MODULE- VI

CONTRACT

Contract may be defined as an agreement which is enforceable by law. It is a written undertaking for execution of work or supply of materials or performance of any service.

An Agreement enforceable by law is a contract". Therefore in a contract there must be (1) an agreement and (2) the agreement must be enforceable by law. A contract is also an "agreement creating and defining obligations between the parties" or an agreement enforceable at law made between two or more persons, by which rights are acquired by one or more to acts or forbearances on the part of the other or others.

An agreement comes into existence whenever one or more persons promise to one or others, to do or not to do something, "Every promise and every set of promises, forming the consideration for each other, is an agreement. Some agreements cannot be enforced through the courts of law, e.g., an agreement to play cards or go to a cinema. An agreement, which can be enforced through the courts of law, is called contract.

The Contract Act is the law of those agreements which create obligations, and in case of a breach of a promise by one party to the agreement, the other has a legal remedy

Parts of a contract

- Offer/Proposal
- Acceptance
- Agreed terms

Offer / proposal

When one person signifies to another his willingness to do a work, he is said to make a proposal. Communication of an Offer: By words or by actions

Acceptance

When the person to whom the proposal is made signifies his assent thereto, the proposal is said to be accepted

1. Acceptance must be absolute
2. It must be communicated.
3. It must be according to the mode prescribed.
4. It must be given within the time specified or within reasonable time.

Essentials of a contract

1. Agreement.
2. Intention to create legal relationship.
3. Free and genuine consent.
4. Parties competent to contract.
5. Lawful consideration.
6. Lawful object.
7. Agreements not declared void or illegal.

8. Certainty of meaning.
9. Possibility of performance.
10. Necessary Legal Formalities.

1. Parties Competent to Contract:-

A person is competent to contract provided

(a) He is of the age of majority according to the law to which he is subject. A person who is not a major according an agreement No contact shall be made by a subordinate authority who has not been directed or authorised to do so.

(b) He is of sound mind. A person is said to be of sound mind for the purpose of making contract provided he is capable of understanding it and of forming a rational judgement as to is effect upon his interest at the time when he performs the contract.

(c) He is not disqualified from contracting by any law to which he is subject.

2. Free Consent of the parties:

Two or more persons are said to consent when they agreed that upon same thing in the same sense. Consent is said free when:

(a) It is not caused under influence. The relations between the two parties performing a contract are not such that one of the parties is in the position to dominate the will of the others and uses that position to obtain an unfair advantage over the other.

(b)It is not caused by committing or threatening to commit any act forbidden by the Indian penal code, or the unlawful detaining or threatening to detain any person to enter into an agreement

(c) It is no caused by fraud.

(d)It is not caused by misrepresentation.

(e) It is not caused by mistake. Where both the parties do an agreement under a mistake the agreement is avoidable.

3. Definite proposal and its acceptance:

Terms of contact must be precise and definite and there must be no room for ambiguity or misconstruction therein. When one person signifies to another his willingness to anything, he is said to make a proposal the communication of a proposal is complete when it comes to the Knowledge of the person to whom it is made. The acceptance must be absolute, unqualified and expressed in some usual and reasonable manner. Acceptance is made by performing conditions or receiving conditions.

4. The considerations or objects are lawful:

The consideration or object of an agreement is said to be unlawful if forbidden by law or fraudulent or of such nature that, if permitted it would defeat the provisions of any law or involves or implies injury to the person or property of another or opposed to public policy or regarded as immoral by the court.

5. That the meaning shall be certain:

Agreement, the meaning of which shall be certain or capable of being made certain.

ESSENTIAL ELEMENTS OF A CONTRACT

An agreement becomes enforceable by law when it fulfils certain conditions. These conditions, which may be called the Essential Elements of a Contract, are explained below.

1. *Offer and Acceptance:* There must be a lawful offer by one part and a lawful acceptance of the offer by the other and acceptance must conform to the rules laid down in the Indian Contract Act regarding offer and acceptance.
2. *Intentions to create Legal Relationship:* There must be an intention (among parties) that the agreement shall result in or create legal relations. An agreement to dine at a friend's house is not an agreement intended to create legal relations and is not a contract.

But an agreement to buy and sell goods or an agreement to marry, are agreements intended to create some legal relationship and are therefore contracts, provided the other essential elements are present.

3. *Lawful Consideration:* Subject to certain exceptions, an agreement is legally enforceable only when each of the parties to it gives something and gets something. An agreement to do something for nothing is usually not enforceable by law. The something given or obtained is called consideration. The consideration may be an act (doing something) or forbearance (not doing something) or a promise to do or not to do something. Consideration may be past (something already done or not done). It may also be present or future. But only those considerations are valid which are "lawful".
4. *Capacity of Parties:* The parties to an agreement must be legally capable of entering into an agreement; otherwise it cannot be enforced by a court of law. Want of capacity arises from minority, lunacy, idiocy, drunkenness, and similar other factors. If any of the parties to the agreement suffers from any such disability, the agreement is not enforceable by law, except in some special cases.
5. *Free Consent:* In order to be enforceable, an agreement must be based on the free consent of all the parties. There is absence of genuine consent if the agreement is induced by coercion, undue influence, mistake, misrepresentation, and fraud. A person guilty of coercion, undue influence etc. cannot enforce the agreement. The other party (the aggrieved party) can enforce it, subject to rules laid down in the Act.
6. *Legality of the Object:* The object for which the agreement has been entered into must not be illegal or immortal or opposed to public policy.
7. *Certainty:* The agreement must not be vague. It must be possible to ascertain the meaning of the agreement, for otherwise it cannot be enforced.
8. *Possibility of Performance:* The agreement must be capable of being performed. A promise to do an impossible thing cannot be enforced.
9. *Void Agreements:* An agreement so made must not have been expressly declared to be void. Under Indian Contract Act there are five categories of agreements which are expressly declared to be void They are:

1. Agreement in restraint to marriage.
2. Agreement in restraint of trade.
3. Agreement in restraint of proceedings.
4. Agreements having uncertain meaning.
5. Wagering agreement.

6. *Writing Registration and Legal Formalities:* An oral contract is a perfectly good contract, except in those cases where writing and/or registration is required by some statute. In India writing and/or registration is required by some statute. In India writing is required in cases of lease, gift, sale and mortgage of immovable property: negotiable instruments; memorandum and articles of association of a company etc. Registration is compulsory in cases of documents coming within the purview of Section 17 of the Registration Act, e.g., mortgage deeds covering immovable property. The terms of an oral contract are sometimes difficult to prove. Therefore important agreements are usually entered into writing even in cases where wiring is not compulsory.

TYPES OF CONTRACT

Following types of engineering contracts are used for execution of civil engineering works.

1. Item rate contract or unit price contract.
2. Percentage rate contract.

3. Lump-sum contract.
4. Material supply contract.
5. Piece work contract or agreement.
6. Labour contract.
7. Cost-plus percentage rate contract.
8. Cost-plus fixed fee contract.
9. Cost-plus fluctuating fee contract.
10. Target contract.
11. Schedule contract or measured contract.
12. Rate contract.
13. Negotiated contract.
14. Package deal or Turn-key contract.
15. Basic price contract.
16. Oral contract.
17. Global contract.
18. All in contract.
19. Illegal contract.
20. Voidable contract.
21. Contracts by minor.

1. <u>Item rate contract:</u> In this type of contracts the contractors are required to quote rates for individual items of work on the basis of schedule of quantities given by the department. This schedule indicates full nomenclature of the items as per sanctioned estimate and estimated quantities. This system is followed in central public works department (CPWD) and railway department.

Advantages

(i) This method is more scientific as it involves more detailed analysis of cost by the contractor. This is because department works out the schedule of quantities against each item and the contractors have to work out the rates against each item.

(ii) The element of guess is altogether absent as authority competent to accept the tender can easily check the rates with reference to his own calculations. This aspect helps decide which of the tenders is favourable.

(iii) Since the contractors have to give their individual rates it is not easy to form a ring of contractors during submission of tender. This eliminates the possibility of allotting work to one of the contractors without competition.

(iv) The contractors work out the rates of all items so as to put it in the tender. This helps avoid unworkable rated tender being accepted. This aspect further leads to smooth progress and timely completion of a work.

Disadvantages

(i) As the quantities may be increased or decreased a contract of this nature requires careful consideration on the part of engineer. Engineer must ascertain the most likely quantities of each item. Larger quantities are generally tendered at lesser rate than smaller quantities of work and vice-versa.

(ii) More than one contractor may be involved on the same work as it is likely that rates of some items are lower for one contractor where as rates as remaining items may be lower of other contractor.

(iii) Comparative statement of item rate is more elaborated and comprehensive and intelligent scrutiny is required.

2. <u>Percentage rate contract:</u> In this contract the department draws up the schedule of items according to the items sanctioned in the estimate with quantities, rates, unit and amount

shown therein. In short the department prepares the item rates of the tender known as item rate tender. The contractors are required to quote their rates which may be at par with the rates shown in item rate tender or percentage above or below them.

Advantages

(i) Comparative positions amongst contractors are immediately known just on the opening of the tender and work may be allotted to the lowest bidder.

(ii) There is no possibility of unbalanced tender. This is because there is no provision to quote contractors own rate for an individual item and benefit due to increased quantity with a beneficial rate cannot be availed of by the contractor.

(iii) Comparative statement is very easily prepared and there is no likelihood of rates being tampered with.

(iv) There is almost no chance of over–writings and erasing and as such the tender is not liable to rejection due to this.

Disadvantages

(i) Contractors mostly depend on guess for their rates and not on analysis of workable rates of the individual items. Thus it is likely that unworkable rated tender may be the lowest.

(ii) If unworkable rated tender become lowest there is always uncertainty about quality, smooth progress and timely completion of the work.

(iii) The contractors can easily form a ring even up to the last moment of submission of tender as they have simply to write down the percentage above, or at par or below the rates of item rate tender. This leads to allotment of work to a particular contractor at a high rate without actual completion. This causes drainage of government money.

3. Lump-sum contract: For this type of contract, tenders are required to quote a fixed sum for execution of the complete work according to the drawings, designs, and specifications supplied to them with the tender within the specified time. Payment of items of work involved for any additions and alterations not covered by the original work is done according to the departmental schedule of rates.

Advantages

(i) Cost of the work becomes known beforehand and as such owner gets sufficient time to arrange for the required finance.

(ii) Except in respect of additions and alterations detailed measurements of the work done is not required to be recorded.

(iii) Since total cost of the work and work to be done are known beforehand better planning and management for execution of work is possible.

Disadvantages

(i) In this contract the work to be done has to be accurately and completely shown on the drawing and described in the specifications. In absence of any information in this respect disputes are likely to crop up.

(ii) It is not suitable form of contract as considerable additions or variations are expected in the works.

(iii) Difficulty arises in making intermediate payment. However this can be done on the certificate given by responsible officer to the effect that the value of the work done is not less than the amount asked for in conformity with contract agreement.

4. Material supply contract: The contractors offer their rates for supply of the required quantity of materials inclusive of all local taxes, carriage and delivery charges to the specified stores within time fixed in the tender. This type of contract is used for the purchase of materials like bricks, stone, chips, furniture, pipes etc. All the materials received are examined and counted or measured when delivery of materials is taken.

Advantages

(i) The department receiving the supply of materials is not worried for the loss of materials, breakage, demurrage charges during transit.
(ii) As payment in this type of contract is made promptly, the contractors try to take the supply order even at less profit. This results in low cost of the materials.

Disadvantages

(i) A constant watch has to be maintained for quality of materials which is received in batches at different times.
(ii) Contractors may form a ring to get the order at a higher rate.

5. Piece work contract: In this type of contract only rate is agreed upon with reference to the total quantity of work to be done within a given period. Petty works valued up to Rs.10000/- including cost of materials may be done through contractors by Piece-work agreement. Detailed specifications and the total cost of whole work to be done are mentioned. It is terminable from either side at any time and cannot be called a contract in true sense. Work may be done under simple "work order". There is no security money and penalty clause.

Advantages

(i) Urgent small works are done without inviting tenders and thus considerable time is saved.
(ii) If a contractor delays to execute the work or uses inferior quality of materials or leaves the work partially done, another contractor may be engaged to complete the work.

Disadvantages

(i) Works being small, good contractors find little interest in it.
(ii) Work has to be entrusted to petty contractor who have little experience and knowledge to carry out the work according to the departmental procedures.

6. Labour contract: In this the tenderer undertakes contract for the labour portion. All materials for the construction are arranged and supplied at the site of work by the owner or department. The labour contractor engages labour and gets the work done according to the specifications. The contract is on item rate basis for labour portion only. The contractor is paid for the quantities of work done on measurement of the different items of work at the agreed rate in the contract agreement. Contractor uses his own tools for working, but plants and machineries are arranged by the department. Scaffolding, centering and shuttering etc. has to be arranged by the department normally but if provided in the agreement may have to be arranged by the contractor.

Advantages

(i) The materials available in government stores is utilized.
(ii) The increase in the cost of the work is checked in spite of any rise in the prices of such materials in the market.
(iii) Difficulty in obtaining certain materials in the open market can be avoided.

Disadvantages

(i) Materials to be supplied by department may not be readily available in the market. In such circumstance the contractor is required to keep himself in touch with the day to day position regarding the supply of the materials.
(ii) Large storage space and constant guard are required to store the materials. Besides this constant accounting of materials is required by employing additional staff.
(iii) Theft from store, shortage of materials, difficulty during handing over charge, accounting all materials are constant worries for the department.
(iv) Refund of surplus departmental materials by the contractor in a good condition, wastage, demurrage etc. are also involved in this type of contract.

7. Cost plus percentage rate contract: In this system the contractor is paid the actual cost of the work, plus an agreed percentage in addition to allow for the profit. In this system of tendering no bill of quantities or schedule of rates have to be prepared but the owner or the

department should carefully define the actual cost and record exactly what is permissible in the cost of the work. Contractor has to arrange all the materials and labours at his cost and keep proper account. He is paid the whole cost together with certain percentage say 10% as his profit or as agreed upon beforehand. An agreement is prepared with all conditions of contract in advance.

Advantages

(i) Contracts of this nature can quickly be drawn up and agreed and work of an urgent nature can be completed without delay. This contract is useful during war time when urgency of works is of paramount importance.

(ii) This contract works very well when there is uncertainty and fluctuation in the market rates of labour and materials.

Disadvantages

(i) Close supervision and checking of delivery notes and invoices is involved for which necessary staff has to be provided.

(ii) It is to the contractor's advantage to make the cost as high as possible by way of wasting materials, using rich mixes and employing inefficient workmen.

(iii) Contractor becomes careless as he has nothing to lose and his profit is assured.

This form of tender is not popular despite the fact that contractor cannot lose on it. This may be due to the fact that this type of contract tends to spoil the dashing qualities of those carrying out of the work.

8. Cost-plus fixed fee contract: This type of contract involves fixed lump-sum-payment to the contractor over and above the actual cost of the work. This fixed fee shall cover as in the case of cost plus percentage rate contract. The advantage of this contract is that contractor tries to complete the work speedily in order to earn his fee as soon as possible. The disadvantage shall be that contractor shall try to complete the work as early as possible even by purchasing materials at higher rate and engaging labour at higher charges. This increases the cost of construction. Secondly the work being speedily done the quality of work is likely to suffer.

9. Cost plus fluctuating fee contract: In this type of contract the contractor is paid by the owner the actual cost of construction, plus an amount of fee inversely variable according to the increase or decrease of the estimated cost as agreed first by both the parties. Thus higher the actual cost lower will be the value of fee and vice-versa.

Since the interest of the contractor is totally involved he would not try to increase the actual cost as in cost plus percentage rate and also he would not be indifferent as in case of cost plus fixed fee contract. So in this case the actual cost is lower and both the owner and the contractor are benefited. This is the best of the cost plus type contracts.

In this case actual cost must be very accurately determined. In case the estimate is much higher than the actual cost due to the inefficiency of the estimator a contractor will get more amounts on the basis of savings and vice-versa.

10. Target contract: In this system the contractor is paid on a cost plus percentage basis for work performed under this contract and in addition he receives a percentage plus or minus on saving or excess effected against either a prior agreed estimate of total cost or a target value arrived at by measuring the work on completion and valuing at prior agreed rates. The advantage of this contract is that contractor is encouraged to use his skill and experience in keeping the cost as low as possible. This type of contract is thus profitable to both the contractor as well as to the owner. The only disadvantage may be that the contractor may show higher cost of construction and thus may gain more amounts even covering the penalty for excess expenditure.

11. Measured contract or schedule contract: Except lump-sum contract all other contracts are measured contracts. Total cost of a work is worked out by detailed measurement of

different items of work after its completion. A bill is then prepared by multiplying the measured quantities by their respective rates.

12. Negotiated contract: When a contract is awarded simply by negotiation it is known as a negotiated contract. There is no open competition and owner carries out negotiations with selected contractors after studying their previous experience, financial status, general reputation, etc. Thus there are less chances of dispute in a negotiated contract because the competition is restricted to a small number of equal ranking contractors and any one from this group can be relied upon to respect the engineers' interpretation of the specification.

13. Rate contract: In every government there is a store purchase department. The function of this department is to facilitate purchase of some common articles by the govt. departments. Steel cement AC pipes, cycles, typewriting machines, steel almirah, duplicating machines hard wares safes steel and wooden furniture are the usual articles and materials which can be purchased by govt. departments through rate contract. In order to fix rate contract of any controlled material or article the director general of supplies and disposal (DGS&D) of central govt. invites tenders from the manufacturers of these articles or materials. After scrutiny of the tenders DGS&D fixes rates of such articles and makes rate contract with the manufacturers or suppliers to supply the articles or materials for a certain period which is known as rate contract. This rate contract is also known as DGS&D rate contract. In state govt. this work is done by 'superintendent of store purchase department and rates fixed by this department' are known as ISSPD rate contract or CSPO rate contract. The rate contract with all the particulars rate, description specifications etc. are notified in gazette for information for all the department.

14. Package deal or Turn-key contract: Sometimes, the owner contemplating a construction wants to deal with only one party for all the services both engineering and construction. The owner gives his requirements in broad outline to the contractors together with the side data. The contractors then proceed to prepare their own design of the construction and finally, submit the same to the owner with the estimated cost of the project as per their design on a lump-sum basis. Thus the owner receives a number of competitive designs and after studying the details, financial aspects and various other factors, the owner decides the design most suitable to him. The construction work is then given to the contractor whose design has been accepted by the owner. In short this contract involves all planning, design, plans specification, preparation of estimates and construction services under one contract on competitive basis.

15. Basic price contract: When the market is unstable and the prices of essential materials are changing substantially very rapidly, it is quite likely that no contractor will come forward to carry out the work. In such conditions a slight modification of unit-price or item-rate contract is made. The contractor mentions in his tender the basic prices of some of the essential engineering materials such as cement steel etc.

16. Oral contract: An agreement made with spoken words and either no writing or only partially written. An oral contract is just as valid as a written agreement. The main problem with oral contracts is proving its existence or the terms. An oral contract is as good as the paper it's written on. It is often provable by action taken by one or both parties which is obviously in reliance on the existence of a contract. The other significant difference between oral and written contracts is that the time to sue for breach of an oral contract (the statute of limitations) is sometimes shorter.

17. Global contract: A global contract is a multilateral agreement between significant actors – that stands above all national and supranational agreements. A global contract either regulates critical issues that are of global relevance within the context of a sustainable global

political order, or supports the establishment of institutions that will effectively deal with such issues. A global contract consists of the following formal criteria:

- significant issues,
- global relevance,
- binding character according to international law
- effective sanctioning mechanisms,
- legitimization of actors,
- global reach,
- funding for implementation,
- establishment of suitable supporting institutions and flexible decision processes, and
- effective regulation.

In addition, a global contract also stands for the normative criteria:

- promotion of sustainability,
- compliance with the principle of justice,
- maintainance of peace,
- safeguarding human rights, and
- promotion of global welfare.

18. <u>All in contract:</u> In this form of contract, the owner specifies his requirements and also the broad and general outline of the proposed work and the contractor has to submit full particular of detailed investigations, designs and construction cost including the maintenance of work done for a limited period.

19. <u>Illegal contract:</u> Illegal contract is a promise that is prohibited due to its very nature. Such contracts are prohibited since the performance, formation, or object of the agreement is against the law. Technically, an illegal contract is not a contract at all and hence the phrase is a misnomer. An illegal contract is exceptionally difficult to define. However, a contract can well be illegal without contravening the criminal law. While a void contract is not necessarily illegal, an illegal contract is often void.

20. Voidable contract: A voidable contract is one that can be affirmed or rejected at the option of one of the parties. Voidable contract is one that is void as to the wrongdoer but not void as to the party wronged, unless that party elects to treat it as void. A voidable contract is a contract which is valid and capable of producing the results of a valid contract, but which may be avoided.

21. Contract by a minor: With some exceptions, a contract made by a minor is *voidable.* The minor, in other words, may avoid the legal liability under a contract. Upon reaching the age of majority, a minor may *affirm* or *ratify* the contract and therefore make it contractually binding on him. Any expression of the minor's intention to avoid the contract will accomplish avoidance.

A minor can only avoid a contract during his minority status and only for a reasonable time after he reaches the age of majority. After a reasonable period of time, the contract is deemed to be ratified and cannot be avoided.

When a minor avoids a contract, there are certain rules of law regarding the effect on any property received by the minor under the contract. If the minor still has what he received from the other party, he must return it to the other party upon seeking to avoid the contract. If he does not return the property in such a situation, he cannot avoid the contract. If the minor cannot return what he has received pursuant to the contract because it has been spent, damaged or destroyed, he still can avoid the contract. He can avoid the contract and is only required to return that part of the consideration he still has. Even if he has nothing left, or what he has is damaged property, he still can avoid the contract.

LAW OF CONTRACT

The Law of Contract deals with agreements which can be enforced through courts of law. The law of contracts differs from other branches of law in a very important respect. It does not lay down so many precise rights and duties which the law will protect and enforce; rather it contains a number of limiting principles, subject to which the parties may create rights and duties for themselves, and the law will uphold those rights and duties. Thus, we can say that the parties to a contract, in a sense make the law for themselves. So long as they do not transgress some legal prohibition, they can frame any rules they like in regard to the subject matter of their contract and the law will give effect to their contract.The Law of Contract is the most important part of commercial law because every commercial transaction starts from an agreement between two or more persons.

The object of the Law of Contract is to introduce definiteness in commercial and other transactions. How this is done can be illustrated by an example. X enters into a contract to deliver 10 tons of coal of Y on a certain date. Since such a contract is enforceable by the courts, Y can plan his activities on the basis of getting the coal on the fixed date. If the contract is broken, Y will get damages from the court and will not suffer any loss. The law of contract is intended to ensure that what a man has been led to expect shall come to pass; and that what has been promised to him shall be performed.

The law of Contracts is not the whole law of agreements nor is it the whole law of obligations. It is the law of those agreements which create obligations, and those obligations which have, their source in agreements

CONSEQUENCES OF MISTAKES IN CONTRACT

MISTAKE

Mistake is an erroneous belief, at contracting, that certain facts are true. It can be argued as a defence, and if raised successfully can lead to the agreement in question being found voidable, or alternatively an equitable remedy may be provided by the courts.

KINDS OF MISTAKE

Following are kinds of mistake.

(I) Mistake of fact

(II) Mistake of law

(I) Mistake of fact:

It was held that where both the parties to an agreement are under a mistake as to matter of fact essential to agreement, the agreement is void.

Mistake of facts has following kinds.

(a) Bilateral mistake

(b) Unilateral mistake

(a) Bilateral mistake:

Where both the parties to an agreement are under a mistake as to matter of fact, essential to the agreement, there is a bilateral mistake and the agreement is void.

Conditions:

(i) Both the parties must be under a mistake.

(ii) Mistake must relate to some fact.

(iii) The fact must be essential to an agreement.

Example:

A agrees to sell to B a specific cargo of goods supposed to be its way from England to Karachi. It turns out that, before the day of bargain, the ship convening the cargo had been cats away and the goods lost. Neither party was aware of this fact. The agreement is void.

I. Types of bilateral mistake:

Bilateral mistake have following types.

(1) Mistake as to existence of subject matter:

The parties may be mistake as to existence of subject matter.

(2) Mistake as to identity of subject matter:

If both parties to contract are under mistake as to identity of subjects matter the contract is void.

(3) Mistake regarding ownership of subject matter:

If a person agree to purchase the property, which already belongs to him but both the parties are not aware of this fact, the agreement is void.

(4) Mistake regarding the quantity of subject matter:

When both the parties are under a mistake regarding the quantity of subject matter the agreement is void.

(5) Mistake as to the quality of subject matter:

It case of mistake by parties as to the quality of subject matter, the agreement is void.

(b) Unilateral mistake:

Where only one of contracting parties is at mistake it is
a unilateral mistake. Unilateral mistake is mistake of one party and does not render the contract voidable.

Effect of unilateral mistake:

(a) Valid contract**:**

If a person due to his own negligence makes a wrong contract, he cannot avoid the contract.

(b) Voidable contract**:**

If unilateral mistake is caused by fraud etc on the part of other party, the contract is voidable and can be avoid by the injured party.

(c) Void agreement
(i) Where identity of the contracting party is essential to the contract, the mistake makes the agreement void.
(ii) Where one of the parties to a contract without of his own, is made to commit a mistake as to nature of the contract, the agreement would be void.
(II) Mistake of law
when a party enters into a contract, without the knowledge of the law in the country, the contract is affected by such mistakes but it is not void. A contract is not voidable because it was caused by a mistake as to any law in force in India. The reason here is that ignorance of law is not an excuse at all. However if a party is *induced* to enter into a contract by the mistake of law then such a contract is not valid. Illustration A and B make a contract grounded on the erroneous belief that a particular debt is barred by the Indian law of Limitation; the contract is not voidable.

CONTRACT DOCUMENTS

As per Indian Contract act 1872 Conditions of a valid contract are Mutual agreement between the parties, Promisor and promisee should be competent, An offer should be made by the promisor and an offer should be accepted by promisee ,Offer proposal and acceptance should be related to something not prohibited by law.

The contract documents include

- The Contract drawing
- The Specifications
- The General conditions of contract
- The Special conditions of contract
- The bill of quantities (BOQ)

Contract drawings
Contract drawings include Site drawings, Architectural drawings, Structural drawings, HVAC, Electrical drawings and Special details.
Specifications
Specifications specify the Quality of materials, Quality of workmanship, Frequency of testing, Approved manufacturers, Relevant Indian standards, Inspection and installation methods.
General conditions of contract
It refers to Standard document in all contract of owner. It Consist of responsibility and obligation involved, Scope and performance of contract, Arbitration and laws, Labour regulations and safety code, Standard general condition of contract advised to be used.
Special conditions of contract
These are Modifications made in GCC to make it suitable to job. It specifies Materials provided by owner, Site visits, Mobilization advance, Start date of construction and Various reports related to progress.
Bill of quantities
It refers to the net quantity to be executed in each item of work. The items are generally classified as Earthwork, Brickwork, Concreting, Foundation work, Painting and whitewashing etc.

CONDITIONS OF CONTRACT

The clauses which relate to the work as a whole written in a separate contract document are known as general provisions or conditions of contract. The main object of framing the conditions of contract is to avoid disputes between the parties concerned and thus to keep them out of the court of law. The conditions of contract are framed in the legal phraseology and in case of complicated contracts, the lawyers are entrusted to frame the conditions for the contract. Thus they carry more weight and any breach of them will lead to serious legal formalities.

The conditions of contract have the following peculiarities

1. Number of the clauses; there is no definite rule regarding the number of clauses to be included in each type of the contract. It mainly depends on the character of the work and clauses which are found suitable for one contract may not fit in the skeleton of other contract. The engineer therefore should make careful study of the work before framing the conditions of contract.
2. Relation with the technical provisions: there is no sharp distinction between the technical provisions and general provisions. As a matter of fact, few clauses may well fit into either group and it is the engineer who decides whether a particular clause is to be inserted in the technical provisions or in the general provisions.
3. Use: the provisions in the technical speciufications are made use of at any stage of work. But it is likely that a clause contained in the general provisionsmay not be used at all during the contract period. This is due to the fact that the situation for which it was framed may not have arisen during the period of contract.

The conditions of contract to be included in any particular work depend upon the nature of work. The following conditions of contract are generally accommodated in case of most of the civil engineering contracts

1. CONDITIONS RELATING TO THE GENERAL OBLIGATIONS OF CONTRACTOR

These pertain to access to works; acts, byelaws and regulations; fencing, watching and Lighting ; instructions of engineer; insurance; setting out; site etc

2. CONDITIONS RELATING TO LABOUR AND PERSONNEL

These pertain to accidents to workmen; contractor's representative; engineer's representative; first aid; rates of wages; removal of employees of the contractor; etc

3. CONDITIONS RELATING TO THE EXECUTION OF THE WORK

These pertain to alterations, additions and omissions during progress of work; amount for extra times; damages; defective work; defects; materials; protection of trees and shrubs; public travel; safety by shoring and during blasting; water for construction; work at night and on holidays; workmanship; etc

4. CONDITIONS RELATING TO DOCUMENTS

These pertain to bill of quantities and schedule of prices; drawings; Indian standard specifications; notices; provisional and prime cost sums; etc

5. CONDITIONS RELATING TO MEASUREMENTS AND PAYMENTS

These pertain to method of measurement of completed works; method of payment; payment to sub-contractors; etc

6. CONDITIONS RELATING TO DEFAULT AND NON COMPLETION OF WORK

These pertain to abandonment of work by the contractor; bankruptancy of contractor; engineer during construction; failure to complete the work in time; right to suspend the work by the owner; time of completion etc

7. CONDITIONS RELATING TO ASSIGNMENTS AND SUB-LETTING

These pertain to assignments; sub-letting; specialist contractors; etc

8. CONDITIONS RELATING TO SETTLEMENT OF DISPUTES

These pertain to arbitration; when engineer's decision is to be final; etc

9. SPECIAL CONDITIONS

These pertain to equipments; names of firms supplying materials; pollution of streams; use of intoxicants; etc

IMPORTANT CLAUSES OF CONDITIONS OF CONTRACT

Clause 1 Security deposit and earnest money deposit

The amount which is to be accompany the tender form as guarantee of the tender is known as the earnest money. It is usually about 1% to 2% of the total estimated cost of the work. This amount is kept with the department till the contract is allocated to some contractor. The earnest money is returned to unsuccessful contractors, forfeited in case of non-bonafide contractors, and is retained for the successful contractor for further adjustment with security deposit. Earnest money serves as a check so that the contractor may not refuse to accept the work or run away when his tender is accepted. The amount of earnest money depends on the estimated cost of works as follows.

Rs. 50/- for works up to 2000/- Rs.100/- for works of 2000/- to 5000/- Rs 200/- for works from 5000/- to 10000/- and Rs 100/- for every additional 5000/- or part there of above Rs. 10000/-

The earnest money may be cash or encashable at any time. It may be in form of deposit in treasury or State Bank or other approved Bank or government security or saving certificate or post office savings pass book or cash certificate pledges to the Executive Engineer.

Security

Once a tender is accepted the selected contractors has to deposit a certain amount with the owner. This amount of the deposit is known as the security deposit. Security deposit is taken as the rate of 10% of the tender amount. Earnest money of the contractor whose tender has been accepted is adjusted in the security deposit. Instead of collecting the whole of security money in one instalment before starting the work, it can be collected gradually by deducting suitable amount from the running account bills of the contractor up to the extent of 10%of total coat of whole work. The security money is refunded to the contractor after the satisfactory completion of the whole work after a specific time, usually after one rainy season or six months of completion of the work. The security amount is kept as a check so that the contractor fulfills the terms and conditions of the contractor and carries out the work satisfactory according to the satisfactory according to the specifications and maintains progress and completes the work in time. If contractor fails to fulfill the terms of contractor his whole part of the security money for forfeited.

For workers costing up to Rs. 100000/- as security money is 10% of the estimated cost. For costing more than one lakh and up to two lakh rupees the security money is 10% on first one lakh and 7.5% on the balance. In case of works costing more than two lakh the amount of security deposit will be 10% on the first, one lakh 7.5% on the next one lakh and 5% on the balance subjected to the maximum of Rs.one lakh only.

Clause 2 Compensation for delay

The time allowed for carrying out the work as entered in the tender shall be started from the 15th day of giving order for its commencement or any other date specified and shall be strictly observed by the contractor. The time allowed in the tender for completion of the work is essence of the contract on the part of the contract. When the work allotted to the contractor remains uncommenced or the delay in the completion of the work or if the progress of the work is not proportionate to the time escaped then contractor shall pay as compensation an amount equal to 1% or such smaller amount as the Superintending

Engineer(S.E) may decide for each day of delay subjected to the maximum of 10% of the tender amount of the whole work. The decision of the S.E in writing as the quantum of compensation to be levied shall be final.

Clause 3 Action when whole of security deposit is forfeited

When the contractor has made himself liable to pay compensation amounting to the whole of his security deposit (due to taking action of clause 2) the engineer-in-charge, on behalf of President/Government shall have power to adopt any of the following courses.

1. To rescind the contract with a written rescission notice of the engineer in charge provided the security deposit of the contractor shall stand forfeited. It shall be absolutely at the disposal of government without prejudice to government's right to recover losses under clause 3(ii) and 3(iii)
2. To get the unfinished work done on behalf of the contractor by the department by the employing labour and purchasing materials. For the cost of labour and prices of the materials purchased certificates of the engineer in charge shall be final and conclusive against the contract
3. To measure the work done by the contractor, and to take such part there of as has been uncommenced out of his and allot it to another contractor for its execution at risk and cost of the original contractor

The extra expenditure if any under clause 3(ii) 3(iii) shall be borne by the contractor and shall be deducted by the engineer in charge from the security deposit. If extra expenditure exceeds the forfeited amount of security deposit the difference between the extra expenditure and the security deposit shall be recovered from any money due to the contractor under the contract or other wise

If the engineer in charge adopts any of the above clauses then the contractor shall have no claim to compensation for any loss sustained by him due to any reason whatever. On the other hand if the unfinished work is executed at a laser cost then the contractor has no right to claim the amount saved.

Clause 4

If there is any delay or no action is taken to exercise clause 3 the same shall not constitute a waiver of any of the condition and the contractor shall remain liable to pay compensation. In the event the engineer in charge is bent up on to use the powers of clause 3(ii) and 3(iii) he may. If he wants to take possession of all or any tool, plants, materials and stores at work and sell them by auction on account of the contractor he can do so but for this he must serve a written notice to the contractor. The certificate of engineer in charge as to the expense of any such removal and the amount of the proceeds and expense of any such shall be final and binding.

Clause 5 Extension of time

If the process of work is delayed by the department or due to some reasons beyond the control of the contractor the time of completion of work may be suitably extended by the engineer in charge. The extension of time shall not in any way violate the terms and conditions of the original contract. The notice for the demand of the extension of time limit for the completion of the works shall be given in writing by the contractor as soon as possible preferably within 7 days of the date of completion. The engineer in charge should grant such extension on time on reasonable grounds.

Clause 6 Site clearance

The contractor on completion of the works under the contractor shall clear up the site and remove from the site all surplus materials plants and equipment, debris, centering etc. and shall hand over the site to the owner in a condition satisfactory to the engineer.

Clause 7 Completion certificate

On completion of the work and site clearance the contractor shall be furnished with a completion certificate by the engineer in charge. The date of completion shall be noticed in the measurement book according to date as certified in the certificate.

Clause 8 Possession prior to completion

The owner has the right to take the possession of or use any completed or partially completed part of the work. Such possessions or use shall not be accepted of any work not completed yet. Such possessions or use must not put any hindrance in any way in performance of the work by the contractor

Clause 9 Running bill payments

The contractor shall be paid at the end of each calendar month for the work done by him during that month. The engineer shall measure approximately all such works and shall determine the amount 90% of such amount shall be paid to the contractor after deducing the amount of all previous running bill payments and other dues at the contract. The engineer shall have the power to withhold the payments, if in his opinion, the amount is too small or the works are not carried out to his satisfaction or the contractor is not respecting the contract obligations. If the contractor does not submit the monthly bill the engineer in charge may depute his sub-ordinates to measure up the said work in the presence of the contractor who will countersign the bill in order to receive his payments. The contractor shall submit all the bills on printed form available from the department on nominal payment or sometimes even free of charge. All payments of running bills shall be regarded as advance against the final payment and not as payments for work actually done.

Clause 10 Works to be open to inspection

The work being conducted by the contractor shall be open to inspection and supervision
of the engineer in charge or his subordinate. The contractor or his authorized agent shall be available at site at the time of inspection the contractor or his agent is required to receive orders and instructions connected with the work.

Clause 11 covering up the work

The contractor shall not cover up or place beyond the reach of measurement any work of the tender without consent obtained from the engineer in charge unless otherwise permission the said work shall be uncovered by the contractor at his own expenses. If it is not possible either no payment is done or allowance shall be made or the materials with which the same was executed

Clause 12 No compensation for curtailment or alteration of work

The contractor shall have no such claim to any payment or compensation for

1. Any curtailment of the work as specified is the tender due to any reason whatsoever on account of profit or advantages from the execution of the original work in full
2. Any alterations in the drawings, designs, specifications and instructions which may cause any curtailment of the original work

Clause 13 Payment of extra work

The contractor shall carry out the execution of the items which are not covered under this contract after obtaining the written order from the engineer and the execution of such extra items shall not in any way violate the terms and conditions of the original contract. The engineer shall fix the rate of the extra items by actual process of the rate analysis if the rate of the item is not available in schedule of rates as well as in the tender. No extension of time

limit shall be granted due to extension of extra items unless it is recommended by the engineer in charge

Clause 14 Rates of contract to remain unaltered

The rate quoted by the contractor shall be in firm and shall remain unchanged during the entire period of execution of the work up to the completion stage and no increase shall be allowed due to increase in prices of materials and wages of labour, increase in railway freight or due to any other reason

Clause 15 Method of measurement of completed work

When measurement is to be taken the engineer shall inform the contractor accordingly who shall remain present or send his agent at the time of taking measurements. If no one remains present from contractor side in spite of the information to him, the measurement taken and approved by the engineer shall be treated as correct and final

Clause 16 Arbitration

All the disputes related to estimates, specifications, designs, drawings quality of workmanship or materials, claims arising out of or relating to the contract shall be referred to the arbitration of the chief engineer or his representative. It is also one of the terms of the contract that no person other than a person appointed by the chief engineer shall act as arbitrator. The award given by the arbitrator shall be final and binding to both the parties unless it is set aside by the court

The contractor invoking arbitration shall specify the disputes to be refereed to arbitration together with the amount of claim

Clause 17 Labour laws

No labour under the age of 15 shall be employed on the work. The contractor has to respect

the provision of all the labour laws which are in force from time to time. The contractor shall be responsible for all claims compensations, minimum wages etc. occurring under the provision of labour laws. The contractor shall bound to provide amenities due to labour. If labour is to be stationed at site of work the contractor is responsible for providing them temporary hut and agreement for conservancy sanitation and water supply at the labour camp

Clause 18 Materials and stores supplied by government

Some of the controlled materials which are in scarcity in open market are promised by the Government to be supplied to the contractor at a fixed issue rate as provided in the tender. The value of the full quantity of materials and stores source applied may be deducted from sums then due or thereafter to become due to the contractor under the contract. This may also be done from the security deposit.

All the materials applied to the contractor shall remain the absolute property of Government and shall not on any account be removed from the site of work. It shall at all times be open to inspection by the engineer in charge or his authorized persons.

On completion of the work excess quantity of materials if any can be returned by the contractor to the departmental stores if so desired by the engineer in charge. If engineer does not consent to return the excess materials to the stores the contractor shall not be entitled to return materials back and shall have no claim for compensation on any account of any such materials. The Government shall not be responsible any loss, wastage or damage to any such materials.

Clauses 19 Secured advanced

Under this clause the contractor shall be entitled to get 75% advanced payment against the estimated value of any materials which have been brought on the site in connection with the work and which are in the opinion of the engineer-in-charge securely stored and protected from any damage. Any such material shall not be used in the works at the time of advance payment. To get such advance payment the contractor shall sign and

indenture in the form to be specified by the engineer in charge. When materials on account of which an advanced payment has been made, are used in the work, the full amount shall be deducted from the next payment made under this contract.

Claus 20 Alteration in specifications and design

The engineer in charge reserves the right to make any change in omission from and additions to or substitutions for the original designs, drawings, specifications and instructions as are necessary in his opinion during progress of the work. These changes shall be given to the contractor in writing and signed by the engineer in charge. Such changes omissions additions or substitutions are deemed to have formed as work included in the original tender and the contractor shall be bound to carry out the work. The time of completion shall be extended by the engineer in charge keeping in view the changes asked for.

The rate of such additions, alterations or substited work shall be worked out as follows.

1. Same rate if any may be specified in the tender.
2. Adopt departmental schedule of rates in force at the time of acceptance of the contractual percentage.
3. By analysis worked out from the basic rates of materials and labour provided in current schedule of rates if basic rates are not in the sechudle then from current market rates without application of the said contractual percentage

In the event of any dispute regarding rates, the decision of superintending engineer of the circle shall be final and binding

Clause 21 Drawings and specifications

All works shall be carried out truly according to designs, drawings, and specifications. All the materials in every respect shall be in strict accordance with the specifications. The contractor shall have few copies of all drawings and specifications out of which at least one copy shall be at site of work with the head mistry or with contractors authorized agent so that work could be properly guided. It also helps in accessing the actual position at the time of inspection.

Clause 22 Revision of the rates

In case of any alterations addition or substation if any additional materials and equipments are involved the contractor may claim revision of the rates specified in the tender for the main work within 7 days from the receipt of the order the engineer in charge may revise such rates having considered increase in the market of such materials.

In event of a dispute the decision of superintending engineer shall be final and binding. But under no circumstances the contractor shall suspend the work on the ground of non settlement of rates of items

Clause 23 final payment

It means payment made to the contractor on the completion or determination of the contract in full settlement of the account. The bill on which final payment is made known as final bill. Final payment is prepared is after expiry of the maintained period of six months.

Clause 24 Penalty

It is a fine levied on contractor for non-fulfillment of terms of contractor. Every contractor usually contains certain penalty for breach of terms and conditions of contract as for not maintaining the progress, for delay in completion, for bad work etc. The penalty may be a fixed sum per day or a certain percentage of the estimated cost but maximum extent being 10% etc

Clause 25 Maintenance period

The clause is introduced in the conditions of the contract to ensure that the works carried out under the contract shall remain in good condition for a certain period after its completion. If any damage, defects, imperfections or other faults become apparent up to the expiry of the maintain period of the contractor shall damage, defects, imperfections or other

faults become apparent up to the expiry of the maintenance period the contractor shall make good the same at his own expence or default the engineer in charge shall be entitled to carryout such work by other workmen and deduct the expence from any sum due to the contractor or from his security deposit.

The security deposit shall not be refunded before the expiry of the maintanence period or till the final bill has been prepared and past, whichever is later. Maintenance period usually varies from 6 months to 12 months, depending up on the nature of work. Normally it is 6 months in most civil engineering works.

Clause 26 Compliance of laws etc

The contractor shall respect and comply with all the national, state and local laws affecting the works under this contract. The contractor shall bear the cost of any claim or damage or loss due to violations of all such laws, ordinances etc.

Clause 27 Liquidate damage

It is a fixed sum payable by the contractor having no relationship with real damage. It is generally exorbitant and fixed per day varying from Rs 50/- to Rs 100/- per day for the excess period taken for the completion of the work. This clause is inserted to give stress that the works are to be completed in time. This amount shall be for the liquidated damages for such delayand not as a penalty. Such amount shall be deducted from the amount due to the contractor or which may become due to the contractor.

Clause 28 Unliquidated damages

These damages have direct relation with the actual damage done. Their amount will increase or decrease according to increase or decrease in the damages. Non maintenance of progress of work, not completion of work by due date are the examples of unliquidated damages.

Clause 29 Termination of contract

The contract can be terminated by the executive engineer or by competent authority in default or bankruptcy of contractor. If the contractor does not fulfill the terms and conditions of the contract such as 1) He leaves the work uncompleted. 2) He does not maintain progress 3) He does not observe the rules and instruction etc. The contract agreement may be rescinded and all of his security money may be confiscated or penalty up to the extent of 10% of the tender cost may be imposed on the contractor. For termination of the contract due notice shall have to be served on the contractor. It is advised that this measure should be adopted as last resort and not as the first resort.

Clause 30 Debitable agency

It is an agency which is employed to execute work or part of a work at the cost of a contractor who either fails to complete or to show satisfactory progress of the work. The debitable agency may be in the form of daily labour or another contractor and may be employed by giving proper notice to the original contractor. The whole cost done by this agency which is usually higher is debited or charged to the original contractor.

Clause 31 Storage of tools and materials

The contractor shall made his own arrangements for the storage of tools, planned materials, etc and shall also construct his temporary office at site of work. The contractor shall include in his tendered price for storage or materials either in his own storages or in suitable godowns hired for the purpose.

Clause 32 Sub-letting

The contractor shall not sub-let or assign any part of the work under this contract to any one without obtaining the written consent of the engineer in charge. Assigning or sub-letting any part of the work shall not in any way give a cause to the contractor to get himself released from the obligations, terms and conditions of this contract. The original contractor

shall be responsible for all the works carried out by the sub contractor. The payment to all sub contractors shall be made by the contractor himself and not by the owner or department.

Clause 33 Fencing, watching and lighting

Fencing, watching and lighting of the works during its execution is the responsibility of the contractor. The responsibility of any accidents taking place due to neglect or defect in such arrangement shall be laid on the contractor. All such arrangements shall be made to the satisfaction of the engineer and / or local authority or any competent authority. All the works where there is likelihood of general public or animals to approach should be properly fenced and during night properly lighted.

Clause 34 patent right and royalties

This clause warns the contractor regarding the use of patented articles and processes. The prices stated by the contractor in his tender shall include all fees and royalties for the use of patented articles, processes, inventions etc and contractor shall be responsible for all such claims.

Here only possible clauses which can be included in conditions of civilengineering contracts have been given. There may be many more clauses which can be included depending up on the conditions, type and urgency of the work. Every work has its own peculiarities and as such conditions should be formulated in such a way that contractor is bound to perform as the owner wishes to be. The engineer's experience in this respect plays a vital role. Being connected with works the engineer can appreciate the likely loop holes where contractor can play mischief and his job is to plug these loop holes by framing competent conditions of contract leave no aspect of the work untouched.

TENDER

Tender is an offer in writing for executing certain specified work or for supplying specified materials subject to certain terms and conditions like rates, time limit etc.

Types of tenders:

1. Open Tenders
2. Limited tenders
3. Single tender
4. Rate contract

Open Tenders

Open tender is a tender in which bids are invited from all contractors. An open advertisement in the important news papers and Indian trade journal will be published.

Limited Tenders

In this kind of tender, only selected contractors are invited to bid or quote the rates for the supply of articles or to execute the work

Single Tender

Only a single firm or contractor is invited for the tender**.** If the quoted rates are high, negotiations prior to agreement are done with the contractor.

Rate Contract

This type of contract is used mainly for the supply of stores of items. The quantities are not mentioned. According to this contract, items are supplied at fixed rate during the period of contract.

Tender Documents

a) Notice Inviting Tenders.

b) Tender form with standard conditions of contract.
c) Schedule of quantities.
d) Special terms and conditions.
e) Complete specification of work.
f) Special specification and additional condition of contract.
g) Approved drawings where necessary.

Invitation of Tender

Tender is published to get sufficient number of bids for an attractive offer. Approved contractors can participate in the tender. A notice inviting tender is published in newspapers and journals. Tender is also informed by post and posting on notice board in the office.

Contents of a Tender notice

The contents of a tender notice are:

a) Name of place and time where the contract documents can be seen and obtained.
b) Name of place and date, receipt and opening.
c) EMD mode and amount to be paid
d) Amount of security.
e) Authority of Acceptance of tenders.

Opening of Tenders

On the date of opening of tender, the sealed tenders are opened in the presence of contractors or their representatives. Officers have to read out the rates/amounts offered. The comparative statement showing the quoted rates all participated contractors must be published. Tenders that are not received in proper form duly filled can be rejected.

Acceptance of tender

After investigating the comparative statement, the lowest tender shall be accepted. If the lowest tender is not accepted- reasons are recorded confidentially.

Letter of Acceptance

Letter of acceptance is the letter communicating the acceptance, after the decision to accept a tender. It is issued on behalf of President of India or Governor of State. It's a notification of the opportunity to complete the formalities of contract. Further directions are also provided.

Work Order

A work order is issued after the intimation of the acceptance. Formal agreement has to be made within the specified days. Letter issued after formal agreement. Date of completion is treated from the date of issue of work order.

Execution of civil engineering works

The execution of any proposed civil engineering work can be divided into two stages.

a) Preliminaries b) Execution of works

Execution of works:

Before a work is taken in hand for execution, the following condition should be followed systematically.

1) Administrative Approval on Rough Cost Estimate
2) Technical Sanction on Detailed Estimate by the Competent Authority
3) Transfer of funds to PWD
4) Handing over of land to PWD
5) Decision by Competent Authority on Mode of Construction

Execution of works comprises of the following activities.

i) Supervision
ii) Site Order Book
iii) Issue of Materials
iv) Scope of Sanction
v) Progress Report
vi) Materials at Site Account
vii) Payment
viii) Excess over Quantity
ix) Excess over Estimate

EARNEST MONEY DEPOSIT

It is the assurance or guarantee in the form of cash on the part of the contractor to keep open the offer for consideration and to confirm his intention to take up the work accepted in his favor for execution. In case if tender fails, this money is forfeited to government.

- Upto 5 lakhsà 2- 0.5%, max 10,000
- Above 5 lakhs à 2%, max 20,000

Return period

- All deposits except lowest three are returned within a week.
- Second and third lowest are returned within 15 days

The amount which is to be accompany the tender form as guarantee of the tender is known as the earnest money. It is usually about 1% to 2% of the total estimated cost of the work. This amount is kept with the department till the contract is allocated to some contractor. The earnest money is returned to unsuccessful contractors, forfeited in case of non-bonafide contractors, and is retained for the successful contractor for further adjustment with security deposit. Earnest money serves as a check so that the contractor may not refuse to accept the work or run away when his tender is accepted. The amount of earnest money depends on the estimated cost of works as follows.

- Rs. 50/- for works up to 2000/- Rs.100/- for works of 2000/- to 5000/- Rs 200/- for works from 5000/- to 10000/- and Rs 100/- for every additional 5000/- or part there of above Rs. 10000/-
- The earnest money may be cash or encashable at any time. It may be in form of deposit in treasury or State Bank or other approved Bank or government security or saving certificate or post office savings pass book or cash certificate pledges to the Executive Engineer.

SECURITY DEPOSIT

Amount deposited by the contractor whose tender has been accepted in order to render himself liable to dept. to pay compensation if the work is not carried out according to specification, time limit, conditions of contract.

- Work <2lakhsà10% on first lakh, 7-0.5% on rest
- Work >2lakhsà 10% on first lakh, 7-0.5% on second lakh , 5% on rest.

Deposit is refundable after prescribed maintenance period.

Once a tender is accepted the selected contractors has to deposit a certain amount with the owner. This amount of the deposit is known as the security deposit. Security deposit is taken as the rate of 10% of the tender amount. Earnest money of the contractor whose tender has been accepted is adjusted in the security deposit. Instead of collecting the whole of security money in one instalment before starting the work, it can be collected gradually by deducting suitable amount from the running account bills of the contractor up to the extent of 10%of total coat of whole work. The security money is refunded to the contractor after the satisfactory completion of the whole work after a specific time, usually after one rainy season or six months of completion of the work. The security amount is kept as a check so that the contractor fulfills the terms and conditions of the contractor and carries out the work satisfactory according to the satisfactory according to the specifications and maintains progress and completes the work in time. If contractor fails to fulfill the terms of contractor his whole part of the security money for forfeited.

For workers costing up to Rs. 100000/- as security money is 10% of the estimated cost. For costing more than one lakh and up to two lakh rupees the security money is 10% on first one lakh and 7.5% on the balance. In case of works costing more than two lakh the amount of security deposit will be 10% on the first, one lakh 7.5% on the next one lakh and 5% on the balance subjected to the maximum of Rs.one lakh only.

MEASUREMENTS

Measurement of a building occupies a very important place in the planning and execution of any civil engineering works from the time of first estimate to the final completion and settlement of payment for the project. The work is divided into sub heads for keeping accounts of money and materials accurately. Accuracy is a must in measurement and should be kept as under.

a) Dimensions shall be measured to the nearest 0.01 metre.
b) Area shall be worked out to the nearest 0.01 square metre.
c) Cubic contents shall be worked out to the nearest 0.01 cubic metre.

Measurement Book (MB):

Measurement Book is a very important document in case of Public Works department and hence it should be maintained carefully. The measurements of all the works and supplies are recorded in the Measurement Book Form 23. It is in form of a note book of size 15cms x 10cms and contains instructions how to write up the columns for particulars. It also contains details of actual measurements in terms of length, breadth and depth and the contents or area. All pages of every measurement book are machine-numbered and all measurement books are numbered serially. A register is maintained in the Divisional Office showing the serial number of each MB, the names of the Sub Division or Officer to whom issued, the Date of Issue, the Date of Return and Remarks. A similar register is maintained at the Sub Divisional Office showing names of the Officers to whom issued, Date of Issue, Date of Return etc. Each MB has some leaves for index, for review by the Divisional Accountant and for review by the Executive Engineer.

Loss of MB:

Loss of MB is a very serious matter and has to be reported to the highest authorities immediately. It is an initial document of accounts and hence a serious matter. After getting

intimation on loss of MB, the Superintending Engineer investigates in detail the cause of loss. Suitable action is taken if any body is found responsible. If the lost MB could not be traced even at the lapse of 6 months, an application for sanction of write-off together with full report and explanation should be submitted to the Chief Engineer who is authorized to sanction the write-off.

Checking of Measurements: In order to exercise proper control and check, certain percentage of measurements recorded by subordinate officers are required to be checked by Assistant Engineer and Executive Engineer.

Percentage of checking is as follows.

a) In case work has been done by the departmental labour AE (Assistant Engineer) will check 15% of measurements and EE (Execute Engineer) 7.5 to 10% of the measurements of each Sub Division.
b) In case of works done by the contractor on item rate basis, AE is supposed to check 25% of measurements and EE 5 to 50% of measurements, of each Sub Division.

The checking of measurements should be done in the presence of the person who recorded the measurements.

On checking:

- If the difference is not more than 1% in the case of original work, 5% in the case of repair work and 10% in the case of earth work, the entries shall be corrected and initialed.
- If the difference exceeds the above mentioned limits the measurements shall be cancelled or order should be given for taking measurements again.

Standard Measurement Book (SMB):

SMB is mainly used for periodical repairs and maintenance works which are to be carried out at fixed intervals of time. For small works it may be single MB but in case of large works it consists of a set of MBs. Single MB or a set of MBs where the detailed measurements of certain items of works of a building is recorded correctly in ink after the completion of construction and whose accuracy is certified by an officer of the rank not less than AE is known as SMB. Any alteration in structure is entered in SMB. SMB is checked every 5 years and this checking is termed as Quin Quennial Checking.

QUALITY

Quality is perceived differently by different people. Yet, everyone understands what is meant by “quality.” In a manufactured product, the customer as a user recognizes the quality of fit, finish, appearance, function, and performance. The quality of service may be rated based on the degree of satisfaction by the customer receiving the service. The relevant dictionary meaning of quality is “the degree of excellence.” However, this definition is relative in nature. The ultimate test in this evaluation process lies with the consumer. The customer’s needs must be translated into measurable characteristics in a product or service. Once the specifications are developed, ways to measure and monitor the characteristics need to be found. This provides the basis for continuous improvement in the product or service. The ultimate aim is to ensure that the customer will be satisfied to pay for the product or service. This should result in a reasonable profit for the producer or the service provider. The

relationship with a customer is a lasting one. The reliability of a product plays an important role in developing this relationship

QUALITY CONCEPTS

1. Quality
2. Grade
3. Inspection
4. Quality control
5. Quality assurance
6. Quality management
7. Total quality management
8. ISO standards

1. Quality

-A subjective term for which each person has his or her own definition.
– Characteristics of a product that bears on it's ability to satisfy the stated or implied needs
– A product or service free of deficiencies.

2. Grade

According to ISO 9001:2000 Category or rank given to different quality requirements for products, processes, or systems having the same functional use.

3. Inspection

-It is the sorting / segregation of Non conforming items from the conforming items
- Means separation of Defective items from the right items

4. Quality Control

Is the operational techniques and activities that are used to fulfill the requirements for quality .

5. Quality Assurance

Is all systematic and planned actions which are necessary to provide adequate confidence that a product or service will satisfy the given requirement for quality.

6. **Quality Management**

Is a systematic set of operating procedures which is companywide, documented, implemented and maintained while ensuring the growth of business in a consistent manner. So QMS is meant to establish a framework of reference to ensure that every time process is performed, the same information, method, skills, and controls are used and applied in a consistent manner.

7. Total Quality Management

The comprehensive approach towards quality management system. The process of individual & organizational development the purpose of which is to increase the level of satisfaction of all the stakeholders.

INSPECTION

Inspection is the art of comparing materials, products or performance with established standards. There can be no intelligent inspection without definite standard. In any such items that are to be inspected, some will fall outside a liberal allowance of variation from the standards some will be well within the limits of error, and others will be very close to the limits. Inspection is the art of selecting from these three classes of product which will be satisfactory for the work in hand.

Objectives of Inspection

i To errors in manufacturing system which tend towards poor quality and then to report to responsible officials in the producing departments so that action may be taken to prevent making units of product that are not acceptable or to a level of quality of produce that is below test specified.
ii To protect the consumer from receiving a product that is below the quality level and limits specified, by sorting the good units or lots from those which are below standard, permits only good quality to pass inspection.
iii To compile information regarding the conformance of the product with specification for the use of engineering, production, purchasing, quality control and other divisions responsible for quality performance.

Methods of inspection

i Sampling Inspection

This kind of inspection is performed over a random number of units which are drawn from a lot of product. This random number is considered as representative of the entire lot. The lot is accepted or rejected as the result of examination. This procedure may be employed in either of the two conditions.

a. To reduce the cost of production by inspecting a minimum number of units knowing that some defective elements are permissible
b. When the test procedure destroys the unit, there is a need to change necessary procedure.

The advantages of this type of inspection are that in this procedure the inspector is not fatigued and sometimes it may be more effective than 100% inspection.

ii Centralized Inspection

Comparatively light and small parts and assemblies are transported to the inspection department for examination. Usually this department is located in a place that is separated from manufacturing areas so that a proper care can be imparted to tools and inspection can be carrid over without interference.

iii Floor Inspection

Heavy parts and assemblies are examined at the production center itself, since they cannot be transported to inspection department.

iv First Piece Inspection

In case of semi-automatic or fully automatic machines some trial pieces are produced and inspected. If defects are found then machine is adjusted and another trial piece is made. When the trial piece fulfills the desired quality then the production time is released for production.

v Working Inspection

After a machine or machines have been released for production, the work be inspected periodically in the production time itself by inspection going to the machine itself. And if any defect occurs then machine may be corrected by shutting down it.

vi Key – operation Inspection

In this step, work is inspected and or after expensive or critical operation thus additional effort on defective unit is avoided.

vii Performance Inspection

Parts or full assemblies are usually subjected to a final inspection before they are being shipped to storage department of customer. This can be

a) Functional Inspection- an assembly is operated either in customers place or in the manufacturing plant to see that whether or not it performs according to the specification
b) Efficiency Inspection- Pumps, engines may be tested to see that whether they develop their rated horse power specified characteristics or not.

viii Endurance characteristic Inspection

Machines may be taken from assembly lines and seen for specified time or until failure occurs. Then the components of the machine are inspected to discover the effect of use. This type of inspection is common with automobiles.

QUALITY CONTROL

Quality control is the control over process.
It consists of two major processes.

1. Statistical process control
2. Training on statistical tools

For attaining proper control everybody in an organization, workers as well as management should be provided with

- Means for knowing quality goals
- Means for knowing his performance on the quality goals
- Means for regulating or correcting his performance

The quality control in short means the continuous appraisal and measurement of the performance of an individual, department or function and organization vis-a vis the 'quality plan' and find out the deviations from the plan ,and take corrective action to eliminate the deviation and put the process back on track .The quality control activity also warrants taking preventive actions so that deviations does not occur in the future. The quality control activity ensures consistency in the performance of the product, process and service and helps to retain the present performance.
Total Quality Control defined as an effective system for integrating the quality development, quality maintenance and quality improvement efforts of the various groups in an organization so as to enable production and service at the most economical level which allow for full customer satisfaction.
It may be classified as a ''Management Tool'' for many industries outstanding improvement in product quality design and reduction in operating costs and losses.
Product quality is defined as ''The composite product of engineering and manufacture that determine the degree to which the product in use will meet the expectations of the customer''.

''Control'' represents a tool with four steps :

- Setting up of quality standards.
- Appraising conformance to these standards
- Acting when these standards are exceeded.
- Planning for improvements in these standards.

Quality control emerges as a based function based on the collection analysis and interpretations of data on all aspects of the enterprise.
Total quality control is an aid for good engineering designs, good manufacturing methods and conscious inspection activity that have always been required for the production of high quality articles.

Quality of any product is effected at many stages of the industrial cycle :

- Marketing : Evaluates the level of Quality which customers want for which they are willing to pay.
- Engineering : Reduces this marketing evaluations to exact specification.
- Purchasing : Chooses, contracts with and retains vendors for parts and materials.
- Manufacturing Engineering : Select the jigs, tools and processes for production.
- Manufacturing Supervision and shop operators : Exert a major quality influence during parts making, sub assembly and final assembly.
- Mechanical Inspection and function Test : Check conformance to specifications.
- Shipping : Influences the caliber of packaging and transportation.
- Installation : Helps ensure proper operations by installing the product according to proper instructions and maintaining it through product service.

In other words, the determination of both quality and quality costs actually takes place throughout the entire industrial cycle. Quality control is responsible for quality assurance at optimum quality costs.

Benefits:

- Improvements in product quality and design
- Reduction in operating costs and losses
- Reduction in production line bottle necks
- Improvement in employee morale
- Improved inspection methods
- Setting time standards for labour
- Definite schedule for preventive maintenance
- Availability of purposeful data for use in co-advertising
- Furnishing of actual basis for cost accounting for standard and for scrap, rework and inspection.

TOTAL QUALITY MANAGEMENT (TQM)

Total Quality Management is formally defined in, as management philosophy and company practices that aim to harness the human and material resources of an organization in the most effective way to achieve the objectives of the organization.

Total quality management can be summarized as a management system for a customer-focused organization that involves all employees in continual improvement. It uses strategy, data, and effective communications to integrate the quality discipline into the culture and activities of the organization.

CONCEPTS OF TQM

1. Top management should be aware of correct situation and needs to be committed towards TQM implementation.

2. Focus customer requirements and product/service expectations.

3. Involve employees in understanding the quality aspects and make them accountable

4. Continuous improvement in the process is required

5. Treat suppliers as your partners

6. Develop tracking mechanism for processes and improve it as per business requirements

PRIMARY CHARACTERISTICS OF TQM

Total quality management can be summarized as a management system for a customer-focused organization that involves all employees in continual improvement. It uses strategy, data, and effective communications to integrate the quality discipline into the culture and activities of the organization.

- **Customer-focused**. The customer ultimately determines the level of quality. No matter what an organization does to foster quality improvement—training employees, integrating quality into the design process, upgrading computers or software, or buying new measuring tools—the customer determines whether the efforts were worthwhile.

- **Total employee involvement**. All employees participate in working toward common goals. Total employee commitment can only be obtained after fear has been driven from the workplace, when empowerment has occurred, and management has provided the proper environment. High-performance work systems integrate continuous improvement efforts with normal business operations. Self-managed work teams are one form of empowerment.

- **Process-centred.** A fundamental part of TQM is a focus on process thinking. A process is a series of steps that take inputs from suppliers (internal or external) and transforms them into outputs that are delivered to customers (again, either internal or external). The steps required to carry out the process are defined, and performance measures are continuously monitored in order to detect unexpected variation.

- **Integrated system**. Although an organization may consist of many different functional specialties often organized into vertically structured departments, it is the horizontal processes interconnecting these functions that are the focus of TQM.

    - Micro-processes add up to larger processes, and all processes aggregate into the business processes required for defining and implementing strategy. Everyone must understand the vision, mission, and guiding principles as well as the quality policies, objectives, and critical processes of the organization. Business performance must be monitored and communicated continuously.

- An integrated business system may be modelled after the Baldrige National Quality Program criteria and/or incorporate the ISO 9000 standards. Every organization has a unique work culture, and it is virtually impossible to achieve excellence in its products and services unless a good quality culture has been fostered. Thus, an integrated system connects business improvement elements in an attempt to continually improve and exceed the expectations of customers, employees, and other stakeholders.

- **Strategic and systematic approach**. A critical part of the management of quality is the strategic and systematic approach to achieving an organization's vision, mission, and goals. This process, called strategic planning or strategic management, includes the formulation of a strategic plan that integrates quality as a core component.

- **Continual improvement**. A major thrust of TQM is continual process improvement. Continual improvement drives an organization to be both analytical and creative in finding ways to become more competitive and more effective at meeting stakeholder expectations.

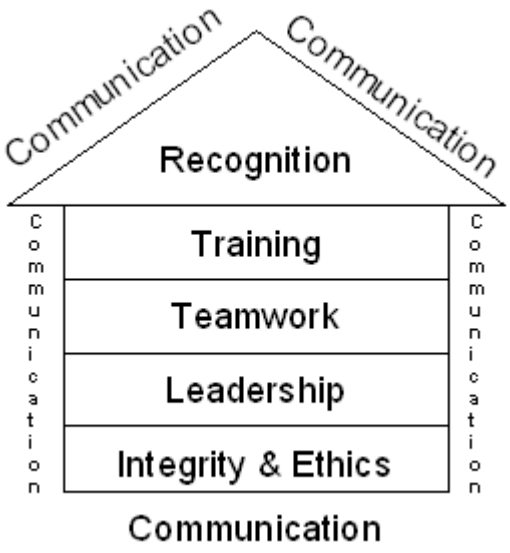
- **Fact-based decision making**. In order to know how well an organization is performing, data on performance measures are necessary. TQM requires that an organization continually collect and analyze data in order to improve decision making accuracy, achieve consensus, and allow prediction based on past history.

- **Communications.** During times of organizational change, as well as part of day-to-day operation, effective communications plays a large part in maintaining morale and in motivating employees at all levels. Communications involve strategies, method, and timeliness.

EIGHT ELEMENTS OF TQM

To be successful implementing TQM, an organization must concentrate on the eight key elements:

1. Ethics
2. Integrity
3. Trust
4. Training
5. Teamwork
6. Leadership
7. Recognition



8. Communication

Key Elements

TQM has been coined to describe a philosophy that makes quality the driving force behind leadership, design, planning, and improvement initiatives. For this, TQM requires the help of those eight key elements. These elements can be divided into four groups according to their function. The groups are:

I. Foundation – It includes: Ethics, Integrity and Trust.
II. Building Bricks – It includes: Training, Teamwork and Leadership.
III. Binding Mortar – It includes: Communication.
IV. Roof – It includes: Recognition.

I. Foundation

TQM is built on a foundation of ethics, integrity and trust. It fosters openness, fairness and sincerity and allows involvement by everyone. This is the key to unlocking the ultimate potential of TQM. These three elements move together, however, each element offers something different to the TQM concept.

1. Ethics – Ethics is the discipline concerned with good and bad in any situation. It is a two-faceted subject represented by organizational and individual ethics. Organizational ethics establish a business code of ethics that outlines guidelines that all employees are to adhere to in the performance of their work. Individual ethics include personal rights or wrongs.

2. Integrity – Integrity implies honesty, morals, values, fairness, and adherence to the facts and sincerity. The characteristic is what customers (internal or external) expect and deserve to receive. People see the opposite of integrity as duplicity. TQM will not work in an atmosphere of duplicity.

3. Trust – Trust is a by-product of integrity and ethical conduct. Without trust, the framework of TQM cannot be built. Trust fosters full participation of all members. It allows empowerment that encourages pride ownership and it encourages commitment. It allows decision making at appropriate levels in the organization, fosters individual risk-taking for continuous improvement and helps to ensure that measurements focus on improvement of process and are not used to contend people. Trust is essential to ensure customer satisfaction. So, trust builds the cooperative environment essential for TQM.

II. Bricks

Basing on the strong foundation of trust, ethics and integrity, bricks are placed to reach the roof of recognition. It includes:

4. Training – Training is very important for employees to be highly productive. Supervisors are solely responsible for implementing TQM within their departments, and teaching their employees the philosophies of TQM. Training that employees require are interpersonal skills, the ability to function within teams, problem solving, decision making, job management performance analysis and improvement, business economics and technical skills. During the creation and formation of TQM, employees are trained so that they can become effective employees for the company.

5. Teamwork – To become successful in business, teamwork is also a key element of TQM. With the use of teams, the business will receive quicker and better solutions to problems. Teams also provide more permanent improvements in processes and operations. In teams,

people feel more comfortable bringing up problems that may occur, and can get help from other workers to find a solution and put into place. There are mainly three types of teams that TQM organizations adopt:

6. Leadership – It is possibly the most important element in TQM. It appears everywhere in organization. Leadership in TQM requires the manager to provide an inspiring vision, make strategic directions that are understood by all and to instill values that guide subordinates. For TQM to be successful in the business, the supervisor must be committed in leading his employees. A supervisor must understand TQM, believe in it and then demonstrate their belief and commitment through their daily practices of TQM. The supervisor makes sure that strategies, philosophies, values and goals are transmitted down through out the organization to provide focus, clarity and direction. A key point is that TQM has to be introduced and led by top management. Commitment and personal involvement is required from top management in creating and deploying clear quality values and goals consistent with the objectives of the company and in creating and deploying well defined systems, methods and performance measures for achieving those goals.

III. Binding Mortar

7. Communication – It binds everything together. Starting from foundation to roof of the TQM house, everything is bound by strong mortar of communication. It acts as a vital link between all elements of TQM. Communication means a common understanding of ideas between the sender and the receiver. The success of TQM demands communication with and among all the organization members, suppliers and customers. Supervisors must keep open airways where employees can send and receive information about the TQM process. Communication coupled with the sharing of correct information is vital. For communication to be credible the message must be clear and receiver must interpret in the way the sender intended.

There are different ways of communication such as:

A. Downward communication – This is the dominant form of communication in an organization. Presentations and discussions basically do it. By this the supervisors are able to make the employees clear about TQM.

B. Upward communication – By this the lower level of employees are able to provide suggestions to upper management of the affects of TQM. As employees provide insight and constructive criticism, supervisors must listen effectively to correct the situation that comes about through the use of TQM. This forms a level of trust between supervisors and employees. This is also similar to empowering communication, where supervisors keep open ears and listen to others.

C. Sideways communication – This type of communication is important because it breaks down barriers between departments. It also allows dealing with customers and suppliers in a more professional manner.

IV. Roof

8. Recognition – Recognition is the last and final element in the entire system. It should be provided for both suggestions and achievements for teams as well as individuals. Employees strive to receive recognition for themselves and their teams. Detecting and recognizing contributors is the most important job of a supervisor. As people are recognized, there can be

huge changes in self-esteem, productivity, quality and the amount of effort exhorted to the task at hand. Recognition comes in its best form when it is immediately following an action that an employee has performed. Recognition comes in different ways, places and time such as,

- Ways – It can be by way of personal letter from top management. Also by award banquets, plaques, trophies etc.
- Places – Good performers can be recognized in front of departments, on performance boards and also in front of top management.
- Time – Recognition can given at any time like in staff meeting, annual award banquets, etc.

PRINCIPLES OF TQM

1. Add value to the process:
Every action by every employee should add value to the process or product in every way all the time. Enhance your work by your actions.

2. Deliver quality on time all the time.
Develop a pattern of delivering perfect products & services on time. Rate your sources by their ability to do this.

3. Base business relationships on mutual trust and confidence:
Providers and Suppliers build trust and confidence through quality and deliverability. Customers build it by quick payment and clear lines of communication. Reliability, Forthrightness, and Honesty are the Basis of forming Business Relations.

4. Train individuals and teams to solve problems:
Teach Problem -Solving Tools / Techniques & Teaming as the means to solve quality, safety, productivity, and deliverability problems.

5. Empower employees
-to be responsible for Quality, Safety, Productivity and Deliverability. Empowering means giving
workers responsibility for their actions affecting their work.

6. Deed 'ownership' of process to employees
-who have proven their capability. Reward and reinforce empowerment with Incentives, Job Security and Equity Sharing. Make employees owners of the process, not attendants.
7. Implement the new technology:
Use modern information resources, internet, databases, telecommunications, applications software, and project scheduling as tools to improve productivity. Use Statistical Process Control (SPC) to eliminate errors and defects and continually improve the system.

8. Collect, measure and evaluate data
- before Making Decisions. "It never hurts to turn the light on." (J. DeSimone). Make Decisions based on evidence. "If you can't measure it, you can't evaluate it."

9. Apply the '80/20' principle:

Use this Problem-Solving Tool to put problems into 'Trivial Many' and 'Vital Few' categories. Record the causes and frequencies of problems on a Tally Sheet. Develop this into a Pareto Chart which plots the frequencies (most- to least-important) of the problems. 20% of the causes create at least 80% of the problems. Importance of resolving vital problems first.

10. Develop 'win-win' scenarios:
Create solutions that will benefit all parties. Cooperation that develops synergism is the best solution.

11. Develop a master plan:
Good Design Precedes Good Craftsmanship. A well-designed plan tracks and benchmarks an action through to its completion. "Quality begins at the Design Level." (Marty Madigan)

12. Plan for all contingencies:
Prepare for all solutions by developing alternatives. If necessary, flowchart plans dealing with all possible alternatives. Apply 'If-Then-Else' type of logic to problems.

13. Make zero defects and accidents your goal:
Use the tools of TQM, SPC, and Problem-Solving to achieve these goals by detecting and eliminating the causes.

14. Qualify your sources and suppliers:
Use Quality and Deliverability as the basis for selecting the source of your materials and services.

15. Deliverability:
The Right Product at the Right Place at the Right Time. In world-class Just-in-Time (JIT) delivery systems, source parts are used without delay and inspection in the process.

16. Meet the needs of your customers:
Customers are anyone affected by your work: co-workers, team members, management, & especially the end-users. They are the rationale for your work. The justification for your work is to deliver products or services that meet or exceed their requirements.

17. Improve continuously and always:
Institute continuous improvement & life-long education, principles based on the 14 Points by W. Edwards Deming. Optimize your curve. They constitute an ever expanding continuum. Add to this list.

IMPLEMENTATION OF TQM:

The implementation of the quality management is a fourteen-step implementation procedure as detailed below:-

1. **Management commitment**: The management should show their commitment by declaring a clear cut corporate policy on quality needs. The commitment in 'quality policy' should be simple, real and easily understandable. Secondly the quality should be periodically and regularly discussed in the 'Management Review Meeting' in specific quantifiable terms. The CEO in all his talks should reflect his commitment to the quality and motivate the employees accordingly.
2. **Quality improvement team**: It is cross-functional and the members should be capable of helping the individual teams and employees in quality improvement activities. The

quality improvement team needs a clear direction and leadership. This team is one of the key parts of the process and helps in coordination and support. The quality improvement team should schedule the education programs and create company-wide events. The chair person of the team should be one of the members of the top team and should have a clear understanding of the overall strategy and the power to influence the same.

3. **Measurement** : the quality improvement team must devise ways and means of measuring the evidence of improvement from the existing way of doing the things. Every function and sub-function is a process which has an input and an output. The objective of the process is value addition. The cost of input resources should be less than the value added for the process be efficient. The effectiveness of the process is determined by its extent of achievement of the organisational goal. All the assessment of input, output, value addition, cost of resources , business objective, etc. needs quantified measurements and units against which the same can be evaluated.
4. **Cost of quality**: the quality improvement team plans and implements a strategy to measure the cost of non-conformance and undertake quality improvement projects to minimise the same progressively until it reaches the target of ' zero defect' by installing a full proof system 'do it right the first time'. The quality improvement team should be able to bring the cost of non-conformance to nil. The cost of conformance should be maintained at a reasonable level to retain the improvements and hold the gains.
5. **Quality awareness**: The quality improvement team should create a no of education and training programmes to create the awareness about quality and its various aspects as propagated by Crosby. The team should create the significance of quality for the organisational success .the team should also define the losses due to the cost of non-conformance and how to reduce it. The creation of quality awareness in the organisation will create self-motivated employees for an excellent performance.
6. **Corrective action** : The quality improvement team should identify all the cost of non-conformance and plan corrective actions and get it implemented to reduce the cost of non-conformance to zero.All the employees as well as the management should develop a habit of taking immediate corrective actions as and when deviations take place.
7. **Zero defect planning** : When the performance of the organisation and its employees has reached a reasonably good level the quality improvement team moves ahead and plans for a foolproof system of the zero defect or the DO IT RIGHT THE FIRST TIME culture. The suitable quality improvement tools are implemented for elimination of the organisational problems.
8. **Employee education** : now the quality improvement team with the help of the consultants imparts training and education on the 'quality improvement tools' for systematically and scientifically undertaking the quality improvement projects and reducing the cost of non-conformnace.
9. **Zero defect days**: the quality improvement team plans for occasional zero defect days as the practical implementation of the zero defect planning.The team closely monitors the processes and the activities on a zero defect day and ensures that the employees actually believes that zero defect is possible by seeing the actual zero defect day happening.
10. **Goal setting** : The quality improvement team should help individual functions and activities set up their on individual objectives and goals and suitable quality improvement project for the same.The team should set up for itself the attainment of the organisational objective and a strategic action plan for the same.
11. **Error cause removal** : the quality improvement team should not settle down for the corrective action alone after finding out the root cause of the problem as it will give only temporary relief from the cost of non-conformance.there is a good likelihood that the

problem may repeat again.hence the quality improvement team should find out the root cause of each problemand try to take preventive action for the removal of the root cause.

12. **Recognization :** the quality improvement team should recognize good efforts done by the individual or the quality improvement team by giving awards ,promotions.the recognition is important for the growth and prosperity of the organisation and the motivation of employee.
13. **Quality council** : The quality improvement team should submit a periodic report of the activity of the quality improvement projects to the quality council.concil discusses all the quality improvement activities and takes a decision on their implementation along with the resource allocation and revises their implementation periodically.
14. **Do it over again** : The quality improvement team take stock of the successful quality improvement projects and measure the gain from such projects . The quality council and the quality improvement team now examine critically all the functions and try to identify the area where the similar spin-off projects can be taken up straight way for implementation.

ADVANTAGES OF TQM

The advantages of total quality management (TQM) include:

- Strengthened competitive position
- Adaptability to changing or emerging market conditions and to environmental and other government regulations
- Higher productivity
- Enhanced market image
- Elimination of defects and waste
- Reduced costs and better cost management
- Higher profitability
- Improved customer focus and satisfaction
- Increased customer loyalty and retention
- Increased job security
- Improved employee morale
- Enhanced shareholder and stakeholder value
- Improved and innovative processes

BARRIERS TO IMPLEMENTING TQM

- Lack of management commitment
- Company culture cannot change
- Plans are not well thought out.
- Poor measurement techniques
- Lack of teamwork.
- Focus on short term profits
- High employee turnover
- Lack of training. No one to lead the company through the process
- Management does not reward success
- Employees are fearful of losing their jobs.

MODULE 6

MODULE 6

Construction procedures: different methods of construction – types of contract – Tenders – prequalification procedure - earnest money deposit – contract document – General and important conditions of contract - measurement and measurement book - Inspection and quality control - need, principles and stages. Basics of Total Quality Management

Contract

- **An agreement enforceable by law is called contract.**

- A contract invariably follows a proposal from one party and its acceptance by the other

- As per P.W.D., contract is an agreement or undertaking by a person or firm to do some work under certain terms and conditions. The work may be for the construction or maintenance and repairs, for the supply of materials, for the supply of labours, for transport of materials etc.

Types of contract

Following are the important types of contract for execution of Civil Engineering works

1. Item rate contract
2. Percentage rate contract
3. Lump-sum contract
4. Labour contract
5. Materials supply contract
6. Cost plus percentage rate contract
7. Cost plus fixed fee contract
8. Cost plus sliding or fluctuating fee-scale contract
9. Target contract
10. Negotiated contract

Types of contract cont..,

1. Item rate contract (or unit price contract or schedule contract)

- A contractor undertakes the execution of work on an item rate basis
- He is required to quote rate for individual item of work on the basis of schedule of quantities furnished by the department.
- The payment to the contractor is made on the basis of the detailed measurement of different items of work actually executed by him

Types of contract cont..,

2. Percentage rate contract

- In this form of contract, the department draws up ‘item rate tender’ i.e., bill of quantities with-rate, amount and total amount
- The contractors are required to offer to carry out the work as per with the rates shown in the specific price schedule or some percentage above or below the rates indicated in the schedule of work attached with tender

Types of contract cont..,

3. Lump- Sum contract

- In this form of contract, a contractor is required to quote a fixed sum for execution of work complete in all respect in the stipulated time according to the drawing, design and specifications supplied to him with the tender

4. Labour contract

- In labour contract, the contractor undertakes contracts for the labour portion only excluding the materials which are arranged and supplied at the work site by the department/owner

Types of contract cont..,

5. Material supply contract

- In this form of contract, a contractor has to offer his rates for supply of the materials, inclusive of all local taxes, carriage and delivery charges to the specified stores within the time limit prescribed in the tender

6. Cost plus percentage rate contract

- In this type of contract, a contractor agrees to take the work of construction on the actual cost of work plus one agreed percentage in addition, for his service

Types of contract cont..,

7. Cost plus fixed fee contract

- The contractor is paid by the owner an agreed fixed lump-sum amount over and above actual cost of work. This fixed fee will include profit to the contractor

8. Cost plus sliding or fluctuating fee scale contract

- The contractor gets actual cost of construction plus an amount of fee (% of construction cost) inversely variable according to the increase or decrease of the estimated cost agreed first by both the parties

Types of contract cont..,

9. Target contract

- The contractor is paid on cost plus percentage basis of work and in addition he receives a percentage plus or minus on savings or excesses effected against a prior agreed estimated by measuring the work on completion and valuing at prior agreed rates

10. Negotiated contract

- When the contract is awarded without calling tenders on the basis of negotiation only, it is called negotiated contract. It may be any form discussed above

Tenders

- Tender is an offer in writing to execute some specific work at certain rates, within a fixed time under certain conditions of contract and agreement between the contractor and the owner
- For execution of a work through a contractor, tenders are called. By this it is possible to obtain lowest cost and select experienced and competent contractors taking advantage of competition among contractors.

Tender Document

Tender documents generally consists of ;

1. Notice inviting tender (N.I.T.)
2. Tender form
3. Standard conditions of contract
4. Schedule of quantities of works to be done
5. Tools and plants to be supplied by Client, if any.
6. Special terms & conditions
7. Complete specification of work & materials to be used.
8. A set of approved drawings where necessary.
9. Programme of works
10. The name of authority who is competent to accept or reject the tender
11. Dispute resolution
12. Nature / scope of work & its location.

Notice inviting tender/ tender notice

- Tender notice is issue in the prescribed form for calling tenders for execution of some work.

•This essentially contains

1. Name of Client/ authority inviting tender
2. Description of work
3. Estimated cost of work / PAC (probable amount of contract)
4. Price of tender form & other documents
5. Earnest money deposit
6. Security deposit
7. Eligibility criteria
8. Acceptance/ evaluation of tender
9. Retention Money
10. Time of completion
11. Last date & time & place of sale of tender
12. Last date & time & place of submission of tender
13. Tender opening date & time

Notice inviting tender/ tender notice

रेल विकास निगम लिमिटेड
Rail Vikas Nigam Limited
(A Government of India Enterprise)

Mezzanine Floor, Tirumailai Railway Station, Mylapore, Chennai 600 004. Phone & Fax : 044 - 2461 8460

NOTICE INVITING TENDER **Dated : 22.06.2016**

Executive Director/Projects invites bids for the following work:

Sl. No.	Name of the work	Estimated cost (in Rs.)	Last date for obtaining bid document	Time and Date for submission of sealed bid	Time and date of opening of bid	Cost of the bidding document
Bid Notification No. RVNL/ED/P/MAS/MDU – TN/Bridges/OT-01 dated 22.06.2016						
1	Provision of Doubling of track between Madurai to Tuticorin – Construction of Major bridges, RCC Box Bridges and Pre cast RCC Box segments in Madurai Division of Southern Railway, Tamil Nadu	90.70 Crores	28.07.2016 Up to 17.00 hours	29.07.2016 @ 11.00 Hrs.	29.07.2016 @ 11.30 Hrs.	Rs.20,000/- and Rs.2,000/- extra by post.

Pre-bid meeting will be held on 13.07.2016 @ 15:00 Hrs. at the Corporate Office, Rail Vikas Nigam Limited, 1st Floor, 'B' Block, August Kranti Bhawan, Bhikaji Cama Place, New Delhi – 110 066. Full details are available at our website www.rvnl.org from 23.06.2016.

Executive Director/Projects

Notice inviting tender/ tender notice KERALA PWD

APPENDIX 2000A

Tender Notice (As per Para 2003)

Tenders are invited from registered contractors for the following works. -

Sl No.	Name of work	Probable amount of contract	Period of completion	Earnest money	Cost of tender form & where available	Last date of sale of tender form	Date of receipt of tender	Office where tender should be submitted	Remarks
1	2	3	4	5	6	7	8	9	10

Place.

Designation

Date.

Earnest money deposit

- **It is an assurance or guarantee on the part of the contractor to keep open the offer for consideration and to confirm his intention to take up the work if accepted in his favour for execution as per the terms and conditions in the tender**
- Usually 1% to 2% of the total estimated cost of the work has to be deposited
- **Main objects of collecting earnest money**
  - Compensation
  - Punishment
  - Restriction on unnecessary competition

Security deposit

- **The contractor whose tender has been accepted is to deposit 10% of the tendered amount as security money with the department inclusive of the earnest money already deposited**
- It is refunded after satisfactory completion of the whole work within specified time limit
- If the contractor fails on this, his whole or part of the security money is forfeited by the department as a punishment

Tender form

- This is a part of tender document
- It is a printed standard form giving the bill of quantities, contractors rates, and cost of work, estimated money, security deposit, time allowed for the work, columns for signature of contractor, signature of witness to contractor's signature and signature of the officer
- Here contractor confirms his bid after reviewing and agreeing on the following,
  - Contract documents
  - Site visit & Environmental condition &
  - Confirming all information obtained affecting the tender.

Template of Contract agreement as per FIDIC (International Federation of Consulting Engineers)

CONTRACT AGREEMENT

This Agreement made the _____ day of _____ 19 _____

Between _____ of _____ (hereinafter called "the Employer") of the one part, and _____ of _____ (hereinafter called "the Contractor") of the other part

Whereas the Employer desires that the Works known as _____ should be executed by the Contractor, and has accepted a Tender by the Contractor for the execution and completion of these Works and the remedying of any defects therein,

The Employer and the Contractor agree as follows:

1. In this Agreement words and expressions shall have the same meanings as are respectively assigned to them in the Conditions of Contract hereinafter referred to.

2. The following documents shall be deemed to form and be read and construed as part of this Agreement:

2. The following documents shall be deemed to form and be read and construed as part of this Agreement:

(a) The Letter of Acceptance dated _____

(b) The Letter of Tender dated _____

(c) The Addenda nos. _____

(d) The Conditions of Contract

(e) The Employer's Requirements

(f) The completed Schedules, and

(g) The Contractor's Proposal.

3. In consideration of the payments to be made by the Employer to the Contractor as hereinafter mentioned, the Contractor hereby covenants with the Employer to design, execute and complete the Works and remedy any defects therein, in conformity with the provisions of the Contract.

4. The Employer hereby covenants to pay the Contractor, in consideration of the execution and completion of the Works and the remedying of defects therein, the Contract Price at the times and in the manner prescribed by the Contract.

4. The Employer hereby covenants to pay the Contractor, in consideration of the execution and completion of the Works and the remedying of defects therein, the Contract Price at the times and in the manner prescribed by the Contract.

In Witness whereof the parties hereto have caused this Agreement to be executed the day and year first before written in accordance with their respective laws.

SIGNED by: _____	SIGNED by: _____
for and on behalf of the Employer in the presence of	for and on behalf of the Contractor in the presence of
Witness: _____	Witness: _____
Name: _____	Name: _____
Address: _____	Address: _____
Date: _____	Date: _____

V

Types of Tender

- **Open tender** – open tender is an arrangement where an advertisement in newspapers or trade journals invites contractors to apply for tender documents. Open tender is a transparent process which ensures that only the contractor with the best price and meeting all the technical requirements will win the tender.

- **Limited / Closed / Selective tender** – in this only prequalified or known bidders are allowed to participate. Limited tenders are not advertised in newspapers , as a result other bidder generally do not come to know that such tender is floated. Lowest bidder wins the contract.

Types of Tender cont..,

- **Global tender** – For big & specialised job , global tenders are invited by the authority throughout the Globe to get competitive offers from reputed firms throughout the world. The particulars & contents of the tender notice is same as that of ordinary tender notice.

- **Negotiated/ Invited tender** – under this tender method normally one contractor is approached and such tender mainly used for specialist work such as lift system or airport project at big level, in such case there are limited number of contractor who do such work in the market. It is based on one to one discussion with contractors to negotiated the terms of contract.

Work order

- When a letter of acceptance is received by the contractor, a formal agreement takes place between the contractor and the authority/owner.
- The contractor is instructed to take possession of the site and start the work immediately
- The letter of the purpose is called work order which is handed over to the contractor

TABLE 8.1			
Division. . Subdivision Headquarter			
Particular of warks	Rate	Per	Remarks
1. 2. 3.			
Sd/ Contractor			Sd/ Officer incharge

Prequalification of Contractor

Criteria for qualification include

- Only those contractors who has carried out similar nature of work of a minimum contract sum is qualified & requested to submit tender.
- Work quality – quality accreditation requirement
- Past performance/ experience record within certain time period.
- Overall competence
- Health and safety record / accreditation
- Financial stability / resource – often balance sheet certified by chartered accountant for a time period.
- Size and resources – including personnel, equipment etc
- Technical and organisational ability
- Ability to innovate – alternate proposal

Contract Document

The following documents defining the rights and obligations of the owner and the contractor are attached to the agreement bond and this is called a contract document

1. Title Page
2. Index
3. Tender Notice
4. Letter of acceptance of tender & written order to commence work
5. Any correspondence between the contractor and the Client /Consultant/ Engineer in clarification of rate or terms of contract.
6. Tender form
7. Conditions of Contract
   - A) general conditions
   - B) Particular conditions
8. Schedule of items of work / BOQ
9. General & additional specification
10. Schedule of issue of materials and tools & plants
11. Labour regulation & safety
12. A complete set of drawings including plans, section & elevations

Conditions of Contract

Conditions of Contract for Works of Civil Engineering Construction :

Part 1 – general conditions

- The Part – I General Conditions, has 72 Clauses with forms of Tender and Agreement.
- Appendix – Dispute Review Board Agreement

Part 2 –conditions of particular application

- The General Conditions are linked with the "Condition of Particular Application", referred to as Part II, by the corresponding numbers of the clauses, so that Part I & II together, comprise the conditions governing the rights and obligations of the parties.
- Normally, the printed version of the General Conditions of Contract is adopted as Part I.
- Part II must be specially drafted to suit each individual contract.

Conditions of Contract cont..,

Web Reference

Measurement & Measurement Book

- Measurement for all works done and supplies received in connection with sanctioned estimate are recorded in a special type of Note Book known as Measurement Book.
- Payments to Contractors & suppliers and other for the work done or materials supplied are made on the basis of measurement recorded in a Measurement Book.
- It is so written that the transactions are readily traceable.

Measurement Book Kerala PWD

Name of Work: Date of measurement
Name of contractor Agreement No.

Reference to estimate		Particulars	1	2	3	4	5	6		7		8			9		Remarks
Sub head	Item no		Measurement up-to-date					Rate		Total value to date		Deduct previous measurement			Since last measurement		
			No	L	B	D	Contents or area	Rs	p	Rs	p	book	Page	quantity	Quantity col (5-8)	Value at rate in col. 6 Rs p	

Different methods of construction

Different methods of construction

Three Basic Sectors of Construction :

- Buildings: Building construction is usually further divided into residential and non-residential (commercial/institutional). Provides places where people live, such as houses, apartments and the office, factory buildings etc.
- Commercial/Industrial Construction: Industrial construction includes refineries, process chemical, power generation, mills and manufacturing plants. It also includes office structures, shopping malls, and factories, as well as churches and other houses of worship.
- Civil Construction/ infrastructure: Infrastructure is often called heavy civil or heavy engineering that includes large public works, dams, bridges, highways, railways, water or wastewater and utility distribution.

Methods of Building Construction

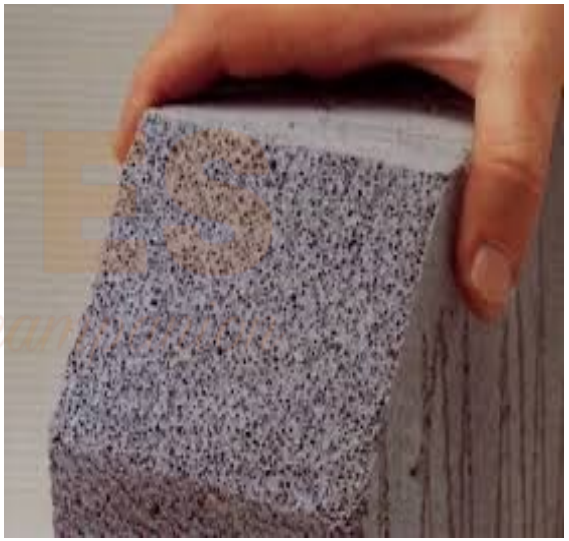
1. Traditional Construction:

- The term ‘traditional build’ is most often used to describe a structure where the internal load bearing leaf of the walling is of masonry construction.
- Although Modern Methods of Construction are taking building practices into the future, traditional brick and block methods still remain one of the most widely used build types.

Methods of Building Construction contd.

2. Lightweight Aerated (Aircrete) Blocks:

- Lightweight Aerated (Aircrete) Blocks are suitable for foundations, internal and external leaves of cavity walls, solid walls, internal walls and party walls.
- They provide a far greater thermal efficiency but usually require the application of an external wall insulation system to achieve current building regulations.



Methods of Building Construction contd.

3. Thin joint blockwork :

- Thin joint blockwork (thin joint masonry) is a fast, clean, accurate system for construction using autoclaved aerated concrete blocks of close dimensional tolerance with 2mm-3mm mortar joints.
- Thin layer mortar is a pre-mixed cement-based product that only requires the addition of water to make an easily-applied mortar.
- It differs from general use mortar in that it sets more rapidly, thus giving early stability to the construction.
- It provides an alternative to traditional sand/cement mortar and allows the depth of the mortar to be reduced from at least 10mm to 3mm or less.

Methods of Building Construction contd.

4. Precast Flat Panel System:

- Floor and wall units are produced off-site in a factory and erected on-site to form robust structures, ideal for all repetitive cellular projects.
- Panels can include services, windows, doors and finishes.
- Building envelope panels with factory fitted insulation and decorative cladding can also be used as load-bearing elements.
- This offers factory qu ther with speed of erection c

Methods of Building Construction contd.

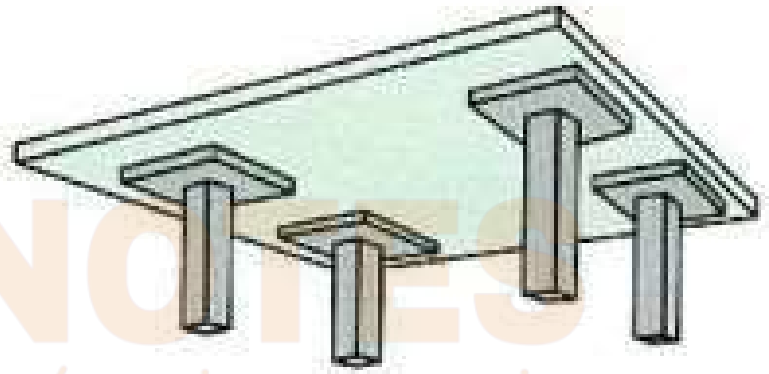
5. 3D Volumetric Construction:

- 3D Volumetric construction (also known as modular construction) involves the production of three-dimensional units in controlled factory conditions prior to transportation to site.
- Modules can be brought to site in a variety of forms, ranging from a basic structure to one with all internal and external finishes and services installed, all ready for assembly.

Methods of Building Construction contd.

6. Flat Slabs:

- Flat slabs are built quickly due to modern formwork being simplified and minimised.
- Rapid turnaround is achieved using a combination of early striking and panelised formwork systems.



Methods of Building Construction contd.

7. Twin Wall Technology:

- The prefabricated panels comprise two slabs separated and connected by cast-in lattice girders.
- The units are placed, temporarily propped, and then joined by reinforcing and concreting the cavity on site.
- Twin wall is usually employed in association with precast flooring systems.

Methods of Building Construction contd.

8. Precast Foundations:

- Precast concrete systems can be used to rapidly construct foundations.
- The elements are usually to a bespoke design and cast in a factory environment, giving assured quality for the finished product.
- The foundations are often supported by concrete piles and connected together.

Inspection and quality control - need, principles and stages

Inspection and quality control - need, principles and stages

Quality:

- "Quality is fitness for use."
- "The totality of features and characteristics of a product or service that bear on its ability to satisfy a given need."
- "Quality involves meeting customers need, preferences and exceeding it."
- "Quality also encompasses people, process and environment."

TQM – total quality management :

- TQM means that the organization's culture is defined by and supports the constant attainment of customer satisfaction through an integrated system of tools, techniques and training.
- This involves the continuous improvement of organizational processes, resulting in high quality products and services.

Quality

Categories of Quality:

- **Quality of Design**: Quality of design of a construction is concerned with the specifications which have to be conformed with. A good quality of design must ensure consistent performance of the facility for the entire life span of the facility.
- **Conforming to Quality:** Conforming to quality means the quality of the product/construction to be of a required order. Use of proper quality of materials, proper work sequences, proper types of equipment and inspections from time to time are factors which should be considered.
- **Quality of Performance:** It is connected with how well the constructed facility gives its performance. It depends on both the quality of design and the quality of conformance.

Quality

Characteristics of Quality:

Quality characteristics may be defined in terms of parameters which may be of the following types:

- Technical parameters – length, viscosity, etc.
- Psychological parameters – taste, beauty, etc.
- Time parameters – speed, life span, etc.
- Contractual parameters – safety, reliability, etc.
- Ethical parameters – honesty, integrity, nature, etc.

Quality control and inspection

Quality Control:

- Quality control are those planned and systematic actions which provides a mean to control and measure the characteristics of a product, process or a service to established requirements
- Quality control includes all such procedures, tools, specifications and the system of norms & specifications which are used to control the quality of an object.

Quality Inspection:

- The ISO standard defines inspection as “activity of measuring, examining, testing one or more characteristics of a product or service and comparing the results with specified requirements in order to establish whether conformity is achieved for each characteristic.”

Need of Quality management

- Quality management ensures that stakeholders are satisfied that their planned benefits have the best chance of being realised and will meet their expectations.

- Quality management must be an activity that runs continuously throughout the life of project and beyond

- If a project does not apply quality effectively to its activities, its assets and outputs are less likely to be fit for purpose, with the consequential detrimental impact on the outcomes and desired benefits.

Need of Quality management contd.

There are some benefits of maintaining quality in the construction. These may be expressed as below:

- Increase in efficiency because of quality consciousness
- Reduction of scrap due to less number of items being rejected
- Easy identification of construction faults
- Decrease in cost in the long run due to benefits of quality control
- Creating quality consciousness in workers

Quality control in construction

Quality of construction is dependent, to a great extent, on;

- The quality of materials which are used in construction
- The expertise of workers
- The technology adopted in construction
- Number, type and quality of inspections
- Quality consciousness of people
- Funds available for construction and quality control
- Time available for quality control procedures
- Existence of norms and guidelines for assessing quality of construction of a particular type
- Experience and expertise of inspectors
- Quality of design
- Nature of the construction project

Stages of Quality management

The specific scope of quality management may be limited to its key functions of quality planning, quality assurance and quality control.

- **Quality planning** refers to the identification of relevant quality standards and determining how to satisfy them.

- **Quality assurance** activities include consistent evaluation of project performance to provide confidence that the project satisfies the relevant quality standards.

- **Quality control** monitors project results related to the compliance to quality standards and identifying

Quality control

Quality control monitors project results related to the compliance to quality standards and identifying means to eliminate non – conformity.

There are two types of quality control:

(1) **Process control** includes control at every stage specifically; and

(2) **End Control** based on end results.

Quality control aspects for general construction operations

1. Earth Work:

Stages

- Measurement of dimensions in different directions in terms of height, width and length
- Excavation of soil
- Determination of soil properties
- Compacting soil

Quality Control Considerations

- Accurate measurements with precise instruments
- Use of good equipment
- Use of standard procedures for testing of soil
- Use of equipment for compaction

Quality control aspects for general construction operations

1. Earth Work:

Stages

- Measurement of dimensions in different directions in terms of height, width and length
- Excavation of soil
- Determination of soil properties
- Compacting soil

Quality Control Considerations

- Accurate measurements with precise instruments
- Use of good equipment
- Use of standard procedures for testing of soil
- Use of good quality equipment for compaction

Quality control aspects for general construction operations

2. Masonry:

Stages

- Measurement of dimensions in different directions in terms of height, width and length
- Construction of masonry
- Curing of masonry work

Quality Control Considerations

- Use of good quality materials
- Use of right construction procedures and correct bonds
- Employment of people with experience and expertise
- Adequate curing of masonry

Quality control aspects for general construction operations

3. Reinforced Cement Concrete:

Stages

- Measurement of dimensions in different directions in terms of height, width and length
- Creation and installation of formwork
- Provision of reinforcement
- Mixing of concrete
- Casting of concrete
- Curing of concrete

Quality Control Considerations

- Use of good quality materials
- Use of right construction procedures
- Employment of people with experience and expertise
- Correct detailing of reinforcement
- Adequate curing of concrete

Quality control aspects for general construction operations

4. Sanitary and Water Supply Services

Stages

- Measurement of dimensions in different directions in terms of length as well as area covered
- Procurement of sanitary and water supply items
- Installation of these items correctly
- Testing of these items

Quality Control Considerations

- Use of good quality materials and items
- Use of right construction procedures
- Employment of people with experience and expertise

Quality control aspects for general construction operations

5. Electrical Services:

Stages

- Measurement of dimensions in different directions in terms of length as well as area covered
- Procurement of items
- Installation of these items correctly
- Testing of these items

Quality Control Considerations

- Use of good quality materials and items
- Use of right connection procedures
- Employment of people with experience and expertise

Ref

- https://nptel.ac.in/courses/105103093/9
- https://www.slideshare.net/guestdb5e498/conditions-of-contract
- https://www.slideshare.net/arpitkvnfc/conditions-of-cpwd-contract-in-india
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Thank you...!!!