Supervisors Training Centre
South Central Railway

MJP-SESSION -I

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Revised Training programme for promote JEs (Selection on seniority-cum-suitability basis)

Session-I (Theory)				
S. No	**Training Module**	**Subject Code**	**No. of Days**	**No. of Weeks**
1.	Computer Awareness	MRT-14	6	4
2	Industrial Safety, First Aid & Fire Fighting	MRT-16	3	
3	Accident and Disaster Management	MRT-17	2	
4	Supervisory Skills	MRT-18	3	
5	Technical English	MRT-19	3	
6	Manufacturing Process	MET-12	4	
7	Industrial Engg.	MET-13	1	
8	Engineering Drawing	MET-14	2	
Sub Total (Theory)			**24**	**4**
9	Stream Specific (Theory) C&W Stream Diesel Stream Workshop Stream	MCT-03&04 MDT-05E/M MWT-05	24	4
Session –II (Practical Training)				
10	Practical Training at production units		6	1
11	Practical Training at POH Workshop		6	1
12	On the job training		12	2
Sub Total (Practical)			**24**	**4**
Session-III (Refreshing/Exam/Viva etc.)				
13	Refreshing/Exam/Viva at STC		6	1
Grand Total			**78**	**13**

***As per existing syllabus**

1. INDUSTRIAL SAFETY, FIRST AID & FIRE FIGHTING

1.1 Causes of fire, identification of unsafe conditions and unsafe acts.

Common Causes of Industrial Fire

- Leaks & spillages of flammable/combustible materials.
- Electrical short circuit & overloading.
- Overheated ware surfaces/heaters/electrical lamps.
- Welding, Cutting, Soldering & other hot work.
- Equipment failure.
- Smoking in prohibited areas.
- Chemical reaction, runaway reaction.
- Frictional heat sparks
- Spontaneous combustion
- Static spark/combustion spark, Lightning
- Naked flames.
- Molten substances

Unsafe Conditions for a Depot/Workshop

The unsafe conditions for a depot/workshop are classified as Mechanical & Environmental.

The following are **Mechanical Conditions**:

- Unsafe mechanical design/structure.
- Hazardous arrangement.
- Improper Machine body.
- Improper material handling.
- Defective device.
- Unsafe apparel.
- Broken safety guards.
- Protruding nails.
- Leaking acid walls.
- Untested boiler/pressure vessel.
- Piling.
- Overloading.

The following are the **Environmental Conditions**:

- Too low temperature leading to shivering.
- Too high temperature leading to headache.
- Bad illumination/lighting leading to eye strain/glares.
- Too high humidity (textile industry) leading to discomfort/dizziness.
- Presence of dust/fumes/smoke & lack of proper ventilation.
- High speed work due to work load.
- Bad odor/noise.
- High working hours
- Reduced rest between breaks.

Unsafe Acts for a Depot/Workshop

The unsafe acts applicable in a depot/workshop are classified as **Personal Acts**. They are listed as below:

- Age
- Lack of knowledge/skill.
- Working at unsafe speeds.
- Health
- No. of dependants
- Financial position
- Home environment
- Improper attitude towards work
- Incorrect machine habits
- Day dreaming or inattentiveness
- Carelessness & recklessness
- Emotional instability & jealousy
- High anxiety level
- Fatigue
- Mental worries
- Non use of safety devices.

1.2Identifying and handling of various types of fire extinguishers, precautions to be taken while extinguishing fire.

Classification of Fires

The fires are classified into 6 categories based on the fuel involved in the Asian countries. The classification is as follows:

i. CLASS – A*:* Solid materials. Eg: Wood, Coal, Paper, Cloth etc.

ii. CLASS – B*:* Flammable liquids. Eg: Petrol, Diesel, Kerosene etc.

iii. CLASS – C: Flammable gases/Plastics. Eg: LPG, CNG, Biogas, Methane

iv. CLASS – D: Flammable metals. Eg: Sodium, Magnesium, Potassium.

v. CLASS – E: Electrical things or due to electrical equipment.

vi. CLASS – F: Edible oils. Eg: cooking oil, ghee, vanaspati etc.

Types of Fire Extinguishers

There are 4 types of fire extinguishers commonly used. They are:

i. Water + CO2

ii. Foam

iii. Dry chemical powder

iv. Co2 gas

Precautions While Extinguishing Fire

The following precautions are to be taken while extinguishing the fire:

i. Think right & act fast.

ii. Extinguish fire with available & suitable fire extinguisher in the incipient stage only.

iii. Use right type of extinguisher as per the classification.

iv. Don't use water type/foam type extinguisher on electrical fires.

v. Switch off electrical supply.

vi. Don't use dcp/CO2 extinguisher on class-A fires.

vii. Use only foam type extinguisher on only class-B & F fires.

viii. Use only dcp/CO2 type extinguishers on electrical fires.

ix. If clothes catch fire, roll-over on the ground.

Precautions While Handling Fire Extinguisher

The following precautions are to be taken while handling the fire extinguisher:

i. Ensure removal of safety clip before using/operating the fire extinguisher.

ii. Water/CO2 type fire extinguisher to be used for class A fires.

iii. Foam types fire extinguisher to be used for Class B & F fires.

iv. Dry Chemical Powder (DCP) type fire extinguisher to be used on class B,C,D,E & F fires.

v. CO2 type fire extinguisher to be used on class B,C,D,E & F fires.

vi. Foam/DCP and CO2 type fire extinguisher should not be used on class A fires due to lack of cooling effect.

vii. Water, Foam and CO2 type fire extinguisher should not be used on class E fires due to certainty of electrocution.

viii. Firmly hold the discharge hose pipe before operating DCP type fire extinguisher.

1.3 Scope and rules of first aid, structure and function of body, general idea about circulation of blood, wound and hemorrhages, Dressing & Bandages.

First Aid

Def: First aid is the initial treatment given to the casualty in the absence of proper medical aid to reduce the extent of the damage caused to an injury or accident.

Aim/Objectives

- Save the life.
- Promote the recovery.
- Prevent the worsening of the condition.
- Arrange the transport.

Classification Of Injuries

A railway employee or a passenger or a trespasser shall be considered to be 'injured' only when he/she is incapacitated from the following customary vocation for more than forty eight hours, such injuries are classified as under –

- 'SERIOUS' (also called as 'GRIEVOUS' injuries)
- 'MINOR' or 'SIMPLE', but excluding '*TRIVIAL*' injuries such as abrasions or bruises.

Serious/Grievous Injuries

The following injuries are classified under serious/grievous injuries:

- Emasculation
- Permanent privation of the sight of either eye.

- Permanent privation of the hearing of either ear.
- Privation of any member or joint.
- Destruction of permanent impairment of powers of any member or joint.
- Permanent disfigurement of head or face.
- Fracture or dislocation of a bone or tooth.
- Any hurt which endangers life, or which causes the sufferer to be, in severe bodily pain or unable to follow his ordinary pursuits during the space of twenty days

Minor/Simple Injuries & Trivial Injuries

The following injuries are classified under Minor/Simple and Trivial injuries:

- Injuries other than those defined above are considered to be minor or simple injuries.
- Apart from the 'injured' cases as above, there may be cases where a passenger or trespasser receives only petty abrasions or bruises. These are of trivial nature and technically speaking should not be taken as 'injured' persons

Contents of the First Aid Box

• Set of splints.	:	One Set
• Roller Bandage	:	10
• Triangular bandages	:	04
• Tourniquet bandages	:	02
• Cotton Wool	:	04
• Safety Pins	:	10
• Adhesive Dressing	:	20
• Paracetamol Tab	:	20
• Antiseptic Cream	:	01
• Diazepam Tab	:	10
• Injury Card	:	01

Utilisation of First Aid Box Items

a. Triangular Bandages:
   i. To retain dressings and splints in position and to immobilize fractures.
   ii. To afford support to an injured pact or in the form of slings.
   iii. To control bleeding.
   iv. To reduce or prevent swelling.
   v. To assist in the lifting and carrying of casualties. Mainly used as bandages like Head bandage, chest bandage, shoulder bandage,

elbow bandage, hand bandage, hip bandage, foot bandage etc. It is also used as slings like Arm sling, Triangular sling and cuff and collar sling.

b. Tourniquet/Rubber Bandage: It is used to stop bleeding and to stop spreading of poison when snake bites.

c. Roller Bandages: It is used to retain dressings and splints in position and to cover the wounds.

d. Splints:They are used to immobilize and support the fractured limbs.

e. Paracetamol Tab:These are used to relieve minor pains.

f. Antiseptic Cream: It is used to minimize or prevent infection to wounds.

g. Cotton wool: It is used to clean/pad the wounds. It is also to be utilised to absorb discharges when there is a wound.

h. Adhesive Dressings:It is used for minor wounds only.

i. Safety Pins:It is used when Triangular bandage used for victim.

j. Injury Card:To maintain the account of the First Aid items.

1.4 Shocks & its management, Asphyxia & Artificial respiration, Render first aid to the burn injuries, Rendering first aid to persons affected by suffocation, and communication.

Asphyxia (Suffocation)

Definition:- When lungs are not getting sufficient fresh air, important organs of body mainly brain deprive of oxygen, it is a dangerous condition called Asphyxia.

Causes:-

- Drowning
- Breathing polluted air
- Pressing of wind pipe (Hanging, Throttling and strangulation)
- Choking
- Pressure/weight on chest.
- Electric shock
- Some poisons.
- Obstruction in air passage.

Signs and Symptoms of Asphyxia/Suffocation

- Low/No Breathing
- Blue/Pale color of cheeks and lips.
- Swelling of veins at neck.
- Unconsciousness.

General Treatment for Asphyxia:

- Remove cause from casualty or casualty from cause.
- Ensure more fresh air (By opening doors and windows and removing the people surrounded); loosen the tight clothing at chest and neck regions.
- Start artificial Respiration without wasting even few seconds.
- Arrange medical aid.
- Normal Breathing (Respiration) Rate 15 – 18 times per minute.
- Normal Heart Beat/pulse rate 72 times per minute.

Heart Attack

The term covers coronary thrombosis coronary obstruction, myocardial infarction and other forms of heart disease.

Symptoms & Signs:

- Sudden crushing, vice-like pain in the centre of the chest (Sometimes described as severe indigestion) which may spread to the arms, throat, jaw, abdomen or back, and does not subside with rest.
- Sudden dizziness or giddiness causing the casualty to sit down or lean against a wall.
- Skin may be ashen, lips and extremities may become blue (Cyanosist)
- Profuse sweating may develop.
- Breathlessness can occur.
- Fast pulse, which becomes weaker and may become irregular.
- Symptoms and signs of shock.
- Unconsciousness may develop.
- Breathing and heartbeat may stop.

Treatment:

- If the casualty is conscious, gently support and place him in a half-sitting position with his head and shoulders supported and his knees bent.
- Do not let him move unnecessarily as this will put extra strain on his heart.
- Loosen any constricting clothing around his neck, chest and waist.
- Check breathing rate, Pulse and level of responsiveness at 10-minute intervals.
- If he becomes unconscious, open his airway and check breathing. Complete the ABC of Resuscitation if required and place him in the Recovery Position.
- Arrange urgent medical aid or removal to hospital. Transport as a stretcher case, maintaining the treatment position.

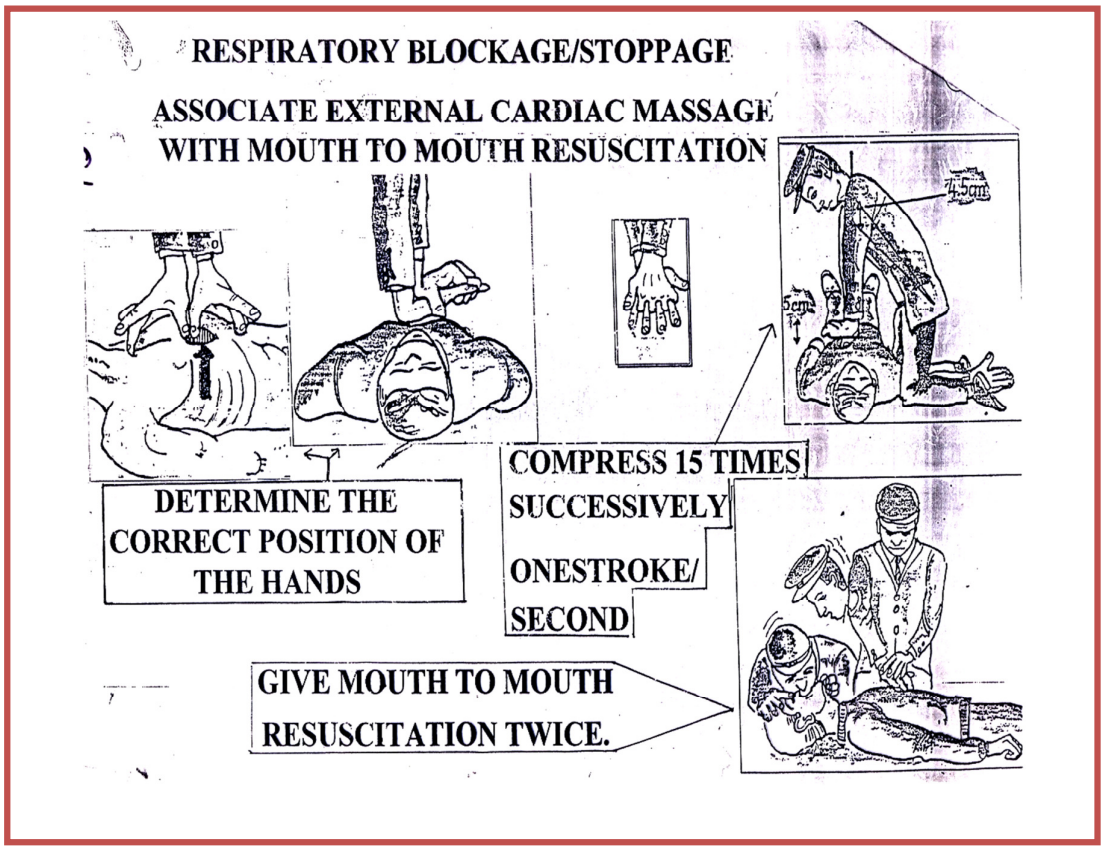
When Heart Stops Functioning: If the Heart is not working you will notice the following:

- The face is blue or pale.
- Heart beat and pulse at the root of Neck (carotid pulse) are not felt.

Note:

a) Even if the casualty is breathing but the breathing is not normal, it is wise to start artificial respiration.

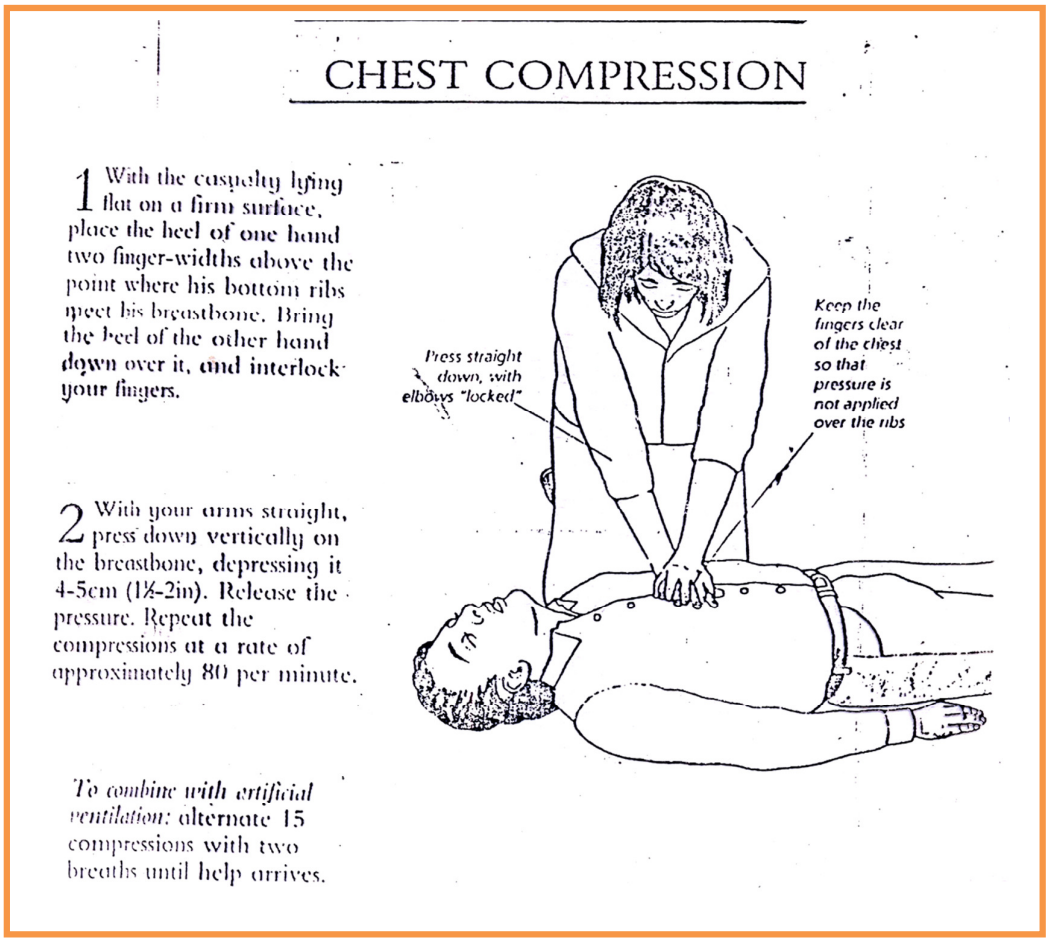
b) Do not begin Heart compression until you are sure that the heart has stopped beating.



External Heart Compression or Cardiac Massage

- Place the casualty flat on his back on a hard surface and remove the cloths over the chest.
- Feel and mark the lower part of the sternum.
- Place the heel of your left hand on the marked point make sure that the palm and fingers are not in contact with chest.
- Place the heel of the right hand over the left hand.
- With your right hand heel press the sternum towards the spine. It can be pressed upto 1 to 1.5 inches.
- Adults should be given about 60 pressures per minute. For children from 2 to 10 years pressure with one hand heel will be enough, but pressure should be @ 80-90 times per minute. For infants below 2 years pressures with two fingers are good enough and applied at a rate of 100 times per minute.
    - Press firmly but carefully, carelessness may cause injury to ribs.

- If the treatment is effectivecolour will become normal.
- Pupil will contract.
- Carotid pulse begins.



- When pulse is not restarted, continue compression till the patient reaches the hospital or doctor arrives to the spot.
- If heart and breathing both are failed:
    - If there is one first aider, give 2 inflations of artificial respiration and then give 15 heart compressions and repeat the process.
    - If there are two first aiders, first person will give two inflations of artificial respiration then second person will give five times heart compressions and repeat the process till the normal is resume or doctor arrives whichever is earlier.

Shock

Definition:- Shock is severe depression to vital functions of organs like brain, heart, lungs etc. due to less blood supply to the brain.

Established Shock: Established shock or true shock is due to less blood supply to the brain.

Causes:

- Wounds.
- Fractures
- Burns & Scalds
- Snake bite
- Sunstroke
- Heart attack
- Dog bite
- Electrical shock etc.

Signs & Symptoms of Shock:

- The skin may appear pale and is cool and clammy to the touch.
- The heartbeat is weak and rapid, and breathing is slow and shallow. The blood pressure is reduced.
- The eyes lack shine and seem to stare. Sometimes the pupils are dilated.
- The person may feel Giddiness (symptom), Vomiting sensation, Thirsty.
- The person may be conscious or unconscious. If conscious, the person may faint or be very weak or confused. On the other hand, shock sometimes causes a person to become overly excited and anxious.

Precautions after an injury

- Get the person to lie down on his or her back and elevate the feet higher than the person's head. Keep the person from moving unnecessarily.
- Keep the person warm and comfortable. Loosen tight clothing and cover the person with a blanket. Do not give the person anything to drink.
- If the person is vomiting or bleeding from the mouth, place the person on his or her side to prevent choking.
- Treat any injuries appropriately (bleeding, broken bones, etc.).
- Summon emergency medical assistance immediately

Wounds and Hemorrhage (Bleeding)

Definition: Wound is breakage of skin/tissue.

Types of Wounds:

1. Contused Wounds
2. Lacerated Wounds
3. Punctured Wounds
4. Incised Wounds.

- Blunt instruments cause contused wounds where there is no opening.
- Lacerated wounds are caused by irregular edges of instruments like glass pieces metal pieces, machine injuries, animal sites and occurrences where the edges of wound is irregular.
- Sharp edged instruments like Razor/knife cause incised wounds where the edge of wound is in straight line.

- Punctured wounds are caused by sharp edged instruments like needles, nails and most of gun-shot wounds where less opening and more deep.

Types of Bleeding (Hemorrhage)

- Artery Bleeding – Bright red in color and flow in jets.
- Vein Bleedings – Dark red in color and flow continuously.
- Capillary Bleedings – Red in color and Oozing from all parts of wound.

Danger of wounds

- It allows precious blood to escape from body.
- It permits harmful Bacteria/virus or other injurious agents to enter into body.
- Direct Pressure Method.
- Indirect Pressure Method.

General Treatment (First Aid) to Wounds

- Place the victim in sitting/lying position and elevate the injured part if possible.
- Expose the wound and clean the wound and surrounding area but do not disturb blood clot if already there.
- Remove any foreign body which is floating.
- Arrest bleeding by applying pressure directly on the wound or apply constrictive bandage.
- Apply Antiseptic cream, dressing and bandage.
- Immobilize the part where it is possible.
- Give pain relievers and treat for shock.
- Arrange Medical Aid.

Nose bleeding Treatment

- Place the victim near a window or against current of air in sitting position with the head slightly bent forward.
- Pinch the junction of the Nose just below the hard part. If available put ice piece over the nose.
- Advice him to use his mouth to breath and avoid breathing through nose.
- Warn him not to blow the nose.
- Do not block the nostrils.
- Arrange medical aid.

Ear bleeding Treatment

- Place the victim on a suitable place on side-ways, and see that the affected ear is down (if both ears bleeding keep face upward and head little bit low for free drainage of blood.

- Do not block the ear.
- Arrange medical aid.

InternalBleeding: Whenever internal organs or blood vessels got damaged and blood comes out through mouth, nose, ears etc. such bleeding is known as internal bleeding.

Symptoms of Internal Bleeding

i. Giddiness.
ii. Skin becomes pale, cold and clammy.
iii. Pulse gets rapid but very weak.
iv. Sweating, Thirsty, feels vomiting sensation.
v. Become unconscious.

Treatment for Internal Bleeding

1. Check-up air-way, breathing and heart if any failure restore them.

2. Lay him on his back and raise the legs by using pillow to enable the blood supply to the brain.

1.5 Injuries to the bones & joints – fractures, unconsciousness and general rules for the treatments of unconscious persons.

1.6 Transport of injured persons, stretcher exercise.

Head Injury: As a result of head injury blood and brain fluid may flow out of the nose, ear or mouth.

Symptoms:

- Giddiness.
- Skin becomes pale, cold and clammy.
- Pulse gets rapid but very weak.
- Sweating, Thirsty, feels vomiting sensation.
- Become unconscious.

Treatment:

Ask the person not to blow his nose. Do not pack ear or nose. Lay the patient on the affected side. Ensure tongue should not fall back.

Embedded Objects:

Whether you've stepped on a nail or fallen on broken glass, never try to pull out an object embedded in a wound. Removing embedded objects from a wound may cause more damage and increase bleeding. Instead, follow these tips:

- Place a clean, preferably sterile dressing around the object.
- Build up padding around the object so it doesn't move.
- Secure padding a narrow bandage.
- Get medical help.

Burns and Scalds

Burns can be caused by fire, the sun, chemicals, heated objects or fluids, and electricity. They can be minor problems or life-threatening emergencies. Distinguishing a minor burn from a more serious burn involves determining the degree of damage to the tissues of the body. If you are not sure how serious the burn is, seek emergency medical help.

First-degree burns are those in which only the outer layer of skin is burned. The skin is usually red and some swelling and pain may occur. Unless the burn involves large portions of the body, it can be treated at home.

Second-degree burns are those in which the first layer of skin has been burned through and the second layer of skin is also burned. In these burns, the skin reddens intensely and blisters develop. Severe pain and swelling also occur. If a second-degree burn is no larger than 2 or 3 inches in diameter, it can be treated at home. If the burn covers a larger area, seek medical attention.

Third-degree burns are the most serious and involve all layers of skin. Fat, nerves, muscles, and even bones may be affected. Areas may be charred black or appear a dry white. These burns should receive emergency medical attention.

Steps to be followed for minor burns at home:

- If the skin is not broken, run cool water over the burn for several minutes.
- Cover the burn with a sterile bandage or clean cloth.

Treatment for major burns:

- Remove the person from the source of the burn (fire, electrical current, etc.).
- If the person is not breathing,begin mouth-to-mouth resuscitationimmediately.
- Remove all smoldering clothing to stop further burning.
- If the person is breathing sufficiently, cover the burned area with a cool, moist, sterile bandage or clean cloth. Do not place any creams, ointments or ice on the burned area or break blisters. Look for medical help. Protect from nearby hazards.Scald is an injury caused by Moist Heat such as Hot water, milk oil tar steam etc.
- If a person's cloth catches fire, do not allow him to run pour plenty of water or gently place him on ground and roll him slowly to put off flames.

Degrees of Burns

Degrees of burns:

Ist degree - Redness of skin and blister formation,

IInd degree - Internal tissue damage and scar formation,

IIIrd degree - Complete charring of part.

General treatment (F.A.Treatment) - for Burns and scalds.

Cool and clean the affected area with wet cloth/cotton or flood with water or dip into water if it is possible. Remove any constraint articles like bangles, rings, watches immediately otherwise they cannot be removed later. Remove the burnt cloths by cutting which is not stick to the skin.

Cover the area preferably with laundered towel and bandage but do not disturb blisters while bandage.

If he is conscious give water with pinch of salt to make good of lost salt and water, weak tea with more sugar also may be given if he is not diabetic patient.

Fracture, Dislocation, Sprain and Cramp

Definitions:

Fracture is breakage, crack/bend of a bone.

Dislocation is displacement of one or more bones from joint.

Sprain is wrenching tearing of cartilage near a movable joint.

Strain is over lapping of muscles at a particular place.

Cramp sudden painful involuntary contraction of voluntary muscles.

Fractures

Causes: Direct Force, Indirect force and Muscle action.

Signs and symptoms:

- Pain
- Tenderness (Sever pain by gentle touch)
- Swelling
- Loss of power
- Deformity (Bending/breaking into pieces)
- Crepitus (bonny grating sounds)
- Unnatural movements.
- Irregularity (by touching or comparing with other limb)

Types of Fractures:

Simple Fracture: The broken ends of the bone do not out open the skin and thus remain inside only.

Compound Fracture: When the fractured bone is in contact with outside air as a result of an injury.

Complicated Fracture: In addition to the fracture, an important internal organ like the brain or major blood vessel, the spinal cord, lungs, lever, spleen etc. may also be injured.

First Aid tips for Fractures:

- Steady and support the injured limb. Do not move the person.
- Dress wounds and control bleeding.
- Check for circulation beyond the site of the fracture. If impaired, get medical help quickly.
- If the injured person must be moved from the site, secure the limb with padded splints and bandages.
- Reassure the injured person, and keep him warm.
- Give pain relievers and treat for shock if necessary.
- Arrange medical aid as early as possible.
- Sprain and Strain F.A.Treatment:
- Place in suitable position and put firm bandage and in case of strain wet it with water frequently.
- Arrange medical aid.

1.7 Principles of accident, Causes & Prevention, unsafe act & unsafe condition, safety on small tools and electrical appliances, Housekeeping and Material Handling.

Workplace Housekeeping-Necessity to Pay Attention to Housekeeping at Work

Effective housekeeping can eliminate some workplace hazards and help get a job done safely and properly. Poor housekeeping can frequently contribute to accidents by hiding hazards that cause injuries. If the sight of paper, debris, clutter and spills is accepted as normal, then other more serious health and safety hazards may be taken for granted.

Housekeeping is not just cleanliness. It includes keeping work areas neat and orderly; maintaining halls and floors free of slip and trip hazards; and removing of waste materials (e.g., paper, cardboard) and other fire hazards from work areas. It also requires paying attention to important details such as the layout of the whole workplace, aisle marking, the adequacy of storage facilities, and maintenance. Good housekeeping is also a basic part of accident and fire prevention.

Effective housekeeping is an ongoing operation: it is not a hit-and-miss cleanup done occasionally. Periodic "panic" cleanups are costly and ineffective in reducing accidents.

Purpose of Workplace Housekeeping

Poor housekeeping can be a cause of accidents, such as:

- tripping over loose objects on floors, stairs and platforms

- being hit by falling objects
- slipping on greasy, wet or dirty surfaces
- striking against projecting, poorly stacked items or misplaced material
- cutting, puncturing, or tearing the skin of hands or other parts of the body on projecting nails, wire or steel strapping

To avoid these hazards, a workplace must "maintain" order throughout a workday. Although this effort requires a great deal of management and planning, the benefits are many.

Benefits of Good Housekeeping Practices

Effective housekeeping results in:

- reduced handling to ease the flow of materials
- fewer tripping and slipping accidents in clutter-free and spill-free work areas
- decreased fire hazards
- lower worker exposures to hazardous substances (e.g. dusts, vapours)
- better control of tools and materials, including inventory and supplies
- more efficient equipment cleanup and maintenance
- better hygienic conditions leading to improved health
- more effective use of space
- reduced property damage by improving preventive maintenance
- less janitorial work
- improved morale
- improved productivity (tools and materials will be easy to find)

Planning a Good Housekeeping Program

A good housekeeping program plans and manages the orderly storage and movement of materials from point of entry to exit. It includes a material flow plan to ensure minimal handling. The plan also ensures that work areas are not used as storage areas by having workers move materials to and from work areas as needed. Part of the plan could include investing in extra bins and more frequent disposal.

The costs of this investment could be offset by the elimination of repeated handling of the same material and more effective use of the workers' time. Often, ineffective or insufficient storage planning results in materials being handled and stored in hazardous ways. Knowing the plant layout and the movement of materials throughout the workplace can help plan work procedures.

Worker training is an essential part of any good housekeeping program. Workers need to know how to work safely with the products they use. They also need to know how to protect other workers such as by posting signs (e.g., "Wet - Slippery Floor") and reporting any unusual conditions.

Housekeeping order is "maintained" not "achieved." Cleaning and organization must be done regularly, not just at the end of the shift. Integrating housekeeping into jobs can help ensure this is done. A good housekeeping program identifies and assigns responsibilities for the following:

- clean up during the shift
- day-to-day cleanup
- waste disposal
- removal of unused materials
- inspection to ensure cleanup is complete

Do not forget out-of-the-way places such as shelves, basements, sheds, and boiler rooms that would otherwise be overlooked. The orderly arrangement of operations, tools, equipment and supplies is an important part of a good housekeeping program.

The final addition to any housekeeping program is inspection. It is the only way to check for deficiencies in the program so that changes can be made. The documents on workplace inspection checklists provide a general guide and examples of checklists for inspecting offices and manufacturing facilities.

Elements of an Effective Housekeeping Program

Dust and Dirt Removal

In some jobs, enclosures and exhaust ventilation systems may fail to collect dust, dirt and chips adequately. Vacuum cleaners are suitable for removing light dust and dirt. Industrial models have special fittings for cleaning walls, ceilings, ledges, machinery, and other hard-to-reach places where dust and dirt may accumulate.

Special-purpose vacuums are useful for removing hazardous substances. For example, vacuum cleaners fitted with HEPA (high efficiency particulate air) filters may be used to capture fine particles of asbestos or fibreglass.

Dampening (wetting) floors or using sweeping compounds before sweeping reduces the amount of airborne dust. The dust and grime that collect in places like shelves, piping, conduits, light fixtures, reflectors, windows, cupboards and lockers may require manual cleaning.

Compressed air should not be used for removing dust, dirt or chips from equipment or work surfaces.

Employee Facilities

Employee facilities need to be adequate, clean and well maintained. Lockers are necessary for storing employees' personal belongings. Washroom facilities require cleaning once or more each shift. They also need to have a good supply of soap, towels plus disinfectants, if needed.

If workers are using hazardous materials, employee facilities should provide special precautions such as showers, washing facilities and change rooms. Some facilities may require two locker rooms with showers between. Using such double locker rooms allows workers to shower off workplace contaminants and prevents them from

contaminating their "street clothes" by keeping their work clothes separated from the clothing that they wear home.

Smoking, eating or drinking in the work area should be prohibited where toxic materials are handled. The eating area should be separate from the work area and should be cleaned properly each shift.

Surfaces

Floors: Poor floor conditions are a leading cause of accidents so cleaning up spilled oil and other liquids at once is important. Allowing chips, shavings and dust to accumulate can also cause accidents. Trapping chips, shavings and dust before they reach the floor or cleaning them up regularly can prevent their accumulation. Areas that cannot be cleaned continuously, such as entrance ways, should have anti-slip flooring. Keeping floors in good order also means replacing any worn, ripped, or damaged flooring that poses a tripping hazard.

Walls: Light-coloured walls reflect light while dirty or dark-coloured walls absorb light. Contrasting colours warn of physical hazards and mark obstructions such as pillars. Paint can highlight railings, guards and other safety equipment, but should never be used as a substitute for guarding. The program should outline the regulations and standards for colours.

Light Fixtures: Dirty light fixtures reduce essential light levels. Clean light fixtures can improve lighting efficiency significantly.

Aisles and Stairways: Aisles should be wide enough to accommodate people and vehicles comfortably and safely. Aisle space allows for the movement of people, products and materials. Warning signs and mirrors can improve sight-lines in blind corners. Arranging aisles properly encourages people to use them so that they do not take shortcuts through hazardous areas.

Keeping aisles and stairways clear is important. They should not be used for temporary "overflow" or "bottleneck" storage. Stairways and aisles also require adequate lighting.

*Spill Control:*The best way to control spills is to stop them before they happen. Regularly cleaning and maintaining machines and equipment is one way. Another is to use drip pans and guards where possible spills might occur. When spills do occur, it is important to clean them up immediately. Absorbent materials are useful for wiping up greasy, oily or other liquid spills. Used absorbents must be disposed of properly and safely.

Tools and Equipment

Tool housekeeping is very important, whether in the tool room, on the rack, in the yard, or on the bench. Tools require suitable fixtures with marked locations to provide orderly arrangement, both in the tool room and near the work bench. Returning them promptly after use reduces the chance of being misplaced or lost. Workers should regularly inspect, clean and repair all tools and take any damaged or worn tools out of service.

Maintenance

The maintenance of buildings and equipment may be the most important element of good housekeeping. Maintenance involves keeping buildings, equipment and machinery in safe, efficient working order and in good repair. This includes maintaining sanitary facilities and regularly painting and cleaning walls. Broken windows, damaged doors, defective plumbing and broken floor surfaces can make a workplace look neglected; these conditions can cause accidents and affect work practices. So it is important to replace or fix broken or damaged items as quickly as possible. A good maintenance program provides for the inspection, maintenance, upkeep and repair of tools, equipment, machines and processes.

Waste Disposal

The regular collection, grading and sorting of scrap contribute to good housekeeping practices. It also makes it possible to separate materials that can be recycled from those going to waste disposal facilities.

Allowing material to build up on the floor wastes time and energy since additional time is required for cleaning it up. Placing scrap containers near where the waste is produced encourages orderly waste disposal and makes collection easier. All waste receptacles should be clearly labelled (e.g., recyclable glass, plastic, scrap metal, etc.).

Storage

Good organization of stored materials is essential for overcoming material storage problems whether on a temporary or permanent basis. There will also be fewer strain injuries if the amount of handling is reduced, especially if less manual materials handling is required. The location of the stockpiles should not interfere with work but they should still be readily available when required. Stored materials should allow at least one metre (or about three feet) of clear space under sprinkler heads.

Stacking cartons and drums on a firm foundation and cross tying them, where necessary, reduces the chance of their movement. Stored materials should not obstruct aisles, stairs, exits, fire equipment, emergency eyewash fountains, emergency showers, or first aid stations. All storage areas should be clearly marked.

Flammable, combustible, toxic and other hazardous materials should be stored in approved containers in designated areas that are appropriate for the different hazards that they pose. Storage of materials should meet all requirements specified in the fire codes and the regulations of environmental and occupational health and safety agencies in your jurisdiction.

Safety Precautions to be Followed While Working With Electrical Hand Tools & Gadgets.

- The electrical hand tools should be of good construction with certification from BIS or any other international agency similar to BIS working on 110V, 50 cycles per second (AC) supply.
- The cable connected to the machine tool should be of good quality double insulated three-core type, so that proper earth is made effectively. The

cable end should have been connected to a 3 pin top. The cable should not have joints. All long cables with joints should have proper protection.

- The electrical circuit should be checked for earth before commencement of work.
- The work should be carried out only by trained personnel. They should wear Safety shoes without nails. They should wear panoramic goggles or spectacle type goggles with side covers while working with portable drilling & grinding machines to avoid eye injury.
- The cable should not be left on the floor where there is chance of running over by trolleys having metal wheels or chance of falling of metal scrap from height on the cable.

Material Handling

A material handling for long has been considered as an activity of lifting, shifting and placing of any material regardless of size, form and weight. However, with the growing complexities of the production operations, a need has been felt to integrate the materials handling function with the production operation and control production control functions. The function of production control in any enterprise is to optimise the production within the limitations imposed by manufacturing and marketing conditions. It determines factors like what is to be done, where it is to be done, how it is to be done and when it is to be done. Whereas materials which are to be moved as per the schedules of manufacturing and production control. The procedures, actions and evaluations used in controlling the movement of materials create a strong link between the functions of materials handling, production operations and production control. Realisation of this integrated systems approach offers a great opportunity for the reduction in production delays and costs in the industry. Materials Handling is, therefore, now being considered as Preparation, Placing and Positioning of materials to facilitate their movement or storage. It relates to every aspect of product except the actual processing".

Definition

The American Society of Mechanical Engineers (ASME) has approved the following definition: "Materials Handling is the art and science involving the moving, packaging and storing of substance in any form." A few other representative definitions mentioned elsewhere are:

*Materials handling is the creation of time and place utility in a material.

*Materials handling IS the lifting, shifting and placing of materials, which effect savings in money time and place.

Materials Movement Management

The growing complexities of the production processes, the increasing competitive practices within the industry and in the country, coupled with the rising cost of labour has led to increased awareness in managers and engineers about the application of materials handling techniques to cut down the unit cost of production and to increase the productivity in the enterprises.

There are a number of success stories, but the desired situation is yet to be obtained. It can be inferred that past approaches to materials handling have frequently led to lessening the magnitude of the problem rather than completely

solving the same. Even now idle lying handling equipments or machines waiting for handling equipments are very common sight in our industries, especially in engineering and construction units.

This can possibly be attributed to the fact that the approach to materials handling, though sometimes claimed to be systems oriented, has mostly been fragmented are ultimately, equipment-oriented.

Growing number of materials handling equipment manufacturers in India, easy availability of the equipment, flexibility in usage, and intensive sales campaign have resulted in the undesirable tendency to confuse the materials handling system with the use of mechanical aids to the handling. Of course, in many a situation the mechanisation can be useful and increase the efficiency of the system but a quick jumping in this direction takes away the opportunity for a logical and a procedural analysis.Thecentralpoint of focus then becomes, "How to handle" which leads to "What type of equipment should be used" and this often, results in purchase of some adhoc equipment which suits the budget only or is being used in similar conditions elsewhere. Whereas the concern should be on “Systematic Movement Analysis” and “Management Requirement Analysis" wherein "Handling Analysis" forms only a part of the exercise.

"Materials Movement Management" thus, is a broader concept covering the analysis, integration, coordination of Production Management System, Materials Management, Materials Handling, Facility Planning and Plant Engineering into an interlinked framework with a view to achieving optimum cost of movement and storage of materials to meet the production and delivery schedules of the company."

The approach based on Materials Movement Management focuses attention on the four aspects viz. material, moves, methods and management.

The basic analysis should therefore, be as follows:

- METHOD
- MATERIAL
- MOVES
  - What materials are to be moved and why?
  - Where and when the materials are to be moved and why?
  - How the material is to be moved?
- MANAGEMENT
  - What is the cost of movement?
  - What are the Systems implications?
  - What is the efficiency of the systems?

Material Handling Principles

Some of the major principles in the design of an efficient system of materials handling are:

(a) Reduce handling to a minimum

As far as possible materials should always move towards completion, over, the shortest distance without back-tracking. Often materials move back and forth over large distances unnecessarily. A large amount of handling can be eliminated by planning the location of operations so that one operation finishes right where the next begins. The flow of product should receive top priority in planning of layout.

(b) Avoid re-handling

It may not be possible to eliminate re-handling completely, nevertheless re-handling is a wasteful and costly operation. Re-handling can be reduced by (i) not keeping anything on floor, (ii) avoiding transfers from floor to container or vice versa or from container to container and (iii) avoiding mixing of materials.

(c) Combine handling with other operations

Many times handling may be, made a productive activity by combining with other operations, such as production, inspection, and storage. In process industries, materials undergo physical and chemical changes while in movement, handling devices may be used as live storages or materials may be sorted and inspected while they are being handled.

(d) Ensure safety in handling

Safety is a key word in handling. A large percentage of industrial accidents are attributed to poor handling practices. Even more costly in terms of money in the damage to equipment and products due to improper handling methods. A good handling system should ensure safety to walkers and materials. Manual handling of heavy objects materials scattered on floor or projecting into aisles are but a few causes of accidents. Keeping gangways and aisles clear is one of the primary precautions against accidents in handling.

(e) Handle materials in unit loads

It is easier and quicker to move a number of materials at a unit rather than piece by piece. Modern material handling devices are designed to take advantage of unutilised loads.

(f) Use gravity where possible and mechanical means if necessary

Remember: The simplest and cheapest way to handle materials is by using gravity.

Often chutes and inclined boards can conveniently used to transport materials quickly to the point of use about much investment on costly handling equipment. Where it is not possible to use gravity for various practical reasons, some mechanical means should be considered. Lifting and carrying of heavy materials mechanical1y saves time and reduces fatigue of workers.

(g) Select proper handling equipment

There are as many types of handling equipment available today as the number of materials to be handled. And any single equipment may not solve all handling problems. It is therefore, necessary to choose the equipment suitable for the job under consideration. The equipment selection needs to be done carefully so that there is an efficient coordination of all handling, resulting in overal1 economy. Use of standardized equipment facilitates maintenance and repair.

Another important factor in the selection of equipment is flexibility.Industrial activity is subject to constant changes and handling equipment should provide for this change. In other words, the equipment selected. should be capable of a variety of uses and applications.

(h) Reduce terminal time of equipment

The advantage of mechanical and power equipment would be lost if they are made

to wait during loading and unloading this may take considerable amount of time. By reducing this waiting time the handling equipment could be released for more productive work. There are various mechanical devices like trailers; tipping arrangements, cranes and hoist attachments, to quicken loading and unloading operations.

(i) Buy equipment for overall savings

In selecting equipment savings in overall handling cost must be the guiding principle rather than the first costs of equipment. Arriving at handling costs is a difficult problem but a fairly accurate estimate can be obtained by determining the handling elements and applying work measurement.

In India labour is still comparatively less costly and a longer period may have tobe allowed foramortizing thehandling equipment. All direct and indirect savings are to be taken into consideration while deciding on handling equipment.

(j) Use labour consistent with handling methods

Manual handling could be done by unskilled labour, whereas mechanical handling may. require semi-skilled or skilled workers. Proper allocation of skills helps in overall economy. As far as possible direct production operators should not be used for handling operations. It is preferable to have a separate gang of material handlers to ensure proper utilization of production workers.

(k) Train workers and maintain equipment

Careful operation and proper upkeep are essential for getting the maximum out of the handling equipment. Careful selection and training of employees in principles, operation and safety rules and planned maintenance of equipment are 'worthwhile investments in the long run.

Efficient Material Handling

Use of right method to provide right amount of right material at the right time in the right sequence, right position, right condition and at right cost

Types of Material Handling Equipment

The material handling equipments are classified under five categories.

(1) CONVEYORS: Used to move the material between two fixed stations either continuously or intermittently. Types: (a) Roller Type (b) Wheel Type (c) Bucket Type (d) Screw Type

(2) INDUSTRIAL TRUCKS AND TROLLEYS: Moving materials in a shop floor in a flexible manner. Examples are: Trolleys, Motor Trucks, Fork Lifts, Platform Truck

(3) CRANES AND HOISTS: Moving the material on over head space without disturbing workers.Examples :Jib cranes, Bridge cranes, Circular cranes, Hoists : Chain hoists, Electric hoists, Pneumatic hoists

(4) CONTAINERS:

a. Dead Container : Contains material but not moved.

b. Live Container : Contains material and can be moved.

E.g. Power trucks, wagons etc.

1.8 Role of supervisors on safety, Accident reporting & investigations.

1.9 Review

2. ACCIDENT & DISASTER MANAGEMENT

2.1 Rail wheel Interaction

Accident – Definition

Accident is an occurrence in the course of working of railway, which does or may affect the safety of the railway , its engines, rolling stock, permanent way works, passengers or servants or which affects the safety of others or which does or may cause delay to train or loss to railway.

Classification of Accidents

1. Train accidents
2. Yard accidents
3. Indicative accidents
4. Equipment failure
5. Unusual Incidents

Train Accidents

Train accident is an accident that involves a train. Train accidents are further divided as

A) Consequential train accidents

B) Other train accidents

Consequential Train Accidents

These accidents include train accidents having serious repercussions in terms of loss of human life, human injury, loss of railway property or interruption to rail traffic. Categories a-1 to a-4, b-1 to b-4, c-1 to c-4, d-1 to d-4 and all cases of e-1.

Other Train Accidents

All other accidents which are not covered under the definition of consequential train accidents are to be treated as other train accidents. These include the categories b-5, b-6, c-5 to c-8, d-5 and e-2.

Yard Accidents

In terms they are not accidents but are serious potential hazards and include all cases of train passing,signal at danger, averted collision, breach of block rules etc., and coming under classification f, g and h.

Equipment Failure

These include the all failures of railway equipment i.e., failure of locomotive, rolling stock, permanent way, overhead wire, signalling and telecommunication equipment etc., falling under classification j, k, l and m.

Unusual Incidents

These include cases related to law and order but not resulting into the train accidents and other incidents under classification n, p, q and r.

Serious Accidents

Accidents to a train carrying passengers which is attended with loss of life or with grievous hurt to a passenger or passengers in the train or with serious damages to railway property of the value exceeding rs 25 lakhs or any other accident which in the opinion of the CCRS / CRS requires the holding of enquiry by CRS shall also be deemed as serious accident.

Classification of Accidents

- Class “A” Collision (A-1 TO A-5)
- Class “B” Fire or Explosion in Trains (B-1 TO B-7)
- Class “C” Trains Running in to Road Traffic / Traffic Running in to Trains at level crossings (C-1 TO C-9)
- Class “D” Derailments (D-1 to D-6)
- Class “E” Other train accidents

Indicative Accidents

- Class “F” Averted collision (F-1 TO F-4)
- Class “G”Breach of Block Rules (G-1 to G-4)
- Class “H” Train passing signal at danger (H-1 to H-2)
- Class “J” Failure of Engine and Rolling Stock (J-1 to J-10)
- Class “K” Failure of Permanent way (K-1 to K-7)
- Class “L” Failure of electrical equipments (L-1 to L-4)
- Class “M” Failure of signaling and telecommunication (M-1 to M-7)

Unusual Incident

- Class “N” Train wrecking (N-1 to N-3)
- Class “P” Casualties (P-1 to P-3)
- Class ‘Q’ Other Incidents (Q-1 to Q-6)
- Class ‘R’ Miscellaneous (R-1 to R-5)

Introduction to Rail Wheel Interaction

Running of a railway vehicle over a length of track produces dynamic forces both on the vehicle and on the track.Rail (track) wheel (railway vehicle) interaction-affects both track and railway vehicle

Effect of Vehicle on Track

1. Deterioration of track geometry
2. Track component wear & damage
3. The large dynamic forces
4. Vibration
5. Noise

Effect of Track on Vehicle

1. Safety risk
2. Vehicle ride
3. Riding comfort
4. Component wear & damage

Need For Understanding

1. Reduce safety risk / elimination of derailment
2. Avoid / reduce deterioration of track geometry

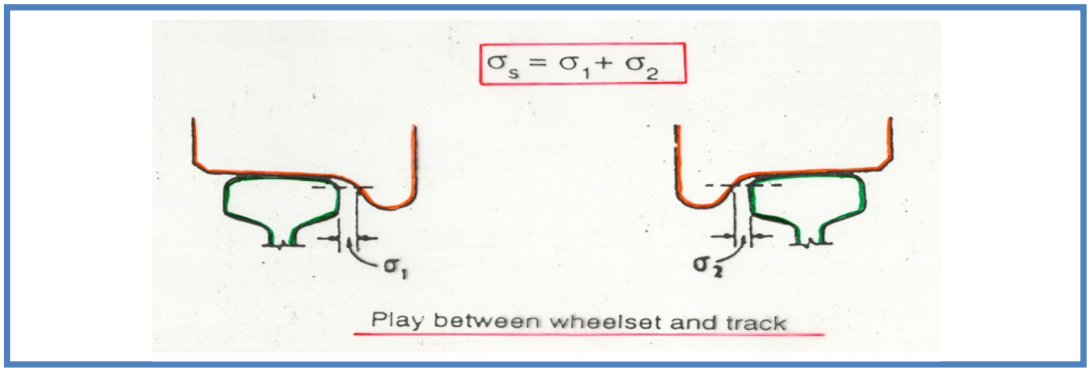
3. Minimize wear
4. Avoid damage of track and wagon components
5. Reduce noise and vibrations in railway vehicle

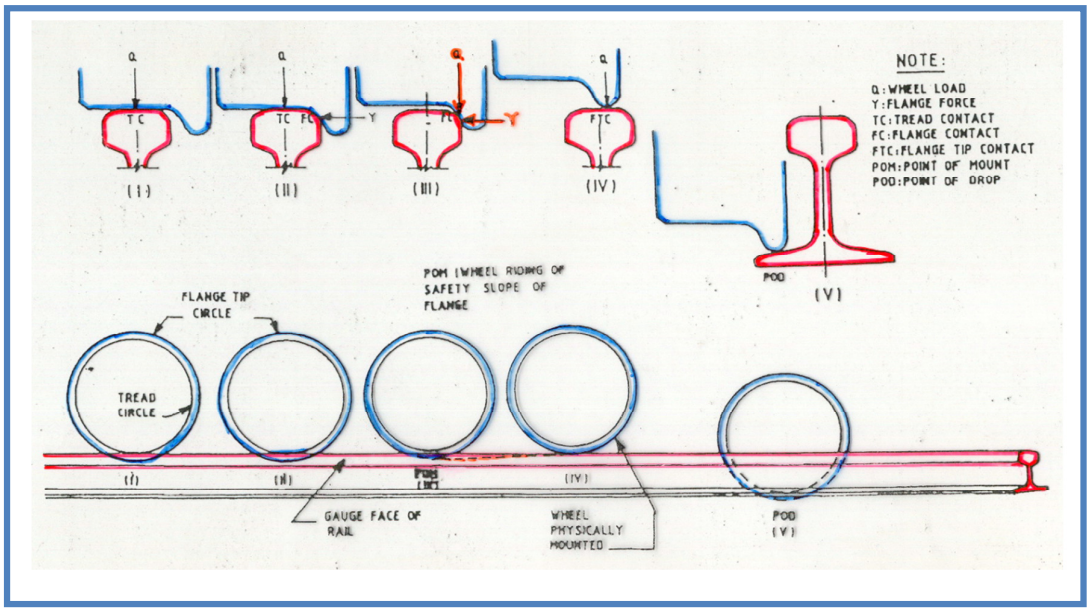
Understanding of Rail -Wheel Interaction

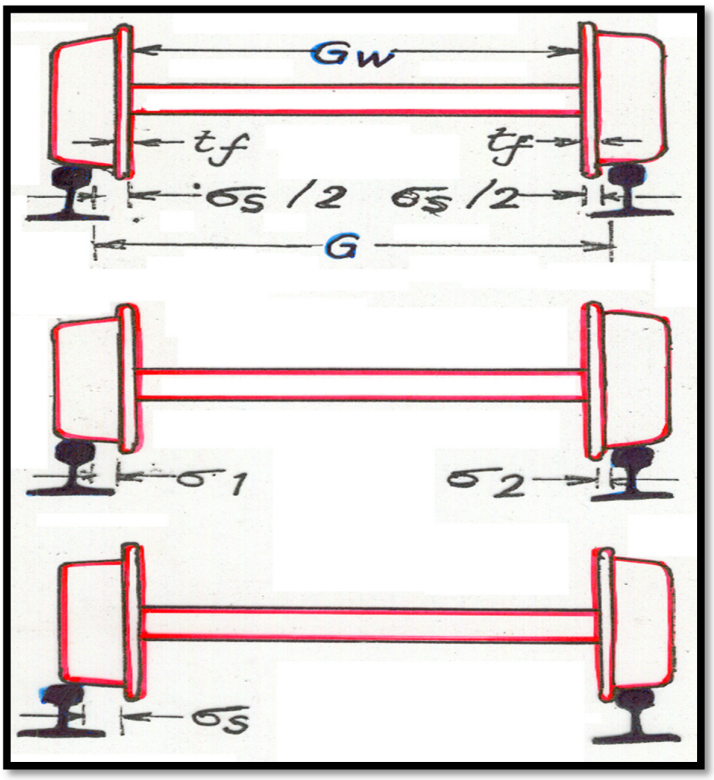
1. Derailment by flange mounting
2. Wheel coincity & gauge play
3. Wheel off-loacing
4. Cyclic track irregularities- resonance & damping
5. Critical speed
6. Track / vehicle twist

Rail-wheel interface

(a) During normal movement of vehicle, (b) when the wheel flange slants sliding, sliding up the rail during the process of flange climbing derailment.







Mean Position

Typical (Asymmetrical) Position

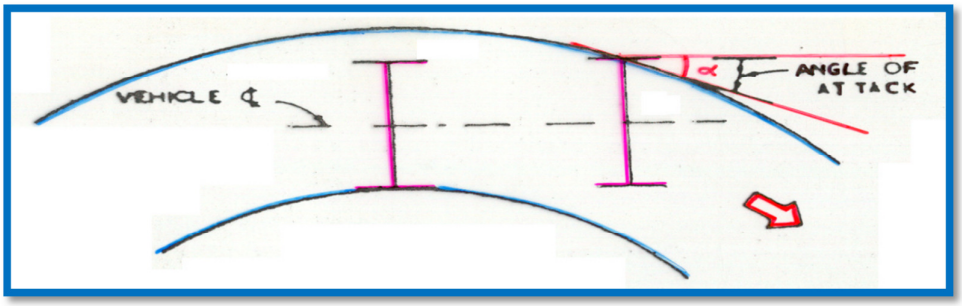
ExtremePosition

- σ1 and σ2 will be varying during the run
- $G = G_w + 2\ t_f + \sigma_s$
- G is track gauge 1676 mm (BG)
- G_w is wheel gauge 1600 mm (BG)
- t_f is flange thickness 28.5 mm new; 16mm worn out
- σ_s is gauge play

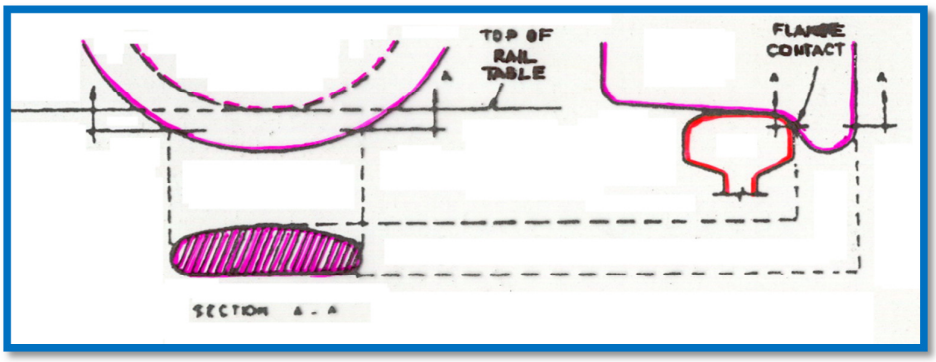
  = 19mm for new wheel

  = 44mm for worn out wheel

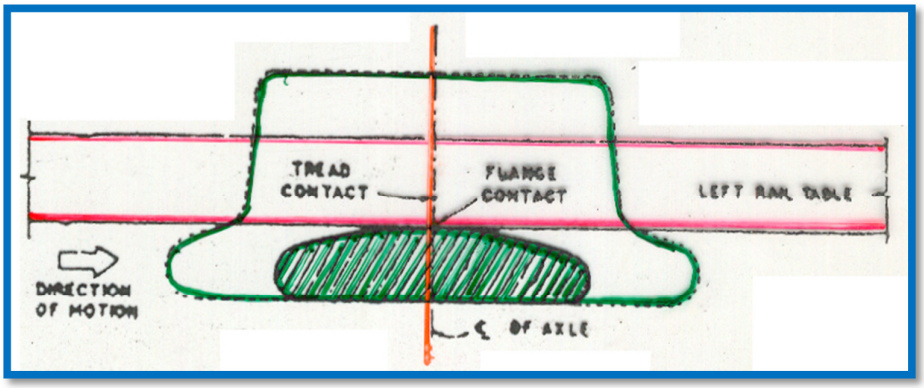
Angularity of axle while negotiating a curve



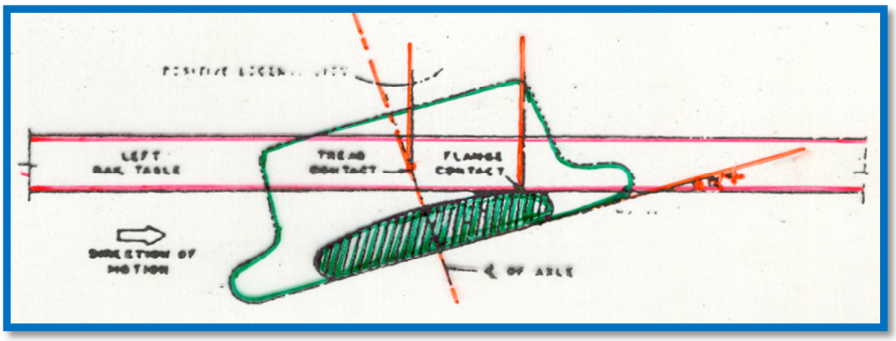
SECTIONAL PLAN OF WHEEL FLANGE AT LEVEL OF FLANGE TO RAIL CONTACT



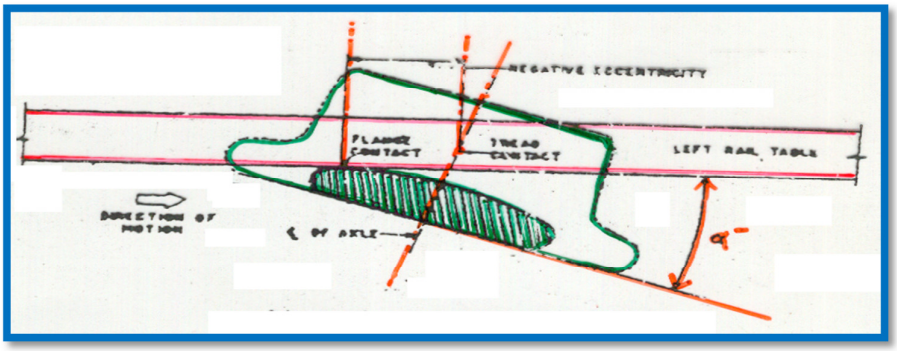
ZERO ANGULARITY (PLAN)



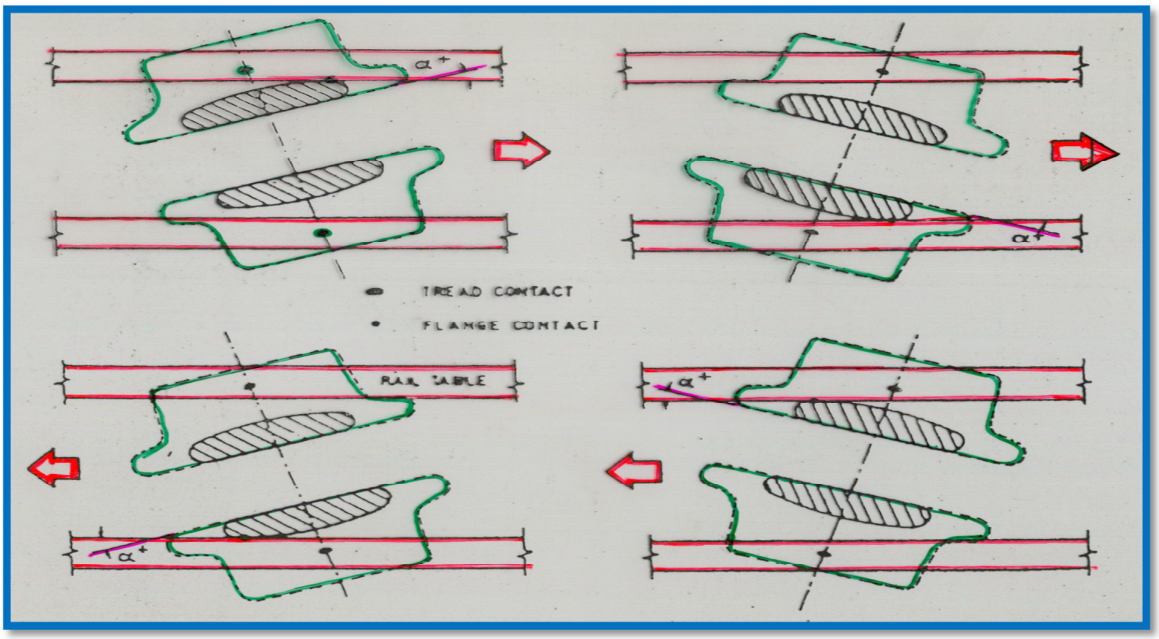
POSITIVE ANGULARITY (PLAN)



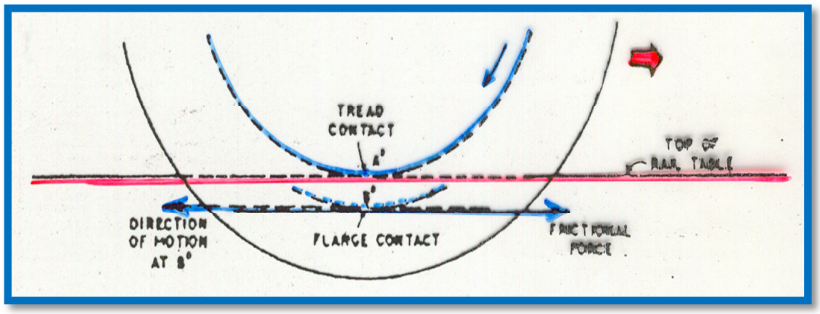
NEGATIVE ANGULARITY (PLAN)



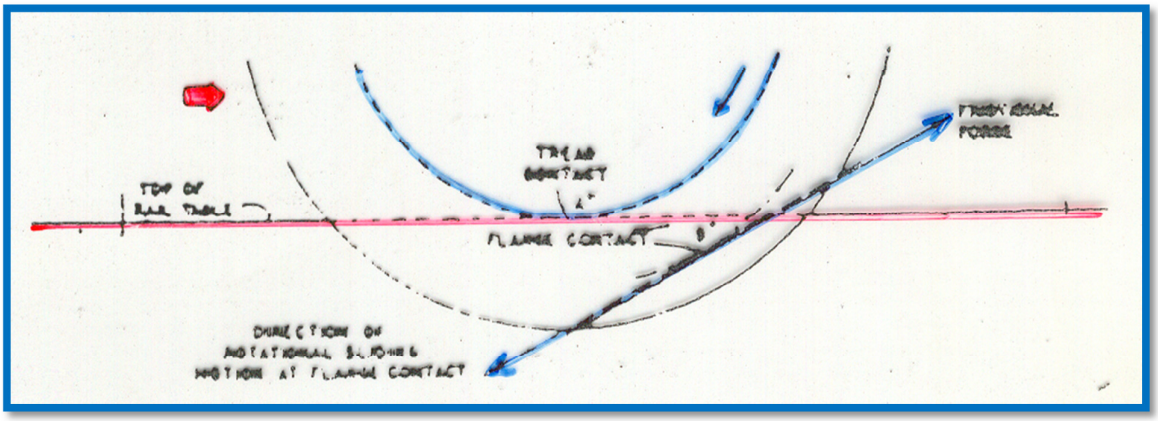
Examples of Wheel Set Configuration With Positive Angularity



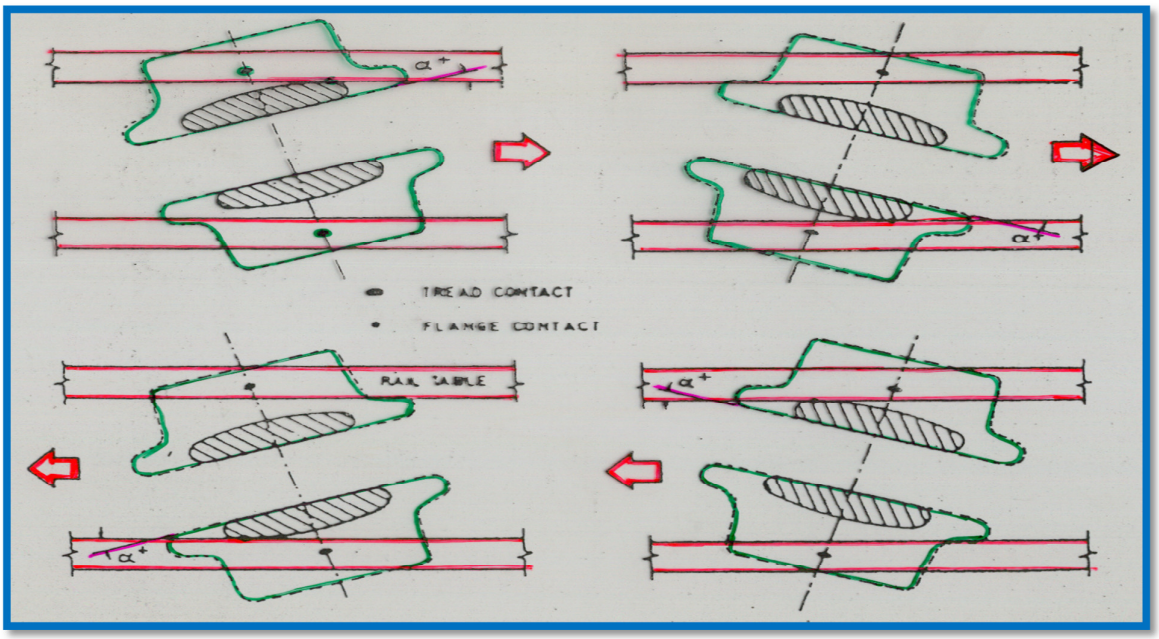
ZERO ANGULARITY (ELEVATION)



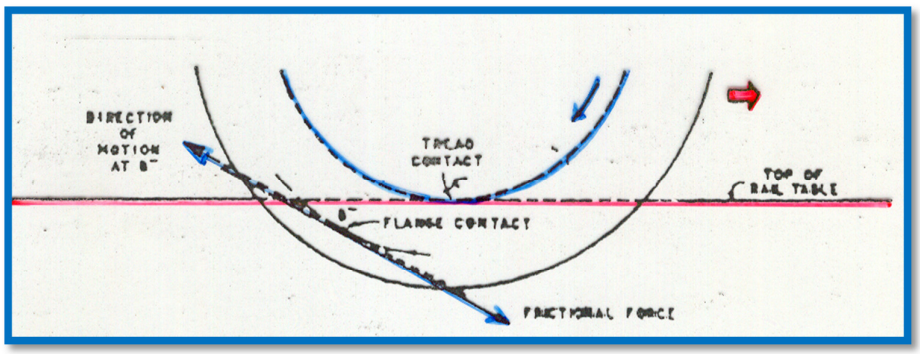
POSITIVE ANGULARITY (ELEVATION)



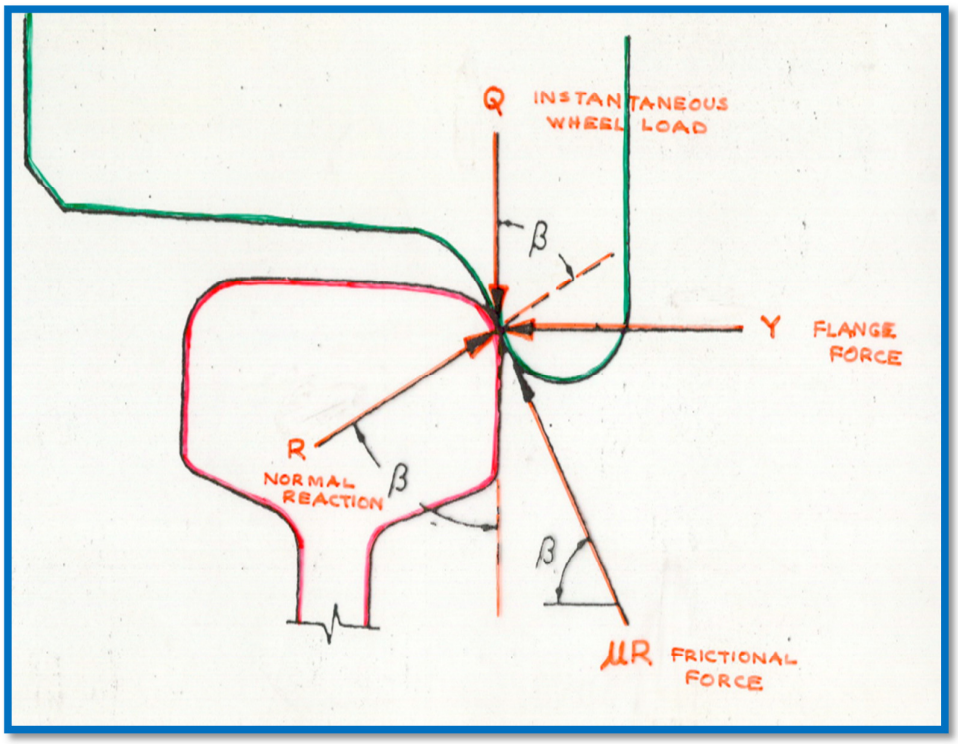
NEGATIVE AN



GULARITY (ELEVATION)



Forces at rail-wheel contact at moment of incipient derailment with positive angularity of axle.



Resolving Along Flange Slope

R= Q cos β + Y sin β…. 1.

For safety against derailment

Derailing forces > stabling forces

Y cos β + μR > Q sin β

Substituting R from equation 1

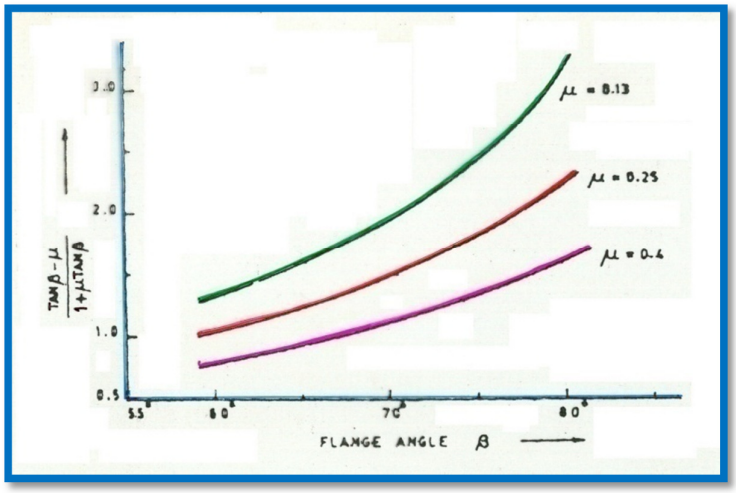
$\Rightarrow$ Y cos β + μ (Q cos β + Y sin β) > Q sin β

Y (cos β + μ sin β) > Q (sin β - μ cos β)

$$\Rightarrow \quad \frac{Y}{Q} > \frac{(\sin\beta - \mu\cos\beta)}{(\cos\beta + \mu\sin\beta)}$$

Nadal's Equation (1908) $$\frac{Y}{Q} > \frac{\tan\beta - \mu}{1 + \mu\tan\beta}$$

- For Safety: LHS has to be small. RHS has to be large
- Y $\rightarrow$ Low
- Q $\rightarrow$ High
- $\rightarrow$ Low
- tan $\beta \rightarrow$ Large



TAN β

β = 90º would indicate higher safety. But with slight angularity, flange contact shifts to near tip. Safety depth for flange reduces. Derailment proneness will increase.

ANGULARITY

Angularity is inherent feature of vehicle movement. If the vehicle has greater angularity β should be less for grater safety depth of flange tip. But there is a limit to it, as this criterion runs opposite to that indicated by Nadal's formula.

On I.R., for most of rolling stock β = 68º 12' (flange slope 2.5:1)

However, for diesel and electric locos, the wheels encounter greater angularity for negotiation of curves and turnouts, β is kept lower as 60º. For uniformity, same β adopted for all wheels.

With wear β increases, but results in greater biting action, hence increase in μ.

Other Factors Influencing Nadal's Formula:-

μ increases with increased α (prof. heumann).

*Greater eccentricity (positive angularity) increases derailment proneness as flange safety depth reduces.

*Persistent Angular Running

As positive angularity increases derailment proneness, persistent angularity leads to greater chances of derailment.

Note: Not possible to know values of Q, Y, μ, α& eccentricity at instant of derailment. Therefore, calculations by NADAL's formula not to be attempted. A qualitative analysis by studying magnitude of defects in track/vehicle analysis by studying magnitude of defects in track/vehicle and relative extents to which they contribute to derailment proneness, should be done.

Defects/Features Affecting μ

- Rusted rail lying on cess, emergency x-over
- Newly turned wheel – tool marks
- Sanding of rails (on steep gradient, curves)
- Sharp flange (radius of flange tip < 5mm) increases biting action

Defects/Features For Increased Angle Of Attack

Increased Play Between Wheel Set & Track Due To -

- Excessive slack gauge
- Thin flange (<16mm at 13mm from flange tip for BG or MG)
- Excessive clearance between horn cheek and axle box groove
- Sharp curves and turnouts
- Outer axles of multi axle rigid wheel base subject to greater angularity, compared to inner wheel

Defects / feature for increased positive eccentricity

- Wheel flange slope becoming steeper (this defect reduces safety depth as eccentricity increases)

Defect/features causing persistent angular running

- Difference In Wheel Dia Measured on same axle
- incorrect centralization & adjustment of brake rigging and brake blocks
- wear in brake gears
- hot axle
    - higher coefficient of friction
    - different bearing pressures

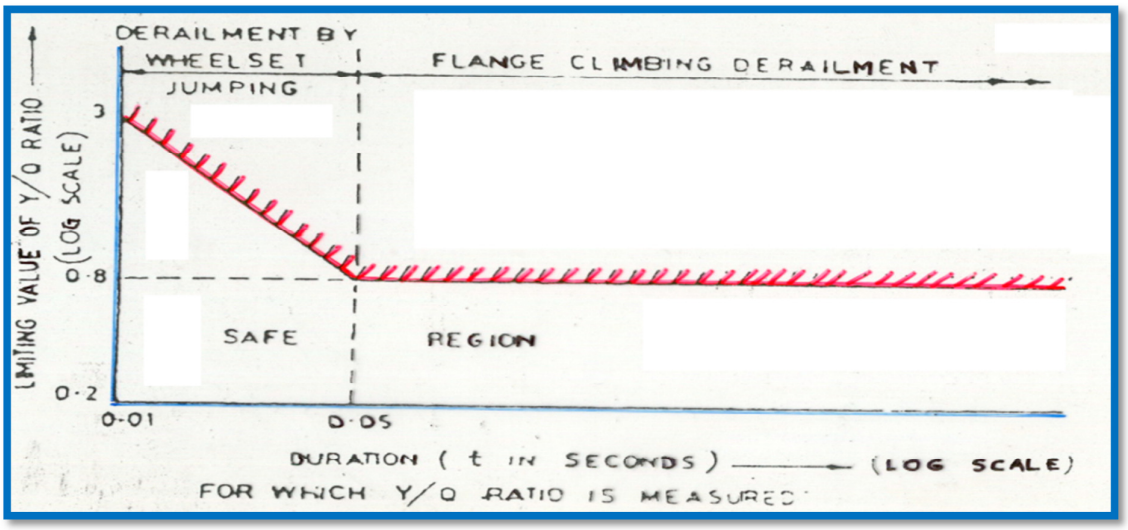
Stability Analysis

Q & Y – Instantaneous values, measurement by MEASURING WHEEL

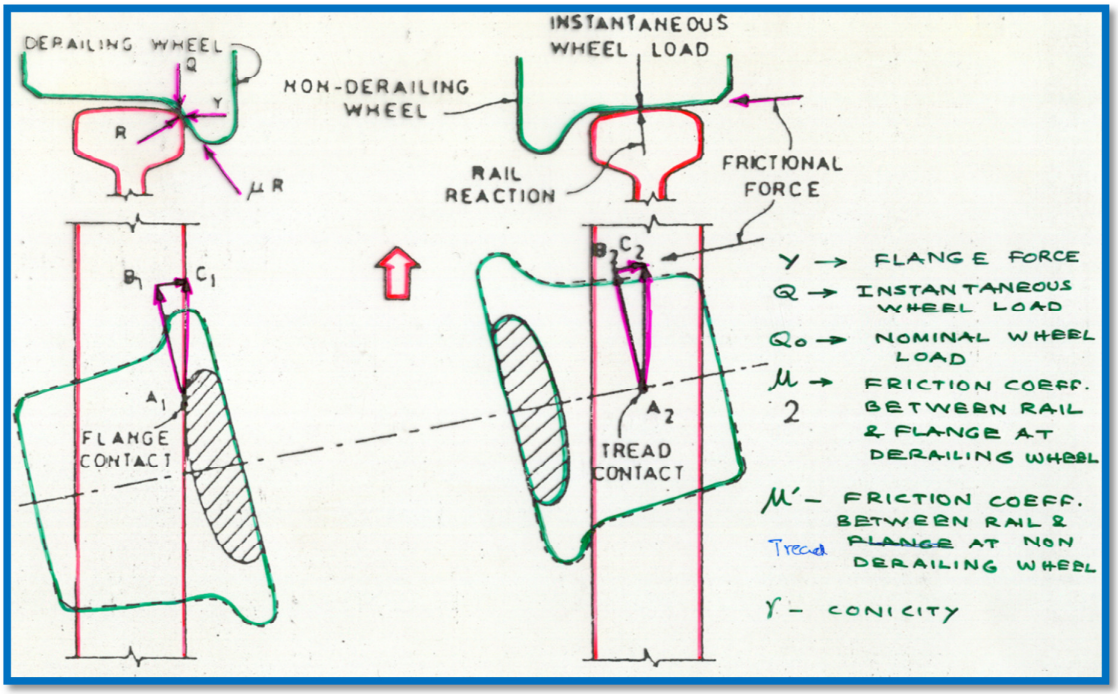
Hy = Horizontal force measured at axle box level

Q = (Vertical) spring deflection x spring constant

LIMITING VALUES OF Y/Q RATIO VS TIME DURATION



DIRECTION OF SLIDING FRICTION AT TREAD OF NON-DERAILING WHEEL



Chartet's Formula

$$K_1 = \frac{\tan\beta - \mu}{1 + \mu\tan\beta} + \mu' + \gamma$$

$$\frac{Y}{Q} > K_1 - K_2\frac{Qo}{Q}$$

$K_2 = 2(\mu + \gamma)$

$$\mu' = \sqrt{2}\mu$$

γ = Angle of coning of wheel γ = 1/20 = 0.05

μ = 0.25 $K_1 = 2$ $K_2 \approx 0.7$

For Safety

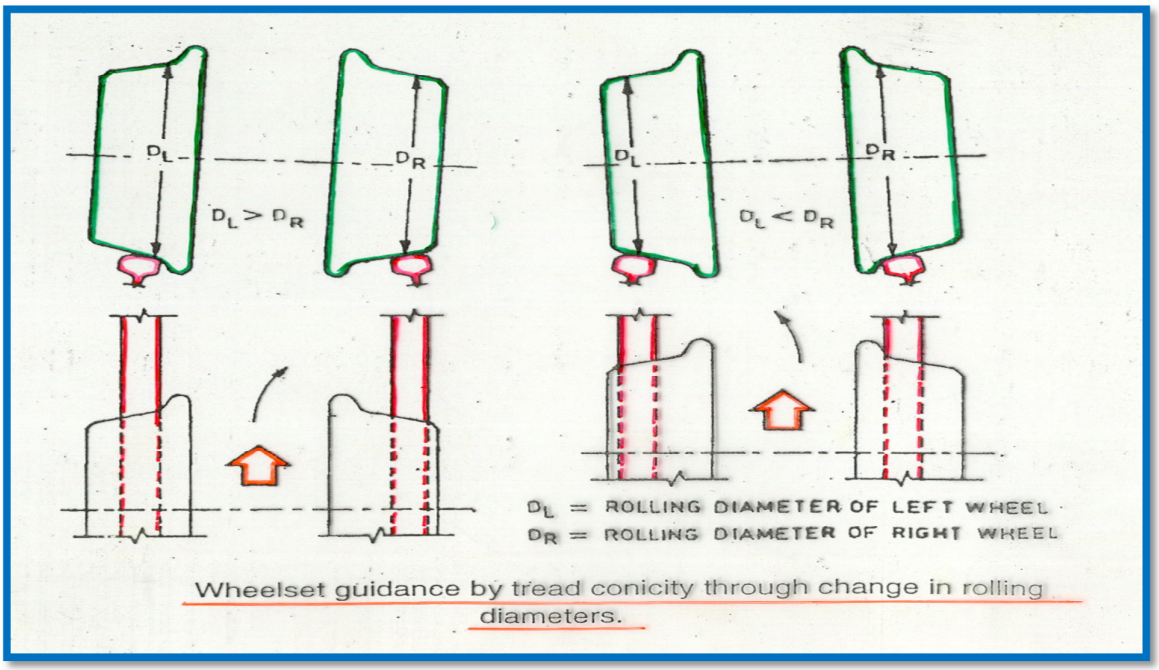
$$\frac{y}{Q} > 2 - 0.7\frac{Qo}{Q}$$

$\Rightarrow$ Y >2Q – 0.7Q_o

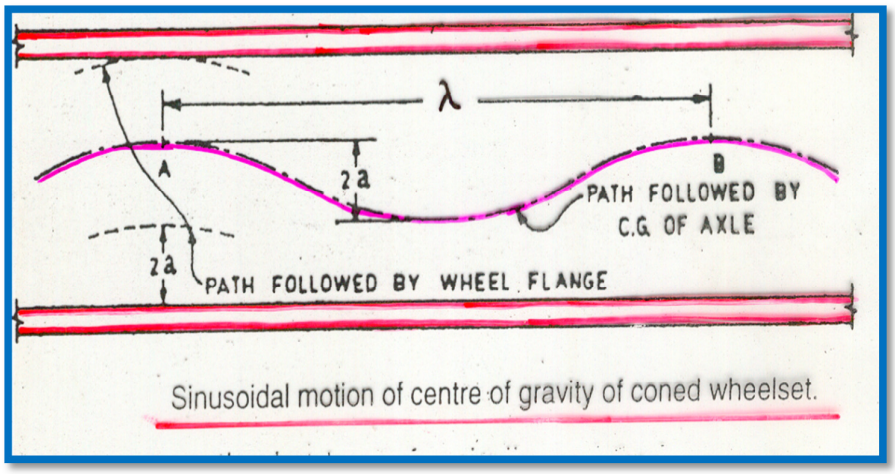
$\Rightarrow$ 2Q <Y + 0.7Q_o

As $Y \to 0$ 2Q <0.7Q_o $\Rightarrow$ Q < 0.35Q_o

Instantaneous Wheel Load Q should not drop below 35% of nominal wheel load Q_o



Wheelset guidance by tread conicity through change in rolling diameters.



Sinusoidal motion of centre of gravity of coned wheelset.

Sinusoidal Motion Of Coned Wheel Kilingel's Formula (1883)

Wave Length λ_0 of a Single wheel

$$\lambda_0 = \quad 2\pi\sqrt{\frac{rG}{2\gamma}}$$

G = Dynamic Gauge

r = Dynamic Wheel Radius

γ = Conicity

$$\lambda_0 \alpha \quad \frac{1}{\sqrt{\gamma}}$$

Frequency $\alpha\sqrt{\gamma}$

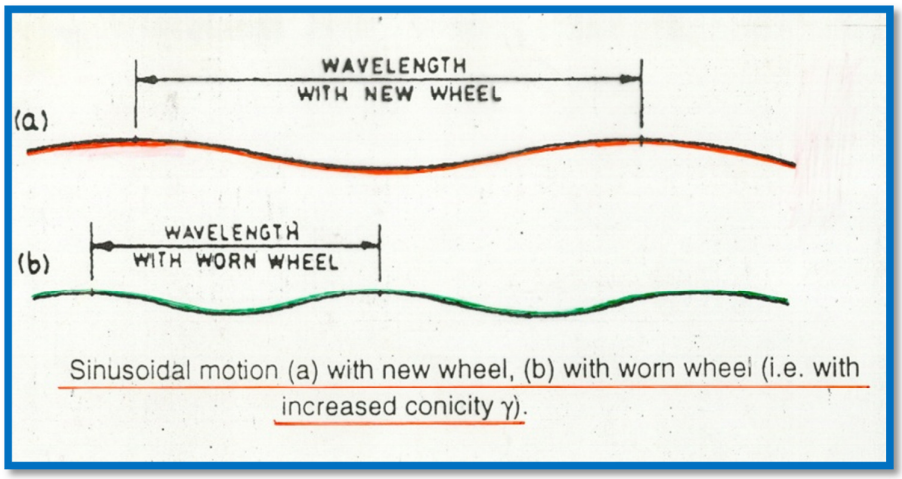
Conclusions:

- With increase γ, λ_0 reduces, f increases – oscillations increase – instability
- For high speed γ – low 1 in 40 on high speed routes
- Worn out wheel γ increases – increasing instability

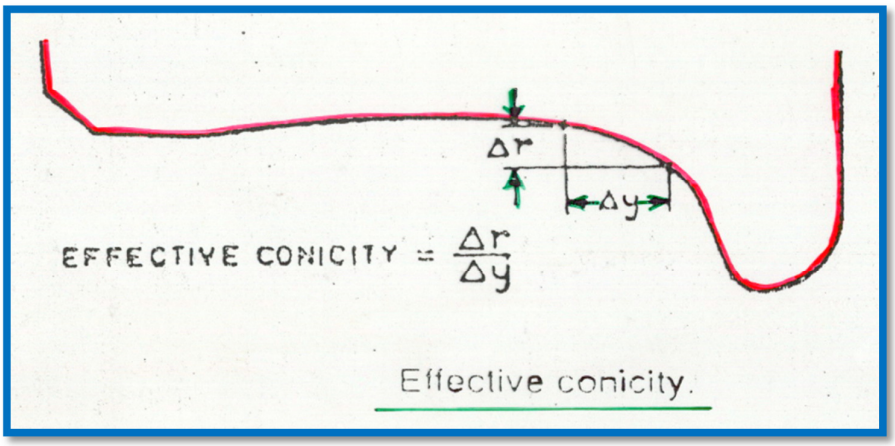
For wheel set

$$\lambda = \lambda o\sqrt{1+\left(\frac{l}{G}\right)^2}$$

l= Rigid wheel base



Sinusoidal motion (a) with new wheel, (b) with worn wheel (i.e. with increased conicity γ).



Effective conicity.

Effect of Play:

Lateral Displacement Y = a sin wt

a → amplitude = σ/2 = Play/2

Lateral velocity = aw cos wt

Lateral Acceleration = -aw^2 sin wt

Max acc = -aw^2

Angular Velocity w = $2\pi f = \frac{2\pi v}{\lambda}$

$$acc = a.\frac{4\pi^2 v^2}{\lambda^2}$$

Conicity

As conicity increases Lat. Accn. Increases $acc \alpha \frac{1}{\lambda^2} \alpha \gamma$

acc α a ασ/2 play

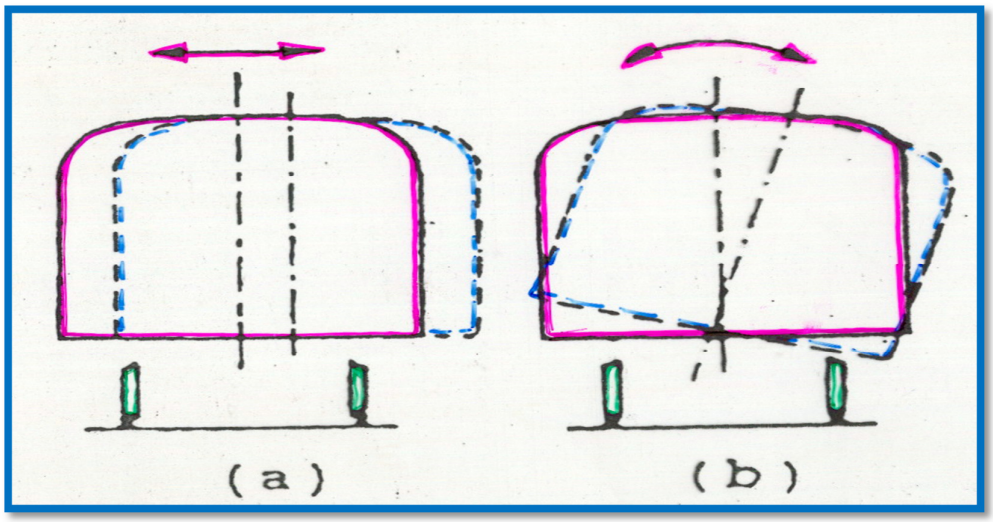
As play increases Lat. Accn. Increases

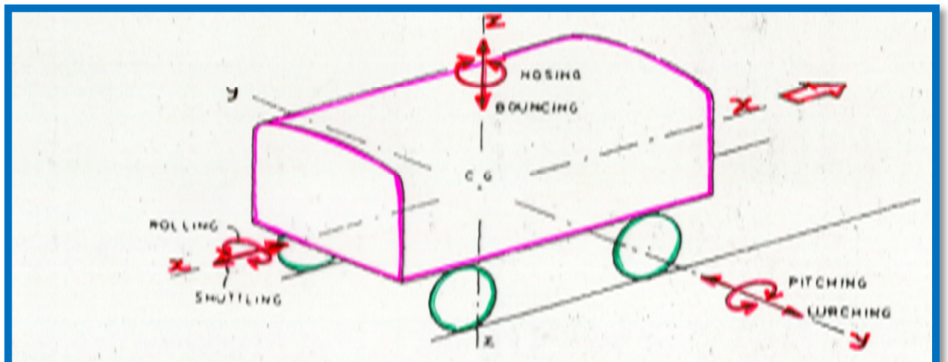
Conclusion:

Excessive Oscillations Due To

- Slack Gauge
- Thin Flange
- Increases Play in bearing & Journal
- Excessive Lateral and Longitudinal Clearances
- Increased Derailment Proneness

(a) Linear oscillation; (b) rotational oscillation





The six modes of oscillation.

Axis	Mode of oscillation	
	Linear	Rotational
x	Shuttling	Rolling
y	Lurching	Pitching
z	Bouncing	Nosing (also called 'yaw')

TRACK & VEHICLE DEFECTSS CAUSING VARIOUS PARASITIC MOTIONS

TRACK DEFECTS	PARASITIC MOTION
1. X-Level	1. Rolling
2. Loose Packing	2. Bouncing, Rolling
3. Low Joint	3. Pitching
4. Alignment	4. Nosing, Lurching
5. Slack Gauge	5. Nosing, Lurching
6. Versine Variation	6. Nosing, Hunting

VEHICLE DEFECTS CAUSING PARASITC MOTION

VEHICLE DEFECT	PARASITIC MOTION
1. Coupling	1. Shuttling, Nosing
2. Worn wheel	2. Hunting, Nosing, Lurching
3. Ineffective spring	3. Bouncing, Pitching, Rolling
4. Side Bearer Clearance	4. Rolling, Nosing
5. In-effective Pivot	5. Nosing

TRACK DEFECT	MODE OF OSCILLATIONS	AFFECTS' VALUE
Low joint Unevenness Loose Packing	Bouncing & Pitching	Q
Alignment Gauge Fault	Lurching, Nosing & Rolling	Y Q
Twist	Rolling	Q
The above track defects when occurring in cyclic form would cause external excitation. Hence, Adequate Damping Necessary		

Effect of Cyclic Track Irregularity of Vehicle

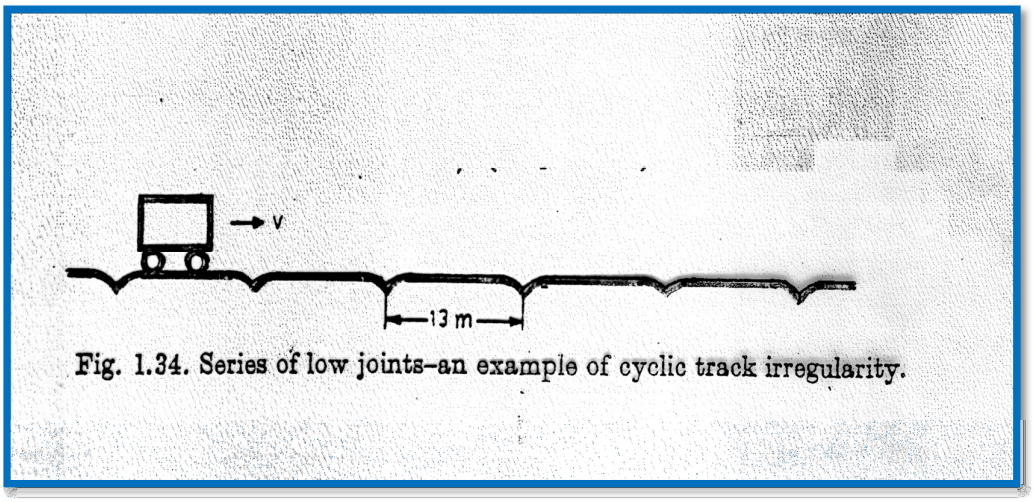


Fig. 1.34. Series of low joints–an example of cyclic track irregularity.

- Oscillation mode of vehicle will be bouncing and pitching
- For speed v = 13 m/s, excitation freq. λ_t=13m
- For speed v = 26 m/s' excitation freq. = 2 cps, λ_t=13m
- This is "forcing" frequency, f = v/λ_t
- "Natural" frequency of a vehicle in a particular mode of oscillation : Frequency of osc. in that mode, when system oscillates freely, after removal of external forcing frequency.
- For simple spring of stiffness "k" & mass "m" natural freq.,

$$f_n = \frac{1}{2\pi}\sqrt{\frac{k}{m}}$$

- For 2 stage suspension system, there would be 2 natural frequencies.

Resonance

- Natural Frequency =

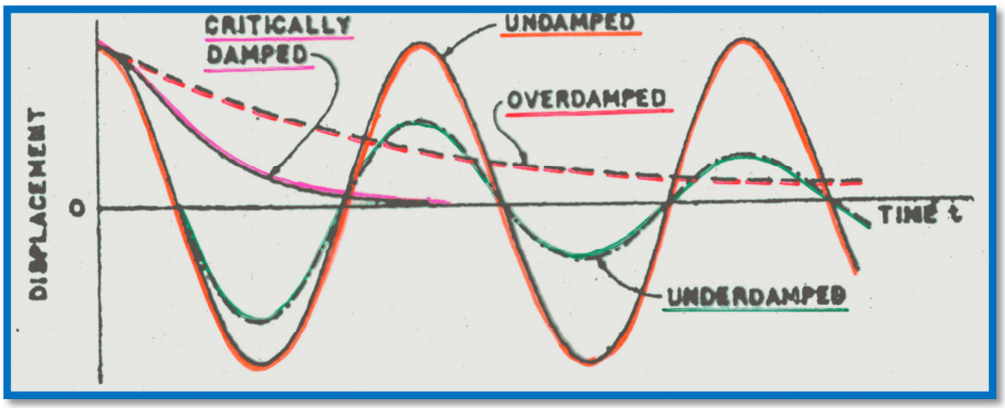
$$\frac{1}{2\pi}\sqrt{\frac{k}{m}}$$

k = Spring Stiffness

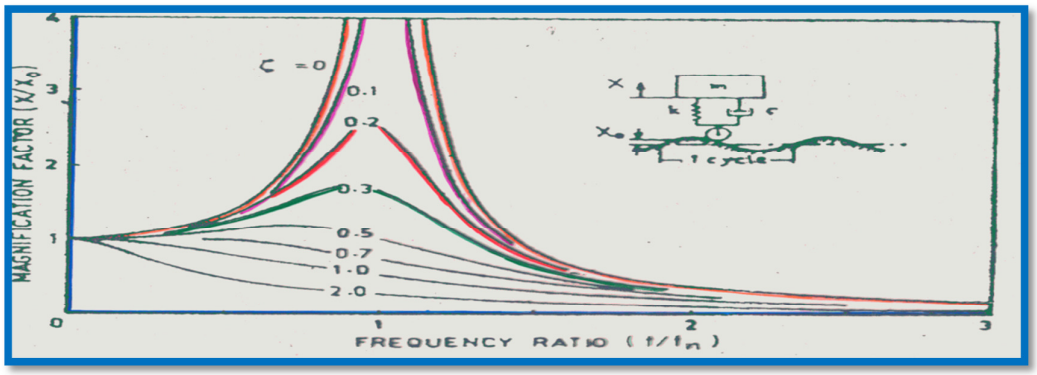
m = Mass

If frequency caused by external excitation is equal to natural frequency, resonance occurs under no damping condition

FOUR TYPES OF FREE OSCILLATIONS FOR SAKE OF COMPARISON



MAGNIFICATION FACTOR VERSUS FREQUENCY RATIO FOR VARIOUS AMOUNTS OF DAMPING FOR SIMPLE SPRING MASS DAMPER SYSTEM SHOWN.



PRIMARY HUNTING

- When the body oscillations are high while the bogie is relatively stable
- Experienced at low speeds
- Mainly affects riding comfort

SECONDARY HUNTING

- When the body oscillations are relatively less. While the bogie oscillations are highExperienced at high speeds
- Affects vehicles stability

CRICITAL SPEED

- The speed at the boundary condition between the stable & unstable condition is called as critical speed of the vehicle
- The speed for which the rolling stock is cleared for the service is normally about 10 to 15% less than the critical speed at which the vehicle has been tested.

FACTORS AFFECTING CRITICAL SPEED

- Vehicle wheel profile
- Rail head profile, inclination & gauge

- Rail wheel coeff. Of friction
- Axle load and distribution of vehicle mass
- Design and condition of vehicle suspension

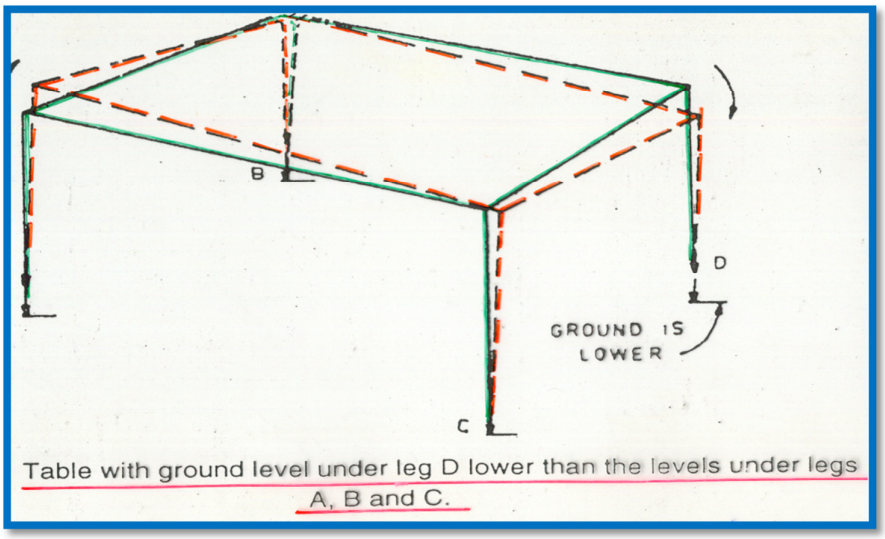
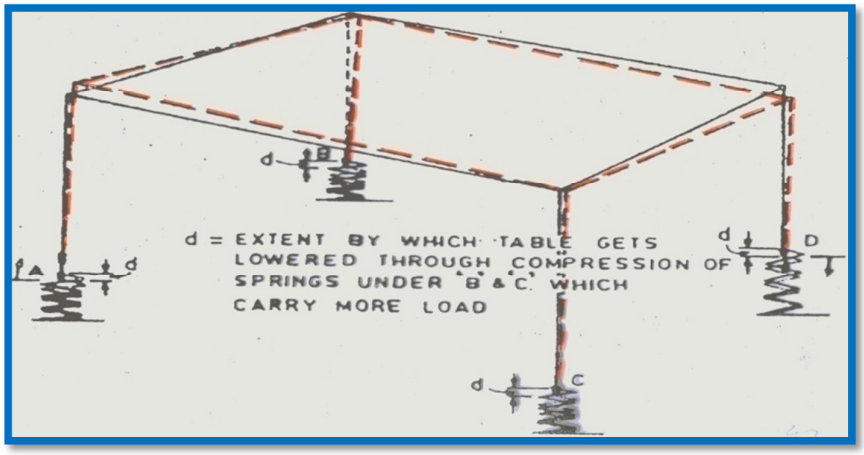
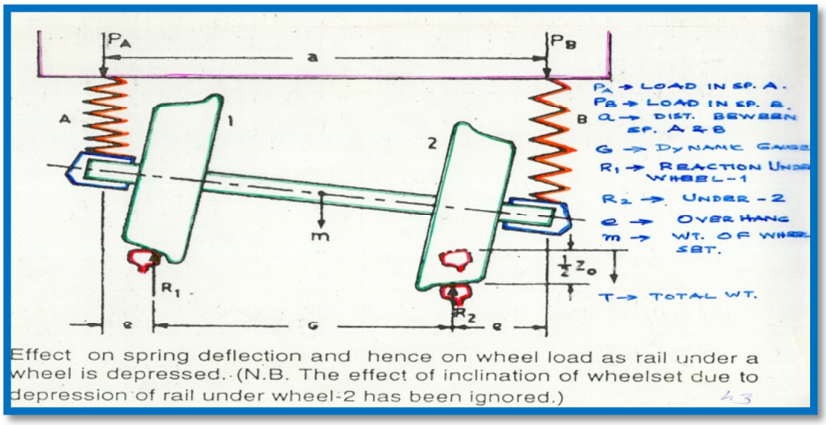


Table with ground level under leg D lower than the levels under legs A, B and C.





Effect on spring deflection and hence on wheel load as rail under a wheel is depressed. (N.B. The effect of inclination of wheelset due to depression of rail under wheel-2 has been ignored.)

REFERRING TO FIG.

- a = Distance between centres of the spring A&B bearing on the wheel set
- P_A = Load reaction in spring A
- P_B = Load reaction in spring B
- G = Dynamic gauge
- R_1 = rail reaction under wheel –1
- R_2 = rail reaction under wheel-2

  e = amount of overhang of spring centre beyond the wheel rail contact point.
- Now, let the rail under wheel-2 be depressed suddenly by an extent ½ Zo, so that the instantaneous value of R2 becomes zero, i.e. the wheel load of wheel-2 drops to zero.
- (N.B.) ½ Zo has been taken for convenience, as will be seen later)
- Under effect of lowering of rail, spring B would elongate and load reaction PB would drop
- Taking moments about spring B :
- PA a+ m (G/2+e)

  = R1 (G +e) + R2e

  = R1 (G+e) (since R2 = 0) (i)
- Taking moments about spring A:
- PB a+ m (G/2+e)

  = R1e + R2 (G+e)

  = R1e (since R2 = 0) (ii)
- Subtracting (i) from (ii)
- (PA-PB) a = R1G
- or PA – PB = R1 G/a
- Now, R1 + R2 = T/2 ∴ R1 = T/2, since R2 = 0
- PA – PB = T/2 G/a
- If it is the specific deflection (I.e. deflection per unit load) of the springs (assuming f to be the same for all the springs), the difference in deflections of the springs A & B (owing to difference in the load reactions viz PA – PB = f (PA – PB).
- That is, the difference in deflections of the two springs. = f T/2 G/a
- By geometry (see Fig. 1.43,) the above difference implies a difference in the levels of the two rails under the wheel set under consideration, to be

$$= \left[f \frac{T}{2} \frac{G}{a} \right]_{\frac{G}{a}} = f \frac{T}{2} \left[\frac{G}{a} \right]^2$$

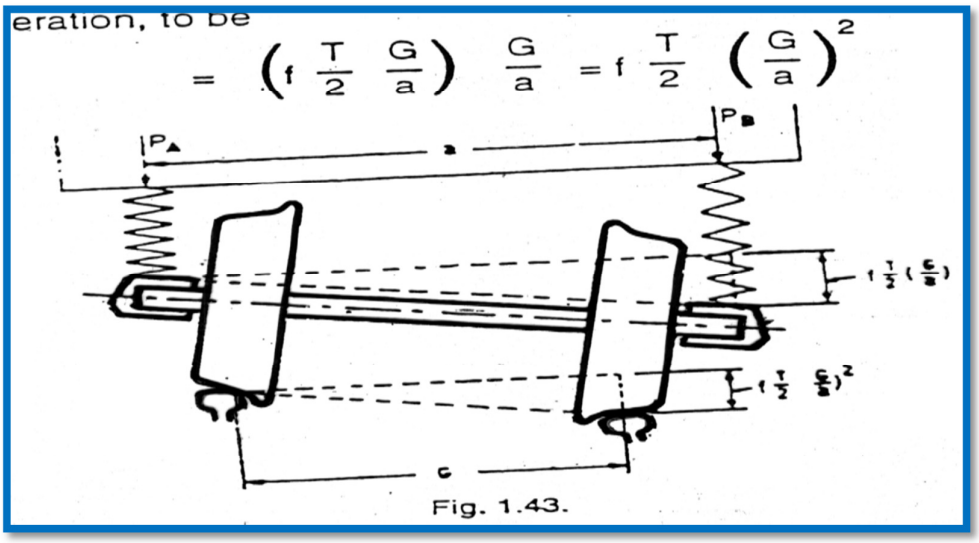
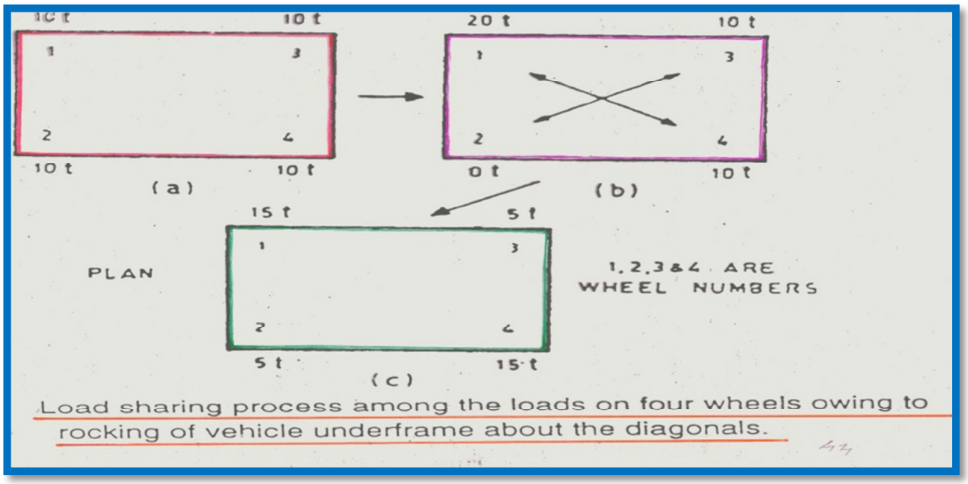


Fig. 1.43.

- Obviously, this is the extent by which the rail under wheel 2 would require to be depressed to reduce R2 instantaneously to zero.
- i.e.

$$\tfrac{1}{2} Z_0 = f \frac{T}{2} \left(\frac{G}{a}\right)^2$$



Load sharing process among the loads on four wheels owing to rocking of vehicle underframe about the diagonals.

EFFECT OF TRACK & VEHICLE TWIST

- Track Defect that will completely off load the wheel
- Zo = fT $(G/a)^2$

STIFFNESS OF SPRINGS

- Larger 'f' i.e. deflection per unit , better

LOADED / EMPTY CONDITION OF VEHICLE

- Larger 'T'; - Better
- An empty wagon is more prone for derailment

G/A RATIO

- It should be Large
- Overhang should be less

VARIATIONS IN SPRING STIFFNESSES

- One spring
- Zs = x/2 (G/a) x → Defect in one spring
- Diagonally opposite springs
- Zs = x (G/a) = 2Zs

TORSIONAL STIFFNESS OF VEHICLE UNDER FRAME

- Equivalent Track Twist
- Zu = φ T/4 (G/a)2
- φ→ Specific deflection of a corner of under frame
- Torsionally flexible under frame is desirable
- Riveted under frame

TRANSITION OF A CURVE

- Track
- Cant Gradient should be as flat as possible
- Vehicle
- Zb = ixl i → Cant Gradient l = wheel base
- Longer wheel base is not desirable

PERMISSIBLE TRACK TWIST:

- Zperm = 0.65 Zo – Zs + Zu – Zb
- (If one spring is defective)
- Zperm = 0.65 Zo – 2Zs + Zu – Zb
- (If two diagonal springs are defective

LATERAL STABILITY OF TRACK

Lateral Track Distortion Due To

- Less lateral strength
- Excessive lateral forces by vehicle

LATERAL STABILITY OF TRACK

This Study Is Important For

- Assessment of stability of rolling stock
- Investigation of derailments

PRUD'HOME'S FORMULA

- Hy > 0.85 (1+P/3)
- Hy> LATERAL FORCE
- P = AXLE LOAD (t)

2.2 Permanent Way parameters, readings in permanent way.

List of Different Track Recordings to be Taken at Accident

- Condition of sleepers.
- Density of the sleepers.
- Ballast provided at the site of accident.
- Condition of fixtures of fasteners.
- Gauge between two rails on straight line curves.
- Angulars & lateral wear on rails.
- Difference of cross levels.
- Reading of twist.
- Reading of versine.
- Reading of super elevation.
- Reading of degree of curvature.
- Group of rail.
- Buckling of rails.
- Staggered rails.
- Welding failures.

2.3 Rolling stock parameters, readings in rolling stock.

Rolling Stock Parameters:

- Root wear
- Flange wear
- Rail guard gap from rail level
- Diameter difference of wheels on same axle
- Two different axles on same bogie and bogies on same locomotive
- Wheel gauge
- Buffer height
- Deep flange
- Sharp flange
- Flat places
- Displaced buffers if any
- Axle box lateral clearances
- Longitudinal clearance
- Variation in spring heights
- Differences in cambers

- Condition of the load in the wagons
- Side bearer clearances
- Wheel diameter any unusuals

2.4 Signal aspects to be recorded at the accident site.

2.5 Duties of officials at accident site, duties of on board staff at accident site, Role of supervisors at the accident site.

Ordering ARTs/ARMVs

Authority to Order ART/ARMV/BD Crane-

Sr.DME/DME of the division is the controlling officer for the Utilization of the ART/ARMV/BD Crane and he is the Authority for ordering the same.

Power Controller as nominated by SR.DME/DME will order the ART/ARMV/BD Crane as per the first information received regarding accident

Ordering ART/ARMV/BD Crane During Accident

Ordering during Passenger Train Accident:

- ARMVs from both directions of accident site shall be ordered, irrespective of the division/Zone in which accident occurred.
- Similarly ART/BD Crane from Both directions shall be ordered depending on the requirement.

Goods train accident involving human life:

- Nearest ARMV irrespective of the division shall be ordered.
- Ordering ART/ARMV/BD Crane During Accident.

Accident Effecting Mainline Running:

ART from both directions shall be ordered. Depending on necessity BD Crane shall be ordered. As far as possible, ARTs/Cranes with in the division shall be ordered without prejudice to ordering ARTs from other divisions.

Accidents not effecting through running of trains:

ART/BD Crane of the particular division shall be ordered.

ART/ARMV Turning Out Time

ART:

During day	-	30 min
During night	-	45 min (18.00 hrs-06.00 hrs.)

ARMV(During Day and Night)

Direct dispatch	-	15 min.
In-direct dispatch	-	20 min.

Duties of Railway Official Present at Site

- Senior Most Railway Men to Take Charge.
- Accident Is Reported Correctly to Controller
- Ask for Assistance Required
- Protect the adjoining lines
- Collect Railway Men & Volunteers
- Allot Duties to Each As Best As Possible
- Save Life & Alleviate Suffering

- Protect Property Including Mail
- Ascertain the Probable Cause of Accident
- Restore Through Line Communication

Duties of Driver

- Note the Time of Accident
- Protect Front Portion of the Train
- In Case of Double Line Other Line to Be Protected First If Fouling
- Take Technical Precaution to Protect the Engine.
- Assist Guard to Assess Damage to Rolling Stock, Locomotive, Track.
- Ask for Required Assistance
- Make Arrangements for Protecting Clues

Duties of Sr.Subordinate

- PROTECT the Train
- First Aid Passengers
- Preserve the Clues
- Convey the Details to Control
- Ask for Required Assistance
- Estimate the Restoration Time
- Record Statements
- Record Evidence & Protect
- Take Assistance From Fellow Rail Men & Other Volunteers
- Investigate the Cause of Accident

Role of C&W Supervisor

- Survey the Accident Site& Assess Damage
- Assess Requirement of Crane/ MFD/ Lucas Etc
- Inspect Site With Other Dept Supervisor Record, Evidences
- Take Track Readings Jointly
- Execute Restoration
- Give Readings of Rolling Stock

Types of BD Cranes

- 140 T Diesel Hydraulic – 4 +1
  - Cowans Sheldon Old (Jessop) –3
  - Cowans Sheldon New (Upgraded) – 1
  - Gottwald (JMP) New Design – 1 (Expected to be received by end of Dec, 2008)
- 35 T Steam (Coal Fired) Cranes – (MG)-1

Sl No	*Description*	*Details*
1	No of vehicles in running order	Crane with two 3- axle bogies + Match truck with two 2- axle bogies.
2	Overall length	27967 mm
3	Length of crane over buffers	13000 mm
4	Length of match truck over buffers	14967 mm
5	Width of crane	3200 mm
6	Width of match truck	3000 mm
7	Maximum height of crane from R.L	4160 mm
8	Overall weight	200t
9	Axle load in running	20t
10	Tail radius	5.5 m, 6.0 m
11	Counter weight • Std duty • Heavy duty • Special Duty	Counter weight is lifted & locked on Super structure 29.345 t (22.610 +6.735) 37.245 t(22.610 +6.735+7.9) 22.610 t on under carriage & 6,735t locked at super structure
12	Outriggers Type Numbers	Swing out 4
13	Propping base	6 m, 5 m, 3.4 m
14	Derrick • Type of Construction • Length	Box secn. (Rectangular) 16.3 m

2.6 Features of Disaster management, Civil Defence and First Aid.

2.7. High Level safety Committee and Railway Safety Review Committee recommendations and corporate safety plan.

Recommendations of High Level Safety Committee

- **Faster response:**

  Air brake accident relief train, SPART, guidelines for passenger to be displayed in coaches, road access to vulnerable locations, co-ordination with state police and civil authorities, disaster management rescue ambulances.

- **Better facilities & equipments:**

  Emergency automatic lights in coaches, disaster resistant control rooms, hiring of cell phones, emergency inflatable lighting towers, video conferencing facilities from the side of accident, digital video, etc

- **Expandingresources**:

  Assistance to NGO's disaster management modules with state, disaster management training films, coordination with civil authorities, specific training to handle fire related disasters.

- **Other logistics:**

  Safe custody of proper disposal of luggage, air conditioned mortuaries, nomination of more staff for ART/MRV.

2.8 Rescue Techniques-Medical Relief.

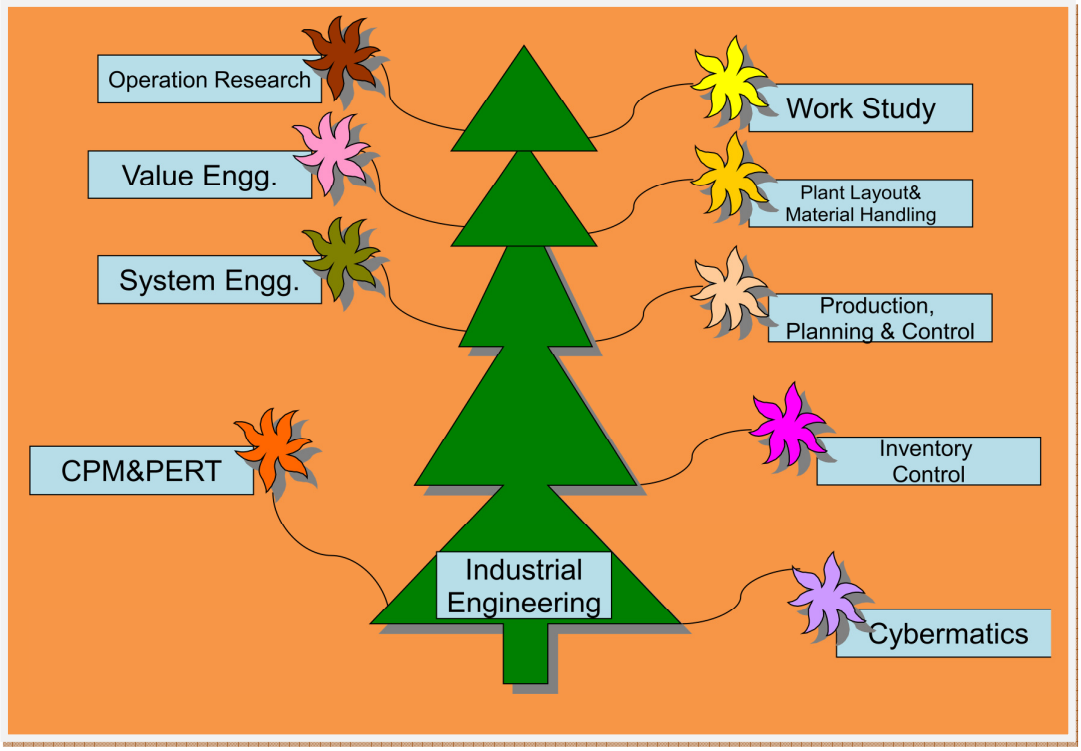
2.9 Review.

3. INDUSTRIAL ENGINEERING

3.1 Introduction

Work Study Concept

In spite of technological and economical development the human element remains the most important resource in production management. There is only one "best method" to do a work. It is the responsibility of the manager to show and teach the best method to the workers to follow. This concept has developed as a separate discipline of knowledge called "Work Study". Work study is a branch of Industrial Engineering.



Definition: Work Study has been defined in many ways. All of them, however, tend to convey the same meaning.

- Work Study is an organised activity of increasing the productivity and quality with reduced cost within the organisation.
- Work Study is a modern technique to analyse and evaluate all the aspects of work systems in order to enhance the effectiveness and functional efficiencies.
- British Standard Institute defines "Work Study is the generic term for those techniques particularly method study and work measurement which are used in examination of human work in all its context and which lead systematically

to the investigation of all the factors which affect the efficiency and economy of the situation being reviewed in order to effect improvements".

- According to ILO, Work Study is the term used to embrace the techniques of method study and work measurement which is employed to ensure best possible use of resources in carrying out a specific activity.

Objective of Work Study

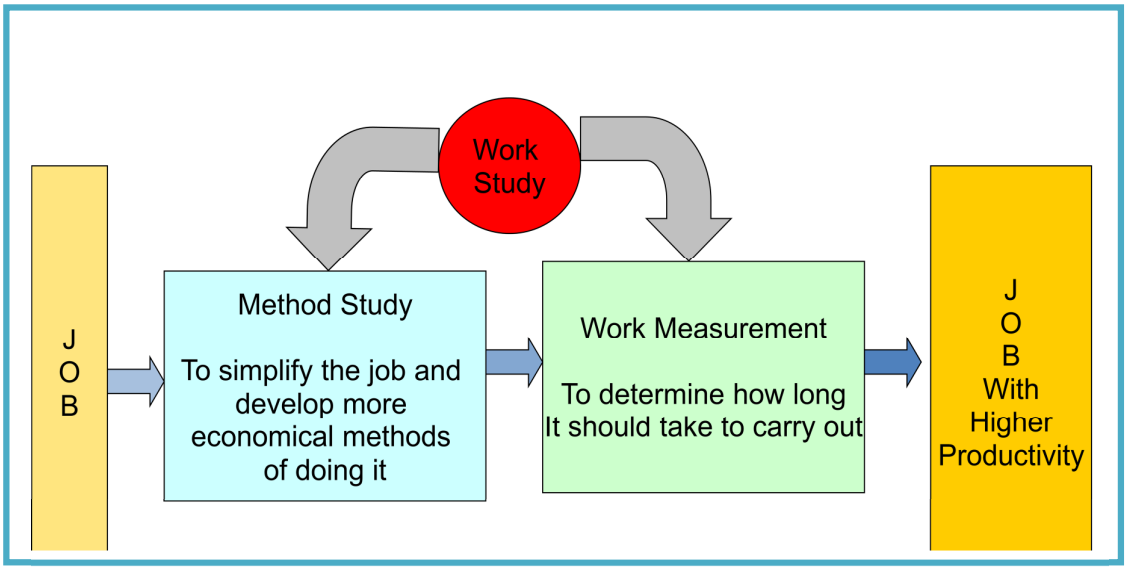
Work Study is "Organised Common Sense". It involves 10 % Technique and 90 % psychology.

Work Study is concerned with finding better ways of doing work and avoiding waste in all its forms. As such the objective of work study is to assist management to obtain the optimum use of the human and material resources available to the organisation for the accomplishment of the work for which, it is engaged. The emphasis is on optimum use.

Therefore, the objective has three aspects.

1. The most effective use of plant and equipment.
2. The most effective use of human effort.
3. The evaluation of human work to make it more convenient.

Techniques of Work Study



Work Study has two steps, viz.,Method Study and Work Measurement. Both these techniques are distinct and interdependent.

Method Study is concerned with finding the true facts about doing a work and after a critical examination of these facts efforts are made to develop a new and better method of doing that work.

Work Measurement is concerned with the establishment of time standards for a qualified worker to perform a specified job at a defined level of performance.

There are number of techniques to establish the work content of any specified activity. Some of these are given below.

(a) Time Study
(b) Analytical estimating
(c) Synthesis
(d) Production studies
(e) Activity sampling
(f) Predetermined Motion Time Standards (PMTS)

Scope of Work Study

There is a school of thought that work study is applicable only in the field of industry where processes are highly repetitive. This is not true. Since it is universal in its application, it does not matter whether the activities studied had occurred in industry, public services or in the armed forces. It is not confined to engineering activities of a repetitive nature.

Principles of Work Study

There are three general principles that should be borne in mind while using work study.

- It is an instrument of progressive management, where responsibility for its use must ultimately rest in exactly the same way as for any its value and the drive to apply it must come from the top.
- Work Study is bound to affect the jobs of many people in the organisation; management must therefore make it quite clear to all concerned as to what it is trying to do and why.
- Method Study must precede work measurement. Establish proper methods before any attempt is made to measure and set time standards for the various jobs concerned.

3.2 Method Study

Method Study is the way in which work is done. Method study is essentially used for finding better ways of doing work. It is a technique for cost reduction. The philosophy of method study is that there is always a better way of doing a job and the tools of method study are designed to systematically arrive at this better way of doing a job.

Method Study, as defined, it is a technique for improving the efficiency of every type of work, ranging from that of complete factories to the simplest manual movements used in mass production.

Definition

The systematic recording and critical examination of existing and proposed ways of doing work as a means of developing and applying easier and more effective methods, and reducing costs.

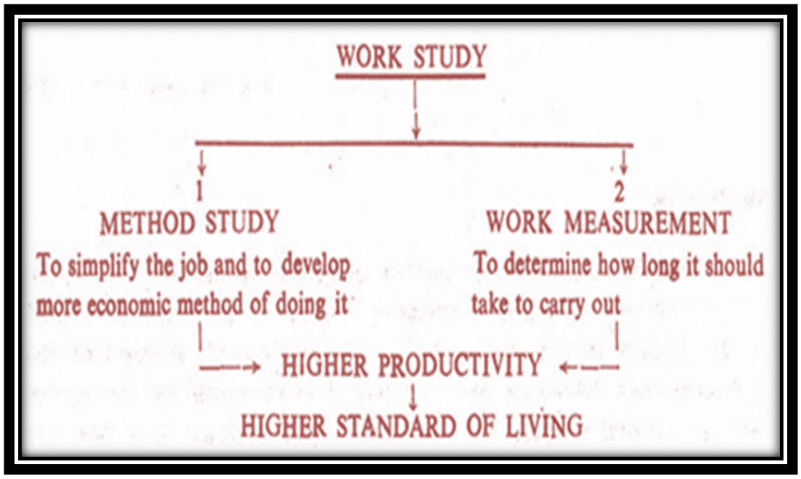
Work Measurement

The application of the techniques to establish the time for a qualified worker to carry out a specified job at a defined level of performance.

The work study aims at improving the productivity through the systematic analysis of existing operations, processes, work methods and resources with a view to increasing their efficiency.

Work Study usually leads to higher productivity with no or little extra capital investment. It is evident that if a job or process is to be examined in order to improve the efficiency, both the method employed to perform the work and the time taken to complete it are significant. Therefore, work study consists of two distinct yet complementary techniques: Method Study, which is concerned with the education of the work content of a job or operation while work measurement is mostly concerned with the investigation and reduction of . any ineffective time associated with it, and for fixing up the standard time to be taken by the job after methods improvement has been carried out.

The relationship between Work study, Method study, Work measurement can be shown as in Figure.



Objectives of Method Study

1. The improvement of processes and procedures
2. The improvement of factory, shop and work place layout
3. The improvement of design of plant and equipment
4. The improvement in use of men, material & machinery and space / services
5. Economy in human effort and the reduction of unnecessary fatigue.
6. The development of a better physical working environment.
7. Improvements in quality of products.

The distinction of method study is that it is a step-by-step procedure for improvements of methods of work, starting with the objectives, the selection of the activity to be studied; it proceeds to the collection and recording of the facts. The critical examination of the facts is the crux of the method study. This is followed by development of an improved method and the attainment of assured results in terms of greater output, cost savings and other benefit. This standard procedure, with flexibility of critical examination makes method study the most penetrating tool of investigation known to the Management.

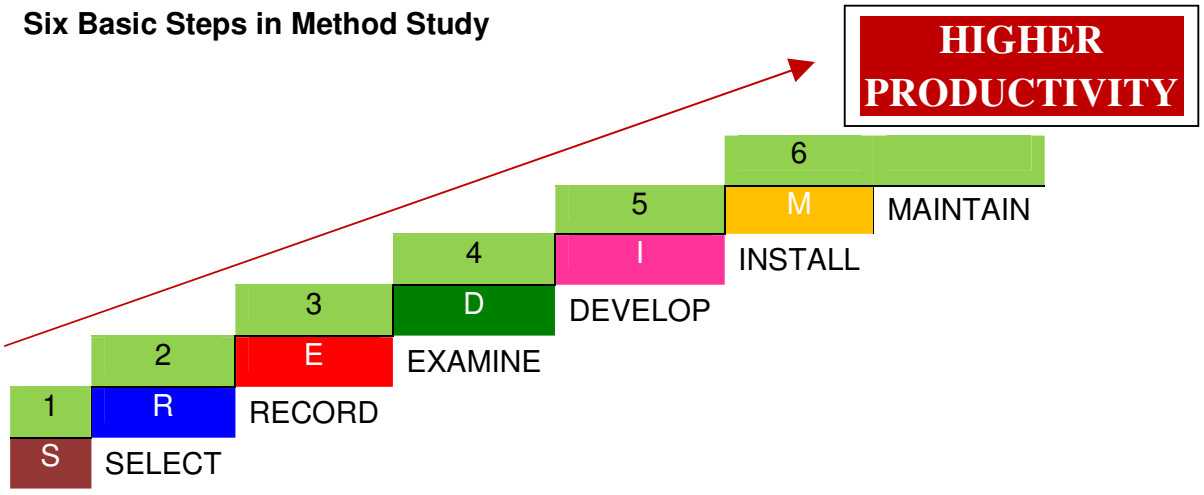
3.3 Principle of Motion Economy

Procedure of Method Study

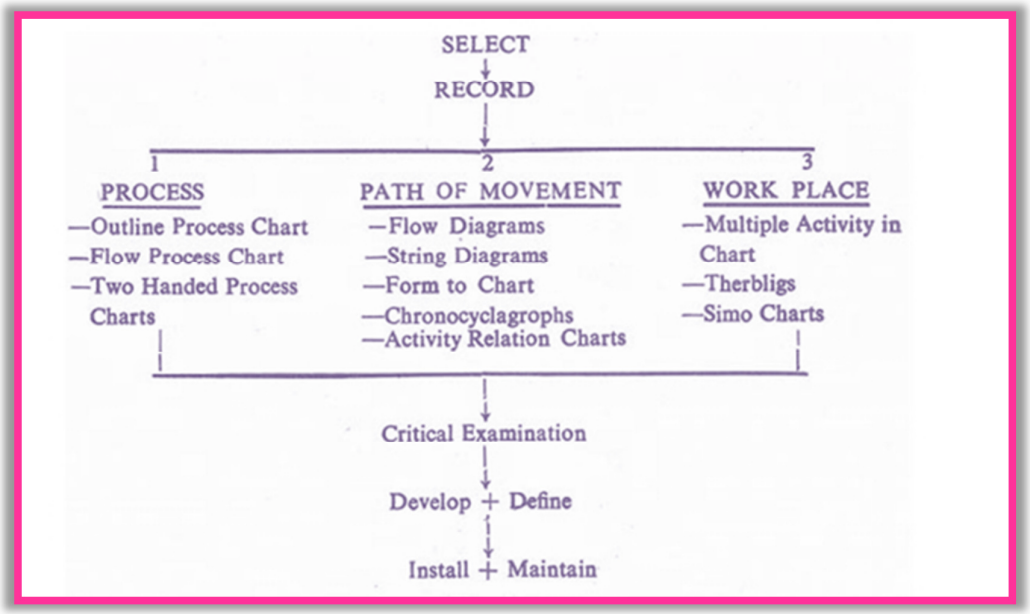
Procedure of method study consists of the following six steps.

1. SELECT
2. RECORD
3. CRITICAL EXAMINATION
4. DEVELOP
5. INSTALL / IMPLEMENT
6. MAINTAIN

Six Basic Steps in Method Study



SELECT: Select the work to be studied and define the problem.
RECORD: All the relevant facts about the present method are recorded.
CRITICAL EXAMINATION: Critically examine those facts and ordered in sequence using the technique best suited.
DEVELOP: Develop most practical, economical and effective method having due regard to all contingent circumstance.
INSTALL OR IMPLEMENT: Implement the developed method as a standard practice.
MAINTAIN: Maintain the method by regular checks and review wherever necessary.



The Simultaneous Motion Cycle Chart (Simo-Chart)

The SIMO Chart is a, refinement over the two-handed process chart. In this chart the activities the two hands (or other parts of the workers, body) in relation to each other, during an operation are recorded against a time scale. The activities recorded are in terms of "Therbligs"; which are very fine basic human motions. Such a chart can be prepared only with the help of photographic aids, involving expensive equipment. Short cycle and highly repetitive jobs are suited for this type of recording. By an analysis it will be possible to identify and remove the idleness and increase the utilisation of both the hands.

An investigation in this detail would be worthwhile only if the expected savings from the improved method justifies the cost of such detailed analysis.

THERBLIGS


Search
Find
Select
Grasp
Hold
Transport Loaded
Transport Empty
Position
Assemble
Use
Disassemble
Inspect
Preposition
Release Load
Unavoidable Delay
Avoidable Delay
Plan
Rest

SIMO CHART

OPERATOR: Ken Reisch
DATE: May 21,
OPERATION: Assembly
PART: Lace Finger
METHOD: Proposed
CHART BY: Joseph Riley

TIME SCALE (winks)	ELEMENT TIME	LEFT-HAND DESCRIPTION	SYMBOL	MOTION CLASS	SYMBOL	RIGHT-HAND DESCRIPTION	ELEMENT TIME	TIME SCALE (winks)
4548	12	Reach for finger	RE		RE	Reach for finger	12	4548
4560	19	Grasp finger	G		G	Grasp finger	19	4560
4579	31	Move finger	M		M	Move finger	31	4579
4610	75	Position and release finger	P RL		P RL	Position and release finger	75	4610
4685	15	Reach for clamp	RE		RE	Reach for clamp	15	4685
4700	15	Grasp clamp	G		G	Grasp clamp	15	4700
4715								4715
7541	12	Grasp assembly	G		G	Grasp assembly	12	7541
	18	Move and release assembly	M RL		M RL	Move and release assembly	18	
7559								7559

SUMMARY

%	TIME	LEFT-HAND SUMMARY	SYM.	RIGHT-HAND SUMMARY	TIME	%
8.56	249	Reach	RE	Reach	245	8.4
7.49	218	Grasp	G	Grasp	221	7.6
12.16	354	Move	M	Move	413	14.2
30.47	887	Position	P	Position	1124	38.6
39.33	1145	Use	U	Use	876	30.1
1.03	30	Idle	I	Idle	0	0.0
.96	28	Release	RL	Release	32	1.1
100.0	2911	TOTALS			2911	100.0

Source: Benjamin W. Niebel, *Motion and Time Study*, 8th ed. [Burr Ridge, IL: Richard D. Irwin, 1988], p. 229. © 1988 by Richard D. Irwin, Inc. Reprinted by permission.

Photographic Aids

Still and cine photography is employed to record and analyse the operations and procedures. There are different types of analysis such as memo-motion and micro-motion studies, cyclographs and chrono-cyclegraphs. All these are very expensive methods involving special photographic equipment. Photographic aids for analysis will be useful for detailed investigation of very short duration, highly repetitive and high speed operations.

Need For Path Movement Recording

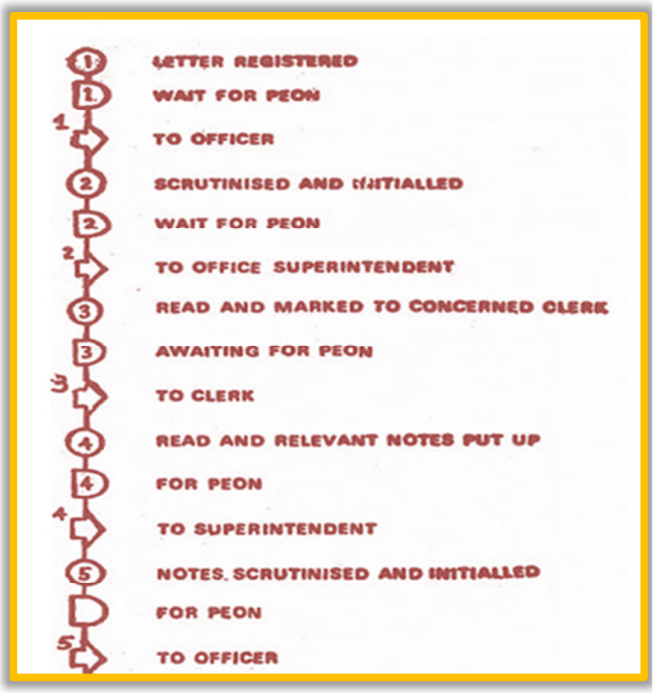
The Process Charts show mainly sequence and nature of activities, the information given regarding the movements involved is, very little. The pattern of movements may have features like back-tracking, congestion, long distances, etc. To record these features the flow and string diagrams are used.

The Flow Diagram

"A flow diagram is a drawing or a model substantially to scale, which shows the location of the various activities carried out and tube routes followed by workers, materials or equipment in their execution."

The various activities on the diagram are identified by their numbered symbols from the corresponding flow process chart either man or material. The routes followed are shown by joining the symbols in sequence by a line.

A flow diagram showing the movement of a paper in an office is given in Fig.



String Diagram

"The string diagram is a scale plan or model on which at bread is used to trace and measure the pat of worker, materials of equipment during a specified sequence of events."

When there is too much of movement involved then, a flow diagram may become incomprehensible. In such cases, string diagram is used.

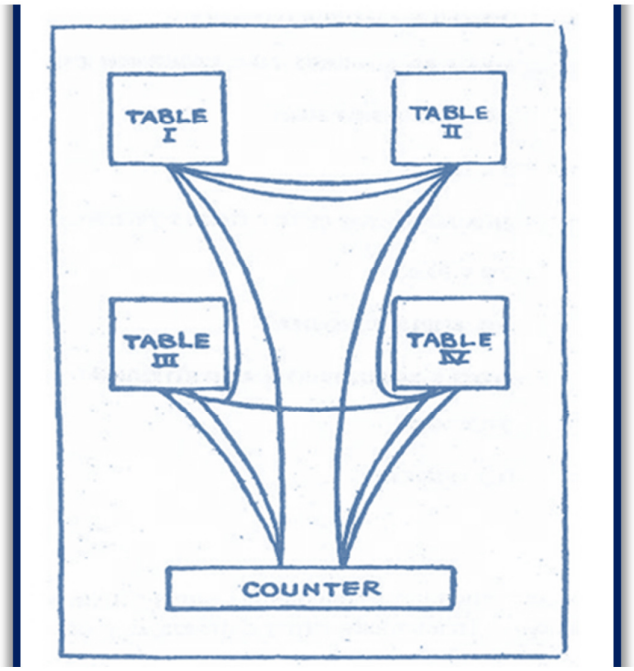
The scale layout is fixed to a board and plans, are driven into the board to mark the location of various activities and also at points where the direction of move changes. A thread is then wound round the pins following the various activities in sequence. The distance covered can be calculated by measuring the length of the thread used.

These diagrams are particularly useful when, considering problems of plant layout and design. Proposed improvements can be effectively demonstrated bold, to management and workers.

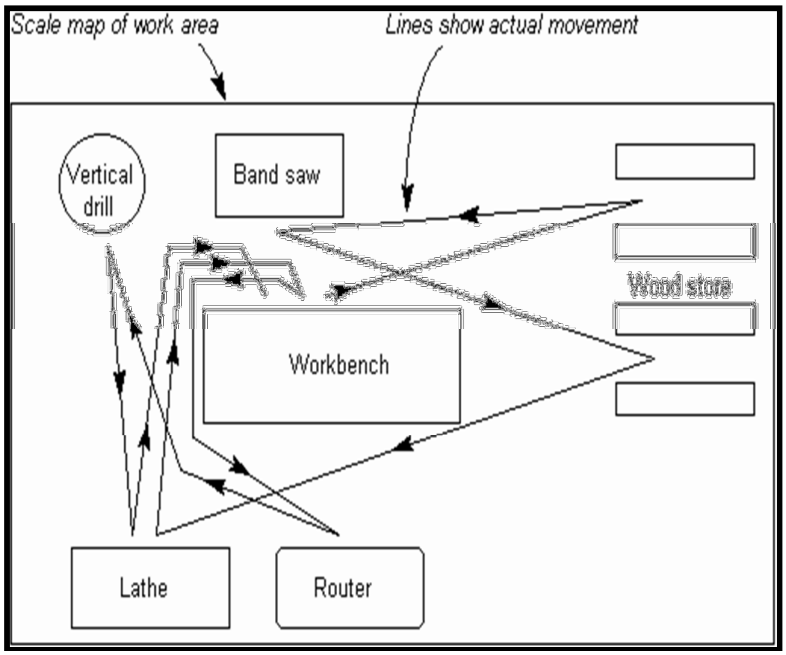
Features like back-tracking, excessive movement and congestion are clearly shown hips to take steps to improve the situation.

String diagrams are particularly useful to study the movement of workers in circumstances like, one man attending several machines, processes involving involvement of the worker from one place to another, etc.

Figure represents a string diagram of a bearer serving refreshments in a canteen.



Example:String Diagram



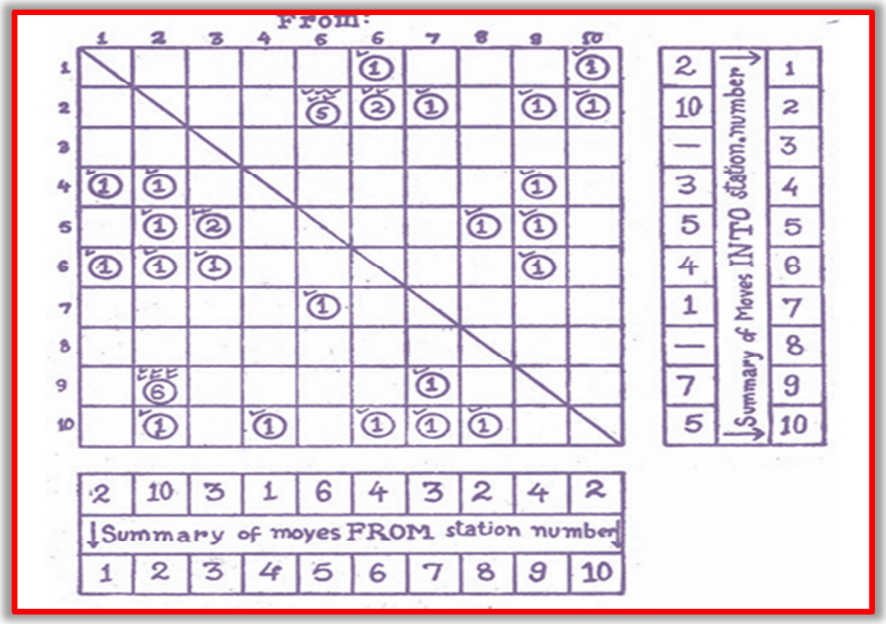
Travel Chart

The string diagrams take rather a long time to construct and when a great many movements along complex paths are involved the diagram may end up looking like a forbidding maze of criss-crossing lines when the movement patterns are complex, the Travel Chart is a quicker and more manageable recording technique.

"A Travel chart is a tabular record for presenting quantitative data about the movement of worker, materials or equipments between any numbers of places over any given period of time."

The travel chart is always a Square, having within it smaller squares. Each small square represents a work station. If for example there are 10 work stations then the travel chart will have 10 x 10 = 100 small squares. The squares from left to right along the top of the chart represent the places 'from where' movement takes place. Those down the left hand edge represent the stations 'to which' the movement is made. For example, consider a movement from station 2 to station 9, to record this, the study man enters the travel chart at the square numbered 2 along the top of the chart, runs his pencil down vertically through all the squares underneath this one until it reaches the square which is horizontally opposite the station marked 9 on the left hand edge. This is the terminal square, and he will mark in that square to indicate his journey from station 2 to station 9. All journeys are recorded in the same way.

The travel chart can also be made to indicate the weight/material moved per trip. This is a particularly useful technique for plant layout and materials handling analysis studies.



Example: Travel Chart

TO / FROM	Gds rec	Store	Mill	Drill	Assy	Pack	Total
Gds rec		24			12		36
Store			8	4	4		16
Mill				10	6		16
Drill					10		
Assy						14	
Pack							

Example: Travel Chart

3.4 Plant Layout

Plant Layout and Materials Handling offer very good scope for improvements and cost reduction. While developing improved methods it is necessary to give a careful consideration to the layout and handling aspects. A poor layout involving excessive movement of materials and men and improper utilisation of space can considerably increase the manufacturing costs besides being unsafe.

Some of the advantages of an improved layout and a handling system are:

(a) Increased production
(b) Savings in time and cost
(c) Reduced materials inventory
(d) Economy in space
(e) Better working conditions, increased safety and greater job satisfaction
(f) Improvement in quality and reduced damages to materials

Plant layout and materials handling are very much linked together. A good layout takes all the aspects of materials movement and vice versa.Some of the aspects of plant layout and materials handling with particular reference to an industry are briefly discussed in this chapter.

Plant layout can be considered as the physical arrangement of industrial facilities. These facilities include:

(a) buildings, (b) equipment, (c) workplaces, (d) shortage points,(e) offices, and (f) employee facilities.

The fundamental objectives of a good layout are that

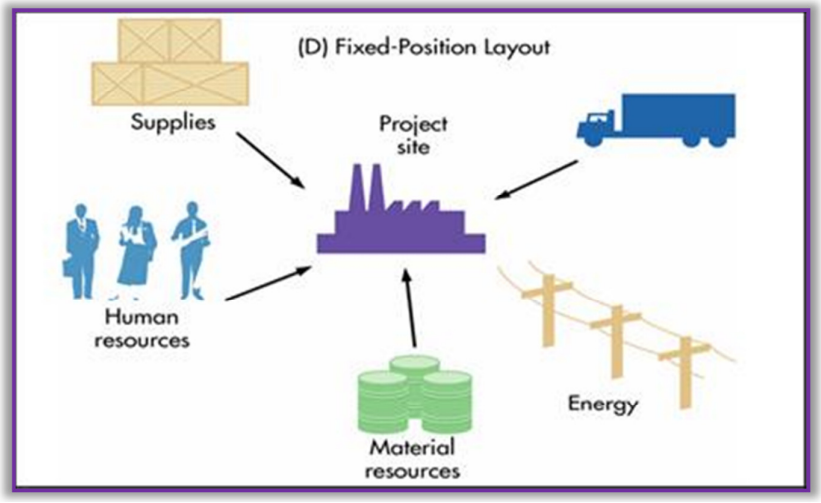
(i) It should integrate all the factors affecting a layout and should be a best compromise.
(ii) It should involve minimum movement of materials.
(iii) There should be a continuous flow of work.
(iv) The space should be effectively utilised.
(v) It should ensure satisfaction and safety for employees.
(vi) It should be flexible to accommodate changes.

There are basically three types of layouts which are described as under:

1. Fixed Position Layout

A fixed position layout is one where the material or major component remains in a fixed place. All tools, machinery, men and other pieces of materials are brought to it and the product is built up into its final shape at the same location. Manufactures of a ship, construction of a building are some of the examples.

Such a layout would be adoptable when the material forming or treating involves only hand tools and small machines or when only a few pieces are made or moving the major component or material is expensive.



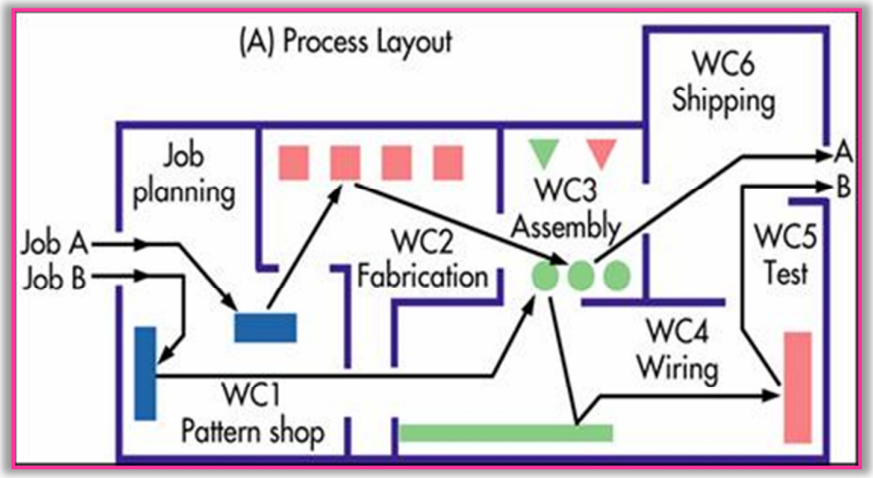
2. Process Layout

In a process layout all machines or process of the same type are grouped together.

EXAMPLE

Milling machines					Drilling machines					Broaching machines				
	1		2			1		2			1		2	
	3		4			3		4			3		4	
Lathe Machines					Shaper machines					Heat treatment section				
	1		2			1		2			1		2	
	3		4			3		4			3		4	

EXMAPLE



The advantages of a process layout are

- Better machine utilization.
- Adoptable to a variety of products and frequent changes in sequence of operations.
- Easier to maintain continuity of production in cases of machine breakdowns and absenteeism.

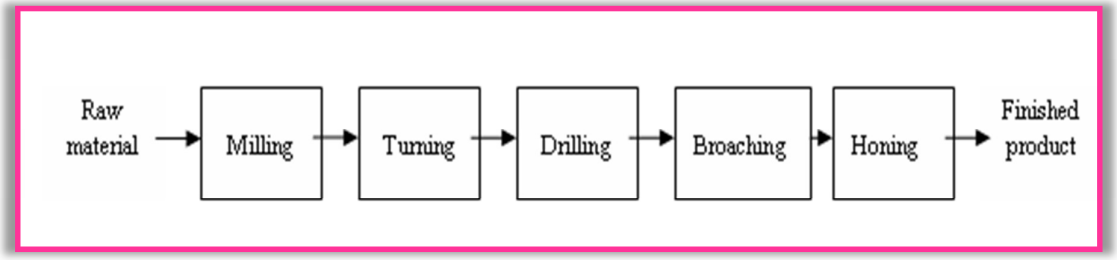
The disadvantages of a process layout are

- Involves more materials handling.
- Occupies more floor space.
- Higher in-process inventory.

A process layout can be used in those situations where the machinery is highly expensive, a variety of products are made, or intermittent or small demand for the product.

3. Product Layout

In a product layout the arrangement of machinery is according to the sequence of operations of the product.

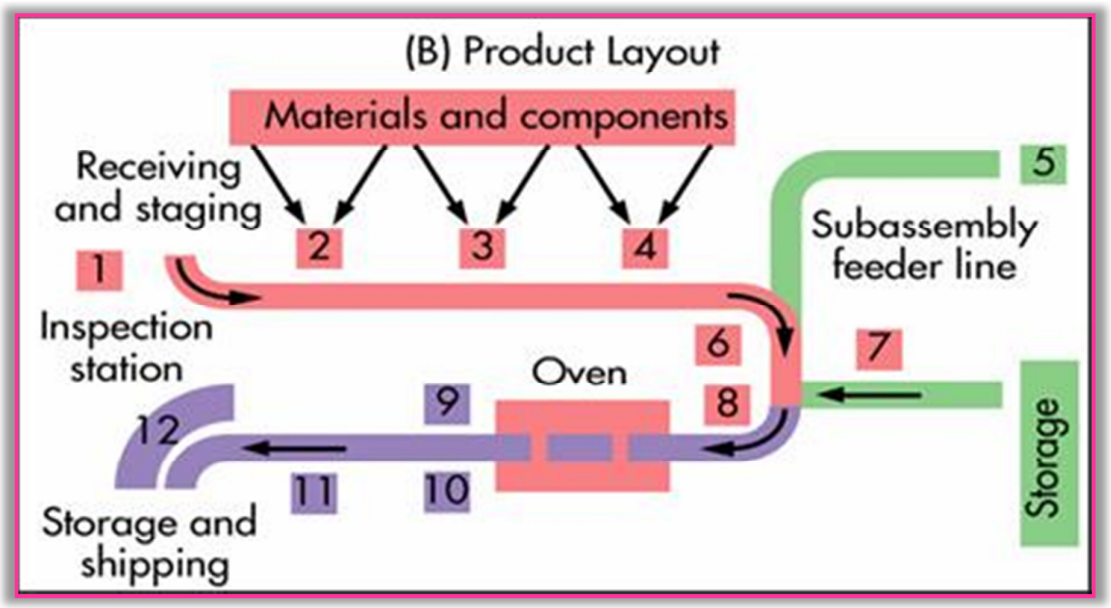


Advantages of such a layout are :(i) less material, handling, (ii) less in-process inventories and (iii) reduced congestion and less floor space is occupied.

Manufacturing costs are low at high volume of production but the costs will be very high at lower volumes of production. The capital investment on machines may be quite high and all operation times need to be balanced. A breakdown on any one machine in the line may hold up the complete production time.

A product layout will be economical when the volume of production is large, when the product design is standardised and when the demand is fairly steady.

Most of the layouts in practice area combination of the above. It may be worthwhile to have a product type of layout for some of the components and others may have a process layout depending on the various factors as discussed above.



Aids for Improving Layout

The Flow Process Chart, Flow Diagram. Travel Charts and String Diagram are all very useful aids for charting the existing methods and movements and for developing improved layouts.

Travel chart is a recording technique which will be very helpful for recording quantitative data about the movement of materials, men and equipment between different locations in a particular period of time. While the flow process chart and flow diagram indicate the direction and distance the travel chart gives the frequency of movements.In addition, templates and scale models are also used to determine the most suitable location of shops, facilities and equipment, for arriving at the best layout.

3.5 Work Measurement

Introduction

Work measurement is usually undertaken after completing the process of Work measurement simplification through the Method Study. This is because without deciding on the best method of doing a job, there is no point in finding out the time required to do the same.

Purpose

The basic purpose of Work Measurement is to determine the allowed time for a qualified worker to perform a given task, using a prescribed method, under a given set of conditions.

Definition

It is the application of the techniques to establish the time for a qualified worker to carry out a specified job at a defined level of performance.The work study aims at improving the productivity through the systematic analysis of existing operations, processes, work methods and resources with a view to increasing their efficiency.

Work Study usually leads to higher productivity with no or little extra capital investment. It is evident that if a job or process is to be examined in order to improve the efficiency, both the method employed to perform the work and the time taken to complete it are significant. Therefore, work study consists of two distinct yet complementary techniques: Method Study, which is concerned with the education of the work content of a job or operation while work measurement is mostly concerned with the investigation and reduction of . any ineffective time associated with it, and for fixing up the standard time to be taken by the job after methods improvement has been carried out.

Objectives of Work Measurement

- To evaluate the existence of ineffective time
- To evaluate a worker's performance
- To plan work-face needs
- To determine the available capacity
- To determine price and cost of a product
- To compare work methods
- To facilitate operations scheduling
- To establish wage incentive schemes

Need For Work Measurement

The main objective of Work Measurement is to obtain the time standard. The performance of an operator is then measured against it for the following purposes:

- Correct loading of labour.
- Correct loading of plant and machinery
- Maintenance of sound Incentive Schemes
- Initial costing of the proiduct and subsequent control of these costs.
- Assisting future planning of the department.
- Assisting method study in the choice of better and quicker methods.

Significance of Qualified Worker

A qualified Worker is one who has the necessary physical attributes, intelligence and education, and has acquired the necessary skill and knowledge to carry out the work in hand to the satisfactory standards of safety, quantity and quality.

Specified Job

Specified job at specified place i.e., job should be same and place should be similar.

Defined Level of Performance

It means that the standard performance at a particular given rating and the rating happen to be a co-efficient of the performance.

Various Measurement Techniques

A number of Work measurement techniques have been developed to suit different types of work. These are:

1. Time Study technique
2. Production Study Technique
3. Analytical Estimating technique
4. Activity/Work sampling
5. Pre-determined motion time standard systems (PMTS)

1. Time Study

Time study is the most widely used technique in Work measurement. It is carried out with the direct observation of a work while it is being performed.

Time study is defined as a technique for determining as accurately as possible, the time required to carry out a specified task by a qualified worker at a defined level of performance.

Breaking the Job into Elements

An element is defined as a distinct part of a specified job, selected for convenience of observation, measurement and analysis. The question of breaking the operation into elements for time study is based on the above considerations. It depends on the nature of job and purpose of study.

Reasons for Breaking the Job

- To know the effective and ineffective part of a job
- To rate as accurately as possible
- To know the elements of high fatigue.
- To give standard time value for every element.

Kinds of Elements

1. Manual Element
2. Machine Element
3. Repetitive Element
4. Non-Repetitive Element
5. Constant Element

Essentials of Time Study

The essentials for Time study are as under:

1. An accurate specification of when the job begins and when it ends, and of the method by which it is to be carried out including details of materials, equipment, conditions etc.
2. A system of recording the observed (actual) time taken by workers to do the job while under observation.
3. A clear concept of what is meant by standard rating.
4. A means of assessing the amount of rest which should be associated with the job.
5. Availability of measuring equipment like stop watches, stationeries, time study sheet etc.

Time Study Procedure

1. Identify the job to be time studied and the operation to be timed.
2. Obtain the improved procedure of doing the job from the method study department.
3. Select the worker for study.
4. Take the worker as well as shop supervisor into confidence and explain the objectives.

5. Collect the equipments and arrange machinery, jigs and fixtures, etc, required to conduct the time study and ensure their accuracy.
6. Explain to the worker the improved working procedure and use of tools to do the job.
7. Break the job into operations and operations into elements and record. Separate constant elements from variable elements.
8. Determine number of observations to be timed for each elements.
9. Conduct observations and record time.
10. Rate the performance of worker.
11. Repeat the steps above two for number of observations as determined in earlier steps.
12. Compute observed time from the measure central tendency.
13. Calculate the "normal time" from the observed time by using performance rating factor.
14. Add process allowance, rest and personal allowances to obtain "standard time".

Production Study Technique

It is defined as a continuous study of a relatively lengthy duration extending over a period of one or more shifts. It is undertaken with an object of checking the existing or proposed standard time on obtaining other information affecting the rate of output.

Criteria for Choosing Production Study

- When the job is performed by a group of persons.
- Where awarding of rating is not possible.
- When the process takes more than one shift.
- Where effective and ineffective are to be separated.
- Where ineffective time required to be segregated into avoidable and unavoidable.
- Where time can be converted into man minutes or man hours.

Advantages of production Study Technique

- To obtain a general picture of pre-incentive performance.
- To check output limit on specified item on section or machines.
- To check the correctness of standard or allowed time.
- To obtain data for contingency allowance etc.
- To check waiting time and bottlenecks in production.
- To obtain information about various allowances required.

Work Sampling Technique

Objectives of Work Sampling

- To evaluate the operating efficiency.
- To locate the causes of loss of efficiency.
- To reduce the idle time of men and machine.

Work Sampling technique Procedure

- Classify the strength of activity design in a chart for recording information.
- Make a pilot study.
- From the pilot study made, compute delay/inefficiency percentage.
- Determine accuracy and confidence limit.
- Calculate the number of observations required for fixing the time.
- Plan the schedule of observations.
- Proceed with sampling of observations making note of unusual point if any
- Analyse the data obtained.

Advantages

- Generally no equipment is required for gathering data.
- Trained persons are not required to collect the data.
- Study of the number of activities can be done simultaneously.
- Work sampling techniques are not expensive to undertake.

- When it is compared to production study, it is generally liked by workers as an observer does not confront the worker through the day.
- Study can be interrupted at any time without affecting the result.
- Operations which are difficult and expensive to be measured by time study can be subjected to the work sampling techniques.

Disadvantages

- It is not capable of giving elemental data.
- It is not economical for study of single operation or operator.
- When compared to stop watch study the statistical approval of work sampling is difficult to be understood by the worker as well as the management.

Analytical Estimating Technique (Standard Data)

- One the work measurement techniques even the time required to carryout the element of the job at defined level of performance is established from the knowledge and practical experience of the observer as far as elements are concerned.
- Almost similar to 'time study technique'.
- The difference - the time for each element is estimated by an observer who is an expert having the knowledge and practical experience of the element concerned.

Applications

Most useful in engineering, construction work, erection work and Inspection.

Procedure

1. Collect the full details of job.
2. Analyze the job into its constituents- elements, activity, grouping to enable synthetic data to be applied if relevant.
3. Apply systematic data and estimate basic time for the remaining elements and contingencies.
4. Apply appropriate relaxation allowance.
5. Verify the details of elemental data for job, its method and conditions.
6. Sum up total time and relaxation allowance, etc. to establish standard time form the job.

Advantages

- It possesses almost the same advantages as enjoyed by synthesis of work measurement.
- It aids in planning and scheduling.
- It provides a basis for rate fixing for non-repetitive works in industries.
- It improves labour control.

Limitations

- Since analytical estimating relies upon the judgment of estimator, the time values obtained are not as accurate and reliable as estimated by other work measurement techniques.

Predetermined Time System (PTS)

- PTS -Pre-determined Time Study.
- Does not measure elements time by a stop watch and thus avoids the inaccuracies being introduced owing to the element of human Judgment.
- It is assumed that all manual tasks in industries are made up of certain basic human movements which one common to almost all jobs.
- The average time taken by the average qualified worker to perform a basic movement to practically constant.

Definition

- A work measurement technique whereby the time is established for basic human motions (Classified according to the nature of the motion and the conditions under which it is made) are used to build up the time for a job at a defined level of performance.

Procedure

1. Select large number of workers doing variety of jobs under normal working conditions in the workshop.
2. The jobs selected are such that they involve most of the common basic motions and are worked under different set of conditions by workers having different ages and other characteristics.
3. Record the job operations on a movie film (Micro motion study).
4. Analyze the film, note down the time taken to complete each element and compile the data in the form of a table or chart.

Advantages

- Eliminates in-accuracies associated with stop watch time study.
- Superior to stop watch time study when applied to short cycle highly repetitive operations.
- Time standard for a job can be arrived at without going to the pace of work.
- Unlike stop watch study, no rating factor is employed.
- PTS data is more reliable and accurate as compared to stop watch time study data.
- The time and cost associated with finding the standard time for a job is considerably reduced.

Rating

There are two main reasons for the variation in method:

(a) Changes which are induced by the operator and will not conform to the specific method.
(b) Changes which are forced on the operator by the circumstances outside his control, either because of change in tools, material specifications or machine feed and speed.

If the work being timed varies in observed time because of the above reasons, then the change is assessed by means of applying a rating factor.

Definition:

Rating is the personal assessment of the worker's rate of working relative to the observer's concept of the rate corresponding to standard pace.

The assessment of rating should be expressed in numeric value only. In other words, rating is defined as the performance of a worker under observation compared with mental concept of standard performance of the observer. Such standard level of performance is called normal performance.

Standard performance is the rate of output which qualified workers will naturally achieve without over exertion as an average.

3.6 Network Techniques

3.6 Exercise on Network.

3.7 Incentive schemes in Railway Workshops.

3.9 Job Evaluation and Merit Rating.

3.10 Review

4. SUPERVISORY SKILLS

4.1 Role of Supervisor in Mechanical Department

The supervisor is a vital link between the management and the works. He is the man who actually involve in giving practical shape to the policies of the enterprise with the help of workmen.

SUPERVISOR TECHNIQUES:

- Suitable Engineering Qualification.
- Skill to meet the demands of the job.
- Mechanical ability.
- Skill in importing instructions.
- Familiarity with production control.
- Familiarity with safety practices.
- Familiarity with Merit rating.
- Familiarity with record keeping.
- Ability to train workers.
- Elementary knowledge of labor psychology.
- Ability to handle any situations.
- Group Sprit.
- Approachability.
- Initiative and drive.
- Acceptability and vision.

4.2 Leadership and leadership style

Leadership Process:

To tell, to see, to do, to be, to be is the source of leadership, to do is the style of leadership, to see and to tell are the leadership, functional tools and techniques of leadership.

Leadership Styles:

Authoritarian Or Autocratic Leaders: Drive their gang through command and by developing fear in their followers and assign duties without consulting employees.

Democratic or Consultative Leaders: They work according to the wishes of their followers. They frame policies and procedures in consultation with them.

Convincing Leaders: These leaders influence his followers due to his personal contacts, to join with him in getting things done.

Functional Leaders: Such leaders lead because of their expert knowledge and with the confidence of their followers by their superior knowledge.

Labour Leaders: These leaders come to prominence due to their qualities of speech, behavior & action. They then organize themselves into trade unions.

Administrative Leaders: By administrative leadership we mean leaders or bosses in the administration. These leaders obtain this position by virtue of these ability, experience and associates with the organization.

4.3 Motivation

Motivation is the means (or) inducements which inspire or impel a person to intensify his willingness to use his capabilities and potentialities for achieving goals of the organization in which he works.

It is a psychological act which attracts the workers to do more work and instigates, if the workers are instigated, they will try to do more than the standard work and earn more for themselves which increases the living standards.

Motivation is a general inspiration process which gets the members of the team to do their task effectively, to give their loyalty to the group, to carry out properly the tasks they have accepted and generally to play an effective part in the job that the group has undertaken.

Motivational Factors

1. Praise the workers and give them credit for all good work done by them.
2. Take a sincere interest in sub-ordinates as individual persons.
3. Promote healthy competition among individual employees.
4. Delegate a substantial amount of responsibility to the sub-ordinates.
5. Fix fair wages, monetary incentives and group incentives.
6. Formulate a suitable suggestion system.
7. If possible permit the employees participation in management matters.
8. Provide opportunities for growth and promotion.
9. Promote good and satisfying inter personal relationships at work and outside.
10. Job rotation.
11. Promote good working conditions like illumination, ventilation, air conditioning,

noise free, pollution free etc.

12. Formulate, fair, clear, firm and consistent management policies.

Internal Motivates: Internal motives motivate people internally. Internal motivation starts from the ego needs of an individual.

Example: The needs to get the job of one's choice, the illusion of self determination and freedom, a sense of accomplishment in doing a job well.

External Motivates: Pay, incentives, praise or punishment.

Positive Motivation: Positive motivation adds to an individual's existing set of satisfactions.

Ex: A better and more responsible job.

Negative Motivation: Influences the behavior of an individual through a threatened loss. Ex: Fear of losing one present job.

4.4 Communication

Communication may be defined as the art of transmitting ideas and information to others with a view to make oneself clearly understood. Communication is the process of conveying messages.

Techniques of Better Communication

1. Sending direct messages
2. Sending simple messages
3. Sending understandable messages
4. Feedback system
5. Using many communication channels
6. Adopting face to face communications
7. Time the management carefully
8. Re-enforce the word's with action's
9. Introduce proper amount of repletion of information.
10. Create, cordial, peaceful atmosphere in the org.
11. Create good suggestion system.
12. Adopt communications with actions, pictures, numbers and graph.

Consequences of Poor Interpersonal Skills

Stress, lack of communication, irritation, close mindedness, no team sprit, lack of credibility, poor self esteem, suspicion, loss of productivity, isolation, poor health, distrust, anger, prejudice, break down of morale, uncooperative behavior, conflict, frustration, unhappiness.

Upward and Downward Communication

Face to face contacts, grievance/complaint procedure, Group meetings, counseling, moral questionnaires, open door policy, labor union etc.

4.5 Time Management

Prologue- TIME IS MONEY.

You can make money; you can't make time. An inch of gold cannot buy an inch of time (Chinese proverb).

Time Management-necessity

To utilise the available time in optimum manner to achieve one's personal and professional goals-Relaxed life.

Time Awareness – Time Tracking

Make sure you know where your time goes. Don't depend on memory. Keep a time log.

See that your time is spending as per your priorities or your core responsibilities.

Managers Time

Planning is a key managerial function- research shows that less than 5% of time goes on planning.

Pareto Principle: 20% time will produce 80% of your productive output. Can you afford not to manage at-least that 20%?

Parkinson's Law: Work expands to fill the time available for it. Beware!

Time Management Matrix-Classification of Activities

Urgency/ Importance	*Urgent*	*Not Urgent*
Important	1	2
Not Important	3	4

Efficiency Vs Effectiveness

Often worst performers are those who seem to be working hardest and longest. They are very busy but not necessarily effective.

Common Time Management Problems

- Procrastination
- Poor Delegation
- Meetings
- Mis-Management of Office
- Interruptions
- Lack of Focus

Procrastination:

Putting off the doing of something intentionally and habitually.

If you suspect yourself; ask – why am I putting this off? If there is no reason, do it. Do not confuse reason with excuse. It is world's number one time waster. Banish it from your life. There is no time like present to do any work.

Delegation

Do not spend time on a work that can be done, to a satisfactory level, by your subordinate. Delegation saves your time and develops subordinates. Delegation improves results by making fuller use of resources. Delegation implies transferring initiative and authority to another.

The Art of Delegation

Delegation begins with a deep sense of the value and limits of your time. Managers often complain that they are running out of time when their subordinates are running out of work.

Delegating the more routine or predictable part of one's job is only the first step. Delegation is not abdication. Some degree of control needs to be maintained.

Delegation is a great motivator. It enriches jobs, improves performance & raises morale of staff.

Office Mismanagement

Develop an efficient system of office working. Muddle makes work and wastes time. Strive for good order in your office. Utilize all resources fully. Handle telephone properly. Don't let it become a nuisance. To the extent possible, handle a piece of paper only once.

Meetings

Meetings are potential time wasters. Meetings are necessary evil; distractions from one's regular work. Try to say 'No' to a meeting where you are not required.

Agenda should be definite. Everyone should receive the agenda and relevant papers well in advance. There should be a finishing time for meeting.

Make the Telephone Work For You

Telephone is a great time-saving tool in right hands. Plan your calls. Set aside a period of time for making and if possible, receiving calls, timing for each call.

How to Control Interruptions

Set a time limit and stick to it. Set the stage in advance: You are very busy with a deadline in light. With casual droppers-in, remains standing. Meet in other person's office.

Get visitors to the point. Be ruthless with time but gracious with people. Have a clock available .Use a call-back system for telephone calls.

Boss-Imposed Time

Time spent doing things we would not be doing if we did not have bosses. Keeping bosses satisfied takes time, but dealing with dissatisfied bosses takes even more time.

Failing to invest sufficient time to satisfy bosses always results in more & more boss-imposed time, with lesser time for others.

Role of Subordinate

Realise that Boss has a wider vision. Devote time as per organisational objectives and your goals. Go to Boss after doing your home work. Manage the problems which can be tackled at your level

Planning the Day

Prepare a list of priorities for the day based on urgency and importance. Get the timing right. Morning is the time for hard work. Interesting work, meetings and social events can take place in off-peak time. Have work-breaks to overcome fatigue. Living 100% in the present improves your work output.

Conclusion

Yesterday is a cancelled cheque, Tomorrow is a promissory note, Today is ready cash. Use it. When feasible, delegate. Plan the day. Don't let paperwork pile up. Do not postpone work. Identify your time waster and resolve to eliminate them. Find time for relaxation / recreation in your schedule. Make use of committed time-travel time, waiting etc. Learn to Say 'NO'-it is not a crime.

Epilogue- TIME FOR EVERYTHING

Take time to work, it is the price of success

Take time to think, it is the source of power

Take time to play, it is the source of youth

Take time to read, it is the source of wisdom

Take time to love, it is the privilege of Gods

Take time to serve, it is the purpose of life

Take time to laugh, it is the music of soul

4.6 Stress management

Stress comes from the external forces, in our lives that push out buttons and provoke extreme emotions. One of the causes for stress is frustration also. And stress is the opposite work of relaxation. Stress management helps us to develop an effective stress management relief methods which are follows:

Get a good night rest, eat healthy, listen to favorite music, exercises, take a worm bath, get a message, read books, watch your favorite program in TV, do not think about past etc.

Reasons for Stress:

Up's-Down's, Promotion-Termination, Marriage-Diverse, Birth-Death,

4.7 Interpersonal skills

Introduction:

Interpersonal skills are the life skills we use every day to communicate and interact with other people, both individually and in groups. People who have worked on developing strong interpersonal skills are usually more successful in both their professional and personal lives.

Employers often seek to hire staff with 'strong interpersonal skills' - they want people who will work well in a team and be able to communicate effectively with colleagues, customers and clients. Interpersonal skills are not just important in the workplace, our personal and social lives can also benefit from better interpersonal skills.

People with good interpersonal skills are usually perceived as optimistic, calm, confident and charismatic - qualities that are often endearing or appealing to others. Through awareness of how you interact with others - and with practice - you can improve your interpersonal skills.

Skills You Need aims to help you learn and develop your interpersonal skills by providing an extensive library of quality content. We hope that you find our content useful and rewarding.

A List of Interpersonal Skills Includes:

- Verbal Communication - What we say and how we say it.
- Non-Verbal Communication - What we communicate without words, body language is an example.
- Listening Skills - How we interpret both the verbal and non-verbal messages sent by others.
- Negotiation - Working with others to find a mutually agreeable (Win/Win) outcome.
- Problem Solving - Working with others to identify, define and solve problems.
- Decision Making – Exploring and analyzing options to make sound decisions.
- Assertiveness – Communicating our values, ideas, beliefs, opinions, needs and wants freely.

We've all been developing our interpersonal skills since childhood - usually subconsciously. Interpersonal Skills become so natural that we may take them for granted, never thinking about how we communicate with other people. With a little time and effort you can develop these skills. Good interpersonal skills can improve many aspects of your life - professionally and socially - they lead to better understanding and better relationships.Interpersonal skills are also sometimes referred to as: social skills, people skills, soft skills, communication skills or life skills. Although these terms can include interpersonal skills they tend to be broader and therefore may also refer other types of skills.

Develop Your Interpersonal Skills:

There are a variety of skills that can help you to succeed in different areas of life and Skills You Need has sections covering many of these.

However, the foundations for many other skills are built on strong interpersonal skills since these are relevant to our personal relationships, social affairs and professional lives.

Without good interpersonal skills it is often more difficult to develop other important life skills. Unlike specialized and technical skills (hard skills), interpersonal skills (soft skills) are used every day and in every area of our lives.

Improve and develop your interpersonal skills including:

Learn to Listen:

Listening is not the same as hearing. Take time to listen carefully to what others are saying through both their verbal and non-verbal communication. Visit our Listening Skills pages to learn more.

Choose Your Words:

Be aware of the words you are using when talking to others. Could you be misunderstood or confuse the issue? Practice clarity and learn to seek feedback to ensure your message has been understood.

Encourage others to engage in communication and use appropriate questioning to develop your understanding.

Understand Why Communication Fails:

Communication is rarely perfect and can fail for a number of reasons. Learn about the various barriers to good communication so you can be aware of - and reduce the likelihood of - ineffective interpersonal communication and misunderstandings.

Relax:

When we are nervous we tend to talk more quickly and therefore less clearly. Being tense is also evident in our body language and other non-verbal communication. Instead, try to stay calm, make eye contact and smile. Let your confidence shine.

Clarify:

Show an interest in the people you talk to. Ask questions and seek clarification on any points that could be easily misunderstood.

Be Positive:

Try to remain positive and cheerful. People are much more likely to be drawn to you if you can maintain a positive attitude.

Empathize:

Understand that other people may have different points of view. Try to see things from their perspective. You may learn something whilst gaining the respect and trust of others.

Understand Stress:

Learn to recognize, manage and reduce stress in yourself and others. Although stress is not always bad, it can have a detrimental effect on your interpersonal communication. Learning how to recognize and manage stress, in yourself and others, is an important personal skill.

Learn to be Assertive:

You should aim to be neither passive nor aggressive. Being assertive is about expressing your feelings and beliefs in a way that others can understand and respect. Assertiveness is fundamental to successful negotiation.

Reflect and Improve:

Think about previous conversations and other interpersonal interactions; learn from your mistakes and successes. Always keep a positive attitude but realize that you can always improve our communication skills.

Negotiate:

Learn how to effectively negotiate with others paving the way to mutual respect, trust and lasting interpersonal relations.

Working in Groups:

We often find ourselves in group situations, professionally and socially. Learn all about the different types of groups and teams.

4.8 Review

5. TECHNICAL ENGLISH

5.1 Communication Vocabulary

Introduction:

Traditionally English learners think that English speech is formed by taking separate words and sticking them together while in fact any language is build from word chunks and phrases. In either case we can quite logically conclude that the more individual words or word combinations you know, the better and more fluently you'll speak.

So you may be focusing on memorizing large English vocabulary lists even before attempting going out there and starting socializing and communicating with English speaking folks.

To a certain degree, you're absolutely right. You can't expect to speak fluently without having acquired SOME English vocabulary, I mean – you wouldn't be able to work as a shop assistant, for example, if you couldn't understand your customers and respond to their questions, right?

There is a point, however, in English studies at which you can actually start speaking fluently even before you've learned advanced English vocabulary!

Here it would be fitting to establish what actually fluent English speech entails and how you can know if you speak fluently or not. It will also help you set your English improving targets and realize what aspects of English you really need to improve upon.

So here's how I define real spoken English fluency:

- Ability to communicate with ease in situations you find yourself on a regular basis!
- And please pay attention to the fact that I didn't specifically mention correct grammar or sufficient vocabulary, it's all about the ease of communication, my friends!

Sure enough, you wouldn't be able to communicate easily if your grammar totally sucked and your vocabulary would be really poor, but that's exactly the point I'm trying to make here – easy communication includes the other factors in itself and implies that you can speak correctly on 95% of occasions and you also have enough English words to use when speaking.

So let's proceed further while keeping in mind what we just defined!

How Many English Words Are Enough

How many English words are there in your active vocabulary (active vocabulary – words you can see when speaking as opposed to words you only recognise)? A thousand? Fifteen hundred ?Five thousand ? In fact this question is rhetoric because you can't really tell how large your English vocabulary is...

Purpose of this question was just to prepare you for more numbers that will follow. And this is where it gets very interesting because the first 100 most commonly used English words will enable you to understand around 50% of spoken English! Bear in mind that the English word list under this link pertains to written English, However, the distribution ratio remains roughly the same among spoken English vocabulary, too.

Quality

Finished

Industrial

Material

Manager

Lines

Production

Large-scale

Assembly

Raw

Process

Levels

Control

Products

Productivity manufacturing

Factory

Layout

Site

Unit

Workshop

Assemble

Batch

Component

Convert

Effectiveness

Efficiency

Line

Lot

Maximize

Optimize

Equipment

Fixtures

Machinery

Materials handling

Raw material

Inventory

Stock

Store

Breakdown

Failure

Fault

Maintain

Repair

Aggregate

Backlog

Back order

Batch

Lot

Bottleneck

Capacity

Cycle

Downtime

Flow

Forecast

Idle

Idealtime

Make-to-order

Make-to-stock

Output

Productivity

Prototype

Requirement

Run

Satisfy

Schedule

Sequence

Set up

Set up time

Stack

Update

Work in progress

Shift

Work force

Work load

5.2 Grammar-Important Terms

1. Active Voice

A type of sentence or clause in which the subject performs or causes the action expressed by the verb. Contrast with Passive Voice.
(See also: Practice in Changing Verbs From Passive to Active.)
Example:
"A census taker once tried to test me. I ate his liver with some fava beans and a nice Chianti."
(Hannibal Lectern in *The Silence of the Lambs*, 1991)

2. Adjective

The part of speech (or word class) that modifies a noun or a pronoun.
(See also: Adding Adjectives and Adverbs to the Basic Sentence Unit.)
Example:
"Send this pestilent, traitorous, cow-hearted, yeasty codpiece to the brig."
(Jack Sparrow in *Pirates of the Caribbean: At World's End*, 2007)

3. Adverb

The part of speech that modifies a verb, adjective, or other adverb.
(See also: Practice in Turning Adjectives Into Adverbs.)
Example:
"There I was, standing there in the church, and for the first time in my whole life I realized I totallyand utterly loved one person."
(Charles to Carrie in *Four Weddings and a Funeral*, 1994)

4. Clause

A group of words that contains a subject and a predicate. A clause may be either a sentence(independent clause) or a sentence-like construction included within another sentence (dependent clause).
Example:
"Don't ever argue with the big dog [*independent clause*], because the big dog is always right[*dependent clause*]."
(Deputy Marshal Samuel Gerard in *The Fugitive*, 1993)

5. Complex Sentence

A sentence that contains at least one independent clause and one dependent clause.
(See also: Sentence-Imitation Exercise: Complex Sentences.)
Example:
"Don't ever argue with the big dog [*independent clause*], because the big dog is always right [*dependent clause*]."
(Deputy Marshal Samuel Gerard in *The Fugitive*, 1993)

6. Compound Sentence

A sentence that contains at least two independent clauses, often joined by a conjunction.

(See also: Sentence-Imitation Exercise: Compound Sentences.)

Example:

"I can't compete with you physically [*independent clause*], and you're no match for my brains [*independent clause*]."

(Vizzini in *The Princess Bride*, 1987)

7. Conjunction

The part of speech that serves to connect words, phrases, clauses, or sentences.

(See also: coordinating conjunction, subordinating conjunction, correlative conjunction, and conjunctive adverb.)

Example:

"I can't compete with you physically, and you're no match for my brains."

(Vizzini in *The Princess Bride*, 1987)

8. Declarative Sentence

A sentence that makes a statement.

(See also: Practice in Forming Declarative Sentences.)

Example:

"A census taker once tried to test me. I ate his liver with some fava beans and a nice Chianti."

(Hannibal Lecter in *The Silence of the Lambs*, 1991)

9. Dependent Clause

A group of words that begins with a relative pronoun or a subordinating conjunction. A dependent clause has both a subject and a verb but (unlike an independent clause) cannot stand alone as asentence. Also known as a subordinate clause.

(See also: Building Sentences with Adverb Clauses.)

Example:

"Don't ever argue with the big dog [*independent clause*], because the big dog is always right[*dependent clause*]."

(Deputy Marshal Samuel Gerard in *The Fugitive*, 1993)

10. Direct Object

A noun or pronoun that receives the action of a transitive verb.

(See also: Practice in Identifying Direct Objects.)

Example:

"All my life I had to fight. I had to fight my daddy. I had to fight my uncles. I had to fight mybrothers."

(Sophia in *The Color Purple*, 1985)

11. Exclamatory Sentence

A sentence that expresses strong feelings by making an exclamation.

Example:

"God! Look at that thing! You would've gone straight to the bottom!" (Jack Dawson looking at Rose's ring in *Titanic*, 1997)

12. Imperative Sentence

A sentence that gives advice or instructions or that expresses a request or a command.

Example:

"Send this pestilent, traitorous, cow-hearted, yeasty codpiece to the brig." (Jack Sparrow in *Pirates of the Caribbean: At World's End*, 2007)

13. Independent Clause

A group of words made up of a subject and a predicate. An independent clause (unlike adependent clause) can stand alone as a sentence. Also known as a main clause.

Example:

"Don't ever argue with the big dog [*independent clause*], because the big dog is always right [*dependent clause*]." (Deputy Marshal Samuel Gerard in *The Fugitive*, 1993)

14. Indirect Object

A noun or pronoun that indicates to whom or for whom the action of a verb in a sentence is performed.

(See also: Practice in Identifying Indirect Objects.)

Example:

"It's a family motto. Are you ready, Jerry? I want to make sure you're ready, brother. Here it is:*Show me the money*." (Rod Tidwell to Jerry McGuire in *Jerry McGuire*, 1996)

15. Interrogative Sentence

A sentence that asks a question.

(See also: Practice in Forming Interrogative Sentences.)

Example:

"What is the name of the Lone Ranger's nephew's horse?" (Mr. Parker in *A Christmas Story*, 1983)

16. Noun

The part of speech that is used to name a person, place, thing, quality, or action and can function as the subject or object of a verb, the object of a preposition, or an appositive.

(See also: Practice in Identifying Nouns.)
Example:
"Waiter, there is too much pepper on my paprika's."
(Harry Burns in *When Harry Met Sally*, 1989)

17. Passive Voice

A type of sentence or clause in which the subject receives the action of the verb. Contrast with Active Voice.
Example:
"Any attempt by you to create a climate of fear and panic among the populace must be deemed by us an act of insurrection."
(First Elder to Jor-El in *Superman*, 1978)

18. Predicate

One of the two main parts of a sentence or clause, modifying the subject and including the verb,objects, or phrases governed by the verb.
(See also: What Is a Predicate?)
Example:
"I don't ever remember feeling this awake."
(Thelma Dickinson in *Thelma and Louise*, 1991)

19. Prepositional Phrase

A group of words made up of a preposition, its object, and any of the object's modifiers.
(See also: Adding Prepositional Phrases to the Basic Sentence Unit.)
Example:
"A long time ago, my ancestor Paikea came to this place on the back of a whale. Since then, in every generation of my family, the first born son has carried his name and become the leader of our tribe."
(Paikea in *Whale Rider*, 2002)

20. Pronoun

A word that takes the place of a noun.
(See also: Using the Different Forms of Pronouns.)
Example:
"A census taker once tried to test me. I ate his liver with some fava beans and a nice Chianti."
(Hannibal Lecter in *The Silence of the Lambs*, 1991)

21. Sentence

A word or (more commonly) a group of words that expresses a complete idea. Conventionally, a sentence includes a subject and a verb. It begins with a capital letter and concludes with a mark ofend punctuation.
(See also: Exercise in Identifying Sentences by Function and Exercise in Identifying

Sentences by Structure.)
Example:
"I don't ever remember feeling this awake."
(Thelma Dickinson in *Thelma and Louise*, 1991)

22. Simple Sentence
A sentence with only one independent clause (also known as a main clause).
Example:
"I ate his liver with some fava beans and a nice Chianti."
(Hannibal Lector in *The Silence of the Lambs*, 1991)

23. Subject
The part of a sentence that indicates what it is about.
Example:
"I don't ever remember feeling this awake."
(Thelma Dickinson in *Thelma and Louise*, 1991)

24. Tense
The time of a verb's action or state of being, such as past, present, and future.
(See also: Forming the Past Tense of Regular Verbs and The Principal Parts of Irregular Verbs.)
Example:
"Years ago, you served [*past tense*] my father in the Clone Wars; now he begs [*present tense*] you to help him in his struggle against the Empire."
(Princess Leia to General Kenobi in *Star Wars Episode IV: A New Hope*, 1977)

25. Verb
The part of speech that describes an action or occurrence or indicates a state of being.
(See also: Ten Quick Questions and Answers About Verbs and Verbal's in English.)
Example:
"Send this pestilent, traitorous, cow-hearted, yeasty codpiece to the brig."
(Jack Sparrow in *Pirates of the Caribbean: At World's End*, 2007)

5.3 Common Errors

1. Its vs. it's

its= A possessive pronoun. Examples would be: The puppy played with its toy. The computer and its power supply are for sale. Do you know whether my car needs itsown inspection?

it's=contraction of it is. Examples would be: It's much too hot in July. I think it'sgoing to rain. I doubt it's ever going to be the same.

Easy reminder: You can replace *it's* with *it is* every time and re-read your sentence for meaning.

2. There vs. their vs. they're

There =an adverb, in or at that place. There is only one lemon left. There should be an easier way to do this. I hope you don't go there.

Their=a possessive pronoun. Their mansion is beautiful. Their olive trees make me dream of Italy. Their baby cries a lot.

They're=contraction of they are. They're simply stunning. They're going to perform for us. Don't act as if they're here already!

Easy reminder: You can replace *they're* with *they are* every time and re-read your sentence for meaning.

3. Lose vs. Loose

Lose = a verb, to come to be without something; to suffer the loss of something. I do not wish to lose more weight. I was about to lose my ear ring. She cannot stand the thought of losing him.

loose=an adjective, free or released from attachment; not bound together; not strict. My belt is very loose around my waist. She likes to wear her hair loose and free.That is a loose interpretation of our document.

Easy reminder= Lose has come to be without its extra "o"!!!

4. Whose vs. who's

whose= possessive form of who. Whose plans are these? Whose money did he take? Do you know whose boat we saw the other day?

who's= a contraction for who is. Who's going to clean all this mess? She was wondering who's going to dance with her. Do we need to tell them who's going to be there?

Easy reminder: You can replace *who's* with *who is* every time and see if it makes sense.

5. your vs. you're

your=possessive pronoun. Your job is very exciting. I wish I were in your shoes. Did you tell me your secret yet?

you're=contraction for you are. You're going to amaze them with your performance i want you to know how much you're delivering for us. Perhaps you'reabout to get started?

Easy reminder: You can replace *you're* with *you are* every time and see if it makes sense.

6. Write and right.

Write=verb, to express in writing. I want to learn how to write well. Did you write this? Write a letter to Mom

right=adjective, correct, justified, suitable, opposite of left. The little boy knew right versus wrong. It's the right way to do things. I meant to write this for

youright away.

7. me vs. I

The best explanation for this rule is here; nonetheless here is a simple explanation: I=subject. Me=object. Which one to use when?

Let's learn by example:

1. This would be wrong: *They are going to send* my wife and I *a package.*

Why? The rule is that the sentence should make sense if you remove *the person and* preceding thei, So in our case:

They are going to send I a package. This is obviously wrong. It should be: *They aregoing to send me a package.*

2 This would be wrong: Jim and me *are going to the beach.*

Why? Remove *Jim and*. In this case, also adjust the verb to match single form of first person. Then re-read the sentence:

Me *am going to the beach.* This is also obviously wrong. It should be: Jim and I *are going to the beach.*

3.This would be wrong: *The best one is sent to Ashley and I*.

Easy way to remember this is that *I* does not follow a verb. *I* should always make sense if it is followed by a verb.

Correct form would be *The best one is sent to Ashleyand me.*

4.I am rather pleased to learn that my favorite phrase, "it is she", upon answering the phone has formal correctness on its side but is rather antiquated

8. Effect and Affect

Effect=noun, produced by a cause; a result. The effect of your leadership is visible here. The rules are in effect as of today. What if the change has no effect?

Affect=verb, to act on; to produce a chance. She affected all of us with her speech. The cold weather affected my plants last night.I let the movie affect me deeply.

9. Accept vs. Except

Accept=verb, to take or receive. I accept the challenge. They accepted the generous gift. Why not accept our flaws and still love ourselves?

Except=preposition, excluding, save, but. So it will never follow a subject such as I, they, We everyone except me decided to go. Do anything you can to please her except calling her. Except for her attitude, I think she is ideal.

10. Gone vs. Went

"Went" is the past tense of the verb to go whereas "gone" is the past participle. Use them correctly.

Correct: I went to the store. I should have gone to the open market instead.

Incorrect: I should've went somewhere.

11. The apostrophe disaster for plural form

The most common error is to put apostrophe where apostrophe has no business. When you form a plural for nouns, there is no need whatsoever to add an apostrophe.

These are all wrong forms of plural nouns = Cat's, Dog's, Lot's (not even a word), ABC'sPlural forms in most cases are made by simply adding an's' to the singular form =Cats, Dogs, lots, ABCs.

Even though the use of apostrophe before an S in an acronym is almost universal when you make it plural, it is still incorrect.

12. Ending sentences with preposition

It has also become common to use prepositions inappropriately or to end phrases and questions with prepositions.

Examples of some prepositions: at, of, with, in.

Wrong: Where are we *at* with our plans? Where is the movie theatre *at*?

Correct: Where are we with our plans? Where is the movie theatre?

When asking about the location of a place, "at" should not be used after "where."

Note: Don't confuse phrasal verbs which make up a huge category in English language and are best described here. For instance, a preposition always is used in the phrase "to hang out" (where did you want to hang out?) and the verb wouldn't make sense without this preposition.

13. The dangling participle

The dangling participle can seriously change the flow and meaning of your writing. It is important to make sure we qualify the intended words.

Examples:

Misinterpreted: *Cooking on the stove, she decided it was time to turn the vegetables.*

It sounds as though she was being cooked on the stove herself.

Better: *She decided it was time to turnthe vegetables which were cooking on thestove.*

Misinterpreted: *Sunburnedand dehydrated, mom decided it was time for the childrento go into the house.*

It sounds as though the Mom is sunburned and dehydrated.

Better: *Mom decided it was time for the children, who were sunburned and Dehydrated,to go into the house.*

14. Could of vs could have

This is very simple. I'm afraid "could of" is not even a phrase. It is often misused perhaps because it is phonetically so close to "could have" *I wonder if I could have majored in English.*

15. Here vs Hear

Here=adverb, in this place; in this spot. I am here and planning to stay. I wish you were here. It is here in this place that we met.

Hear=verb, to be within earshot; to perceive by ear. I hear you. We do not want tohear the policies one more time. If only she heard what he had to say!

Easy reminder: Here is there with a preceding T and the two are almost opposites so think of them in a pair.

16. irregardless vs regardless

This is very simple also. I'm afraid "iregardless" has never and will never be a valid word. It is completely made up. It's not going to join the ranks of words regardlessof what we do!

17. Then vs Than

Then=adverb, at the time; immediately or soon afterward. I will eat; then I will go. He shall see you then. If you want to be there by then, you had better hurry. Than=used after comparative adjectives. He is taller than she is. I wonder how much more than this I can pay. Will you please speak louder than them?

18. To vs Too

To=preposition. If you want me to do this, I will. You should be prepared to go. Too=adverb, also. They want to perform too. She too has one. So will they see youtoo?

Two=noun, one plus one. I want you two to decide amongst yourselves. If only thetwo of them could see you. How long before you two grow up?

19.Were vs Where We're

were=past tense of verb to be. If I were a rich girl, I would live in Italy.

You werehappier then. I think they were going to stay.

where=adverb, in or at what place. Where were you last night? Where can we go from here? Where in this world did my dog disappear?

we're=contraction of we are. We're going to be famous. We're not there yet. We'reabout to make a huge difference.

5.4 Official/Business Correspondence

To gain practice in identifying common problems in correspondence, perform the following exercises.

- Memos. Typically, you write memos to people within your place of work, and you write letters to people outside your place of work. ...
- Letters. Formats for letters vary from company to company. ...
- E-mail.

Correspondence:

Correspondence of memos, letters, and electronic mail. In engineering and science, correspondence is an effective way to make requests, submit changes to a job, and deliver specific information. Unlike telephone conversations, correspondence presents the audience with a legal contract that is dated and can support a claim in court. This section presents formats for memos and letters. Because electronic mail usually has a built-in format, no format is assigned here for it. In addition, this section provides helpful links for job letters and resumes.

In your correspondence, you should concentrate on being clear and precise. Because audiences tend to read letters and memos quickly, opt for shorter sentences and paragraphs than you would use in a formal report or journal article. Also, in correspondence, you should consider carefully the tone. Tone is difficult to control in correspondence. For instance, in a job application letter, how do you talk about your accomplishments without sounding boastful? Or in a letter complaining about faulty workmanship, how do you motivate the reader to repair the damage without alienating the reader? The answers are not simple. Often, engineers and scientists lose control of tone by avoiding simple straightforward wording. When some people sit down to write a business letter or memo, they change their entire personality. Instead of using plain English, they use convoluted phrases such as "per your request" or "enclosed please find." Because these phrases are not natural or straightforward, they inject an undesired attitude, usually arrogance, into the writing. To gain practice in identifying common problems in correspondence, perform the following exercises.

Memos:

Typically, you write memos to people within your place of work, and you write letters to people outside your place of work. One major difference between memos and letters is the title line found in memos. Because readers often decide whether to read the memo solely on the basis of this title line, the line is important. Another difference between letters and memos is that you sometimes write memos that serve as short reports. In such cases, the format for the memo changes somewhat. For instance, in a memo serving as a progress report for a project, you might include subheadings and sub-subheadings. Notice that people who are mentioned in a memo or are directly affected by the memo should receive a copy.

Letters:

Formats for letters vary from company to company. For instance, some formats call for paragraph indents; others don't. Included in this section is a sample format for

letters. Also included in this section is a sample thank-you letter written by someone after a job interview. In this letter, notice how the writer gets to the point in the first sentence of the first paragraph. Notice also the simple and straightforward salutation (“Sincerely”). As with a memo, people who are mentioned or directly affected by the letter should receive a copy.

E-mail:

Electronic mail is a less formal version of memos and letters. Electronic mail is relatively new and is changing in terms of sophistication in format and expectation by audience. The principal advantages of electronic mail over other types of correspondence are its speed and ease of use. For instance, in minutes, you can send out information to many recipients around the world. Included in this section is a sample e-mail format.

One disadvantage of electronic mail is the crudeness of the format. Many electronic mail systems do not allow such things as tabs or italics. For that reason, the look of the message is not as attractive as a memo or letter that has been printed on letterhead paper. Because the message does not look formal, many people mistakenly adopt a style that lacks the "appropriate formality" [Markel, 1996]. For instance, these people include needless abbreviations (such as "BTW" rather than "by the way").

Another disadvantage of electronic mail is also one of its advantages: its ease of use. With letters and memos, you must print out the correspondence before you send it. That printing out allows you to view the writing on paper--a step that makes it easier for you to proof for mechanical mistakes in spelling, usage, and punctuation. With electronic mail, though, you are not forced to print out on paper before you send. For that reason, electronic messages often are not as well proofed as regular correspondence. Remember: Because most networks archive electronic mail, you should take the same care with electronic mail as you do with printed correspondence. That means using the appropriate formality in style and carefully proofing your message before you hit the "send" button.

5.5 General Report Writing

Here are the main sections of the standard report writing format:

- Title Section :
  If the report is short, the front cover can include any information that you feel is necessary including the author(s) and the date prepared. In a longer report, you may want to include a table of contents and a definitions of terms.
- Summary:
  There needs to be a summary of the major points, conclusions, and recommendations. It needs to be short as it is a general overview of the report. Some people will read the summary and only skim the report, so make sure you include all the relevant information. It would be best to write this last so you will include everything, even the points that might be added at the last minute.
- Introduction :
  The first page of the report needs to have an introduction. You will explain the problem and show the reader why the report is being made. You need to give a definition of terms if you did not include these in the title section, and explain how the details of the report are arranged.
- Body:
  This is the main section of the report. The previous sections needed to be written in plain English, but this section can include jargon from your industry. There needs to be several sections, with each having a subtitle. Information is usually arranged in order of importance with the most important information coming first. If you wish, a "Discussion" section can be included at the end of the Body to go over your findings and their significance.
- Conclusion:
  This is where everything comes together. Keep this section free of jargon as most people will read the Summary and Conclusion.
- Recommendations - This is what needs to be done. In plain English, explain your recommendations, putting them in order of priority.
- Appendices :
  This includes information that the experts in the field will read. It has all the technical details that support your conclusions.

This report writing format will make it easier for the reader to find what he is looking for. Remember to write all the sections in plain English, except for the Body. Also remember that the information needs to be organized logically with the most important information coming first.

Tips for Good Writing:

Here are a few tips for good writing,

- Keep it simple. Do not try to impress, rather try to communicate. Keep the sentences short and to the point. Do not go into a lot of details unless it is needed. Make sure every word needs to be there, that it contributes to the purpose of the report.
- Use an active voice rather than passive. Active voice makes the writing move smoothly and easily. It also uses fewer words than the passive voice and gives impact to the writing by emphasizing the person or thing responsible for an action. Here is an example: Bad customer service decreases repeat business.
- Good grammar and punctuation is important. Having someone proofread is a good idea. Remember that the computer can not catch all the mistakes, especially with words like "red, read" or "there, their."

Communication Skills

There is a growing consensus among business executives that there is a lack of good writing skills among job applicants, as reported in several recent surveys. Because of this, employers are including writing skills as one of the skills they look for when hiring. Some even ask for a sample report when screening applicants. It is even included in the job description that the job requires a motivated communicator.

Good communication is essential in business. Usually there is more than one individual that is working on a goal, and good communication will allow an exchange of ideas and concerns.

- There can be no team effort without communication, as it is necessary to coordinate the efforts of everyone.
- Bad communication can waste valuable time and effort.
  If a team member discovers a short cut or solves a problem, that information needs to go out to every team member so they can benefit from it and reach their goal quicker.

5.6 Technical Report Writing

1 Introduction:

A technical report is a formal report designed to convey technical information in a clear and easily accessible format. It is divided into sections which allow different readers to access different levels of information. This guide explains the commonly accepted format for a technical report; explains the purposes of the individual sections; and gives hints on how to go about drafting and refining a report in order to produce an accurate, professional document.

2. structure:

A technical report should contain the following sections;

Section	Details
Title page	Must include the title of the report. Reports for assessment, where the word length has been specified, will often also require the summary word count and the main text word count
Summary	A summary of the whole report including important features, results and conclusions
Contents	Numbers and lists all section and subsection headings with page numbers
Introduction	States the objectives of the report and comments on the way the topic of the report is to be treated. Leads straight into the report itself. Must not be a copy of the introduction in a lab handout.
The sections which make up the body of the report	Divided into numbered and headed sections. These sections separate the different main ideas in a logical order
Conclusions	A short, logical summing up of the theme(s) developed in the main text
References	Details of published sources of material referred to or quoted in the text (including any lecture notes and URL addresses of any websites used.
Bibliography	Other published sources of material, including websites, not referred to in the text but useful for background or further reading.

Acknowledgements	List of people who helped you research or prepare the report, including your proofreaders
Appendices (if appropriate)	Any further material which is essential for full understanding of your report (e.g. large scale diagrams, computer code, raw data, specifications) but not required by a casual reader

3 Presentation:

For technical reports required as part of an assessment, the following presentation guidelines are recommended;

Script	The report must be printed single sided on white A4 paper. Hand written or dot-matrix printed reports are not acceptable.
Margins	All four margins must be at least 2.54 cm
Page numbers	Do not number the title, summary or contents pages. Number all other pages consecutively starting at 1
Binding	A single staple in the top left corner or 3 staples spaced down the left hand margin. For longer reports (e.g. year 3 project report) binders may be used.

4 Planning the report:

There are some excellent textbooks contain advice about the writing process and how to begin Here is a checklist of the main stages;

- Collect your information. Sources include laboratory handouts and lecture notes, the University Library, the reference books and journals in the Department office. Keep an accurate record of all the published references which you intend to use in your report, by noting down the following information;

  Journal article:
  Author(s),
  Title of article,
  Name of journal (italic or underlined),
  Year of publication,
  Volume number (bold),
  Issue number, if provided (in brackets),
  Page numbers,
  Book:
  Author(s),
  Title of book (italic or underlined),
  Edition, if appropriate,
  Publisher,
  Year of publication,

N.B. the listing of recommended textbooks in section 2 contains all this information in the correct format.

- Creative phase of planning:

  Write down topics and ideas from your researched material in random order. Next arrange them into logical groups. Keep note of topics that do not fit into groups in case they come in useful later. Put the groups into a logical sequence which covers the topic of your report.

- Structuring the report:

  Using your logical sequence of grouped ideas, write out a rough outline of the report with headings and subheadings.

5. Writing the first draft:

Who is going to read the report? For coursework assignments, the readers might be fellow students and/or faculty markers. In professional contexts, the readers might be managers, clients, project team members. The answer will affect the content and technical level, and is a major consideration in the level of detail required in the introduction.

Begin writing with the main text, not the introduction. Follow your outline in terms of headings and subheadings. Let the ideas flow; do not worry at this stage about style, spelling or word processing. If you get stuck, go back to your outline plan and make more detailed preparatory notes to get the writing flowing again.

Make rough sketches of diagrams or graphs. Keep a numbered list of references as they are included in your writing and put any quoted material inside quotation marks

Write the Conclusion next, followed by the Introduction. Do not write the Summary at this stage.

6. Revising the first draft:

This is the stage at which your report will start to take shape as a professional, technical document. In revising what you have drafted you must bear in mind the following, important principle;

- The essence of a successful technical report lies in how accurately and concisely it conveys the intended information to the intended readership.

During year 1, term 1 you will be learning how to write formal English for technical communication. This includes examples of the most common pitfalls in the use of English and how to avoid them. Use what you learn and the recommended books to guide you. Most importantly, when you read through what you have written, you must ask yourself these questions;

- Does that sentence/paragraph/section say what I want and mean it to say? If not, write it in a different way.
- Are there any words/sentences/paragraphs which could be removed without affecting the information which I am trying to convey? If so, remove them.

7. Diagrams, graphs, tables and mathematics:

It is often the case that technical information is most concisely and clearly conveyed by means other than words. Imagine how you would describe an electrical

circuit layout using words rather than a circuit diagram. Here are some simple guidelines;

Diagrams	Keep them simple. Draw them specifically for the report. Put small diagrams after the text reference and as close as possible to it. Think about where to place large diagrams.
Graphs	For detailed guidance on graph plotting, see the 'guide to laboratory report writing'
Tables	Is a table the best way to present your information? Consider graphs, bar charts or pie charts. Dependent tables (small) can be placed within the text, even as part of a sentence. Independent tables (larger) are separated from the text with table numbers and captions. Position them as close as possible to the text reference. Complicated tables should go in an appendix.
Mathematics	Only use mathematics where it is the most efficient way to convey the information. Longer mathematical arguments, if they are really necessary, should go into an appendix. You will be provided with lecture handouts on the correct layout for mathematics.

8. The report layout

The appearance of a report is no less important than its content. An attractive, clearly organised report stands a better chance of being read. Use a standard, 12pt, font, such as Times New Roman, for the main text. Use different font sizes, bold, italic and underline where appropriate but not to excess. Too many changes of type style can look very fussy.

9. Headings:

Use heading and sub-headings to break up the text and to guide the reader. They should be based on the logical sequence which you identified at the planning stage but with enough sub-headings to break up the material into manageable chunks. The use of numbering and type size and style can clarify the structure as follows;

3.0 Methods of harnessing wave energy
3.1 Shore-based systems
3.2 Deep-water systems
3.2.1 *"Duck"* devices
3.2.2 Rafts

10. References to diagrams, graphs, tables and equations:

- In the main text you must always refer to any diagram, graph or table which you use.

- Label diagrams and graphs as follows;

  Figure 1.2 Graph of energy output as a function of wave height.

  In this example, the second diagram in section 1 would be referred to by "...see figure 1.2..."
- Label tables in a similar fashion;

  Table 3.1 Performance specifications of a range of commercially available GaAsFET devices

  In this example, the first table in section 3 might be referred to by "...with reference to the performance specifications provided in Table 3.1..."
- Number equations as follows;

  $F(dB) = 10*\log_{10}(F)$ (3.6)

  In this example, the sixth equation in section 3 might be referred to by "...noise figure in decibels as given by eqn (3.6)..."

11. Originality and plagiarism:

Whenever you make use of other people's facts or ideas, you must indicate this in the text with a number which refers to an item in the list of references. Any phrases, sentences or paragraphs which are copied unaltered must be enclosed in quotation marks and referenced by a number. Material which is not reproduced unaltered should not be in quotation marks but must still be referenced. It is not sufficient to list the sources of information at the end of the report; you must indicate the sources of information individually within the report using the reference numbering system.

Information that is not referenced is assumed to be either common knowledge or your own work or ideas; if it is not, then it is assumed to be plagiarised i.e. you have knowingly copied someone else's words, facts or ideas without reference, passing them off as your own. This is a serious offence. If the person copied from is a fellow student, then this offence is known as collusion and is equally serious. Examination boards can, and do, impose penalties for these offences ranging from loss of marks to disqualification from the award of a degree

This warning applies equally to information obtained from the Internet. It is very easy for markers to identify words and images that have been copied directly from web sites. If you do this without acknowledging the source of your information and putting the words in quotation marks then your report will be sent to the Investigating Officer and you may be called before a disciplinary panel.

12. Finalising the report and proofreading:

Your report should now be nearly complete with an introduction, main text in sections, conclusions, properly formatted references and bibliography and any appendices. Now you must add the page numbers, contents and title pages and write the summary.

13. The Summary:

The summary, with the title, should indicate the scope of the report and give the main results and conclusions. It must be intelligible without the rest of the report. Many people may read, and refer to, a report summary but only a few may read the full report, as often happens in a professional organisation.

- Purpose - a short version of the report and a guide to the report.
- Length - short, typically not more than 100-300 words
- Content - provide information, not just a description of the report.

14. Proofreading:

This refers to the checking of every aspect of a piece of written work from the content to the layout and is an absolutely necessary part of the writing process. You should acquire the habit of never sending or submitting any piece of written work, from email to course work, without at least one and preferably several processes of proofreading. In addition, it is not possible for you, as the author of a long piece of writing, to proofread accurately yourself; you are too familiar with what you have written and will not spot all the mistakes.

When you have finished your report and before you staple it,you must check it very carefully yourself. You should then give it to someone else, e.g. one of your fellow students, to read carefully and check for any errors in content, style, structure and layout. You should record the name of this person in your acknowledgements.

15. Word processing / desktop publishing:

Advantages	Disadvantages
Word processing and desktop publishing packages offer great scope for endless revision of a document. This includes words, word order, style and layout.	Word processing and desktop publishing packages never make up for poor or inaccurate content
They allow for the incremental production of a long document in portions which are stored and combined later	They can waste a lot of time by slowing down writing and distracting the writer with the mechanics of text and graphics manipulation.
They can be used to make a document look stylish and professional.	Excessive use of 'cut and paste' leads to tedious repetition and sloppy writing.
They make the process of proofreading and revision extremely straightforward	If the first draft is word processed, it can look so stylish that the writer is fooled into thinking that it does not need proofreading and revision!

Two useful tips;

- Do not bother with style and formatting of a document until the penultimate or final draft.

- Do not try to get graphics finalised until the text content is complete.

6. COMPUTER AWARENESS

6.1 Introduction to computers and applications of computers/windows

Computer Fundamentals

A computer is any device capable of making calculations--it performs a computation and produces an answer. But this is a little too broad to describe most computers today. Today's computers can perform very complex calculations at almost the speed of light.

Most modern computers are 'general purpose' computation machines. They have a place to store instructions, registers to store intermediate values created during computations and a computation engine to perform calculations. When people think of a *personal computer* they think of the big pieces they can lay their hands on.

Computer Monitor

The computer monitor is the piece of equipment that the computer uses to display text and images. Computer monitors are either a cathode ray tube design (shown here) or a flat panel design.

Computer Chassis or Computer Case

The 'guts' of the computer are in the computer case. There are two basic types of personal computer case designs, desktops and towers. On the left we see a desktop design. Its called a desktop design because it sits on top of the desk.

Here is the second kind of computer chassis or computer case design, the *tower* design. The tower sits on the floor under the desk, usually.

The Keyboard

The next item people think of is the keyboard. The keyboard provides the ability to input text to the computer. There are many different keyboard designs with all kinds of nifty functions.

The Mouse

Last, but certainly not least is the mouse. The mouse is what you use to point-and-click, but then if you're surfing this web page, odds are, you already know what a mouse is and what it does.

Computer Components

A computer consists of a collection of three kinds of components

- hardware
- firmware
- software

Hardware

A computer's hardware components are the parts you can touch. Computer hardware is the physical part of the computer. The smallest hardware component that can still perform computations is the computer chip. A computer chip is composed of semi-conductors and tiny wires laid out on top of thin wafers of silicon. Layers of wire and semi-conductors sandwiched between layers of silicon comprise a computer chip. The semi-conductors can be configured to represent either a 0 or a 1 when electricity is supplied to them. The configuration of most computer chips cannot be changed once they are built and most kinds of hardware are thus said to be 'hard-wired'.

Examples of computer hardware would include:

- Basic Input Output System (BIOS)
- Central Processing Unit (CPU)
- Memory (RAM)
- Video Processor
- Sound Processor
- Hard Drives
- Floppy Disks

Software

A computer's software is a file or set of files containing instructions that tell the computer what calculations to perform. Software is stored on a storage device, retrieved and loaded into memory and then executed by the processor. Execution is

just the process of the computer processor performing the instructions it retrieved from the software. Computers execute the software one instruction after the other.

Firmware

Firmware is a combination of hardware and software. Computer chips are composed of semi-conductors, wire and silicon. When the semi-conductors are created, they can be configured to represent either a 0 or a 1 when electricity is supplied to them. It is possible to use semi-conductors whose state can be changed *after* they are placed in a chip. This allows the configuration of the semi-conductors within the chip to be changed. The process of changing the software in a firmware chip is called *flashing* as it requires loading new software into the chip and then momentarily raising the strength of the electrical current for just a flash of a second to fix the new software into the semi-conductors.

Supercomputers

Supercomputers are the heavyweights in the computing world. These systems perform heavy calculations using hardware and software that is on the cutting edge of technology. These systems often require special liquid or gas cooling to keep them running, incorporate hundreds or thousands of processors, frequently require a large amount of physical space and a dedicated team of professionals to keep the system running. The thousands of processors are all designed to work in parallel and/or as part of a neural network within the computer or a cluster of computers. Only government agencies, the U.S. military and a select few corporations and universities own supercomputers because they are exceedingly *expensive*. These systems are often custom designed to perform specific types of tasks such as graphics rendering, image enhancement (NASA JPL), or mathematical analysis. Supercomputers push the limits of current computer and electronic circuit design and are frequently so huge that they occupy a whole building or series of rooms.

Keep in mind that this is only a general definition, that technology is constantly advancing and that all of this is subject to change. When I was in college in the 80's, a supercomputer was defined as any device capable of 1million floating point calculations or *megaflops* (*mega*=million, *flop*=floating point operations) per second or more. Today's desktop computers have this much power, so supercomputers today claim hundreds of *gigaflops* or billions of calculations per second.

The last time I looked, Cray was building 40 *teraflop* systems... (Trillions of floating point operations per second).

Mainframes

Mainframe is an older term used to refer to a large, powerful computer which performs the bulk of the data processing within an organization and is accessed using dumb terminals as the user interface. Mainframes are a single computer usually containing less than one hundred processors. Users access a mainframe by using a terminal or a terminal emulation application. Today, most mainframes are general-purpose systems designed to perform any data processing function needed by an organization. Most mainframes are housed in a single data center (one large room). IBM (International Business Machines) and DEC (Digital Equipment Corporation) were to of the bigger mainframe manufacturers. DEC is now a division of Compaq, which is owned by Hewlett-Packard who also toyed with the minicomputer before focusing on printing technologies.

Minicomputers

Most of these systems were built before 1987 and are slightly more powerful than mainframes of the same era. These systems were physically smaller than the 'big iron' systems from IBM but had more computing power than their rivals. Many of these were manufactured by Digital Equipment Corporation (DEC) before they were bought out by Compaq. The PDP-1 was the first of these DEC computers, the last was the PDP-11 on which portions of the operating system Unix was developed.

Microcomputers

Microcomputers are physically the smallest computers and fit on top of or underneath a desk and are therefore often referred to as *desktops, towers* or even *personal computers.* They are general-purpose machines and frequently have networking capability. These systems run a mix of operating systems, running the gamut from Microsoft, Mac OS, Linux and Unix.

Portable Computers

Portable computers are called (in order of size) laptops, notebooks and tablet PC's. These are complete, full-blown systems using much of the same hardware and software used on other microcomputer systems.

Palmtops and Handhelds

The Palm Pilot, Journada, iPaq and Handspring devices all count as *palmtop* or *handheld* devices. These devices contain considerable computing power and are small enough to be held in the palm of one hand. They often come with a mini operating system, synchronization software (for transferring data between the palmtop and a microcomputer (desktop).

Embedded Systems

These are the chips and systems built into your favorite electronics, your house, your car, and even your appliances. Chips and software are *embedded* in the product to add functions that would otherwise not be possible without them. Today's cars use dozens of embedded computers to control fuel consumption, exhaust emissions, braking, acceleration, climate control and many other basic functions that once were purely mechanical. Houses use embedded chips in the thermostats of the hot water heater, the heating system and in the security system if you have one.

Nano Computers

These computers don't exist yet. Though researchers have created simple molecular machines, this type of computer has not yet been developed. Nanocomputers will be smaller than the human eye can detect, will use molecular technology to perform computational functions and have a wide variety of functions not currently ascribed to computers today.

Personal Computer Hardware

Primary Components

- Chassis
- Display / Monitor
- Adaptor Cards
- Peripherals

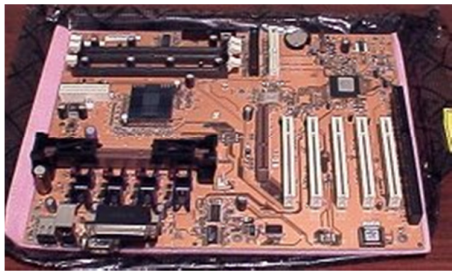
Chassis Components

- Main board

Main boards are the core of the computer's structure. When you build a computer, you plug everything into the main system board, thus the name "main board" or even "motherboard" as expansion cards were sometimes called "daughter cards". The main board contains a *clock oscillator*, many chips, capacitors, resisters and a multitude of slots to insert components. Mainboards support all the other components in the computer including the processor, memory, peripheral cards (EISA, ISAand PCI), video cards (AGP), and I/O ports

Main boards are the core of the computer's structure. The main board is where all the components are inserted to make a working computer. The main board contains several critical chips and slots for those chips.

Here is what a main board looks like. This board was made to fit an AMD K6 chip in a Slot A configuration. Click on it to see an enlarged picture, with the parts labeled.



CPU
AMD K6
AMD K7
Pentium II
Pentium III
Pentium IV
Core 2

- BIOS
- Central Processing Unit (CPU) slot/socket
- Main bus
- Memory slots (SIMM, DIMM etc.)
- System Slots
    - EIDE Hard Drive controller, bus, connector slots
    - Floppy Drive controller, bus, connector slot
    - Serial I/O controller, bus, connectors (Serial, Parallel)
- ISA controller, bus, connector slots
- PCI controller, bus, connector slots
- Controller Chipsets

Some systems will have the following additional slots:

- Advanced Graphics Port (AGP)
- Universal Serial Bus (USB) controller & connector slot
- Front Panel Audio, USB

BIOS is variously referred to as "Basic Input Output System" or "Binary Input Output System". BIOS is what gets the computer up and running at startup. BIOS is intended to provide the basic input/output services between the computer's mainboard and its busses, disks, card slots and controller chipsets. Newer BIOS is often built with a SYMBIOS link to the Desktop Management Interface in the operating system allowing the operating system to directly query and change BIOS settings (such as date and time) while running.

The term BIOS should be used to refer to the actual ROM or Flash ROM or EPROM containing the program code gets the computer running and helps it load an operating system. The BIOS frequently stores values it determines what type of hardware is installed or after configuration changes are made through its configuration interface. The memory where these BIOS settings are stored is called the CMOS. The two terms are frequently (and mistakenly) used to refer to the BIOS itself.

When powered on, the BIOS is copied from the ROM into RAM and begins to run. The BIOS performs a POST (Power On Self Test) of the computer hardware, establishes communication with a boot device, searches for the operating system on that device, loads the operating system from disk. Today's modern BIOS is stored in EPROMS.

Drive Controllers

- Disk drives store data on a physical disk covered with magnetic material. In order for any device on the system to access the disk, (such as the RAM, processor etc.), there must be some coordination.
- The drive controllers manage this, and all basic mid-level disk access functions. Most personal computer disk drives are smart enough now to do their own reading and writing and even caching of data to speed up access.
- On a main board there is usually a socket for the floppy drive, a socket for EIDE ATA drives and/or a socket for SCSI drives. Often, the SCSI controller is on a separate adapter card.

Disk Drives

Drive Types

- Hard Drives
    - IDE: Integrated Drive Electronics
    - SCSI :
- Removable Drives
    - Floppy Drives
    - CD-ROM
    - CD-RW
    - DVD+RW
    - DVD-RW
    - Zip and Jaz

Hard Drives

These are also called 'fixed disks' in older computers because the storage media is mounted within the computer and not intended to be removed.

Hard drives consist of one or more metal platters stacked together on a single spindle. Multiple read/write heads (one for the top and bottom of each platter) float next to the surface of the drive. Hard Disk drive capacities are determined by the number of cylinders and blocks per cylinder a drive will support.

Floppy Drives

Named for the media disks that could be pulled out and that would 'flop' when carried. These disks are designed to allow users to store data to a disk, remove it and carry the data elsewhere. These typically come in one of two formats in the United States: 3.5" @1.44Mbytes and 5.25" at 1.22 Mbytes.

Removable Drives

These are drives where the drive itself can be removed or ported elsewhere. The media is usually not pulled out. Removable hard drives are a good example of these.

- FLOPPY DISK - AKA 'flexible disk'
  - 5.25" - 640kb (ancient) or 1.25 Mb (not quite as ancient)
  - 3.5" (most common)
- FIXED DISK
  - ATA : Integrated Drive Electronics
  - SATA
  - IDE
    - UDMA 33
    - UDMA 66
    - UDMA 100
    - UDMA 133
  - SCSI
    - Wide
    - Ultra-Wide
  - RAID : Redundant Array of Inexpensive Disks

RAM

Memory, better known as Random Access Memory (RAM) is a set of chips used to store information. These chips can only store information as long as there is electrical power. When the power is turned off, they 'forget' everything and all data is lost. This is because the RAM uses the electricity to store the information. When the electricity dies, so does your data.

Memory comes in a number of configurations for IBM compatible PC's. Memory also comes in parity checking vs. non-parity checking. Parity checking is verifying that there is an even or odd number of 1's or zeroes in the data set. This means that memory that does parity checking is able to verify that it is functioning correctly when

running. Most memory sold today is non-parity RAM, and is only checked for errors on start up by writing to and reading from every location in memory.

PC Memory Categories

- ROM
- RAM
- CACHE
- VIRTUAL
- Flash Memory
    - EPROM
    - EEPROM

PC Memory Types

- EDO (obsolete)
- Fast Page (obsolete)
- SIMMS (obsolete)
- DIMMS (almost obsolete)
- DRAM
- SDRAM
- DDR
- RAMBUS

I/O Controller

- The Input/Output Controller manages the keyboard, mouse, serial, printer and parallel ports, as well as the PCI and ISA slots. Data flowing into the system from these points and out to these devices are controlled by this device.
- Serial and parallel communications require specific events to occur in order for communication to succeed. The I/O controller handles much of the basic functions of this process.

Display Monitors

Display monitors, or *monitors* for short, display computer data and images for the user. They come in two basic hardware configurations, cathode ray tube (CRT) and flat panel.

General Tips for Buying a Monitor

- SPLURGE on a GOOD monitor
- Get the largest monitor you can afford
- Buy the highest resolution on that monitor size you are comfortable looking at.
- 72 Hz refresh rate or better for CRTs.

- 60 Hz refresh rate for Flat Panel Displays

Monitor Sizes

Monitor inch or centimeter sizes indicate the distance diagonally across the screen. However, not all monitors that say they are a certain size *are* a certain size. For example: a 17-inch monitor is never actually 17 inches, it's usually between 16.1 and 16.9 inches. The measured distance used for most monitors is the physical size of the plastic case across the diagonal, not the screen. Thus, you should always read the fine print and bring a measuring tape.

You should also be careful about a monitor that is not a standard size or resolution as you will have to install custom software to make that monitor work. Apple, Gateway and Dell sell flat panel monitors that are non-standard sizes; these monitors are often used for watching DVD's and movies on the computer.

Aspect Ratio

The aspect ratio is simply the vertical measurement to the horizontal measurement expressed by a ratio. All standard monitors are have a 4:3 aspect ratio--that is, for every 4 pixels of resolution in the horizontal, there are three pixels of resolution in the vertical. Any monitor that does not comply with this ratio and is of a non-standard physical size or whose primary operating resolution is not a standard 4:3 ratio is going to require special software to run.

Standard Sizes

- 15"
- 17"
- 19"
- 21"
- 22"
- 24"

Standard Resolutions

- 640 x 480
- 800 x 600
- 1024 x 768
- 1280 x 1024
- 1152 x 824
- 1600 x 1200
- 1920 x 1440
- 2048 x 1536
- 2560 x 2048

- Monitor Types

- Cathode Ray Tubes
- Flat Panel Displays
- Liquid Crystal Displays (LCD Screens)
-

Monitor Characteristics

Dot Pitch: Dot pitch is used with CRT monitors to describe the distance between the centers of two adjacent phosphors of the same color on the screen and is expressed in fractions of a centimeter such as .22cm. The smaller the dot pitch, the sharper the picture. However, manufacturers don't always tell the truth about dot pitch. Often, when you do the math, you will find that the dot pitch multiplied by the resolution doesn't match the physical dimensions of the screen.

Refresh Rate: For CRT monitors, refresh rate is very important since the phosphor compounds chosen are much faster to discharge their light and go dark faster, so the screen is more prone to flicker at lower refresh rates. Select a monitor that supports the resolution you're looking for and does it at refresh rates above 70-72 Hz.

Resolution:

- Resolution refers to how many pixels are displayed across the horizontal and vertical distance of the screen and are listed as Horizontal x Vertical (i.e. 800x600). Higher resolutions (larger numbers) indicate a monitor with higher resolution display capabilities. Resolution is really the driving factor behind the size of monitor you buy. Depending upon how good your eyes are, a monitor with a small size but a high resolution would produce tiny icons and text which might be uncomfortable to look at. Larger monitors spread the same number of pixels across a larger distance and so although the resolution is higher, the icons and text don't look quite so tiny.
- Here is a table of common resolutions seen on most PC's today. Keep in mind that older Macintosh computers have their own screen resolutions and are thus incompatible with the large majority of monitors on the market. This was Apple's way of insuring Apple customers bought Apple monitors. Their monitors were always of decent quality and produced good displays, however they were very expensive. This is why Apple has very loyal, and very broke customers and why Apple has the smaller portion of the retail PC market.

Resolution	Name	Type	Description/Age
<640x480	CGA	--	Ancient. Used on non-graphical displays
640x480	VGA	--	Ancient. Was once common but is now frequently used for troubleshooting purposes.
800x600	SVGA	VESA standard	Older, less common. Windows XP will auto-adjust to this resolution if it is possible.
1024x768	XVGA	VESA	Most common resolution (as of 2004)

	standard
1280x1024	VESA standard
1600x1200	VESA standard

Peripherals

Modems

A modem is a communication device which allows your computer to communicate with other computers over a communications link. The modem's job is to convert your data into the format used on the communications connection and the remote modem converts that transmission back into data. Examples of modems include a standard fax/phone modem, a cable modem or a DSL modem or even a satellite modem. All modems perform what is called *modulation* to encode your data into the line signal and *demodulation* to decode it from the line signal. The term MODEM is short for Modulator/Demodulator.

Modems come in many shapes and sizes but can be generally broken down into two categories, internal and external. As the names imply, an internal modem goes inside your computer into either an ISA or PCI slot. External modems are attached to the computer through some other connection but are physically outside the computer case.

Modem Form Factors

I. External
II. Internal
    A. ISA
    B. PCI

Modem Types

I. Standard Analog (phone/voice/fax)
II. ISDN modems
III. Digital cable modems
IV. xDSL modems
V. Satellite

Modem Functions

I. Modulation/Demodulation
II. Error Correction
III. Compression/Decompression

- Printers
- Scanners

- Digital Cameras
- USB devices (USB Hubs)

Keyboard:

A *keyboard* is a long flat device that has 102, 104 or more keys on it that is designed to allow a user to type data and feed it into the computer. Keyboards are attached to either the PS2 port or the USB port on your computer. Keyboards draw electrical power from the computer, detect your keystrokes and transmit the keystrokes back to the computer.

Types of Keyboard:

WINDOWS KEYBOARDS

Windows keyboards aren't all that special. You DO NOT need a Windows keyboard to work with a Windows computer. The Windows keyboard contains one special key that opens up the context menu in Windows. Most computer stores that sell keyboards call Windows keyboards 'standard keyboards', so like it or not, you often get a Windows keyboard whether you want it or not.

MAC KEYBOARDS

Yes, MacIntosh computers DO use a special keyboard. The Mac computer has the following special keys: 'Open Apple', 'Closed Apple', 'cmd', 'Option' and 'Alt' which are not found on other keyboards. Yes, other keyboards will work, but the keys won't be marked correctly and you may have to guess which key is which.

MULTIMEDIA KEYBOARDS

Multimedia is a term used to describe anything that combines audio, video and/or graphics. Multi-media keyboards often have a Pause/Play and volume buttons on them for controlling audio and video players configured on the computer. These keyboards don't work with all multimedia applications and you have to install special drivers just to get these keyboards to work. If you can't figure out how to change the volume on Windows media player or in WinAmp, you're probably going to have a hard time getting your spiffy new multimedia keyboard to work (since you must install the driver and installing drives is far more difficult than changing the volume setting).

WIRELESS KEYBOARDS

These are keyboards that do not use a physical wire to communicate with the computer. A small object is connected to the keyboard port (PS2 or USB port) and that small device communicates with the keyboard using a radio frequency. Problems with this technology: radio interference--someone else might be using the same keyboard you are or using a device that uses the same radio frequencies. Second problem--a standard keyboard draws electricity from the computer through the port it is connected to. Therefore, all wireless keyboards (and mice) use batteries. When the batteries go dead, the keyboard goes dead and you can't use your computer.

Mouse

The computer mouse is a display-selection device used to 'point and click' on various things on your computer. The graphical user interface (GUI) often uses a

graphical pointer to indicate the currently pointed-to location on the computer's display. The computer mouse is the conception of Douglas Engelbart, head of the self-founded Augmentation Research Center of Stanford University's Research Institute. designed and sketched out the concept for a mouse, performed studies on effective interface devices (with ARPA research dollars) and Bill English built it. Not Apple, Not Xerox. It was the Advanced Research Projects Administration that brought you this cute little point-and-click thingy we are all so attached to. That's right, the United States Government funded the development of the mouse.

Internally, a standard mouse consists of a roller ball a guide wheel and two sensor wheels. When the mouse is moved, the roller ball moves the sensor wheels. The sensor wheels detect this movement, calculate the amount and send data to the computer to indicate how much and in which direction the digital pointer on the screen should move.

TYPES OF MICE

- STANDARD MOUSE
- This type of mouse comes in a two button and three button design. The two button mouse has a left mouse button and a right mouse button.
- WHEEL MICE
- Wheel mice have a rolling wheel between the two mouse buttons. Most graphical user interfaces (GUI) have scroll bars for areas where the content of the window exceeds the size of the display device.
- OPTICAL MICE
- This is a mouse that uses an optical sensor instead of a rolling ball. The advertised advantage is accuracy, but the real advantage is a clean mouse that never gets dirty as roller-based mice are prone to do.
- GAME MICE
- These are special mice that the mouse manufacturers claim are more accurate and which respond faster. These mice often have buttons that can be programmed to perform special functions within a game.
- WIRELESS MICE
- These mice use a radio frequency or infrared transmitter to communicate with a 'base station' that is connected to the computer.
- WIRELESS OPTICAL MICE
- This is a mouse that combines the features of an optical and a wireless mouse.

Computer Software

Software is a sets of instructions telling the computer how to process store and retrieve data. Software is divided into two broad categories, Operating Systems and Applications.

- Operating Systems
- Drivers
- Applications

Operating Systems

Operating Systems run the computer and provide us with an interface with which to issue commands to the computer system. There are many varieties of operating systems. The differences between them stem from the hardware they were originally designed to run on and who engineers and manufactures the software.

IBM Produced a number of operating systems including OS/360 for mainframes and OS/2 for desktop and personal computers. To sell their Personal Computers (PC's), IBM contracted with Microsoft to install a variation of "Quick and Dirty DOS" on all IBM PC's sold. This "Quick and Dirty DOS" became Microsoft DOS.

Microsoft is the most well know manufacturer of operating systems today. Microsoft got their lead by making an exclusive deal with IBM in 1981 to include their variation of "Quick and Dirty DOS" operating system on every "IBM Personal Computer" microcomputer sold. Ever since that time, the vast majority of Intel-processor based computers have shipped with Microsoft operating systems on them. The most recent version is Microsoft Windows XP.

AT&T produced what has become the System V version of the UNIX operating system designed to run on Digital Equipment Corporation computers (PDP-11). LINUX, or "Linus Torvald's UNIX" was inspired by UNIX, but written for the Intel processor.

Apple computer corporation produces Mac OS and OS X exclusively for their MacIntosh computers (which run on Motorola processors). Sun produces Solaris Unix for their Sparc (their own chip design) and Intel based Sun platforms. HP produces HP-UX for their computers (which utilize either an Intel or DEC RISC architecture).

Types of Operating Systems

Operating systems can be divided into two broad categories. Those that are designed to run on workstations, PC's and microcomputers and those designed to run on massive computers often referred to as 'big iron', or *mainframes.* This section currently focuses on those operating systems that run on workstations and smaller, non-mainframe servers.

Mainframe Operating Systems

- IBM System 370, 380, 390
- AIX (IBM Unix)
- VMS (VAX)
- DEC Operating System

Computer Operating Systems

UNIX

- BSD
- HP-UX
- Solaris
- Tru64

LINUX

- Red Hat
- Suse
- Slackware
- YellowDog (Linux on MacIntosh)
- OS2/Warp

Microsoft Operating Systems

- MS-DOS (command-line)
- Windows 3.1
- Windows 95
- WIndows ME
- Windows NT
- Windows 2000
- Windows XP
- Windows vista
- Windows 7
- Windows 8

Apple Operating Systems

- Mac OS 7
- Mac OS 8
- Mac OS 9
- Mac OS X

Computer Device Drivers

Device drivers are small pieces of software that provide the operating system with easier access to the hardware. Drivers are installed for every device on the computer. Some devices such as disk drives, the processor and the chipset on the motherboard are shipped with the operating system (the operating system wouldn't be able to get up and running without them). Other drivers must be installed after installing a new device. The manufacturer of the device will provide drivers if the operating system does not support the device. Drivers for any given device will differ by operating system and version. This means that a video card manufacturer may not make a driver for the particular operating system you are using. This is especially the case when you have an old operating system and a brand new piece of hardware. Drivers are free, come with the hardware and usually can be downloaded from the manufacturer's website as well. If your game crashes whenever it switches in and out of the game, you probably need to update your video drivers. If your computer's sound goes berzerk and then it crashes, you might need to update the sound drivers.

Driver problems are more likely to be an issue on Windows based computers instead of MacIntosh computers. This is NOT because Windows computers are 'more complicated', it's because there are more CHOICES with Windows computers. There

are many times more devices available to be installed on Windows-compatible computers. Microsoft also assumes you are smart enough to handle drivers yourself. This is one of the fundamental differences between Microsoft and Apple: Microsoft assumes you are smart, Apple assumes you are stupid.

Windows Compatible Computers

The processes surrounding the management of drivers on Windows-based computers are becoming more standardized with each release of Windows. Thus, the drivers install the same way, regardless of where they come from.

- Downloading Drivers
- Installing Drivers
- Uninstalling Drivers
- Troubleshooting Driver Problems

6.2 MS-Word

Introduction into Microsoft Word

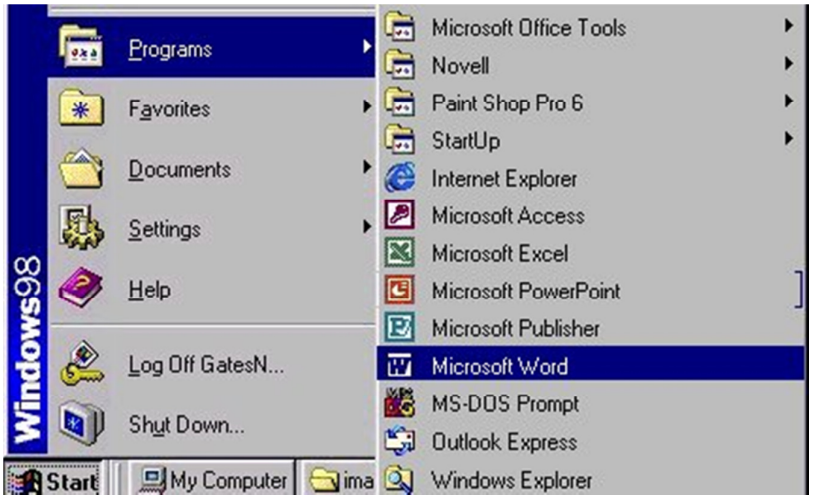
Microsoft Word is a powerful tool to create professional looking documents. This tutorial will help you get started with Microsoft Word and may solve some of your problems, but it is a very good idea to use the Help Files that come with Microsoft Word.

Starting Microsoft Word

- Two Ways
  1. Double click on the Microsoft Word icon on the desktop.

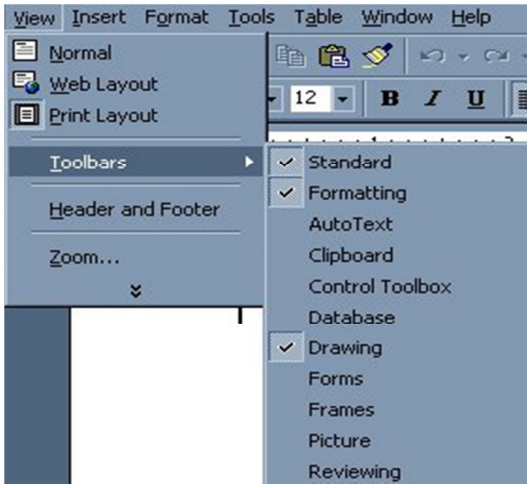
     Click on Start --> Programs --> Microsoft Word



Viewing the toolbars

The toolbars in Microsoft Word provide easy access and functionality to the user. There are many shortcuts that can be taken by using the toolbar. First, make sure that the proper toolbars are visible on the screen.

1. Click **View**
2. Select **Toolbars**
3. Select **Standard, Formatting, and Drawing**
4. Other toolbars can be selected if you wish



Name	*Icon*	*Description*

New Blank Document		Creates a new, blank file based on the default template.
Open (File menu)		Opens or finds a file.
Save (File menu)		Saves the active file with its current file name, location, and file format.
Mail Recipient		Sends the contents of the document as the body of the e-mail message.
Print (File menu)		Prints the active file or selected items. To select print options, on the File menu, click Print.
Print Preview (File menu)		Shows how a file will look when you print it.
Spelling and Grammar (Tools menu)		Checks the active document for possible spelling, grammar, and writing style errors, and displays suggestions for correcting them. To set spelling and grammar checking options, click Options on the Tools menu, and then click the Spelling and Grammar tab.
Cut (Edit menu)		Removes the selection from the active document and places it on the Clipboard.
Copy (Edit menu)		Copies the selection to the Clipboard.
Paste (Edit menu)		Inserts the contents of the Clipboard at the insertion point, and replaces any selection. This command is available only if you have cut or copied an object, text, or contents of a cell.
Format Painter (Standard toolbar)		Copies the format from a selected object or text and applies it to the object or text you click. To copy the formatting to more than one item, double-click  , and then click each item you want to format. When you are finished, press ESC or click  again to turn off the Format Painter.
Undo (Edit menu)		Reverses the last command or deletes the last entry you typed.
Redo (Edit menu)		Reverses the action of the Undo command.

Hyperlink		Inserts a new hyperlink or edits the selected hyperlink.
Tables and Borders		Displays the Tables and Borders toolbar, which contains tools for creating, editing, and sorting a table and for adding or changing borders to selected text, paragraphs, cells, or objects.
Zoom		Enter a magnification between 10 and 400 percent to reduce or enlarge the display of the active document.
Office Assistant		The Office Assistant provides Help topics and tips to help you accomplish your tasks.

Creating A New Document

1. Click on File
2. Select New
    - To create a blank document, simply select **Blank Document**. To create a document based on one of the templates provided in Microsoft Word, select which one you would like to create and select **OK**

Formatting Text

1. Highlight the text that you want to format by dragging your mouse over while holding down the left mouse button
2. Change the text to your desire
    - 

Inserting a Table

1. Click where you want your table to go
2. Click **Table** at top of screen
3. Select **Insert**
4. Select Table
5. Give your table dimensions

Inserting a Picture

1. Click where you want your picture to go
2. Click **Insert** at top of screen
3. Select **Picture**
4. Select **Clip Art or From File**
5. Select picture and click **Insert**

Inserting Page Numbers and Date/Time

1. Click **Insert** at top of screen
2. Select **Page Numbers and/or Date & Time**

Spell Checking Your Document

1. Click **Tools** at top of screen
2. Select **Spelling and Grammar**

6.3 MS-Excel

Introduction into Microsoft Excel

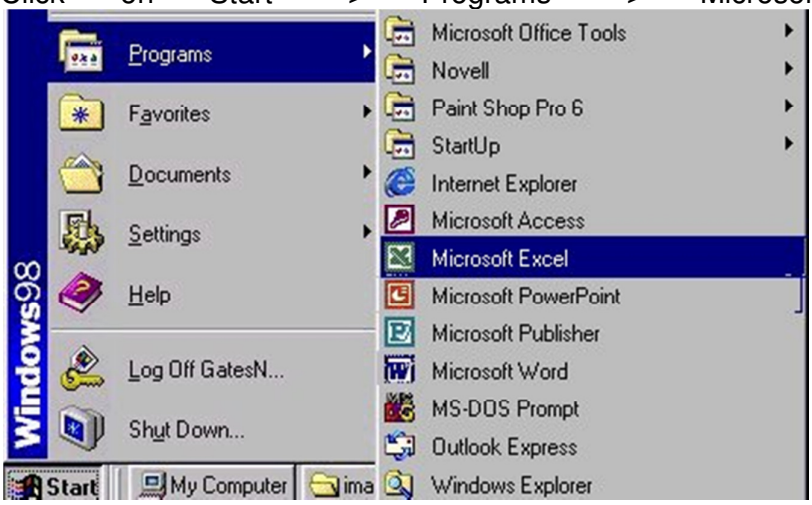
Microsoft Excel is allows you to create professional spreadsheets and charts. It performs numerous functions and formulas to assist you in your projects.

This tutorial will help you get started with Microsoft Excel and may solve some of your problems, but it is a very good idea to use the Help Files that come with Microsoft Excel.

Starting Microsoft Excel

- Two Ways
    1. Double click on the Microsoft Excel icon on the desktop.

2. Click on Start --> Programs --> Microsoft Excel



Creating Formulas

1. Click the cell in which you want to enter the formula.
2. Type = (an equal sign).
3. Click the Function Button 
4. Select the formula you want and step through the on-screen instructions

Order of Operations Excel Uses

Precedence	Operation	Operator
1	Exponentiation	^
2	Multiplication	*
2	Division	/
3	Addition	+
3	Subtraction	-
4	Concatenation (putting 2 strings together, like Jenn & ifer)	&
5	Equal To	=
5	Greater Than	>
5	Less Than	<

Adding Borders and Shading to Cells

1. Make sure you have the **Formatting** toolbar visible
    - Click on View --> Toolbars --> Formatting
2. Select cells you wish to format by left clicking on them and highlighting them

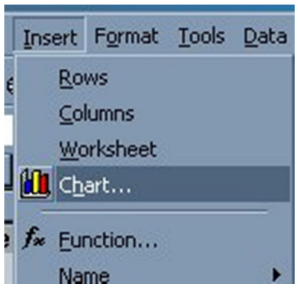
3. Click the  button to shade a cell and/or the  to give a cell a border

Inserting A Chart

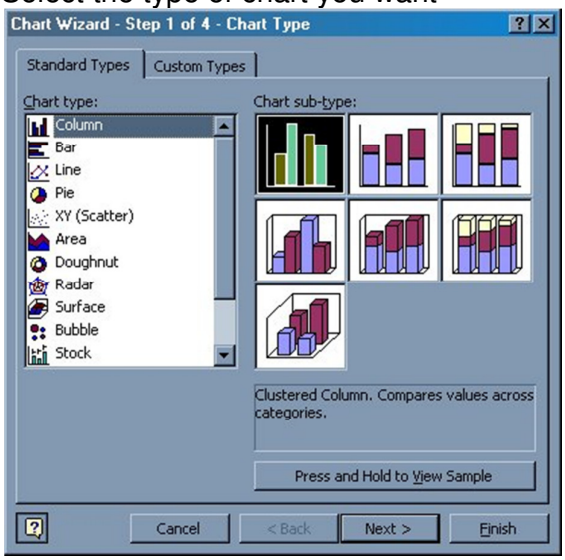
1. Select over the text you want to make your chart with

Year	State	Population
2000	Indiana	5,000,000
2000	Ohio	7,000,000
2000	Michigan	12,000,000

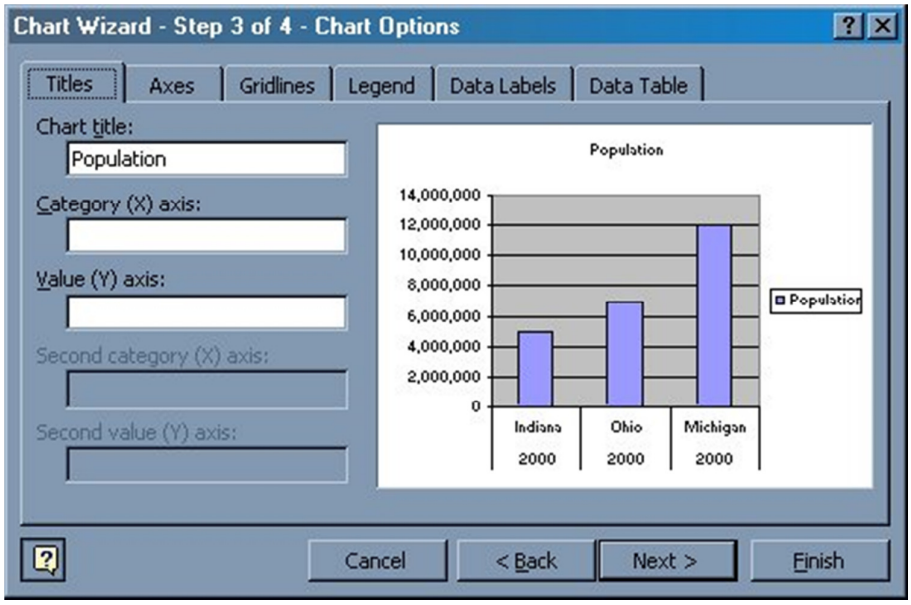
2. Click **Insert -->Chart**



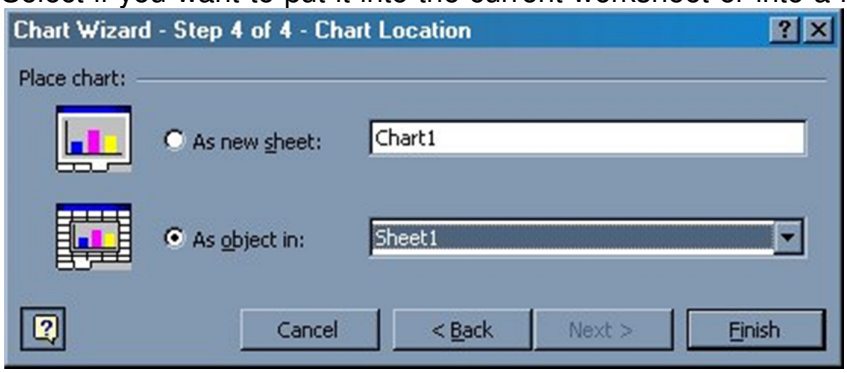
3. Select the type of chart you want



4. Confirm or change your data range
5. Update the Chart Options



6. Select if you want to put it into the current worksheet or into a new worksheet



6.4 MS-Power Point

Introduction into Microsoft PowerPoint

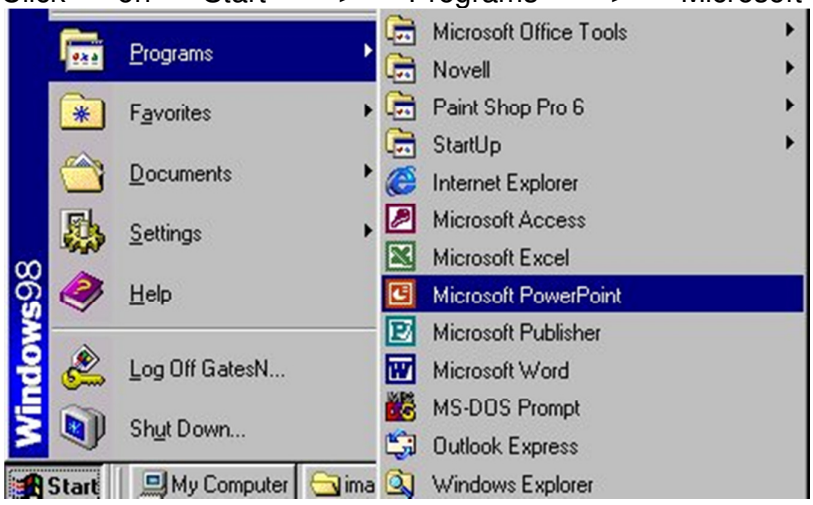
Microsoft PowerPoint is a powerful tool to create professional looking presentations and slide shows. PowerPoint allows you to construct presentations from scratch or by using the easy to use wizard.his tutorial will help you get started with Microsoft PowerPoint and

may solve some of your problems, but it is a very good idea to use the Help Files that come with Microsoft PowerPoint.

Starting Microsoft PowerPoint

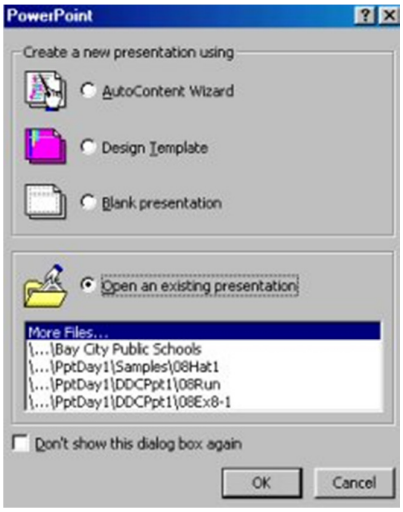
- Two Ways
  1. Double click on the Microsoft PowerPoint icon on the desktop.

  2. Click on Start --> Programs --> Microsoft PowerPoint



Creating & Opening a Presentation

After you open up Microsoft PowerPoint, a screen pops up asking if you would like to create a New Presentation or Open An Existing Presentation.



AutoContent Wizard

- Creates a new presentation by prompting you for information about content, purpose, style, handouts, and output. The new presentation contains sample text that you can replace with your own information. Simply follow the directions and prompts that are given by Microsoft PowerPoint.

Design Template

- Creates a new presentation based on one of the PowerPoint design templates supplied by Microsoft. Use what is already supplied by Microsoft PowerPoint and change the information to your own.

Blank Presentation

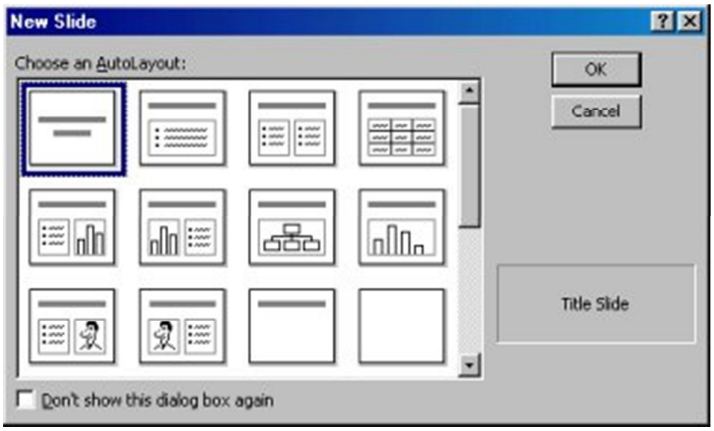
- Creates a new, blank presentation using the default settings for text and colors. Go to next step:

Opening An Existing Presentation

1. Select Open An Existing Presentation from the picture above
2. Click on your presentation in the white box below step 1
   - If you do not see your presentation in the white box, select More Files and hit OK.
   - Locate you existing Presentation and hit the Open button

Create a Blank Presentation

After you select Blank Presentation a window pops up asking you to select the layout of the first slide.



Pre-Designed Slide Layouts (Left to Right)

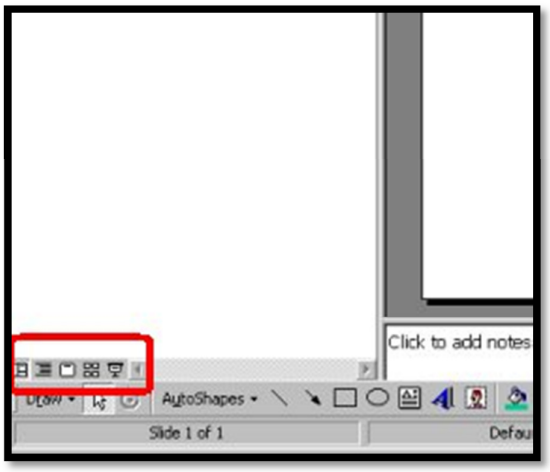
- Title Slide
- Bulleted List
- Two Column Text
- Table
- Text & Chart
- Chart & Text
- Organizational Chart

- Chart
- Text & Clip Art
- Clip Art & Text
- Title Only
- Blank Slide

NOTE:*If you already know what you want in your next slide, it is a very good idea to choose one of the pre-designed layouts from above. However if you do not, then you can still insert what you want in throughout your Presentation anytime you desire. Just choose Blank Slide and insert items as you see fit*

Different Views That PowerPoint Demonstrates

There are different views within Microsoft PowerPoint that allow you to look at your presentation from different perspectives.



Normal View	Outline View	Slide View	Slide Sorter View	Slide Show View
				
Switches to normal view, where you can work on one slide at a time or organize the structure of all the slides in your presentation	Switches to outline view, where you can work with the structure of your file in outline form. Work in outline view when you need to organize the	Switches to slide view, where you can work on one slide at a time	Displays miniature versions of all slides in a presentation, complete with text and graphics. In slide sorter view, you can reorder slides,	Runs your slide show in a full screen, beginning with the current slide if you are in slide view or the selected slide if you are in slide sorter view. If you simply want

	structure of your file.		add transitions, and animation effects. You can also set the timings for electronic slide shows.	to view your show from the first slide: 1. Click Slide Show at the top of the screen 2. Select View Show

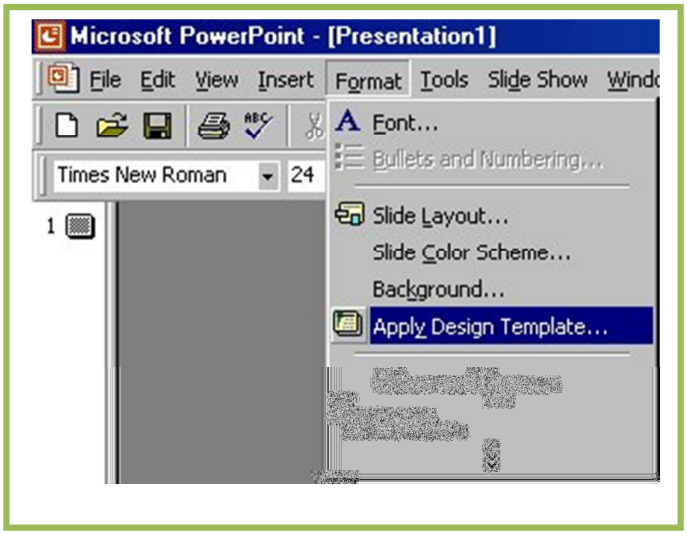
Slide Manipulation

Inserting A New Slide

1. Click Insert at top of screen
2. Select New Slide

Formatting A Slide Background

3. You can format your slide to make it look however you would like, whether it be a background color, picture, or a design template built into Microsoft PowerPoint. The next step will show you how to apply a Design Template, but the other items mentioned above can be accomplished the same way.
    1. Click Format at the top of the screen
    2. Select Apply Design Template



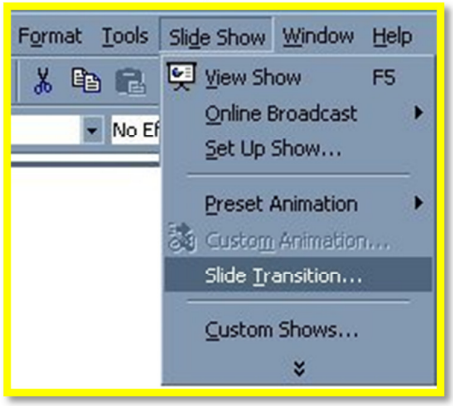
Inserting Clipart & Pictures

1. Display the slide you want to add a picture to.
2. Click **Insert** at the top of the screen
3. Select **Picture**
4. Select **ClipArt**
5. Click the category you want
6. Click the picture you want
7. Click Insert Clip on the shortcut menu
8. When you are finished using the Clip Gallery, click the Close button on the Clip Gallery title bar
9. Steps 1-4 are very similar when inserting other Pictures, Objects, Movies, Sounds, and Charts

Adding Transitions to a Slide Show

You can add customized transitions to your slide show that will make it come alive and become appealing to your audience. Follow these steps when adding Slide Transitions.

1. In **slide or slide sorter view**, select the slide or slides you want to add a transition to.
2. On the Slide Show menu at the top of the screen, click **Slide Transition**



3. In the Effect box, click the transition you want, and then select any other options you want
4. To apply the transition to the selected slide, click Apply.
5. To apply the transition to all the slides, click Apply to All.
6. Repeat the process for each slide you want to add a transition to.
7. To view the transitions, on the Slide Show menu, click Animation Preview.

Viewing The Slide Show

You can view your slide show by any of the following ways:

1. Click Slide Show at the lower left of the PowerPoint window.
2. On the Slide Show menu, click View Show.
3. On the View menu, click Slide Show.

4. Press F5 on the keyboard

Navigating While In Your Slide Show

Forward Navigation

- Simply click on the left Mouse Button or hit the Enter Button on your keyboard

Reverse Navigation

- Hit the Backspace on the keyboard

Exiting the show

- Hit the Esc Button on the keyboard

Pack up a presentation for use on another computer

1. Open the Presentation you want to pack
2. On the **File** menu, click **Pack and Go**
3. Follow the instructions in the Pack and Go Wizard.

Unpack a presentation to run on another computer

1. Insert the disk or connect to the network location you packed the presentation to
2. In My Computer, go to the location of the packed presentation, and then double-click **Page setup**
3. Enter the destination you want to copy the presentation to.

6.5 Internet usage

Introduction

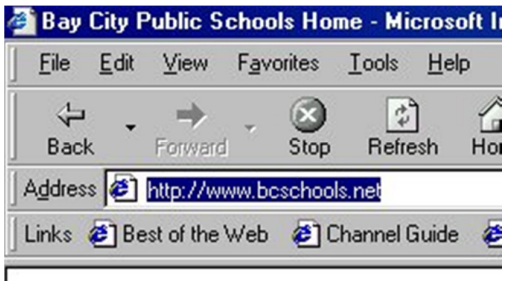
The Internet is a worldwide network of networks that allows us, the users, to Inter-Relate, Communicate, and Educate. Think of it as a system of roads, freeways, and bridges. All computer users connected to this "network of networks" is what makes up the Internet. The Internet itself does not store information. It is a slight misstatement to say that something was found on the Internet. It should be said that something was found through or by using the Internet.

The Internet was originated by the US Department of Defense in 1960's. This was to keep military, universities, and defense contractors linked together in the event of war. In the early days, what we call the Internet was then known as ARPANet (Advanced Research Projects Agency Network). Educational Institutions joined in on the Internet Band-Wagon in the early 1980's. According to Global Reach there are an estimated 322 million users online.

Main Keywords Associated With The Internet

- Web Browser
  - Web Browsers are programs you use to view the Internet. There are two main Web Browsers, Microsoft Internet Explorer, and Netscape Navigator. The program we will be using to view the Internet is Microsoft Internet Explorer.

- Website vs. Webpage
  - A Website is a place within the Internet that contains multiple "Webpages". For example the Bay City Public Schools is a "Website", while this Internet Tutorial Page you are viewing is a "Webpage".
- URL
  - URL is the address of a website or webpage. The URL for the main BC Schools website is *http://www.bcschools.net/*. This is the address that you would type in the address bar at the top of Internet Explorer to go to BC School's main page.



- HTML
  - HTML is an Internet programming language that is used to create webpages. Most pages you see on the Internet are HTML pages.
- Hyperlink
  - A Hyperlink is a string of text or a picture that takes you to another part of a webpage or another website/webpage. It is nothing more than a transport to somewhere else. Hyperlinks are usually a different font color and are underlined. You can notice a hyperlink by scrolling your mouse over the words and/or pictures and viewing

Searching the Internet

There are many search engines throughout the Internet that allow you to type in a word or phrase to search millions of websites. Below are a list of the most popular search engines found on the Internet. Simply click on the title of each search engine to go to that site.

- Yahoo!
    - You can browse Yahoo! by simply clicking on the various categories listed on each page. You can also search Yahoo! by entering a word (or, a few words) into the search box that appears on every page in the directory. Combine the two strategies and you can "browse and then search" or "search and then browse."
- Altavista
    - Altavista is a popular search engine that you can browse by simply entering in text and/or text phrase on what you are looking for. Altavista also allows you to search by category.
- Infoseek
    - Infoseek works much the same as Yahoo! and Altavista. You can select categories, and/or search by keyword or phrases.

The latest search engines are google search, Mozilla fire fox etc.

Educational Sites

Below is a extensive list of education sites found on the Internet. At the time this page was created all sites work. If you notice any broken sites (sites that do not connect) please let us know. Also, if you have any suggestions on some good educational sites that would benefit other users, we would be more than happy to add them to the list. Contact Cheryl Quade at quadec@bcschools.net

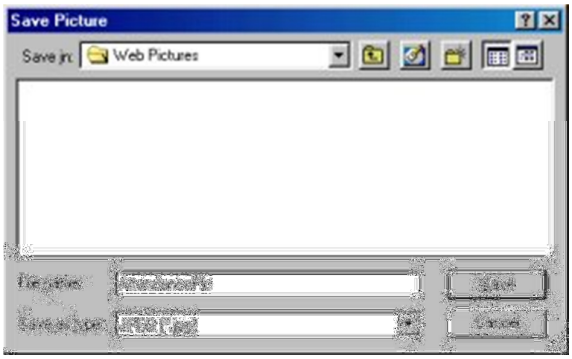
Viewing & Saving Graphics On The Internet

Graphical images make your web page come alive. Images give personality and pizzazz to your site. Graphics viewed on the web come from two different types of files,(.jpg and .gif) . JPG pictures are more compressed whereas GIF files show more detail and in some cases show animation. GIF files also allow for transparent backgrounds.

- Saving Graphics Off The Internet
    1. Move your mouse over the image you want to save
    2. Right click on your mouse

3. Select **Save Picture As..**

4. Save it to the folder you desire
5. Click Save



7. MANUFACTURING PROCESSES

7.1 Production of Metals

7.2 Hot and Cold W

orking

7.3 Smithy and Forging

7.4 Foundry

7.5 Metal Joining

7.6 Lathe

The lathe can be defined as a machine tool which holds the work between two rigid and strong supports called centers or in a chuck or in a face plate and rotates the work on a horizontal axis while cutting tool shapes the work.

The chuck or the face plate is mounted on the projected end of the machine spindle.

- The cutting tool is rigidly held and supported in a tool post and is fed against the revolving work.
- While the work revolves about its own axis and tool is made to move either parallel to or at an inclination with this axis to cut the desired material.
- In doing so it produces cylindrical surface, if it is fed parallel to axis or will produce a tapered surface, if it is fed at an inclination.
- Cutting tool material must be harder than the work material

Types of Lathes:

- Speed Lathe
- Bench Lathe
- Engine lathe
- Tool room lathe
- Capstan and turret lathe
- Automatic lathe
- Special purpose lathe

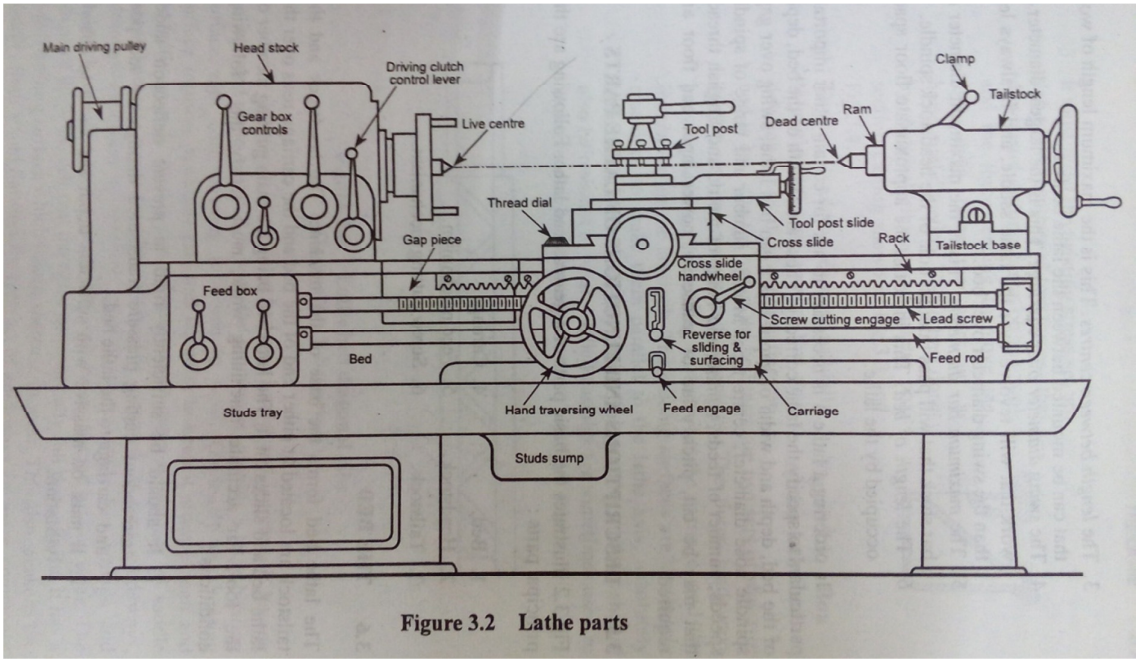


Figure 3.2 Lathe parts

Specifications of a Lathe:

- Height of the centers

measured from the bed.

- Maximum swing dia over bed.
- Maximum swing dia over carriage.
- Length between centres
- Maximum bar diameter
- Length of bed.

Parts of the Lathe:

The lathe carries the following main parts

1. Bed
2. Headstock
3. Tailstock
4. Carriage
5. Feed Mechanism
6. Screw cutting mechanism

1. Bed: The bed of a lathe acts as the base on which the different fixed and operating parts of the lathe are mounted. This facilitates the correct relative location of the fixed parts and at the same time provides ways for a well guided and controlled movement of the operating part (carriage).

2. Head stock. The headstock is that part of lathe which serves as housing for the driving pulley and back gears, provides bearing for the machine spindle and keeps the latter in alignment with the bed. It consists of the following parts.

- Cone pulley
- Back gears and back gear lever,
- Main spindle,
- Live centre, and
- Feed reverse lever – This lever is primarily used for providing power feed to the Carriage.

3. Tail Stock: It is mounted on the bed of the lathe such that it is capable of sliding along the latter maintaining its alignment with the head stock. The main function of the tail stock is to provide bearing and support to the job which is being worked between centers.

4. Carriage: The lathe carriage serves the purpose of supporting guiding and feeding the tool against the job during the operation on the lathe. It consists of following main parts:

Saddle: It is that part of carriage which slides along the bed ways and supports the cross-slide, compound rest and tool post.

5. Apron: It is the hanging part in front of the carriage. It serves as housing for a number of gear trains through which power feeds can be given to the carriage and the cross-slide.

6. Split nut: The split nut is engaged to lead screw to give power feed to carriage when threads are cut. An important feature of the apron mechanism is the provision of a fool – proof arrangement to avoid the simultaneous operation of the split nut and automatic feed to carriage. To avoid this clash a lever is provided inside the apron which engages with both the mechanisms and acts in such a way that when the later will engaged the automatic feed will not act.

Lathe accessories: The devices employed for holding and supporting the work and the tool on the althe are called its accessories. They include the devices like chucks, driving plate, dogs, tool holders and posts, centers, collets, rests, mandrels, jigs and fixtures, etc.

Various operations on the lathe:

- Plain turning
- Taper turning
- Step turning
- Eccentric turning
- Facing
- Screw cutting on the lathe
- Drilling
- Boring
- Knurling

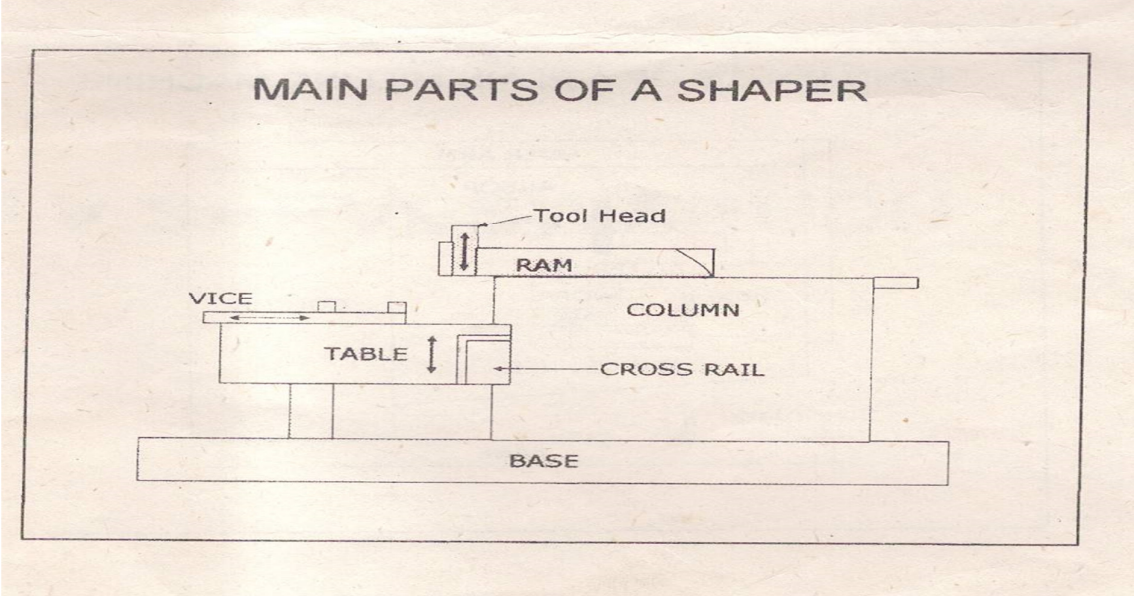
7.7 Drilling Machine

The cutting action results from the rotary movement of the cutting tool or workpiece, with a feed motion of the workpiece or tool, in the direction of the rotating axis is called Drilling.

Drilling machines are used for drilling, boring, counter-sinking, reaming and tapping operations.

7.8 Shaper and Planner

Shaper: Shaper is a versatile machine which is primarily intended for producing flat surfaces. These surfaces may be horizontal, vertical or inclined. This machine involves the use of a single point tool held in a properly designed tool box mounted on a reciprocating ram. The main significance of this machine lies in its greater flexibility on account of ease in work holding, quick adjustment and use of tools of relatively simple design.



Working principle: The working principle of a shaper is illustrated in Fig. In case of a shaper job is rigidly held in a suitable device like vice or clamped directly on the machine table. The tool is held in the tool post mounted on the ram of machine. This ram reciprocates to and from and, in doing so, makes the tool to cut the material in the forward stroke. No cutting of material takes place during the return stroke of the ram. Hence it is termed as idle stroke. The job is given an indexed feed (equal amount after each cut) in a direction normal to line of action of the cutting tool.

Size and specifications: The size of a shaper is determined by the maximum length of cut or stroke it can make.

Types of Shaper

a) According to type of mechanism

i) Crank ii) Geared iii) Hydraulic

b) According to plane of ram

i) Horizontal ii) Vertical iii) Travelling head

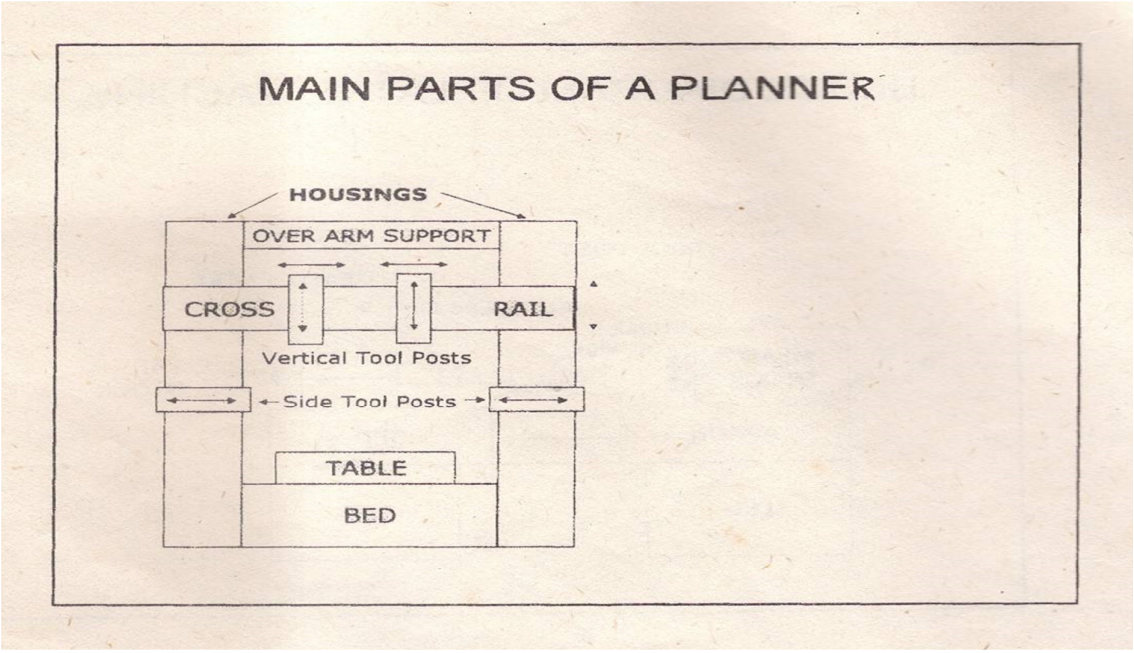
c) According to type of table design

i) Standard ii) Universal

d) According to action of cutting stroke

i) Push ii) Draw

<u>Planer</u>: Planning is one of he basic operations performed in machining work and is primarily intended for machining large flat surfaces.



<u>Working principle</u>: Here it is almost reverse case to that of a shaper. The work is rigidly held on the work table of the machine. The tool is held vertically in tool – head mounted on the cross rail. The work table together with the job is made to reciprocate past the vertically held tool. The indexed feed, after each cut is given to the tool during the idle stroke of the table.

<u>Types of Planer</u>:

1) **Double housing planer**
2) **Open side planer**
3) **Pit planer**
4) **Edge or plate planer**
5) **Divided table planer**

<u>Similarities and dissimilarities between Planer and Shaper</u>:

S.No.	Planner	Shaper
1.	It is heavy duty machine	It is comparatively light machine.
2.	It requires more floor area.	It requires less floor area.
3.	It is used for machining large flat surfaces – horizontal, vertical and inclined.	It is also used for the same purposes but for relatively smaller surfaces.

4.	The work is usually clamped directly on the machine table by means of suitable fixtures or clamping devices.	The work may be clamped directly on the table or held in a vice or chuck.
5.	Cutting takes place by reciprocating the work under the tool.	Cutting takes place by moving the cutting tool over the job.
6.	Indexed feed is given to the tool during the idle stroke of the work table.	Indexed feed is given to the work during the idle stroke of the ram.
7.	Heavier cuts and coarse feeds can be employed.	Very heavy cuts and coarse feeds cannot be employed.
8.	Several tools can be mounted and employed simultaneous, usually four as maximum, facilitating a faster rate of production.	Usually only one tool is used on a shaper.

7.9 Grinding Machine

A grinding machine, often shortened to grinder, is a machine tool used for grinding, which is a type of machining using an abrasive wheel as the cutting tool. Each grain of abrasive on the wheel's surface cuts a small chip from the workpiece via shear deformation.

Grinding is used to finish workpieces which must show high surface quality (e.g., low surface roughness) and high accuracy of shape and dimension. As the accuracy in dimensions in grinding is on the order of 0.000025mm, in most applications it tends to be a finishing operation and removes comparatively little metal, about 0.25 to 0.50mm depth.

Types of Grinding:

- **Surface Grinding**
- **Cylindrical Grinding**
- **Internal Grinding**
- **Centerless Grinding**
- **Others**
  - **Tool and cutter grinders**
  - **Tool-post grinding**
  - **Swing-frame grinders**
  - **Bench grinders**
- **Creep-Feed Grinding**

7.10 Milling Machine

Milling Machine: Milling is the name given to machining process in which the removal of metal takes place due to the cutting action of revolving cutter when the work is fed past it. The revolving cutter is held on a spindle or arbor and the arbor and the work, clamped on the machine table fed past the same. In doing so the teeth of cutter remove the metal, in the form of chips, from the surface of the work to produce the desired shape.

Size and specifications: size of a milling machine is usually denoted by the dimensions (Length and breadth) of the table of the machine.

Types of milling machines:

a) Column and Knee type

i) Hand milling machine

ii) Plain or Horizontal milling machine

iii) Vertical milling machine

iv) Universal milling machine

v) Omniversal milling machine

b) Planer milling machine

c) Fixed bed type

i) Simplex milling machine

ii) Duplex milling machine

iii) Triplex milling machine

d) <u>Special type</u>

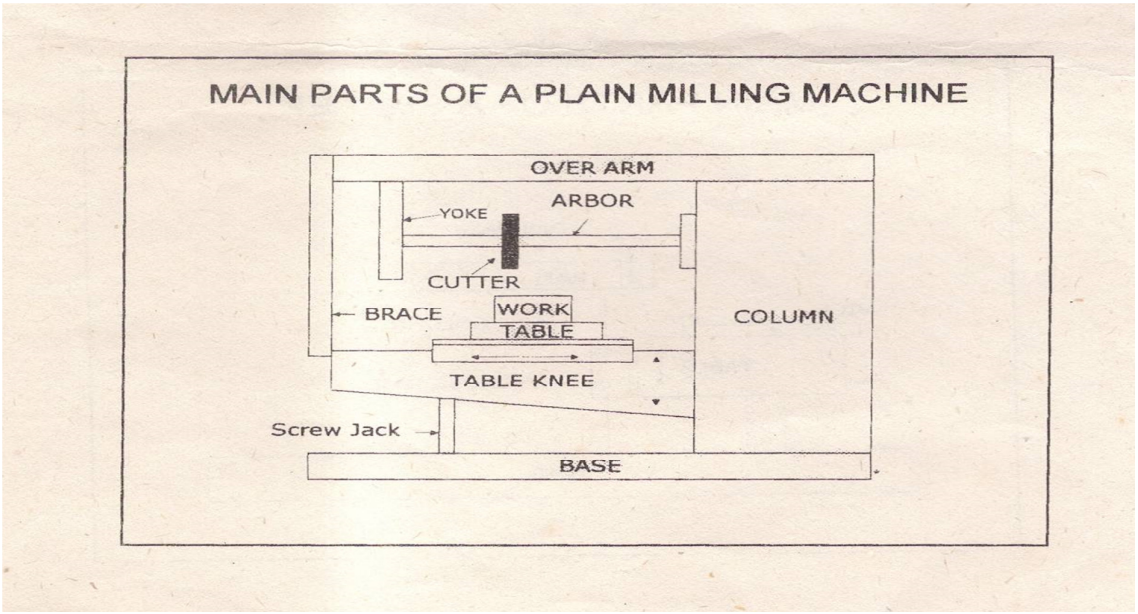
i) Rotary table milling machine

ii) Drum milling machine

iii) Planetary milling machine

iv) Duplicating milling machine

v) Profile milling machine



<u>Plain milling machine</u>: is also called horizontal milling machine. Its principal parts shown in the block diagram. The vertical column serves as a housing for all electrical, the main drive, spindle bearings etc. The knee acts as a support for the saddle, work table and other accessories like indexing head, etc. Over arm provides support for the yoke which, in-turn supports the free end of the arbor. The arbor carrying the cutter rotates about a horizontal axis. The table can be given straight motions in three directions that are longitudinal, cross and vertical (up and down) but cannot be swiveled. For giving vertical movement to the table the knee itself together with the whole unit above it, slides up and down along the ways provided in front of the column. For giving cross movement to table the saddle is moved towards or away from the column along with the whole unit above it. Both hand and power feeds can be employed for the work.

<u>Vertical milling machine</u>: In which the spindle is in vertical position.

<u>Universal Milling machine</u>: It is the most versatile of all the milling machines and after the lathe it is the most useful machine tool as it is capable of performing almost all machining operations. It differs from plain milling

machine only in that the table can be given one more additional movement. Its table can be swiveled on the saddle in horizontal plane. For this, circular guide ways are provided on the saddle along which it can be swiveled. A graduated circular base is incorporated under the table, with a datum mark on the saddle, to read directly the angle through which the table has been swiveled. The special feature enables the work to be set at an angle with the cutter for milling helical and spiral flutes and grooves.

7.11 Review

8. ENGINEERING DRAWING

8.1 Introduction and Use of Drawing Instruments

8.2 Geometrical Construction

8.3 Lettering and Dimensioning

8.4 Scales

8.5 Symbols used in Engineering Drawing

8.6 Sketching Simple Objects.

8.7 Principles of Projections

8.8 Orthographic Views

8.9 Isometric Drawing