

**B.Sc Civil  
Engineering**

**CONTRACT**



# Project & Contract Management CE 206

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# CONSTRUCTION Site SAFETY & ENVIRONMENT MANAGEMENT

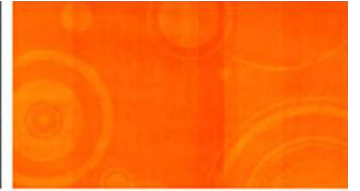
# Introduction

- Safety means free from danger or risk
- Management here refers to managing the workers/labours for ensuring safety. Therefore the construction site safety & management deals with the safety of labour and employees working at the construction site.
- The best way to protect workers against hazards is to control problems at the source.
- The first week on each new site is the most dangerous
- Accidents are more frequent at the end of the day
- Small building jobs are the most risky
- To prevent health hazards at work, all possible hazards that may be encountered should be identified in advance.
- The problem regarding construction industry is not that the hazards and risks are unknown, but it is very difficult to accurately identify in a constantly changing work environment.

# Benefits of a Safety Program

- ❖ Reduced workers' compensation claims and payments, hence the overall project cost
- ❖ Reduced expenses related to injuries and illnesses, hence the overall project cost
- ❖ Reduced absenteeism
- ❖ Lower employee complaints
- ❖ Improved employee morale and satisfaction
- ❖ Higher productivity
- ❖ Reduction of hidden cost
- ❖ Reduced medical and insurance costs
- ❖ Increased efficiency and quality
- ❖ Improved reputation as an employer of choice
- ❖ Fewer project delays due to accidents during construction allow continued focus on quality
- ❖ Encourages client-designer-constructor collaboration

## Consequences of an Unsafe and Unhealthy Work Environment - Hidden Cost



- ❖ Workers Compensation Cost
- ❖ Replacement and training cost for new or substitute employee
- ❖ Poor Quality
- ❖ Penalties for non-compliance

# Global Organizations Recommendations

- International Labour Organization (ILO)
- World Health Organization (WHO)
  - Strengthen international and national policies.
  - Develop practices for improving health at work.
  - Promote health at work through technical assistance/support.
  - Develop human resources for the field of occupational health.
  - Establish relevant and useful registration and data systems.
  - Raise public awareness.
  - Strengthen research on occupational health.

# Construction Accidents

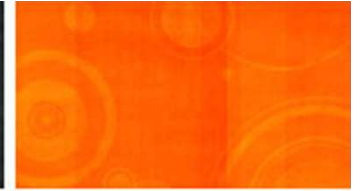
- ❖ 56% falls from height
- ❖ 21% trapped by something collapsing or overturning
- ❖ 10% struck by a moving vehicle
- ❖ 5% contact with electricity or electrical discharge
- ❖ 4% struck by a flying/falling object during machine lifting of materials
- ❖ 3% contact with moving machinery or material being machined
- ❖ 1% exposure to a hot or harmful substance

# Workplace Safety and Health Hazards

- Occupational Accidents:
  - Factors most affecting workplace accidents:
    - Working conditions and times
    - Tools and technology available to do the job
- Characteristics that make people more susceptible to accidents:
  - Emotionally “low”
  - Stressed



# Consequences of an Unsafe and Unhealthy Work Environment



- Injury and Disease
  - Back injuries are most prevalent
  - Exposure to Chemicals
    - Undetected effects, possible long-term risk
- Mental Health
  - Psychological symptoms can affect productivity and life away from work
- Deaths and Violence
- Economic Costs

# ACCIDENT- EFFECTS & CAUSES

- **Accident**

- “Any unplanned, uncontrolled, unwanted or uor undesirable event, or sudden mishap which interrupts an activity or function”

- **Effects of accidents**

- Injury (disability, pain, suffering)
- Damage (equipment, building)
- Loss (life, earning, output, image, time)
- Emotion (following injury, pain, death)

# ACCIDENT- EFFECTS & CAUSES

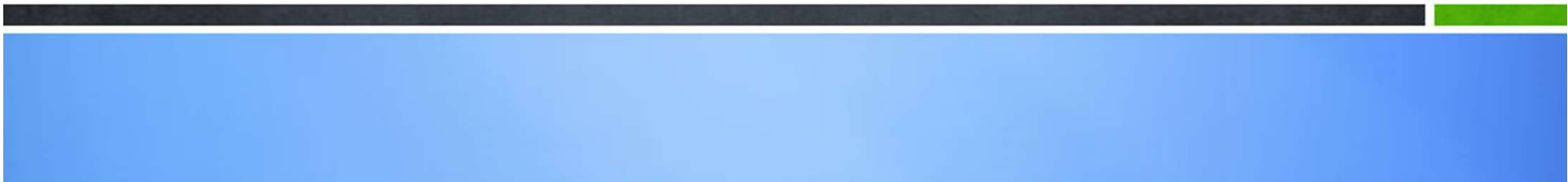
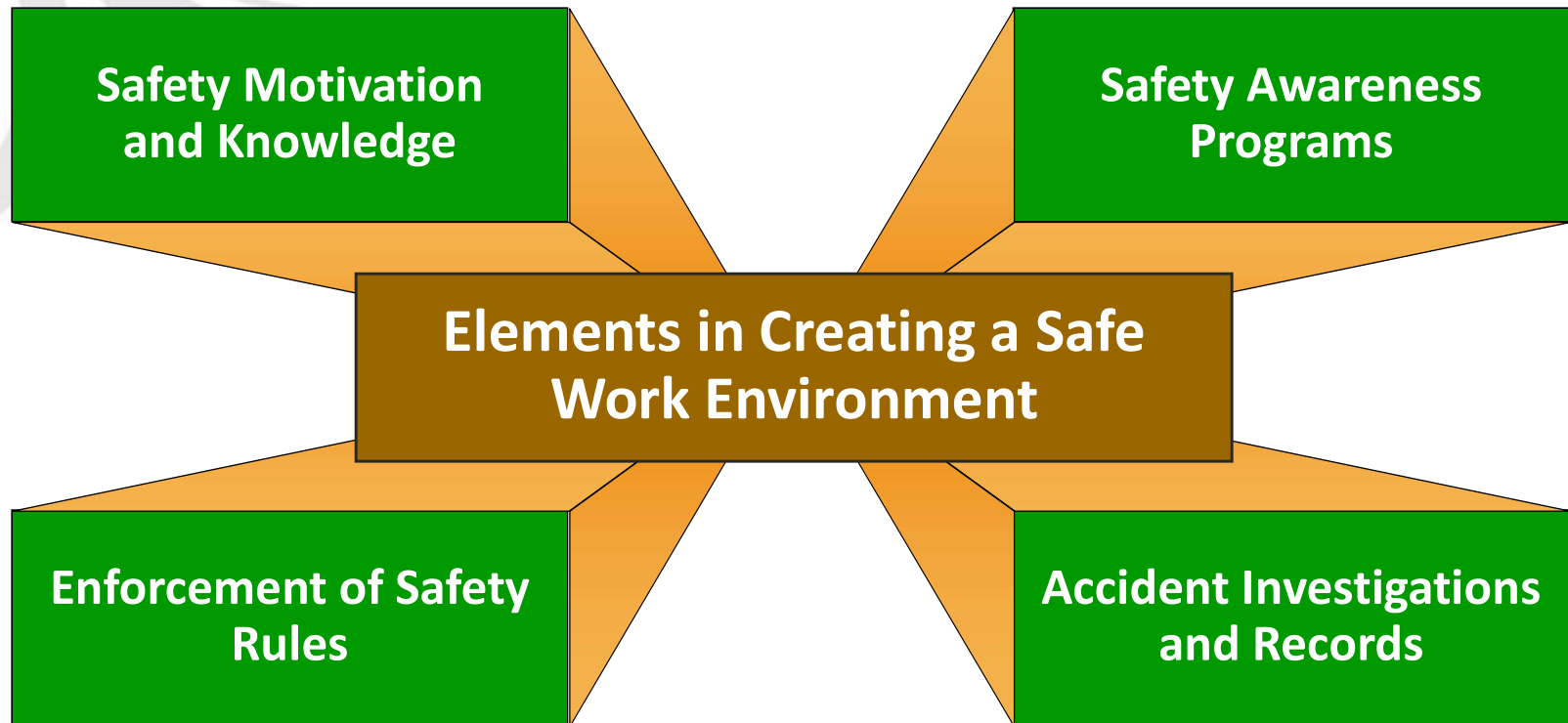
- **Causes of accidents**

- “Accidents don’t just happen, they are caused”
  - Plant & Equipment (faulty staircase, electrical hazards, defective/incorrect equipment)
  - Environment (high noise, insufficient light)
  - People (careless, untrained, overstressed)
  - System of work (poor design/site procedures)
  - Natural Hazards (EQ, Typhoons, Landslides, etc.)

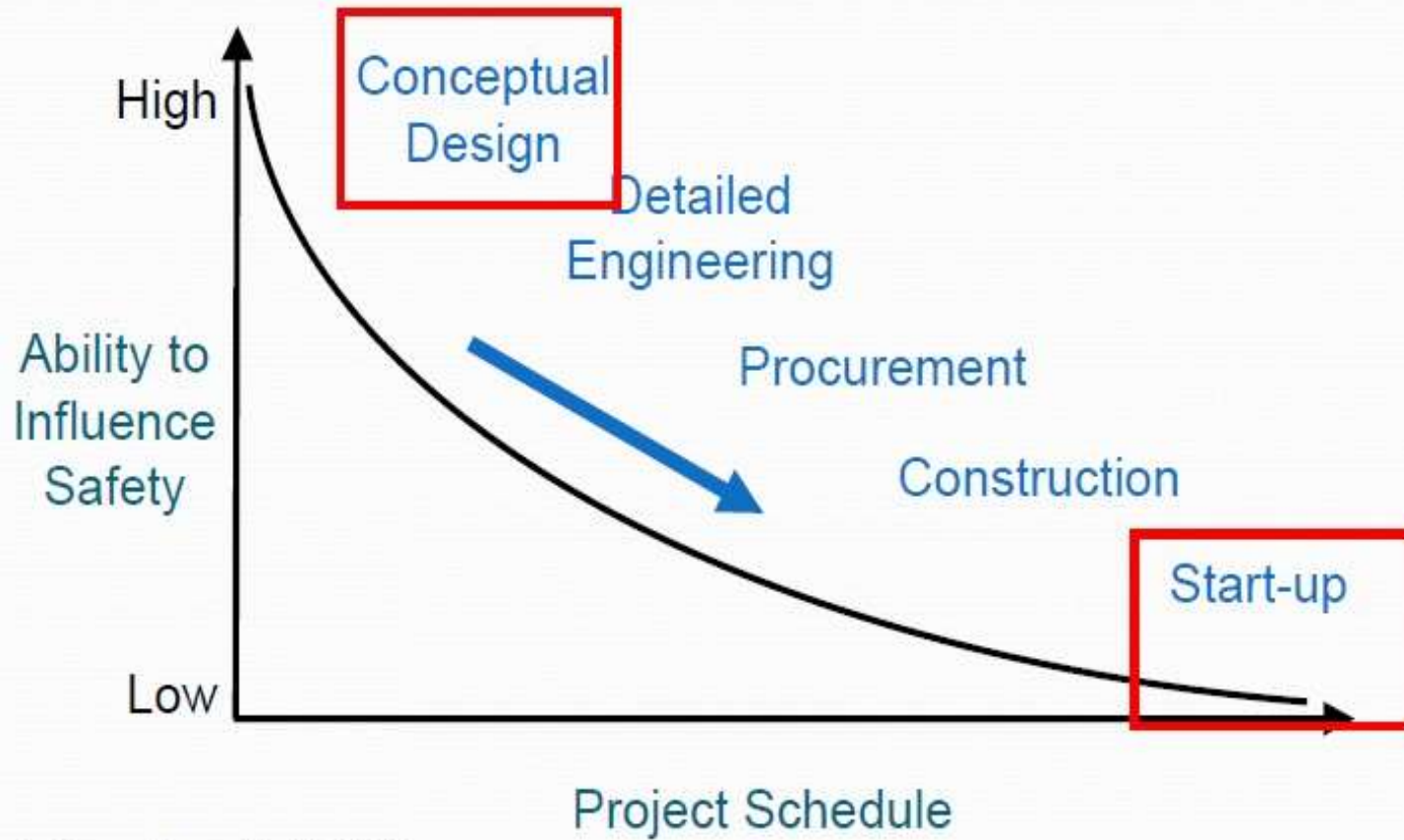
# ROLES AND RESPONSIBILITIES

- There are humanitarian, legal, and economic grounds for providing a safe place and system of work.
- Clear allocation of responsibilities within the management structure, especially at senior executive level and safety advisers.
  
- Supervisors/Management
  - Establish safe work practices
  - Enforce safety rules and regulations
  - Train employees how to avoid hazards
  - Enforce reporting work-related injuries, illnesses, and near misses
    - Investigate causes of incidents or near misses
    - Take the appropriate action to prevent recurrence
  - Ensure prompt medical attention
  
- Safety Coordinator
  - Develop and implement accident prevention programs
  - Advise management on company policies and governmental regulations
  - Evaluate effectiveness of existing safety programs
  - Train management in safety observation techniques

# Creating a Safe Work Environment



# PLANNING FOR SAFETY



<sup>1</sup> Szymberski (1987)

# Creating a Safe Work Environment (cont'd)

- Design a safe work environment
  - Guards, handrails
  - Safety goggles, helmets
  - Respiratory protection- Mask
  - Ear protection- Ear Defenders
  - Face protection- Face Mask
  - Hand protection- Gloves
  - Foot protection- safety shoes
  - Body protection- Jackets
  - Fall protection- Belts
  - Warning lights
  - Self-correcting mechanisms
  - Automatic shutoffs
- Ergonomics
  - Change job environment to match capabilities limitations of employees
- Health and Safety Committees
  - At the department level, do implementation and administration
  - At the organization level, formulate policies
- Behavior Modification
  - Small percentage of workforce responsible for majority of health insurance claims
  - Measure, communicate, monitor, and reinforce desired behavior
- Assessing Intervention Effectiveness

# Creating a Safe Work Environment (cont'd)

- Promoting Safety Awareness
  - The Key Role of the Supervisor
    - Communicating the need to work safely.
  - Proactive Safety Training Program
    - First aid, defensive driving, accident prevention techniques, hazardous materials, and emergency procedures.
  - Information Technology and Safety Awareness and Training
- Typical Safety Rules
  - Using proper safety devices
  - Using proper work procedures
  - Following good housekeeping practices
  - Complying with accident- and injury-reporting procedures
  - Wearing required safety clothing and equipment
  - Avoiding carelessness and horseplay



## Creating a Safe Work Environment (cont'd)

- Recognizing and Controlling Health Hazards Related to Hazardous Materials and Processes
  - Use substitutes for hazardous materials.
  - Alter hazardous processes and engineering controls.
  - Enclose or isolate hazardous processes.
  - Issue clothing to protect against hazards.
  - Improve ventilation.

## Creating a Safe Work Environment (cont'd)

- Key Elements for a Successful Ergonomics Program
  1. Provide notice and training for employees.
  2. Conduct pre-injury hazard assessment.
  3. Involve employees.
  4. File injury reports.
  5. Plan and execute.
  6. Evaluate and assess the ergonomics program.

# Safe Access On Site

- Everyone can get to their place of work safely
- Edges from which people could fall are provided with double guard rails or other suitable edge protection
- Holes are protected with clearly marked and fixed covers to prevent falls
- Site is tidy
- Good lighting
- Fenced off from public

# Working at Height

## Height **HAZARDS** on Construction Sites

*Holes in Floors, Gaps on Working Platforms, Shafts and Stairwells not Adequately Covered, Barricaded, Fenced Off*

- ❖ Using ladders or scaffolding without proper fixing is crazy
- ❖ Never use incomplete scaffolding.
- ❖ Make sure there are hand rails and toe boards at all edges
- ❖ Things fall on sites, wear your helmet
- ❖ Before starting work at heights check for clearance from any overhead power lines

# LETHAL LADDERS:

- **Ladders kill a lot of people.**
- **Make sure the ladder is:-**

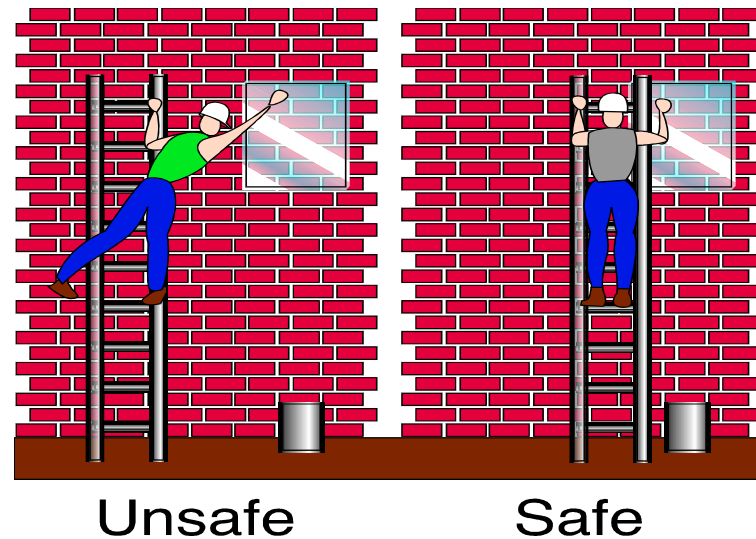
- ❖ Right for the job. Would scaffolding or a cherry picker be better?
- ❖ In good shape
- ❖ Secured near the top
- ❖ On a firm base and footing
- ❖ 4 up – 1 out
- ❖ Rising at least 1 meter beyond the landing place OR that there is a proper hand hold



**Always have a firm grip on the ladder and keep a good balance**

# Safe Ladders

- ❖ Never allow more than one person on a ladder
- ❖ Use tool belts or hand lines to carry objects.
- ❖ Do not lean out from the ladder in any direction
- ❖ If you have a fear of heights – don't climb a ladder
- ❖ Do not allow others to work under a ladder in use



# THE ROOF: A RISKY PLACE TO BE.

- **Very Simply:-**

- ❖ Always inspect a roof before you walk on it
- ❖ You must have protection to stop you from falling off the edge
- ❖ You must use proper safety harnesses and running cables when working on top of a roof

**Remember:** a walk along a fragile roof could be your last

*50% of fatal injuries involving roofs are falls thru' fragile materials, 30% are falls from edges and openings*

# EXCAVATION WORK.

- **If you want to avoid being buried alive apply these rules:-**

- ❖ All excavations deeper than 1.25meters MUST be shored or battered.
- ❖ Excavations deeper than 2 meters MUST have a guard rail or barrier
- ❖ Vehicles working too close to the
  - ❖ side of the trench or rubble piled
  - ❖ on the sides may cause collapse
- ❖ Vehicles tipping into the excavation
  - ❖ must use stop blocks

- **If you want to avoid being buried alive apply these rules:-**

- ❖ Make sure the excavation is inspected daily
- ❖ Make sure you know where any underground pipes and cables are before you hit them
- ❖ REMEMBER: There is no safe ground that “will not collapse”
- ❖ Trench sides can collapse without warning



# CRANE SAFETY

- **Very Simply :-**

- ❖ The weight of the load must be carefully estimated
- ❖ The crane must be fitted with an automatic safe load indicator (one that works)
- ❖ The crane must always work on a hard, level base
- ❖ The load must be properly fixed and secured
- ❖ The banksman must be trained to give clear signals
- ❖ **NEVER, NEVER** be carried with a load

# Traffic Vehicles & Plant

- ❖ Vehicles and pedestrians should be kept apart on-site – separate them as much as possible using barriers
- ❖ Adequate clearance around slewing vehicles
- ❖ Avoid reversing where possible & use one-way system
- ❖ Vehicles should have reversing alarms/sirens
- ❖ Passengers only on vehicles designed to carry them

# ELECTRICITY

- ***Good practice with electricity on site:-***
  - ❖ Treat electricity with respect
  - ❖ Check constantly that cables are not damaged or worn
  - ❖ Keep trailing cables off the ground and away from water
  - ❖ Never overload or use makeshift plugs and fuses

# Working near Sewage

## Health Risks:

\*Gastroenteritis  
infections

\*Hepatitis  
\*Inflammation of the lungs

\*Asthma

\*Skin/Eye

## How to become infected:

- ❖ Hand-to-mouth contact(eating, drinking, smoking, wiping the face with contaminated gloves) – most common
- ❖ Skin contact(cuts, scratches or wounds and some organisms enter the body through the eyes)
- ❖ Breathing(either as dust or mist)

## How to protect yourself:

- ❖ Understand the risks
- ❖ Understand how you may be infected
- ❖ Wear protective clothing
- ❖ Avoid sewage if possible
- ❖ Apply good personal hygiene
- ❖ Cleanse all wounds & cover
- ❖ Change out of contaminated clothing
- ❖ Clean equipment & boots etc on site
- ❖ If in doubt - see your doctor

# BASIC SAFETY PHILOSOPHY FOR SUCCESS

## *A NEW SAFETY CULTURE*

- ❖ All accidents are preventable.
- ❖ No job is worth getting hurt for.
- ❖ Every job will be done safely.
- ❖ Incidents can be managed.
- ❖ Safety is everyone's responsibility.
- ❖ Continuous improvement.
- ❖ Safety as a "way of life" for 24 hours/day
- ❖ All individuals have the responsibility and accountability to identify eliminate or manage risks associated with their workplace
- ❖ Legal obligations will be the minimum requirements from our health & safety standards
- ❖ Individual will be trained and equipped to have the skills and facilities to ensure an accident free workplace

# BARRIERS/LIMITATIONS

- Like many good ideas, construction safety faces a number of barriers that slow down its adoption.
- Potential solutions to these barriers involve long-term education and institutional changes.
- **Barrier-1: Fear of Liability**
  - Barrier: Fear of undeserved liability for worker safety.
  - Potential solutions:
    - Develop revised model contract language.
    - Propose legislation to facilitate construction safety without inappropriately shifting liability onto client/designers/contractors.
- **Barrier-2: Increased Construction Costs**
  - Barrier: Implementation of construction safety rules will increase both direct and overhead costs for designers.
  - Potential solutions: Educate owners that total project costs and total project life cycle costs will decrease.
- **Barrier-3: Lack of Safety Expertise**
  - Barrier: Few engineering firms possess sufficient expertise in construction safety.
  - Potential solutions:
    - Add safety to design professional's curricula.
    - Develop and promote safety courses for professionals.

# CONCLUSIONS

- **Three Steps towards Safety**
- 1. Establish an adoptable culture
- 2. Establish adoptable / enabling processes
- 3. Secure clients who value life cycle safety



THANKS

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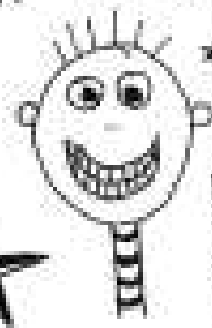
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