerage and Sanitation Arrangements**

Appropriate Sewerage and Sanitation Arrangements are eessential at all work sites. Adequate arrangements should be made for the disposal of sewage to some suitable place.

**(g) Site Office**

Depending on the size and nature of the project, a site office is established for technical and supporting staff. For large projects, the site office of the Executive Engineer, Assistant Engineer and other staff is constructed for coordination, supervision and control of the construction activity. Aproject conference/display room is also provided for large projects. Site offices are

temporary structures provided with G.I. or A.C. sheet roofing.

**(h) Labour Huts**

For medium and large projects, temporary huts are constructed with brick masonry in lean cement mortar or mud mortar and G.I. sheet roofing to provide shelter for labourers. These huts should be located away from the construction activity zone for safety reasons.

**JOB LAYOUT**

Asite drawing of the proposed construction showing the location of entry, exit, temporary services, material stores and stacks, plant/equipment and site offices is known as the job layout or site layout. Ajob layout is prepared to ensure that work proceeds smoothly without interruptions. The various construction resources such as men, machinery, materials. space etc., should be organised for their optimal utilisation. The larger and more complex the project, the greater is the need for planned job layout and detailing at site.

**Purpose of Job Layout**

The purpose of job layout is to facilitate the realisation of:

* more economical method of working
* shorter leads for materials
* reduction in completion time
* reduction in wastage and deterioration of materials
* higher productivity from labour and machinery
* greater safety.

**Factors Affecting Job Layout**

The following factors affect the job layout of a construction site:

* Access to Site
* Temporary Roads
* Topography of Ground
* Construction Plant/Machinery
* Construction Methods
* Construction Materials
* Accommodation
* Services

**(i) Access to Site**

ideally, there should be one entrance and exit to the site for proper flow of traffic and from the security point of view. Proper sign-post should be erected to direct transport vehicles delivering various construction materials at site. The main gate should be manned by watch and ward staff to regulate entry to and exit from the site.

**(ii) Temporary Roads**

Temporary roads are constructed within the site and also to provide access to the site from the nearest existing road. Temporary roads should be planned to serve all major items of plant/machinery and material storage yards at site. In some cases, permanent roads may be constructed before commencement of building work. These roads are used to transport plant/machinery and materials during the comb action phase.

**(iii) Topography of Ground**

In order to avoid flooding of the work site during monsoons, temporary drains should be incorporated in the job-layout. The storage yards should be located on higher and firm ground to avoid submergence and deterioration of materials. Heavy plant/machinery should be installed on firm ground. If firm ground is not available at the required location, provision for timber piling etc. may be made.

**(iv) Construction Plant and Machinery**

Plant/machinery should be located in a manner so that it serves the entire building or structure to be constructed. The location should also ensure minimum possible leads for the various construction materials.

**(v) Construction Methods**

The job-layout should take into account the construction methods to be adopted at the worksite. For example, if the building elements are to be pre-cast, the provision of a casting yard should be made in the job layout.

**(vi) Construction Materials**

Provision of adequate storage yard sand covered stores should be made in the job layout for storage of various construction materials such as cement bricks. aggregate, steel rounds and structurals, shuttering, scaffolding, timber, paints, hardware, tools, spare-parts etc. The location of stores and yards is governed by considerations of minimum lead and protection of materials against atmospheric and weathering effects. Separate provision should be made for storing P.O.L. and other materials susceptible to fire hazard. Materials constantly in use should be stored relatively nearer the place of use. Location of fire fighting equipment should be indicated on the job layout.

**(vii) Accommodation**

All site offices should be centrally located, preferably in a noise-free area. This will facilitate better coordination among the various sections at site. Accommodation for labour should be provided in a separate area away from the construction zone for reasons of safety and security. Appropriate toilet and other facilities should be provided in the labour camp. The job layout should indicate the location of drinking water, canteen, and toilets at the work site.

**(viii) Services**

The job layout should take into account the provision of various services such as water supply, power supply, telephone lines, repair and maintenance yards, etc. at site.

**PREPARATION OF JOB LAYOUT**

The job layout is prepared by the engineer in-charge or the site engineer. In order to prepare the job layout, the contract document, layout plans, drawings, specifications and other available documents are studied carefully to assess the nature and extent of the work. A scaled drawing is then prepared which shows the outline of the job to be constructed, entry and exit points, various facilities such as storage yards, offices, repair and maintenance sheds, toilets, canteen, labour huts, temporary services including water and power supply etc.

A typical job layout for a three storeyed building block is shown in figure below

**IMPORTANCE OF SAFETY**

Safety in construction is a prime requisite but it often gets neglected on work sites. With the advancement in construction technology, the need for proper attention to safety aspects has become essential for human, economic and other considerations. The wide range of construction and building activities involving complex techniques have led to many new problems of safety. Proper steps should be taken to improve safety on construction sites so that loss of limb and life, suffering and damage resulting from avoidable accidents is prevented. Promotion of safety measures at site will result in a better work environment, higher productivity and greater contentment among workers. Most of the accidents in the construction industry happen due to lack of proper education and training in regard to safety measures and also because of

negligence and ignorance on the part of either the worker or management or both. It is well known fact that the construction industry in India employs more labour than any other industry. The construction industry is also one of the least organised and as a result there is scope for the

exploitation of labour. In a country like India, safety is all the more important because of lack of social security to the family left behind. Thus, it becomes necessary to consider certain safety measures to prevent accidents.

**SAFETY MEASURES**

Prevention of accidents is a major aim of construction management, both for human and financial considerations. Whatever the nature of construction projects, accidents are likely to occur causing physical injury, casualties and loss of money. In order to prevent accidents at construction sites, certain safety measures need to be taken in the following major activities prone to risks of accidents:

* Excavation
* Drilling and Blasting
* Hot Bituminous Works
* Scaffolding, Ladders, Form-work and other equipment
* Fabrication and Erection
* Storage
* Demolition

**Safety Measures for Excavation**

The following safety measures should be adopted at the time of excavation:

(i) In all works, an experienced and competent foreman or supervisor should look after the excavation work. He should have authority to enforce safety rules and prevent the use of defective/unsafe appliances.

(ii) Before doing the excavation work, a complete knowledge of underground structures (such as sewers, water pipe lines, gas mains etc.) is essential and proper precautions should be taken to prevent accident to the workmen **t"ligatged** in excavation work.

(iii) Safety helmets should be worn by all persons entering a trench where hazards from falling stones, timber or other materials exist.

(iv) Whenever workmen have to excavate in trenches, in soil, soft or fissured rock, or hard soil exceeding **2**m in depth, the trenches should be securely shored and timbered.

(v) Sheathing should be placed against the side of the trench so that the length of each piece of sheathing is vertical. Where the trench is excavated in loose or soft soil, each piece of sheathing should be driven into the bottom of the trench so as to be firmly held in place.

(vi) Excavated material should be kept away from the edge of the trench in order to provide a clear berm width of not less than one third the final depth of excavation. However, in special cases where disposal area is limited, the minimum berm width should not be less than 1 m.

(vii) Heavy equipment, such as excavating machinery, trucks, dumpers etc. should be kept away from the excavated sides at a distance not less than the depth of the trench or at least *6* m for trenches deeper than 6 m.

(viii) At places where public is likely to tress pass, fences or barricades should be erected to avoid accidents. At night, excavated areas should be adequately lighted.

For other details, refer to IS: 3764-1966.

**Safety Measures for Drilling and Blasting**

Various safety measures to be adopted at the time of drilling and blasting operations are:

(i) To transport small quantities of explosives (approximately 5 kg) specially designed insulated containers may be used which are made of finished wood not less than S cm thick or plastic not less than 6 mm thick. The container should be water proof and free from any metal parts (such as nails, screws etc.).

(ii) Vehicles to be used for transporting explosives should be in good working condition with tight wooden or non-sparkling metal floor and sides.

(iii) Smoking is strictly prohibited at places where explosives are stored.

(iv) Explosives should be stored only in a magazine which is clean, dry, well ventilated, reasonably cool, bullet and fire resistant.

(v) Explosives and fuse lighters should not be stored in a damp or wet place or near oil, gasoline or steam pipes, or other sources of heat.

(vi) Leaves, grass or debris of. any kind should not be allowed to accumulate within 8 m of the magazine.

(vii) Any package containing explosives should not be dragged, dropped or handled roughly and these packages should be opened only at a safe distance from the packages of explosives in bulk storage.

For further detailed precautions, IS: 4081-1967.

**Safety Measures for Hot Bituminous Works**

Various safety measures to be adopted for hot bituminous materials are:

(i) On all major works, an experienced foreman or supervisor should be Placed incharge of the work who should guard against the use of defective/unsafe appliances, equipment and tools and should keep stock of fire extinguishing equipment and first aid kit etc.

(ii) Workers engaged on jobs involving handling of hot bitumen should Use protective wares such as boots, gloves, goggles and helmets.

(iii) When heating and handling of hot bituminous materials is to bed one in the open, sufficient stocks of clean dry sand or loose earth should be kept ready at the work site to cepe with any resultant fire. When such materials are not available, arrangement must be made for adequate supply of water to extinguish the fire.

(iv) Bitumen plants should be provided with safe means of access. Working platforms should be provided with handrails, and pulleys, belts and Drive mechanisms should all be protected by suitable guards.

(v) Compressors, electrical installations and other equipment such as elevators and conveyors should be adequately protected from weather, mechanical damage and dust particles.

(vi) When bitumen plants are working on a public road, an adequate traffic control system must be established.

For further detailed precautions refer IS: 5916-1970.

**Safety Measures for Scaffolding, Ladders, Formwork and other Equipment**

Various safety measures to be adopted while using ladders, formwork and scaffolds are:

(i) Every scaffold should be securely supported or suspended and properly strutted or braced to ensure stability.

(ii) All scaffolds and working platforms should be securely fastened to the building or structure. If independent of a building, they should be braced or guyed properly.

(iii) If scaffolds are to be used to a great extent for long periods of time, a regular plank stairway, wide enough to allow two people to pass, should be erected with handrails on both sides.

(iv) When work is being performed above a scaffold platform, a protective overhead covering should be provided for the men working on the scaffolds. The protection should not be more than 3 m above the scaffold platform and should be made of planks.

(v) For wooden ladders, no rung should be fixed to the stringer with nails, Spikes or other similar fixings. In case of bamboo ladders, rungs may be fixed To the rails with spikes of appropriate design and strength.

(vi) Ladders employed in heavier trades should not exceed 6 m in length.

(vii) During dismantling of scaffolds, necessary precautions should be taken to prevent injury to persons due to fall of loose materials, bracings and other parts of scaffolds. ***.***

(viii) Care should be taken to see that no un-insulated electric wires exist within **3** metres of the working platform, gangway etc. of a scaffold.

(xi) The supporting ballies for formwork should be checked for each individual member. The ballies should be properly braced. Many accidents occur due to negligence on this account.

(x) All operators and supervisors of machines should be thoroughly trained in operating the machines and equipment. All persons handling construction equipment should be completely acquainted with the safety aspects of machines and then operation.

(xi) Safety in terms of both main and auxiliary equipment should be considered at all construction sites. Unauthorised persons should not be allowed to handle or operate any equipment. Ropes, guys and connections should be thoroughly checked before use.

For detailed precautions, refer IS: 3696

**Safety in Fabrication and Erection**

The following safety measures should be adopted during fabrication and erection:

(i) All equipment such as gas cutting and welding sets, drills, power hacksaws, grinders etc. should be checked periodically to ensure their safe working.

(ii) Moving parts of all equipment should be provided with safety guards.

(iii) Rubber pipe-lines for oxygen and acetylene gas should be regularly checked for leakage or damage. Leakage of gas from regulators, pipe-lines or connections with the gas torch should be rectified immediately.

(iv) Workers engaged in gas cutting and welding operations should wear suitable gloves and aprons and use proper welding screens.

(v) Power cables for all equipment should be properly insulated and protected from damage and cuts.

(vi) Danger signs should be prominently displayed on all poles of overhead electric lines/conductors used at site.

(vii) Cut pieces and scrap should be stored at an appropriate place to avoid accidents.

(viii) All lifting tools and tackles such as wire ropes, U-clamps, shackles, chain-pulley blocks hooks etc. should be checked thoroughly before undertaking erection work.

(ix) All erection equipment such as cranes, derricks, hoists etc. should be thoroughly checked before use.

(x) Workers engaged in erection work should wear helmets and use safety belts to avoid accidents.

**Safety in Storage**

(i) Timber including sleepers, runners, scantlings, ballics, plywood etc. should be stored separately in neat stacks. Adequate space should be left in between the stacks to avoid fire hazard. Smoking and open fires should be prohibited in timber yard sand stores.

(ii) Petroleum products should be separately stored. Smoking and open **hres** should be strictly prohibited where these products are stored. Only essentially required quantities of such products should be stored at site.

(iii) Adequate fire lighting arrangements should be provided at site particularly in areas where petroleum products and timber are stored.

(iv) Explosives must be stored in proper magazines and the prescribed safety measures for handling and storage of explosives should be observed.

**Safety Measures for Demolition**

Various safety measures to be adopted at the time of demolition of buildings are:

(i) On every demolition work, danger signs should be provided all around the structure and doors giving access to the structure. Barricades should be erected around the structure and at least two exits must be provided for the escape of workmen during any emergency.

(ii) During night time, red lights should be placed around the barricades and entry of unauthorised persons restricted.

(iii) At the time of demolition work, workers should use all safety appliances such as helmets, goggles, gloves etc.

(iv) In case any danger is anticipated to the adjoining structure during the process of demolition, the same should be got vacated to avoid any danger to human life.

(v) The process of demolition may weaken the side walls of an adjoining structure and to prevent possible damage, these walls should be supported until permanent protection is provided.

(vi) The power on all electrical service lines must be shutoff and all such lines disconnected before the demolition work is started.

(vii) All gas, water, steam and other service lines must be shutoff before the demolition work is started.

(viii) If a structure to be demolished has been partially wrecked by fire, explosion or other catastrophe, the walls and damaged roofs should be braced suitably

(ix) No demolition work should be carried out at night especially when the Structure to be demolished in an inhabited area.

For further detailed precautions, refer IS: 4130-1976.

**CONSTRUCTION ACCIDENTS**

**INTRODUCTION**

Construction workers build, repair, maintain, renovate, modify and demolish houses, office buildings, temples, factories, hospitals, roads, bridges, tunnels, stadiums, docks, airports and more. The International Labour Organization (ILO) classifies the construction industry as government and private-sector firms erecting buildings for habitation or for commercial purposes and public works such as roads, bridges, tunnels, dams or airports. Construction workers are exposed to a wide variety of health hazards on the job. Exposure differs from trade to trade, from job to job, by the day, even by the hour. Exposure to any one hazard is typically intermittent and of short duration, but is likely to reoccur. A worker may not only encounter the *primary hazards* of his or her own job, but may also be exposed as a *bystander* to hazards produced by those who work nearby or upwind. This pattern of exposure is a consequence of having many employers with jobs of relatively short duration and working alongside workers in other trades that generate other hazards. The severity of each hazard depends on the concentration and duration of exposure for that particular job

**CLASSIFICATION OF** **ACCIDENTS**

As in other jobs, accidents for construction workers are typically of four classes

1. Physical accidents
2. Chemical accidents
3. Biological accidents
4. Social accidents

**PHYSICAL ACCIDENTS**

Physical accidents are those substances that threaten an individual's physical safety. The most common types of physical hazards include fire, explosion, light, noise, vibration, chemical reactions, ultraviolet that are visible like frequencies and noise. The machines that have transformed construction into an increasingly mechanized activity have also made it increasingly noisy. Pneumatic hammers, many hand tools and earth-moving and other large mobile machines also subject workers to segmental and whole-body vibration. Heat and cold hazards arise primarily because a large portion of construction work is conducted while exposed to the weather, the principal source of heat and cold hazards. Those who work under water or in pressurized tunnels, in caissons or as divers are exposed to high barometric pressure. Such workers are at risk of developing a variety of conditions associated with high pressure The principal sources of non-ionizing ultraviolet (UV) radiation are the sun and electric arc welding. Exposure to ionizing radiation is less common, but can occur with x-ray inspection of welds, for example, or it may occur with instruments such as flow meters that use radioactive isotopes. Lasers are becoming more common and may cause injury, especially to the eyes, if the beam is intercepted.

**CHEMICAL ACCIDENTS**

Result of exposure to any of a wide range of chemicals. Similar effect may arise at once or a considerable period of time may elapse before signs and symptoms of diseases are noticed. By this time, the effects are often permanent. A chemical may be in the form of a substance or a preparation. A substance is a chemical element or a compound, including any impurities. A preparation is a mixture of substances, often with a deliberately proportioned composition. Chemical hazards are often airborne and can appear as dusts, fumes, mists, vapours or gases; thus, exposure usually occurs by inhalation, although some airborne hazards may settle on and be absorbed through the intact skin (e.g., pesticides and some organic solvents). Chemical hazards also occur in liquid or semi-liquid state (e.g., glues or adhesives, tar) or as powders (e.g., dry cement). Skin contact with chemicals in this state can occur in addition to possible inhalation of the vapour resulting in systemic poisoning or contact dermatitis. Chemicals might also be ingested with food or water, or might be inhaled by smoking. Several illnesses have been linked to the construction trades, among them: silicosis among sand blasters, tunnel builders and rock drill operators asbestosis (and other diseases caused by asbestos) among asbestos insulation workers, steam pipe fitters, building demolition workers and others bronchitis among welders skin allergies among masons and others who work with cement

neurologic disorders among painters and others exposed to organic solvents and lead.

**BIOLOGICAL ACCIDENTS**

These may occur in workers using bacteria, viruses or plants or in animal handlers and workers dealing with meat and other food. Diseases produced range from infective hepatitis in hospital workers (virus infection) to ring worming farm laborers (fungus infection) Biological hazards are presented by exposure to infectious micro-organisms, to toxic substances of biological origin or animal attacks. Excavation workers, for example, can develop histo plasmosis, an infection of the lung caused by a common soil fungus. Since there is constant change in the composition of the labour force on any one project, individual workers come in contact with other workers and, as a consequence, may become infected with contagious diseases—influenza or tuberculosis, for example. Workers may also be at risk of malaria, yellow fever or Lyme disease if work is conducted in areas where these organisms and their insect vectors are prevalent. Toxic substances of plant origin come from poison ivy, poison oak, poison sumac and nettles, all of which can cause skin eruptions. Some wood dusts are carcinogenic, and some (e.g., western red cedar) are allergenic.

Attacks by animals are rare but may occur whenever a construction project disturbs them or encroaches on their habitat. This could include wasps, hornets, fire ants, snakes and many others. Underwater workers may be at risk from attack by sharks or other fish.

**SOCIAL ACCIDENTS**

Social accidents stem from the social organization of the industry. Employment is intermittent and constantly changing, and control over many aspects of employment is limited because construction activity is dependent on many factors over which construction workers have no control, such as the state of an economy or the weather. Because of the same factors, there can be intense pressure to become more productive. Since the workforce is constantly changing, and with it the hours and location of work, and many projects require living in work camps away from home and family, construction workers may lack stable and dependable networks of social support. Features of construction work such as heavy workload, limited control and limited social support are the very factors associated with increased stress in other industries. These hazards are not unique to any trade, but are common to all construction workers in one way or another.