

CONSTRUCTION QUALITY, SAFETY AND HUMAN VALUES

INTRODUCTION

Quality not only impacts aesthetics, appearance, durability and it also impacts performance. And poor performance can lead to failures in everything from an improperly installed section of roof flashing resulting in a leak to the deflection of a structural steel beam resulting in a roof collapse.

The characteristics of a good quality management plan and a good safety management plan are quite similar. Although each is defined by distinct concepts and specific mechanisms of control, which, it makes sense to administer quality and safety plans as one integrated management function.

Good contractors stake their reputations on-quality and safety. Successful construction manager's/ Site engineers are well-aware of what they must do to achieve quality results and maintain high safety performance. They must do the following:

- Insist upon good quality plans and specifications whenever possible.
- Provide experienced and adequate supervision on all jobs.
- Provide thorough and adequate inspections.
- Make sure that all workers are qualified to do the job they are hired to do.
- Never accept inferior work.

Although the project manager and superintendent are accountable for developing and implementing the quality and safety plans on the job, they must have support and participation from the field: quality and safety are ultimately achieved at the labour force level. Employees and subcontractors alike must embrace the plans and be encouraged in and recognized for their efforts to produce high-quality work and a safe work environment. And when they are, it sends a loud message, not only to other workers on the job but also to the project owner and the public at large. This is (the goal of the construction manager.)

DEFINING QUALITY

The term "quality" implies that a product or deliverable is fit for the intended purpose. Fitness normally involves a wide range of criteria, such as performance, safety, reliability, ease of handling, maintainability, logistical support, and no harmful environmental impacts.

Quality also implies an absence of defects. A defect is a nonconformity-something other than what the customer had expected, a problem or mistake. One way to achieve quality is to identify and correct as many nonconformities as possible, and to identify them as soon as possible.

In construction, quality is defined as meeting or exceeding the requirements established in the design documents. Fundamentally, the quality of the construction project is set through the plans and specifications provided by the architects and engineers. There are various levels of quality that can be specified for any given project. The design team works with the owner to determine exactly what their expectations for quality are.

In construction, the job of the project team is to deliver whatever quality standard has been set for the facility by the design team.

Construction is not a perfect science, and it would be impossible to produce a project without some defects, failures, or complaints. However, the goal of the construction manager is to produce a project with as few defects, failures, and complaints as possible.

Fundamentally, quality plan must focus on three primary objectives:

1. Doing things right the first time.
2. Preventing things from going wrong.
3. Continually improving the process.

QUALITY: MANAGEMENT IN CONSTRUCTION PROJECTS

Quality management can be defined as "the application of quality management system in managing a process to achieve maximum customer satisfaction at the lowest overall cost to the organization while continuing to improve the process."

Quality in construction projects includes not only the quality of products and equipment used in the construction, but the total management approach to completing the facility as per the scope of works to customer/owner satisfaction within the budget and in accordance with the specified schedule to meet the owner's defined purpose.

The nature of the contracts between the parties plays a dominant part in the quality system required from the project, and the responsibility for fulfilling them must therefore be specified in the project documents. The documents include plans, specifications, schedules, bill of quantities, and so on.

Quality control in construction typically involves ensuring compliance with minimum standards of material and workmanship in order to ensure the performance of the facility according to the design. These minimum standards are contained in the specification documents. For the purpose of ensuring compliance, random samples and statistical methods are commonly used as the basis for accepting or rejecting work completed and batches of materials.

PROCESSES OF PROJECT QUALITY MANAGEMENT

Project quality management consists of three processes:

1. Quality planning,

Quality planning guides future quality activities; it sets the requirements and standards to be met and the actions necessary to meet them.

2. Quality assurance

Quality assurance performs the planned quality activities and ensures the project utilizes processes necessary to meet quality standards and end-item requirements.

3. Quality control.

Quality control ensures that quality assurance activities are performed according to quality plans, and that requirements and standards are being met.

4. Quality Planning

Quality planning should provide confidence that everything necessary to ensure quality has been thought through. It has two aspects:

- Establishing project quality management procedures and policies for the entire organization
- Establishing a quality plan as part of the project master plan for each project. Projects often employ quality standards that already exist in the organization, such as the ISO 9001 standard, in a quality management system.

The quality plan for construction projects is part of the overall project documentation consisting of the following

1. Well-defined specification for all the materials, products, components, and equipment to be used to construct the facility.
2. Detailed construction drawings.
3. Detailed work procedure.
4. Details of the quality standards and codes to be compiled.

Quality Assurance

Project quality assurance related to the execution of the project quality management plan. It reduces the risks related to not meeting desired features or performance requirements of deliverables.

Quality assurance covers the following:

1. Activities performed in a specific project to ensure that requirements are being met and that the project is being executed according to the quality plan.
2. Activities that contribute to the continuous improvement of current and future projects.

According to ISO, Quality assurance is defined as a set of activities whose purpose is to demonstrate that an entity (such as product, processes, person, department and organization) meets all quality requirements.

Quality assurance (QA) takes a long-range view toward developing systems that produce high-quality work consistently over time. To be effective, a good quality assurance plan must influence every aspect of the company, from the management to the field.

Project organizations that strive to continually improve their technical operations and managerial processes conduct a formal closeout or post-completion review for every project. The review happens upon completion of the project or, ideally, upon completion of each phase of the project. The reviews enable the organization to improve its technical processes and project management.

With respect to construction industry, quality assurance activities include all those planned and systematic administrative and surveillance functions initiated by project owner or regulatory agents to enforce and certify, with adequate confidence, compliance with established project quality standards to ensure that the completed structure and/or its components will fulfil the desired purposes efficiently, effectively and economically.

Quality assurance programmes cover the following:

- i) Establishing the procedure for defining, developing and establishing quality standards in design, construction and occasionally the operational stages of the structure and/or its components.
- ii) Establishing the procedure to be used to monitor, test, inspect, measure and perform current and review activities to assure compliance with established quality standards, with regard to construction materials, methods and personnel.
- iii) Defining the administrative procedure and requirements, organizational relationships and responsibilities, communications and information patterns, and other management activities required to execute, document and assure attainment of the established quality standards.

Quality Control

According to ISO, quality control is defined as a set of activities or techniques whose purpose is to ensure that all quality requirements are being met.

Quality control (QC) addresses quality at the project level and is implemented on the job site. Quality control is the ongoing process of monitoring and appraising work, and taking corrective action so as to achieve the planned quality outcomes.

The process also verifies that quality assurance activities are being performed according to the quality plan, and that project requirements and specifications are being met. All of the materials, systems, and workmanship applied to the project must conform to the requirements set forth in the contract documents.

Quality control refers to verifying adherence to specifications and standards previously set, scope verification also includes verifying acceptability of those specifications and standards. Control activities, include both planned quality control activities and adhoc problem-solving. Planned activities include, for example, site inspections on a construction project, tests on a product component, or an audit of a supplier to ensure that it is using correct materials.

QA is a construction management process while-QC is a sampling or inspection process. The focus in quality assurance is on defect prevention, while the focus in quality control is on defect detection once the item is constructed. In fact, it can be said that quality-control is an element of a quality assurance programme.

With respect to construction industry, quality control is administered by the contractors or by the specialist consultants such as consulting engineers or testing laboratories. Construction quality control needs performing inspection, test, measurement and documentation necessary to check, verify and correct the quality of construction materials and methods. Primary objectives of construction quality control are to produce a safe, reliable and durable structure so that the owner gets the best value for his investment.

Three major quality control methods commonly used on construction projects are:

1. Inspection
2. Testing
3. Sampling

QUALITY OF CONSTRUCTION

Quality of construction projects can be evolved as follows:

1. Properly defined scope of work.
2. Owner, project manager, design team leader, consultant, and constructor's manager are responsible to implement quality.
3. Continuous improvement can be achieved at different levels as follows:
4. Owner-Specify the latest needs.
5. Designer-Specification should include the latest quality materials, products and equipment.
6. Constructor-Use the latest construction equipment to build the Facility.

Establishment of performance measures

1. Owner

To review and ensure that designer has prepared the contract documents that satisfy his needs.

To check the progress of work to ensure compliance with the contract documents.

2. Consultant

As a consultant designer, to include the owner's requirements explicitly and clearly define them in the contract documents.

As a supervision consultant, supervise contractor's work per contract documents and the specified standards.

3. Contractor

To construct the facility as specified and use the materials, products, and equipment that satisfy the specified requirements

4. Team approach.

Every member of the project team should know that TQM is a collaborative effort, and everybody should participate in all the functional areas to improve the quality of the project work. They should know that it is a collective effort by all the participants.

5. Establish leadership

Organizational leadership should be established to achieve the specified quality. Encourage and help the staff and labourers to understand the quality to be achieved for the project. Quality in construction is achieved through the complex interaction of many participants in the facilities development process.

COSTS OF QUALITY IN CONSTRUCTION

Quality of construction is defined as

i) Scope of work

Cost of quality refers to the total cost incurred during the entire life cycle of construction project in preventing non conformities to owner requirements (defined scope). There are certain hidden costs that may not directly affect the overall cost of the project; however, it may cost the consultant/designer to complete the design within the stipulated schedule to meet owner requirements and conformance to all the regulatory codes/standards, and for the contractor to construct the project within the stipulated schedule meeting all the contract requirements. Rejection/non-approval of executed/installed works by the supervisor due to noncompliance with specifications will cause the contractor loss in terms of

- Material
- Manpower
- Time

The contractor shall have to rework or rectify the work, which will need additional resources and will need extra time to do the work as specified.

This may disturb the contractor's work schedule and affect execution of other activities. The contractor has to emphasize the "Zero Defect" policy, particularly for concrete works. To avoid rejection of works, the contractor has to take the following measures:

Execution of works per approved shop drawings using approved material.

Following approved method of statement or manufacturer's recommended method of installation.

1. Conduct continuous inspection during construction/installation process.
2. Employ properly trained workforce.
3. Maintain good workmanship.
4. Identify and correct deficiencies before submitting the checklist for inspection and approval of work.

ii) Time

Timely completion of a project is one of the objectives to be achieved. To avoid delay proper planning and scheduling of construction activities are necessary. Since construction projects have the involvement of many participants, it is essential that the requirements of all the participants are fully coordinated. This will ensure execution of activities as planned resulting in timely completion of the project.

iii) Budget

Normally, the construction budget is fixed at the inception of the project, therefore it is necessary to avoid variations during the construction process as it may take time to get approval of an additional budget resulting in time extension to the project.

Since quality is always related to value for the money spent, quality planning should consider the costs and benefits of quality activities. A cost-benefit analysis is performed to evaluate and justify proposed quality activities, and to compare the costs of quality assurance and control activities with the savings or benefits from fewer or eliminated nonconformities owing to those activities.

Money spent on quality assurance and control should be justified in terms of reduced risk of not meeting requirements. Costs of quality can be classified as follows

1. Prevention: costs of training, design reviews, and any activity aimed at preventing errors; includes cost of quality planning.
2. Appraisal and control: costs of evaluating products and processes, including product reviews, audits, tests, and inspections.
3. Internal failure: costs associated with nonconformities discovered by the producer; includes costs for scrap, rework, and retest.
4. External failure: costs incurred as a result of product failures after delivery to the customer; includes costs for replacements, warranty repairs, liability, lost sales, and damaged reputation.

TOTAL QUALITY MANAGEMENT

Total Quality Management (TQM) is an enhancement to the traditional way of doing business. It is a proven technique to guarantee survival in world-class competition.

Therefore, TQM is the art of managing the whole to achieve excellence. TQM is defined as both a philosophy and a set of guiding principles that represent the foundation of a continuously improving organization. It is the application of quantitative methods and human resources to improve all the processes within an organization and exceed customer needs now and in the future.

The TQM includes all activities like quality planning, quality operation and systematic evaluation. For attaining TQM in the organization, a total commitment and participation of all the members who are in the organization is essential. The responsibility for quality management should belong to top management of the organization.

TQM is a management-led approach applicable in all the operations of a company and the responsibility of ensuring quality is collective. The philosophy of TQM is one of prevention rather than defect detection. In other words, TQM is a way of thinking about goals, organizations, processes and people to ensure that -the right things are done right the first time. It is an approach to improving the competitiveness and effectiveness, and flexibility of the whole organization.

The essential elements of TQM are:

1. Management commitment and leadership
2. Training
3. Teamwork
4. Statistical methods
5. Cost of quality
6. Supplier involvement

TQM is based on the following principles:

1. Primary responsibility for product quality rests with top management.
2. Quality should be customer focused and evaluated using customer-based standards.
3. The Production process and work methods must be designed consciously to achieve quality conformance
4. Every employee is responsible for achieving good product quality.
5. Quality cannot be inspected into a product, so make it right the first time.
6. Quality must be monitored to identify problems quickly and correct quality problems immediately.
7. The organization must strive for continuous improvement.
8. Companies must work with, and extend TQM programs to their suppliers to ensure quality inputs.

TQM helps in

1. Achieving customer satisfaction.
2. Continuous improvement.
3. Developing teamwork.
4. Establishing vision for the employees.
5. Setting standards and goals for the employees.
6. Building motivation within the organization.
7. Developing corporate culture.

Total Quality Management in Construction Industry

Construction projects being unique and non-repetitive in nature need specified attention to maintain the quality. Each project has to be designed and built to serve a specific need. TQM in construction projects typically involves ensuring compliance with minimum standards of material and workmanship in order to ensure the performance of the facility according to the design.

TQM in a construction project is a cooperative form of doing the business that relies on the talents and capabilities of both labour and management to continually improve quality. The important factor in construction projects is to complete the facility per the scope of works to customer/owner satisfaction within the budget and to complete the work within the specified schedule to meet the owner's defined purpose.

It is believed that adoption of TQM by construction companies will result in higher customer satisfaction, better quality products and higher market share. However, adoption of TQM requires a complete turnaround in the corporate culture and management approach, as compared to the traditional way of top management giving orders and employees merely obeying those.

INTRODUCTION TO ISO 9000

ISO (International Organization for Standardization) is a worldwide federation of national standards bodies from each country. The object of ISO is to promote the development of standardization and related activities in the world with a view to facilitating international exchange of goods and services, and to developing cooperation in the spheres of intellectual, scientific, technological and economic activity. The results of ISO technical work are published as International Standards.

ISO is the International Organization for Standardization. It is located in Switzerland and was established in 1947 to develop common international standards in many areas. It is rapidly becoming the most important quality standard. Thousands of companies in over 100 countries have already adopted it.

ISO 9000 applies to all types of organizations. It can help both product and service oriented organizations achieve standards of quality that are recognized and respected throughout the world.

The term ISO 9000 refers to a set of three standards ISO 9000, ISO 9001; and ISO 9004. All three are referred to as quality management system standards. ISO's purpose is to facilitate international trade by providing a single set of standards that people everywhere would recognize and respect.

Management principles

1. ISO 9000 is based on eight management principles:
2. Customer focus, resulting in meeting customer requirements and striving to exceed them;
3. Leadership, aiming to create an internal environment in which people are fully involved;
4. Involvement of people who are the essence of an organization;
5. Process approach, resulting in improved efficiency to obtain desired results;
6. System approach to management, leading to improved effectiveness and efficiency through identification, understanding and management of interrelated processes;

7. Continual improvement, which becomes a permanent objective of the organization;
8. Factual approach to decision-making, based on the analysis of data and information; and
9. Mutually beneficial supplier relationships, based on an understanding of their interdependence.

How to implement ISO 9000

1. Following procedure adopted to get ISO certification:
2. Select an appropriate quality system model.
3. Conduct status review against the standard.
4. Develop quality system as per standard.
5. Implement quality system in line with the standard.
6. Apply for registration with certification body.
7. Get the quality system verified and certified by a recognised certification body.

Benefits of ISO 9000

The following are the benefits of ISO certification:

1. Customer satisfaction and confidence in the organization's products services
2. Management's confidence.
3. Improvement in staff performance.
4. Effectiveness in the utilization of staff.
5. Efficient utilization of time, money, and other resources.
6. Improved quality, higher productivity any profitability.
7. Consistency in products/services quality.
8. Access to global market.
9. Organisations become system dependent and not people dependent.
10. Continuous improvement in organizational process.

Although ISO does not define product quality, it ensures that customer feedback is captured and measured to improve future processes.

To enhance efficiency, competitiveness, and customer satisfaction, an increasing number of organizations are adopting the philosophy of total quality management (TQM)

QMS{IS/ISO 9001)

BIS is the National Standards Body of India and is a founder member of ISO. BIS represents India, in ISO. The Technical Committee (TC) number 176 (ISO/TC 176), and its Sub-committees of ISO are responsible for the development of ISO 9000 standards. Quality and industry experts from India including BIS officers nominated by BIS participate in the meetings of the Technical

Committee ISO/TC 176 and its Sub-committees. ISO 9001 'Quality Management Systems - Specifications with Guidance for use is a standard and adopted by BIS as IS/ISO 9001. IS/ISO 9001 is the exact replica of ISO 9001.

It is a requirements standard. It contains a set of requirements to define the operation of the Quality Management System. Since the requirements are expressed in a general form, it has the flexibility to be applied to any organization. IS/ISO 9001 is the only certification standard in the IS/ISO 9000 family.

Benefits of BIS Certification of Quality System QMS(IS/ISO 9001)

1. Conformance to the quality specification as documented by organization.
2. Ensure corrective action is taken whenever defects occur
3. Early detection of defects and avoidance of wastage.
4. Defect rates decrease and reduce costs.
5. Procedures identify current practices and that continuously improved upon.
6. Helps in training.
7. Increase in market share, increasing in sales or revenue.
8. Better management control and reporting.
9. Consistent quality.

ACCIDENTS

An unintended occurrence arising out of and in the course of employment of a person resulting in injury or an accident is defined as an event that is unplanned, undesired, unexpected and uncontrolled, and one that may or may not result in damage to property or injury to person, or both, in the course of employment or occupational accident as an unexpected and unplanned occurrence, including acts of violence, arising out of or in connection with work, which results in one or more workers incurring a personal injury, disease, or death..

Accidents in Construction Industry

Accidents in the construction industry tend to be costly in both human and financial terms. These expenses are concentrated in the areas of health care, litigations, management time, and workers compensation. Safety is not a luxury and may be considered an important function to be used against unnecessary loss of property, injury or death. Preventing occupational injuries and illness should be a primary concern of all employers. Especially in developing countries, there must be an effort to raise the level of awareness among both employees and employers of the importance of health and safety at work-sites.

Hazard's condition at construction site

Several accidents are caused by the following factors:

1. Unsafe mechanical or physical condition Example: Over loading, poor light.
2. Unsafe acts Example: Working under suspended loads, operating without authority, using damaged tools.
3. Personal factors

Construction accidents that can occur include

1. defective and collapsing scaffolds
2. falls from ladders,
3. falls from roofs and roofing structures; cranes,
4. injuries from faulty machinery like tractors and forklifts, toxic welding rod injuries; crane accidents,
5. electrical accidents,
6. power tool accidents,
7. holes in flooring,
8. construction debris accidents,
9. lift accidents,
10. fires and explosions,
11. burn injuries,

The effects of accidents in construction industry are

1. Loss of human life.
2. Temporary or permanent injuries to workers.
3. Loss or damage of materials and equipment's.
4. Loss of time in completion of work.
5. Loss of money by way of compensation, medical expenses and cost involving in re-doing the work.

In construction industry accidents due to the following causes:

1. Failing to identify an unsafe condition that existed before an activity was started or that developed after an activity was started.
2. Deciding to proceed with a work activity after the worker identifies an existing unsafe condition.
3. Carelessness of workers during the work i.e. the workers carrying heavy materials such as stones, bricks, cement concrete etc., at higher level by moving over temporary support and the painters and masons during plastering or masonry work..

4. During dismantling of the building, loose unprotected and unsafe parts such as walls, beam etc., results in accidents.
5. Due to overcrowding of workers at a particular spot of support there may be accident occurs due to failure of support
6. The greediness of contractor will lead to the accident

The objective& of safety managements are:

1. To help increase in speed in construction,
2. To increase the standard of living,
3. To reduce cost of construction,
4. To conserve the available labour force by minimizing idle time,
5. To reduce human suffering.
6. Safety in Planning and Design
7. Plan the works to meet the complete requirements.
8. Design the structure considering all the loads and to meet the codal requirements.
9. Procure and use standard material.

HEALTH AND SAFETY ISSUES FOR CONSTRUCTION WORKERS

Majority of the health issues that labours are facing in construction field are the following:

1. Pain or injury from overexertion.
2. Repetitive manual tasks, or working in uncooperative postures.
3. Exposure to moulds, fungi or rodent droppings.
4. Exposure to paints, lead, wood dust, asbestos and/or toxic chemical solutions.
5. Working in extreme conditions like high temperatures and under UV radiations.
6. Working with hand tools, powered tools and heavy machinery equipment's.
7. Excessive vibration of hands, arms or body from powered tools or equipment's.
8. Extension of work days, stress or Shift work hours.
9. During night, working in low lightening or poor visibility

SAFETY PRECAUTIONS TO PREVENT ACCIDENTS

1. The supports provided at higher levels over which the workers move in connection with the work should be strong and stable.
2. For workers moving at higher levels the support should have side protections to prevent the workers from falling due to slipping.
3. Before dismantling the building all unsafe parts should be properly protected to prevent any accidents to the workers.
4. No unskilled person should be engaged on jobs such as operation of heavy equipment's like bulldozers, cranes, etc.
5. For workers engaged in operations such as welding, etc., effective screens or proper goggles should be provided to the workers for the protection of eyes.
6. No workers should be allowed to enter into pits or chambers or confined spaces where danger fumes are present.
7. Safety training is provided for workers.
8. Making use of personal safety devices and protective equipment's(wearing Helmet, Safety belts etc.)

SAFETY MEASURES TO BE ADOPTED FOR

Excavation

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

1. In all works, an experienced and competent foreman or supervisor should look after the excavation work. He should have authority to enforce safety rules and prevent the use of defective/unsafe appliances.
2. Before doing the excavation work, a complete knowledge of underground structures (such as sewers, water pipe lines, gas mains, etc.) is essential.
3. Safety helmets should be worn by all persons entering a trench where hazards from falling stones, timber or other materials exist.
4. Whenever workmen have to excavate in trenches in soil, soft or fissured rock, or hard soil exceeding 2m in depth, the trenches should be properly shored and timbered.
5. Sheathing should be placed against the side of the trench so that the length of each piece of sheeting is vertical. Where the trench is excavated in loose or soft soil, each piece sheathing should be driven into the bottom of the trench so as to be firmly held in a place.
6. Excavated material should be kept away from the edge of the trench in order to provide a clear berm width not less than one third the final depth of excavation. However, in special cases where disposal area is limited, the minimum berm width should not be less than 1m.

Drilling and Blasting

The following safety measures should be adopted at the time of Drilling and Blasting

1. Detonators and other explosives for blasting shall be transported to the site of work in the original containers or in securely locked separate non-metallic container and shall not be carried loose or mixed with other materials.
2. Care should be taken in loading and unloading of explosives. The Shield containers shall not be handled roughly or dropped.
3. Explosives shall be stored only in a magazine which is clean, dry, well ventilated, reasonably cool, correctly located, protected against lightning.
4. Any package containing explosives shall not be dragged, dropped or handled roughly. The packages shall be opened at a safe distance.
5. Smoking shall not be permitted nor matches, open lights, fire, flame, or any other device capable of producing sparks or flame shall be carried while handling or using explosives.
6. Basting shall be carried out only, with the permission of the engineer-in-charge. The blasting operation shall remain in the charge of competent and experienced supervisor and workmen who are thoroughly acquainted with the details of handling explosives and blasting operations.
7. All the materials, tools and equipment used for blasting operations shall be of approve type.
8. No drilling shall be started until previous holes in the blasted area are flushed with air and filter.
9. The blaster shall be in good physical condition and not be under influence of drugs alcohol intoxicants, etc.
10. While planning drilling operations for blasting purposes, consideration must be given to the nature of startum and the overburden with a view to avoiding the possibilities of land-slides after blasting.
11. The face of rock shall be carefully examined before drilling, to determine the possible presence of unfired explosive.
12. The position of all holes to be drilled shall be marked out with white paint.

13. The bore hole shall be carefully checked for length, presence of water, dust, etc, with a wooden tamping pole or a measuring tape before loading. It shall be cleared of all debris before explosives are inserted. The diameter of the bore of each hole shall be greater than the outside diameter of the cartridges of explosive. The line of detonating fuse extending into a bore hole shall be cut from the spool before loading the remainder of the charge. Use of short pieces of fuse shall be prohibited for detonation purposes.
14. Surplus explosives shall not be stacked near working areas during loading.
15. Loading and drilling shall not be carried out at the same time in the same area.
16. A bore hole shall not be loaded with explosives after springing (enlarging the hole with explosives) or upon completion of drilling without making sure that it is cool and that it does not contain any hot metal, burning or smouldering materials. Temperatures in excess of 65°C are dangerous. No force shall be used for inserting a blasting cap or an electric blasting cap into explosive. Metallic devices of any kind shall not be used in tamping.
17. Rock drillers shall be equipped with approved respirators for use in sillicious dusty atmosphere arising out of drilling operations.
18. Firing circuit shall be kept completely insulated from the ground or other conductors, such as bare wires, rails, pipes or other paths' of stray current. .
19. The fuse shall not be lighted until sufficient stemming has been placed over the explosives to prevent sparks of live match head from coming into contact with an explosive.
20. Before blasting, sufficient warning shall be given to enable the people working in the blasting area to get off the danger zone. All persons, other than blaster, shall leave the danger area at least 10 minutes before the blasting starts. The danger zone shall be suitably cordoned off and flag men posted at important points.
21. No loose materials, such as tools, drilling implements, etc, shall be left on the rock surfaces to be blasted.

22. Blasting in the open shall be carried out during fixed hours every day or on fixed days in the week. This information shall be amply publicized and the following precautions observed:
23. All approaches to the project site, where regular blasting operations are undertaken, shall be sign-posted for warning the public and indicating the days and timings when blasting is to be carried out;
24. All approaches to the project site, shall be closed by barriers at a distance of not less than 400 m, 10 minutes before firing is to take place and
25. Loud wailing note of not less than 1-minute duration shall be sounded on sirens to warn the public before commencement of firing. The end of firing operations must be followed by sounding an all clear signal on the sirens as a continuous long note of not less than 1-minute duration.

Hot bituminous works

The following safety measures should be adopted at the time of Hot bituminous works

1. All necessary precautions should be taken to avoid fire.
2. Those working with bitumen and boilers must be trained in the action to take in the event of fire, and in first-aid treatment and procedure for dealing with bitumen burns.
3. Care to be taken when using and storing materials used for ignition purposes, i.e. matches, lighters.
4. Keep the Hot Work Area clean, tidy and free from any combustible materials.
5. Bitumen is heated only to the temperature required for the particular application.
6. Hot bitumen does not come in to contact with water.
7. Excessive moisture should not present in the aggregate as it may lead to frothing. In case of frothing, addition of some hygroscopic material or anti-frothing agent may be required.
8. Suitable protective clothing, goggles, boots and gloves are supplied to, and used by, operators when handling hot bitumen.
9. Dust is suppressed and reduced to a minimum.
10. Bitumen products and solvents are not spilt on to the ground or into ditches or into water courses.
11. Any bitumen products or solvents which are spilt are immediately removed along with any contaminated soil, etc. and disposed off in a place and manner such that without effecting environment.
12. Waste or over-heated bitumen or solvents are not disposed off by burning.
13. Because of the highly flammable nature of the solvent, great care is required when using rapid-curing cutback bitumen.

Scaffolding, Ladders, Form work and other equipment

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

1. Every scaffold should be securely supported or suspended and properly braced to ensure stability
2. If independent of a building, they should be braced properly.
3. If scaffolds are to be used to a great extent for long periods of time, a regular plank stairway, wide enough to allow two people to pass, should be erected with handrails on both sides.
4. When work is being performed above a scaffold platform, a protective overhead covering should be provided for the men working on the scaffolds. The protection should not be more than 3m above the scaffold platform and should be made of planks.
5. All scaffolds should be erected and dismantled by workmen who are thoroughly experienced in the erection and dismantling of scaffolding.
6. All scaffolds should be inspected by a competent person at least every three days after erection. and the results of inspections recorded and the records shall be kept available for checking by the Employer's representative.
7. Tags shall be fitted to all scaffolds to show whether they are safe for use or not: All Safe for Use tags shall be signed by a senior site engineer from the Contractor .
8. All scaffolds shall be constructed of sound materials free from patent defect.
9. For wooden ladders, no rung should be fixed to the stringer with nails spikes or other similar fixings. In case of bamboo ladders, rungs may be fixed to the rails with spikes of appropriate design and strength.
10. Ladders employed in heavier trades should not exceed 6m in length. For lighter trades, ladders should not exceed 8m in length.
11. During dismantling of scaffolds, necessary precautions should be taken to prevent injury to persons due to fall of loose materials, bracings and other parts of scaffolds.

12. Care should be taken to see that non-insulated electric wires exist within 3 metres.
13. The supporting bracing for formwork should be checked for each individual member. The bracing should be properly braced. Many accidents occur due to negligence on this account.
14. All operators and supervisors of machines should be thoroughly trained in operation of the machines and equipment. All persons handling construction equipment should be completely acquainted with the safety aspects of machines and their operation.
15. Safety in terms of both main and auxiliary equipment should be considered at all construction sites. Unauthorized persons should not be allowed to handle or operate any equipment.
16. Ropes, guys and connections should be thoroughly checked before use.

Fabrication and Erection

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

1. All equipment such as gas cutting and welding sets, drills, power hacksaws, grinders, etc.
2. Should be checked periodically to ensure their safe working.
3. Moving parts of all equipment should be provided with safety guards.
4. Rubber pipe-lines for oxygen and acetylene gas should be regularly checked for leakage or damage. Leakage of gas from regulators, pipe lines or connections with the gas torch should be rectified immediately.
5. Workers engaged in gas cutting and welding operation should wear suitable gloves and aprons and use proper welding screens.
6. Power cables for all equipment should be properly insulated and protected from damage and cuts.
7. Danger signs should be prominently displayed on all poles of overhead electric lines/conductors used at site
8. Cut pipes and scrap should be stored at an appropriate place to avoid accidents.
9. All lifting tools and tackles such as wire ropes, U-clamps, shackles, chain-pulley hooks, etc., should be checked thoroughly before undertaking erection work.
10. Worker engaged in erection work should wear helmets and use safety belts to avoid accidents.

Storage

Construction materials should be stored in such a manner as to prevent deterioration, mixing up with foreign matter and to ensure preservation of their quality.

Cement should be stored in damp proof place. The stocks should not be more than 10 bags high and at least 30cms away from the works. Otherwise cement is likely to form into lumps and stacking and removal will be difficult Sand and aggregate should be stacked on firm ground and in bins this will avoid soil and dust getting mixed with sand and aggregate.

Bricks shall not be dumped at site. They should be stacked on level ground to minimize breakage. Height of stacks to be limited to 1.5metre.

Timber including sleeper's runners, scantlings, ballies, plywood, etc., should store separately in neat stacks. Adequate space should have left in between the stacks to avoid fire hazard. Smoking and open fires should be prohibited in timber yards and stores.

Petroleum products should be separately stored. Smoking and open fires would be strictly prohibited when these products and stored. Only essentially required quantities of such products should be stored at site.

Adequate firefighting arrangements should be provided at site particularly in areas where petroleum products and timber are stored.

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

Steel reinforcement bars should be stacked section wise. ·

Demolition

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

1. On every demolition work, danger signs should be provided all around the structure and doors giving access to the structure. Barricades should be erected around the structure. and at least two exit must be provided for the escape of workmen during any emergency.
2. During night time, lights should be placed around the barricades and entry of unauthorized persons restricted.
3. At the time of demolition work, workers should use all safety appliances such as helmets, goggles, gloves, etc.
4. The process of demolition may weaken the side walls of an adjoining structure and to prevent possible damage, these walls should be supported until permanent protection is provided.
5. The power on all electrical service lines must be shut off and all such lines disconnected before the demolition work is started.
6. If a structure to be demolished has been partially wrecked by fire, explosion, the walls and damaged roofs should be braced suitably.
7. No demolition work should be carried out at night especially when the structure to be demolished is in an inhabited area.

Handling building materials

1. When moving materials manually, workers should attach handles or holders to loads. In addition, workers should always wear appropriate personal protective equipment and use proper lifting techniques.
2. To prevent injury from oversize loads, workers should seek help in the following:
3. When a load is so bulky that employees cannot properly grasp or lift it,
4. When employees cannot see around or over a load, or
5. When employees cannot safely handle a load.
6. Using the following personal protective equipment prevents needless injuries when manually moving materials:
7. Hand and forearm protection, such as gloves, for loads with sharp or rough edges.
8. Eye protection.
9. Steel-toed safety shoes or boots.
10. Metal, fibre, or plastic metatarsal guards to protect the instep area from impact or compression.

Employees should use blocking materials to manage loads safely. Workers should also be cautious when placing blocks under a raised load to ensure that the load is not released before removing their hands from under the load. Blocking materials and timbers should be large and strong enough to support the load safely. In addition to materials with cracks, workers should not use materials with rounded corners, splintered pieces, or dry rot for blocking.

using mechanical equipment to move and store materials increases the potential for employee injuries. Workers must be aware of both manual handling safety concerns and safe equipment operating techniques. Employees should avoid overloading equipment when moving materials mechanically by letting the weight, size, and shape of the material being moved dictate the type of equipment used. All materials-handling equipment has rated capacities that determine the maximum weight the equipment can safely handle and the conditions under which it can handle that weight.

SAFETY MEETINGS

Safety meetings are frequently carried out to review the safety measures at project site at different levels:

- Job Site Safety Meetings

Since conditions are constantly changing on a construction site, regular and frequent jobsite safety meetings are essential to the safety performance on the site. The contractor should be required to host and conduct the meetings to monitor safety activities on the project. Two types of jobsite safety meetings commonly included on construction projects are initial project orientation and weekly safety meetings.

- Project safety orientation

New employees to the project should be required to attend an initial project safety orientation that covers the site-specific rules and procedures that must be followed, along with the disciplinary action that may result if such procedures are violated or ignored.

- Weekly safety meetings

Weekly safety meetings should be held by all contractors on the site to review safety conditions and corrective actions taken. The Prime contractor should be required to attend all of these meetings, to hear the concerns that are raised and make sure they are addressed in a timely manner. Documentation in the form of minutes, of all meetings should be required in the contract documents. On larger or complex projects, a separate meeting may be held weekly to discuss safety health and environmental liaison.

- Monthly safety meetings

A monthly safety meeting is normally held at a higher level on larger projects, in order to decide strategic issues rather than the detail of day to day work. Discussion between the most senior management of the participants in the work, to review reports and recommendations and to review minutes of the weekly meetings held on site to identify trends and points where executive action is required to implement necessary changes.

- SAFETY CAMPAIGN

With the increase in the number of accidents in the construction industry, it has become essential to educate people in regard to safety measures. It is the duty of management to provide a safe working environment to workers at construction sites. Unsafe practices must not be tolerated at any cost and proper safeguards must be provided at all times.

Frequent exchange of ideas between the labour and the management would help in minimizing the accident rate.

A continuing education programme using posters, booklets, films lectures and discussions with emphasis on supervisory safety training will prove effective in reducing the accident rate. It should be understood both by management and the workers that all accidents occur due to negligence on the part of someone. Accidents result in loss of life, property and reputation of the construction agency apart from financial loss and litigation. Accidents adversely affect the progress of work and have a demoralizing effect on the construction team. Safety play an important role in executing a construction project with speed, economy and efficiency.

EMPLOYER'S LIABILITY FOR COMPENSATION

1. If a personal injury is caused to a workman by an accident in the course of his employment, then the employer should pay the compensation according to the provision of the act. The compensation is provided if the employer shall have:
 2. The injury disabling the workers for a period more than three days.
 3. Have the injury resulting in death caused by an accident, if the worker being not under the influence of drinks or drugs.
 4. No disobedience of the worker to the orders issued for the safety of the workers.
 5. No removal of any safe guard.
 6. If the worker refuses to undergo medical examination and other medical free of charge and by a medical qualified doctor and if any injury resulted in disablement of the worker, then the worker will not be entitled for compensation.

SAFETY THROUGH LEGISLATION

In construction industry the legislation is needed for:

1. Improving the working condition
2. Determining the terms of employment
3. Providing social security i.e. compensation
4. Regulating the relationship between employers and employees
5. Safe guarding the lives of workman for the welfare of worker

Some of the important Acts are:

- a) Payment Wages Act (1936)
- b) Minimum Wages Act (1968)
- c) Workmen Compensation Act (1923)
- d) Industrial Dispute Act (1967)
- e) Indian Trade Union act (1926)
- f) Factories Act (1948)

- **Workmen Compensation Act (1923)**

This act covers all persons employed in construction, maintenance, repairs or demolition of any building, dam, roads, bridges, tunnel works, plastering operations, etc.

The salient features of the Act are

- a) The Act defines partial and total disablement and fatal accidents while on duty.
- b) It sets a schedule of compensation to be paid for various injuries.
- c) The Act protects workers against injuries arising out of and in the course of employment. But no compensation is payable in respect of
- d) Injury which will not result in partial or total disability
- e) Non-fatal injury caused by the worker under the influence of alcohol
- f) The Act identifies important occupational diseases.
- g) The Act decides the quantum of loss of earning capacity in terms of percentage in the event of injury.
- h) The Act prescribes rate of compensation to be paid by employer to the injured or deceased person in proportion to the quantum of injury.
- i) The Act provides appointment of commission for workmen's compensation whose functions are:
- j) Settlement of disputed claims
- k) Disposal of claims in case of fatal cases
- l) Revision of periodical payments
- m) It is liable on the employer to pay compensation to workers as per provisions of the Act, failing

Indian Factories Act (1948)

The Factories Act 1948, contains provisions in respect to health of workers, safety, welfare of labour, working hours, leave with wages concerning the workers employed in factories, etc. In this Act, is defined as the precincts where 10 or more workers. are engaged for over 12 months in the manufacture of a product with the use of power. Hence this Act does not hold good for civil construction unless a rule is made making the Factories Act applicable to construction industry.

Indian Trade Union Act (1926)

Trade union means any association of persons temporarily or permanently formed primarily for the purpose of regulating the relations between workmen and employers or between workmen and workmen or between employers and employers or for imposing restrictive conditions on the conduct of any trade or business. Some of the important trade unions in India are listed below:

- a) All India Trade Union Congress (AITUC)
- b) Indian National Trade Union Congress (INTUC)
- c) Hind Mazdoor Sabha (HMS)
- d) United Trade Union Congress (UTUC)
- e) Centre of Indian Trade Union (CITU)
- f) Bharatiya Mazdoor Sangh(BMS)

The following are objectives of a trade union in India.

- The wage formula for the workers should be based on the cost of living and the prevailing standards of living in India.
- To improve the working conditions, the workers should have the following:
 - limited working hours and leaves facilities.
 - education & other welfare facilities.
- To ensure that the workers get adequate bonus.
- To defend individual workers from improper treatment.
- To ensure the workers security of employment and justice when punishment is imposed.

Ethics

Ethics can be defined as the branch of philosophy that defines what is good for the individual and for society and establishes the nature of obligations, or duties, that people owe themselves and one another. It involves defining, analysing, evaluating and resolving moral problems and developing moral criteria to guide human behaviour.

Ethics is concerned with truth and justice, concerning a variety of aspects like the expectations of society, fair competition, public relations, social responsibilities and corporate behaviour. Some of the universally accepted ethical principles are honesty, integrity, fulfilling commitments, abiding by agreements, open minded and willing to admit mistakes, being caring and compassionate, having respect for human dignity, responsible pursuit of excellence and being accountable for one's decisions and their consequences.

Aspects of ethics

There are two aspects to ethics:

- The first involves the ability to discern right from wrong, good from evil and propriety from impropriety.
- The second involves the commitment to do what is right, good and proper. Ethics entails action.

Significance of Ethics

The study of ethics can offer some understandings of basic ethical principles and strategies of moral reasoning that can be used in discussion and debate in support of moral issues positions. Significance of ethics listed below:

- Ethics Set/Establish moral standards/norms of behaviour.
- Ethics Suggest moral behaviour, prescribes recommendations about Do's & Don'ts.
- Ethics create credibility and image for the corporations with the public.
- Ethics improve the employee morale and enhance the credibility of the management with the employees.

Benefits of Ethics at Work Place

- a) Ethics at work place brings discipline and order. It improves and strengthens relationships amongst superiors, peers and subordinates. It enhances commitment and accountability of the top managers and ensures safety of interest of its various stakeholders.
- b) Ethics programmes support employee growth and also the more emotionally healthy executives are higher on ethics work.
- c) Work ethics promotes team work and productivity as employees feel strong alignment between their values and those of the organisation.
- d) Ethics at work place helps manage values associated with quality management, strategic planning and diversity management. TQM includes high priority on certain operating values, e.g. trust among employees, customers, performance reliability, measurement and feedback.
- e) Ethics programmes promote a strong public image as employees operate with integrity and self-respect. Ethical values build socially responsible business and commercially successful.

MORALS

Morals are the standards, norms and principles for right and wrong concepts. They are standards that help to guide behaviour. These issues related to these standards are based on science and logic. In other words, these are scientific standards developed by the society.

Moral reasons include

- a) Respecting others and ourselves,
- b) Respecting the rights of others,
- c) Keeping promises,
- d) Avoiding unnecessary problems to others and avoiding cheating and dishonesty,
- e) Showing gratitude to others and encourage them to work.

ETHICS AND MORALITY

Ethics is often used in connection with the activities of organisations and with professional codes of conduct whereas Morality, on the other hand, is more often used in connection with the ways in which individuals conduct their personal, private lives, often in relation to personal financial probity, lawful conduct and acceptable standards of interpersonal behaviour (including truthfulness, honesty, and sexual propriety).

Sl. No.	Ethics	Morality
1	The term ethics is rooted in the Greek ethos, meaning custom or common practice.	The word morality derives from the Latin mores, meaning custom, habit, and way of life.
2	The rules of conduct recognized in respect to a particular class of human actions or a particular group, culture, etc. It defines how things are according to the rules.	Principles or habits with respect to right or wrong conduct. It defines how things should work according to an individual's ideals and principles.
3	Refers only to professional behavior.	Refers only to personal behaviour.
4	Ethics referring to the examination, justification, and critical analysis of morality.	Morality referring to values and beliefs about what is right and wrong, good and bad, just and unjust.
5	Thrust is on influence, education, training through codes, guidelines, and correction.	Thrust is on judgment and punishment, in the name of God or by laws.
6	Ethics generally uniform.	Morals may vary from society to society and culture to culture.
7	Example: Notions or beliefs about tastes, customs, and towards laws.	Example: Character flaw, corruption, extortion, and crime.

PROFESSIONAL ETHICS

Professional ethics is a codified formal system or set of rules which are explicitly adopted by a group of people. It encompasses how professionals should behave in their professional work and how they conduct themselves.

The main characteristics of a professional ethics are given below:

1. Professional ethics is based on certain ethical values and norms which a professional is supposed to follow.
2. Professional ethics speaks about managing values and conflicts among professionals
3. Most of the ethical dilemmas faced by managers in the workplace are highly complex.
4. The value of code of ethics to an organization is its priority and focus regarding certain ethical values in that workplace. Managing ethics in the workplace includes every one working as a team to help each other and remain ethical at work.
5. Profit maximization, expanding market share, etc. can be very strong influences on morality. Laws, regulations and rules influence behaviours to be more ethical.

Objectives

Improvement of the cognitive skills:

1. Cogent moral reasoning.
2. Moral coherence & imagination.
3. Moral communication, to express and support one's views to others.

To act in morally desirable ways, towards moral commitment and responsible conduct:

1. Willing and able to be morally responsible.
2. Respect for persons.
3. Tolerance of diversity.
4. Integrity.

PROFESSIONAL ETHICS AND HUMAN VALUES

Professional ethics is necessary to reveal, sustain and enhance certain basic human values.

These values are kindness, care and compassion, trust and reliability, truthfulness and honesty, justice and fairness, performance of a duty for the benefit of others, non-violence and non-injury, and accountability and social responsibility.

ENGINEERING ETHICS

The term professional ethics is interchangeable with engineering ethics. Engineering Ethics deals with the moral issues and decisions confronting individual or organizations engaged in engineering. The questions about the moral ideals, character, policies and relationships of people and corporations involved in technological activities. Engineering Ethics is the activity and discipline aimed at understanding the moral values that may be used to guide engineering practice, resolving moral issues in engineering and justifying moral judgements concerning engineering.

Objectives

To understand that moral values that ought to guide the Engineering profession, resolve the moral issues in the profession, to justify the moral judgment concerning the profession. It is intended to develop a set of beliefs, attitudes, and habits that engineers should display concerning morality, to increase one's ability to deal effectively with moral complexity in engineering practice.

As related to engineering ethics, these skills include the following:

1. Moral awareness: Proficiency in recognizing moral problems and issues in engineering.
2. Cogent moral reasoning: Comprehending, clarifying, and assessing arguments on opposing sides of moral issues.
3. Moral coherence: Forming consistent and comprehensive viewpoints based on consideration of relevant facts.
4. Moral imagination: Discerning alternative responses to moral issues and finding creative solutions for practical difficulties.
5. Moral communication: Precision in the use of a common ethical language, a skill needed to express and support one's moral views adequately to others.
6. Moral reasonableness: The willingness and ability to be morally reasonable.
7. Respect for persons: Genuine concern for the well-being of others as well as oneself.
8. Tolerance of diversity: Within a broad range, respect for ethnic and religious differences and acceptance of reasonable difference in moral perspectives
9. Moral hope: Enriched appreciation of the possibilities of using rational dialogue in resolving moral conflicts.
10. Integrity: Maintaining moral integrity and integrating one's professional life and personal convictions.

VALUES

Values are the rules by which we make decisions about right and wrong, should or shouldn't, and good or bad. The word 'value' expresses the qualitative significance we assign to ideas, feeling, activities and experiences. Value are the evaluative standards we use for deciding what is right and what is wrong, what is good and what is bad, what is desirable and what is undesirable? The quality of living space we create for ourselves is determined by our system of value.

Human Values Vs. Moral Values

- a) Moral values regard matters of right and wrong whereas human values help a person to distinguish between right and wrong.
- b) Moral values are constant and unchanging whereas human values change from person to person and from time to time.
- c) Moral values are for self-development and self-discipline whereas human values are about how we treat others in society.
- d) Moral values can be taught whereas human values are inherited values and are intact in all of us.

INTEGRITY

Integrity is one of the core qualities that any professional practitioners should possess. It also refers to honesty and open mindedness either with oneself or others. Mostly integrity involves the discovery of truth and its communication. In specific terms, integrity refers to the capacity to communicate the truth in proper manner so, that it enables the client and others to make informed decisions. Integrity as well as honesty are very vital for the development of trust. Integrity plays its important role in different situations and contexts, in order to lead to the consistency of character and operation.

Integrity is one of the self-direction virtues on commitment and on putting understanding to action. Moral integrity refers to the unity, which is a consistency among human attitudes, emotions and conduct in relation to justified moral values. Thus integrity acts as a link between responsibility in private and public life

The integrity of the engineers is most essential in the following works:

- a) Engineering research and testing,
- b) In the use of intellectual property,
- c) Client professional confidentiality,
- d) Expert testimonials and
- e) Failure to inform the public.

WORK ETHICS

Work ethic is a set of values based on hard work and diligence. It is also a belief in the moral benefit of work and its ability to enhance character. A work ethic may include being reliable, having initiative, or pursuing new skills or maintaining social skills.

In general, employees need some jobs and wages, but they also desire to be treated humanely with dignity. Moreover, they look for a workplace which is safe and healthy, that respects their privacy, and provides meaningful work, and offers some security during retirement periods.

Work ethics are laid down by the organization to bring uniformity in the behaviour of workers and managers. A good work ethic creates a work culture in the organization and increases the productivity. This value helps the engineer to work hard, discipline and build team in an organization.

Factors That Demonstrate a Strong Work Ethic

- *Integrity:* Integrity stretches to all aspects of an employee's job.
- *Sense of Responsibility:* A strong sense of responsibility affects how an employee works and the amount of work he does.
- *Emphasis on Quality:* Some employees do only the bare minimum, just enough to keep their job intact. The employee's commitment to quality improves the company's overall quality.
- *Discipline:* It takes a certain level of commitment to finish your tasks every day. An employee with good discipline stays focused on his goals and is determined to complete his assignments.
- *Sense of Teamwork:* An employee with a high sense of teamwork helps a team meet its goals and deliver quality work.

DUTIES AND RIGHTS

Duties are moral obligations. The main duties that a person should perform are as follows:

- ▶ Respect for truth,
- ▶ Respect for laws,
- ▶ Respect for society and the state,
- ▶ Respect for life,
- ▶ Respect for freedom and personality.

Right is the entitlement or empowerment to do certain things rights are moral claims of individuals recognized by society. There are many types of rights, like, legal, constitutional, fundamental and moral. Right gives us the liberty and choice and empowerment. There are many basic rights given to every citizen of a country. These rights include life and security, education, freedom of speech, employment, express opinion, legal remedies, contractual right, equality and human rights. Rights are based on several sources of authority. Moral rights give individuals the (freedom to pursue one's own interest so long as the interests of others are not violated. Moral rights need to be justified, and they are necessary for self-realization. These rights are essential for the highest personal good and social benefits.

The two phrases 'rights' and 'duties' co-exist with each other. In other words, the rights and duties are two sides of the same coin, to regulate the values and behavioural patterns of an individual.

On one side, rights are important in developing the human personality and behaviour. The duties on the other hand, direct the individual's importance of their contribution for the promotion of social good. In a way duty targets at the realization of rights guaranteed by various laws and regulations both nationally and internationally.

Engineers have many types of moral rights apart from their responsibilities. The rights and responsibilities to some extent coincide with each other. These rights are as follows:

- a) Human Rights: These should be possessed by engineers by virtue of being people or moral agents. These rights include the basic rights to pursue legitimate personal interests, right to make a living and right to privacy.
- b) Professional Rights: These rights are possessed by virtue of being professionals having special moral responsibilities.

Examples of such rights are:

- Right to form and express professional judgment without any obstacles.
- Right to deny participating in unethical activities.
- Right to express professional judgment, including the right to disagree.
- Right to warn the public about dangers.
- Right to fair recognition and remuneration for services.
- Right to talk freely about the work.
- Right to get involved in the activities of professional societies.

Sl. No.	General Ethics	Engineering Ethics
1.	Ethics is an activity which concerns with making investigations and knowing about moral values, finding solutions to moral issues and justifying moral issues and justifying moral judgments.	Like ethics, engineering ethics also aims at knowing moral values related to engineering, finding accurate solutions to the moral problems in engineering and justifying moral judgements of engineering.
2.	Ethics is a means of contrasting moral questions from non-moral problems.	Engineering ethics gives total view of the moral problems and how to solve those issues specifically related to engineering field.
3.	Ethics is also used as a means of describing the beliefs, attitudes and a habit related to an individual's or group's morality. Eg: Ethics given in the Bhagavat Gita or the Bible or the Quran.	Engineering ethics is also using some currently accepted codes and standards which are to be followed by the group of engineers and engineering societies.
4.	As per the definition of dictionaries - 'moral principles' is about the actions and principles of conduct of the people i.e., ethical or unethical.	Engineering ethics also concerns with discovering moral principles such as obligation, rights and ideas in engineering and by applying them to take a correct decision.

CONFLICTS OF INTEREST

Conflict of interests has been a subject of extreme importance in recent scandals in which employees, agents, and professionals failed to exercise proper judgment on behalf of their principals.

Conflicts of interest are the situations where professionals have self-interest. If self-interest is given importance, it may keep them away from meeting their obligations to their employers or clients. i.e., a conflict of interest occurs when the employee has more than one interest.

It can be stated as, "A conflict of interests occurs when the independent judgment of a person is swayed, or might be swayed, from making decisions in the best interest of others who are relying on that judgment".

Conflict of interest created by Interest in other companies

- Serving as a consultant for a competitor's company.
- Personal interest, such as making private investments in a competitor's company. Having partial ownership or substantial stock holdings in the competitor's business.
- It may not arise by merely having a spouse working for sub-contractor to one's company, but it will arise if one's job also includes granting contracts to that subcontractor.
- Tempting customers away from their current employer, while still working for them to form their own competing business.
- Moonlighting usually creates conflicts when working for competitors, suppliers or customers but does not conflict when working for others without affecting the present employer's business.

Conflicts of interest created by Insider information

- Using inside information to set-up a business opportunity for oneself or family or friends.
- Buying stock in the company for which one works is not objectionable but it should be based on the same information available to the public. •
- The use of any company secrets by employee to secure a personal gain threatens the interest of the company.

Types of Conflicts of Interest

- a) Actual conflict of interest
- b) Potential conflicts of Interest
- c) Apparent conflict of Interest
- d) Interest in other companies
- e) Moonlighting
- f) Insider information

I. Actual conflict of interest

It is based on weaker judgment and service. It refers to the loss of objectivity in decision making and inability to faithfully discharge professional duties to employer. For example, an engineer may have financial interest or returns in the company, the suitability of which he has to judge for procurement of materials or any specific contract as the case may be.

II. Potential conflicts of Interest

There are situations where the interest of an employee extends beyond the current employer and into the interest on one's spouse, relative or friend.

▪ Bribe

A bribe is a substantial amount of money or goods offered beyond a stated business contract with the aim of winning an advantage in gaining or keeping the contract, and where the advantage is illegal or otherwise unethical. Bribes

are illegal or immoral because they are substantial enough to threaten fairness in competitive situations. Since bribes can bias judgments, companies have given elaborate guidelines for their employees, illustrating acceptable and unacceptable gifts. But in some company's officials are prohibited by law from accepting anything of value.

- Gifts

Gifts are not bribes as long as they are small gratuities offered in the normal conduct of business. A gift one believes is given in friendship rather than for influence. Often companies give gifts to employees of government agencies or partners in trade. Many such gifts are unobjectionable.

Engineers should not accept money directly or indirectly from contractors, or their agents in connection with the work. This is one of the guidelines. If one receives any gifts which will cause an embarrassing consequence for the company when made public, then the gift is considered as a bribe. Entertainment, travel and other social functions give rise to special difficulties. Many companies encourage their employees to form social relationships with the suppliers and the clients, in order to enhance their business interest. This is also another form of bribery. Engineers are the objects of bribery attempts.

Bribe	Gift
1. Given before	Given after
2. Large amount	Small amount, articles of daily use.
3. Usually poor quality of product.	May be good or high quality.
4. Given in secret.	Given in open.
4. Expect undue favour.	Expect a favour or thanking for the favour.
5. Damages the goodwill and reputation of organization.	No damage is involved to organization.

III. Apparent conflict of interest

Apparent conflict of interest may occur, when an engineer is paid based on a percentage of the cost of the design and there is no incentive for him to cut-costs. In this situation, it appears that the engineer is making the design more expensive in order to make a large commission for himself.

The distrust caused by this situation compromises the-engineer's ability to do this and future work and leads to a situation for questioning his judgment.

There are some other forms of conflicts of interest. They are as follows:

IV. Interest in other companies

This kind of conflict of interest consists of having an interest in the business of a competitor or a sub-contractor. For example, working as an employee or consultant for the competitor or subcontractor, and partial ownership or large stock holding in the business of competitors.

Holding a few shares of competitor's business will not create conflict of interest, but when the number of stock holdings increases it will create a conflict of interest. Likewise, if the wife of a person works for a sub-contractor, there will not be any form of conflict of interest, but at the same time, a conflict of interest arises if that person grants contracts to that sub-contractor. This kind of outside interest may be possible when an engineer prepares to leave a company in order to form his own company to compete with the former company, where he worked.

V. Moonlighting

It deals with a person who is working in two companies. This will break the rights, to pursue a person's self-interest. Moonlighting will produce the conflict of interests only when a person is working for competition, suppliers or even customers. Another effect of moonlighting is that it leaves the person exhausted and harms the job performance in both places.

VI. Insider information

It is a kind of sensitive conflict of interest which consists of using "inside" information to make an advantage or to start a new business opportunity for oneself, one's family or one's friends. The information may be of a person's own company or another company with which he does business.

For example, holding stocks of the company in which a person works will not be objectionable. But that ownership must be based on the same information available to general shareholders of the company and not more than that. Thus the use of company's secrets by its employees to get a personal benefit is always dangerous in the interest of the company and will create a conflict of interest between the employer and employee.

CONFIDENTIALITY

Confidentiality is an ethical principles associated with several professions. Employed engineers must keep information about their companies and clients confidential. They are expected not to leak out any confidential information to unauthorized people both inside and outside the company.

confidential information with respect to business includes:

- a) Any information that the employer or client would like to have kept secret in order to compete effectively against business rivals. i.e., data concerning the company's business or technical processes.
- b) Most information about how a business is run, its products and its suppliers, directly affects the company's ability to compete in the market place. Such information can be used by a competitor to gain advantage or to catch up.
- c) Test results and data.
- d) Information about upcoming unreleased products.
- e) Designs or formulas for products.
- f) The number of employees working on a project and the identity of suppliers.
- g) Marketing strategies.
- h) Production costs:
- i) Production yields.

There are two terms that are related to confidentiality, they are

VII. Privileged information

Information available only on the basis of special privilege such as granted to an employee working on a special assignment. It covers information that has not yet become public or widely known within an organization.

VIII. Proprietary Information

"Proprietary Information" is an information that a company owns. It is the information owned by the proprietor in a legal sense. This means "property" or "ownership". This is primarily used in legal sense. Also called Trade Secret. A trade secret can be virtually any type of information that has not become public and which an employer has taken steps to keep secret.

It may be data about designs and technical processes and so on. Patents differ from trade secrets. Patents legally protect some specific products from being manufactured and sold by other competitors without any written permission of the patent holder.

No such protection exists in the case of trade secrets. A patent holder has legally protected monopoly power. But in case of trade secrets, the legal protection is limited to keeping relationships of confidentiality and trust.

Effect of change of job on confidentiality

- a) Employees are obliged to protect confidential information regarding former employment, after a change of job.
- b) The confidentiality trust between employer and employee continues beyond the period of employment
- c) But, the employee cannot be forced not to seek a change of job.
- d) The employer's right to keep the trade secrets confidential by a former employee should be accepted at the same time, the employee's right to seek career advancement cannot also be denied.

WHISTLE BLOWING

A whistle-blower (whistle-blower or whistle blower) is a person who exposes any kind of information or activity that is deemed illegal, unethical, or not correct within an organization that is either private or public. The term whistle-blower comes from the whistle a referee uses to indicate an illegal or foul play.

Exposing misconduct, illegal, or dishonest activity is a big fear for public employees because they feel they are going against their government and country. These laws were enacted to help prevent corruption and encourage people to expose misconduct, illegal, or dishonest activity for the good of society

The reasons for whistleblowing may be:

- a) Violation of company policy/rules, law, regulation
- b) Threat to public interest
- c) Threat to national security
- d) Fraud and corruption.

Types

Whistle blowing may be broadly classified into two types: 1. Internal whistle blowing and 2. External whistle blowing. Those who become whistle-blowers can choose to bring information or allegations to surface either internally or externally.

Internal Whistle blowing

Internally, a whistle blower can bring his/her accusations to the attention of other people within the accused organization. Individuals who expose information regarding wrongdoing, fraud, corruption or mismanagement and report such acts inside an organization i.e. to the Chief executive officer or any member of the senior management are called as internal whistle blowers.

Most whistle-blowers are internal whistle-blowers, who report misconduct on a fellow employee or superior within their company., One of the most interesting questions with respect to internal whistle-blowers is why and under what circumstances do people either act on the spot to stop illegal and otherwise unacceptable behaviour or report it..

External Whistle blowing

Individuals who report of such wrongdoings or misconduct outside of the organisation i.e. to the media, law enforcement agencies, etc. are called as external whistle-blowers. Externally, a whistle-blower can bring allegations to light by contacting a third party outside of an accused organization. Whistle-blowers can reach out to the media, government, law enforcement, or those who are concerned.

In these cases, depending on the information's severity and nature, whistle-blowers may report the misconduct to lawyers, the media, law enforcement or watchdog agencies, or other local, state, or federal agencies.

Individual harm, public trust damage, and a threat of national security are three categories of harm that may come to whistle-blowers. Revealing whistle-blower identities automatically puts their life in harm's-way. They face stiff reprisal and retaliation from those who are accused or alleged of wrong doing.