Glass in some form or another has been used since the ***dawn of civilization***. It appears naturally as **obsidian**, and the ***first man-made glass objects date from 3500 BC***. The ***Romans*** were the first to ***use glass as an architectural material***, with semi-clear glass in windows beginning around 100 BC. Glass production was a highly skilled and labor intensive process. In the middle ages, **stained *glass was developed by adding different minerals to molten glass***, and there are stunning examples of the technology throughout Europe, some dating back to the 13thcentury. Mirrors with decent effectiveness were not developed until the late 17th century. The technology used for modern mass production glass is relatively new, dating from around the time of the **WWI** (World War I).

The subject of glazing has many aspects, including emissivity (heat transmission), light transmission, insulating value, leak prevention, wind-resistance, acoustics, sealants, and architectural considerations. This lesson is safety glazing, and the areas where inspectors look at the hazards posed by glazing.

Glazier

A **Glazier is** a person whose trade is fitting glass into windows and doors. A skilled tradesman responsible for cutting, installing, and removing glass and materials used as substitutes for glass such as some plastics. Glaziers may work with glass in various surfaces and settings, such as windows, doors, shower doors, skylights, storefronts, display cases, mirrors, facades, interior walls, ceilings, and tabletops. This trade provides a valuable service to the construction industry, in order to sustain this valuable service may need adequate training specific to the work to ensure that glaziers are kept up to date with current product design and installation requirements; training in Health & Safety ensures that following proper recognized procedures on site.

A set of glazier tools

The Occupational Outlook Handbook of the U.S. Department of Labor lists the following as typical tasks for a glazier:

- Follow blueprints or specifications
- Remove any old or broken glass before installing replacement glass
- Cut glass to the specified size and shape
- Make or install sashes or moldings for glass installation
- Fasten glass into sashes or frames with clips, moldings, or other types of fasteners
- Add weather seal or putty around pane edges to seal joints.

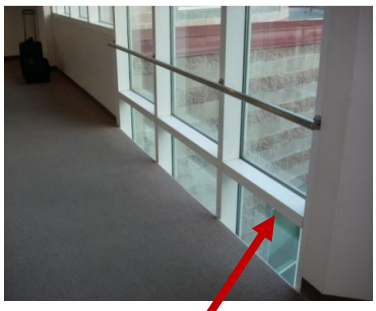
The Danger When a person accidentally impacts glass, there are two immediate dangers.

1. The first is from lacerations due to the large shards that might slice into the person. There have been numerous instances of persons who have died from injuries such as a severed femoral artery. Unless pressure is brought to bear immediately on such a wound, the victim can bleed to death in as little as five minutes.
2. The second danger is from the “rebound” effect. The first reaction to impacting glass is to pull back. By then the glass is broken, and during the rebound, the person is pulling away from the sharp broken edges. The result can be deep lacerations that tear off large flaps of skin along with possible deep tissue damage.

Most accidents with glass are due to one or more of three contributing factors

1. Failure to see the glass
2. Slips and falls – even knowing the glass was there, and
3. Intentional breakage.

Locations Subject to Human Impact What then, is a “hazardous location” for glazing? Here means areas subject to human impact. The International Building Code and the International Residential Code (IRC) provide us with definitions. These include areas where a person might be ***aware of the glass*** yet still slip and fall, such as a ***shower*** or ***walkway***. Another hazard is glass that people might ***not be aware of,*** such as ***sliding doors*** where a person could think the door was open and walk (or run) straight into the glass. Glass that might be broken for forced entry is a hazardous location, such as glass near a doorknob.



Protective bar in front of window

What is generally dangerous about this job?

- Glaziers are often injured by sharp edges of glass sheets, glass splinters, by sharp tools, etc.
- Glaziers may fall from the height while setting glass in windows, on walls and ceilings.

- Glaziers may be severely injured by collapsing heavy glass sheets.
- Glaziers sometimes use strong chemicals, and their fumes may have adverse health effects.
- Glass sheets are bulky and heavy, and handling them may put Glaziers at risk of injuries, back, arms and hands pains, etc.

There are a number of risk factors in the glazier industry that account for most injuries, which include:

- Cuts
- Abrasions
- Punctures
- Muscle strains
- Slips, trips and falls
- Eye injuries
- Caught in or crushed by injuries
- Bone fracture

Additional risk factors associated with glazier work include:

- Handling agents that cause allergic-contact dermatitis.
- Using adhesives, finishes or sealants, harmful solvents etc .

Structural steel and metal works:

Who is a structural steel worker?

A structural steel worker is a metal worker who is engaged in building metal structures, especially in high-rise buildings, where he joins together steel beams, columns and surfaces, and creates a metal skeleton. Structural steel workers could also perform other tasks involving metal construction building sites, including work on air conditioning systems, ironwork fixing, and the like.

What is Hazardous about this job?

- ✓ Hazard of falling down from considerable heights, while joining metal components of a building
- ✓ Being hit by falling objects

- ✓ Eye injury, as a result of flying metal splinters, while working with a chisel and hammer, or when doing sharpening, cutting or welding works
- ✓ Back and spinal column injury caused by lifting and moving heavy loads
- ✓ Exposure to very high noise levels
- ✓ Electrocution, as a result of touching lives electric wires, or while working with portable power tools the isolation of which is defective.

Accident hazards 	Hazard of falling down from considerable heights, while joining metal components of a building; and/or when the work is done while standing on a ladder or at an elevated surface	**1**
	Being hit by falling objects (falls of heavy loads on the feet or on other parts of the body	**2**
	Stepping on, colliding or hitting an object (falling objects aren't included here)	**2**
	Slips, trips and falls, esp. where there is an oil spill	**2**
	Injuries and cuts caused by sharp objects, broken glass, knives and other sharp tools	**2**
	Over-exertion, or strained movements (Potential injury of back and spinal column as a result of lifting and moving heavy loads)	**3**
	Eye injury, as a result of flying metal splinters, while working with a chisel and hammer, or when doing sharpening, cutting or welding works	**2**
	Exposure to, and/or contact with electric current	**4**
	Exposure/contact with extreme temperatures	**5**
	Injuries caused as a result of working on scaffolding, including their installation, work done while standing on top of them, falling from them, and the like; or as a result of being hit by a cable of a hoist and/or by the loads carried by it	**6**
Physical hazards 	Exposure to very high noise levels (including ultra and infra sound)	**2**
	Cold or heat load	**5**
	Hand and arm vibrations influencing various body organs and systems	**7**
	Eye injury caused by UV radiation emitted during welding operations	**2**
	Exposure to various environmental factors, including extreme heat or cold, high moisture, increased or decreased air pressure, and the like	**5**
Chemical hazards	Dermatitis and allergic skin diseases, caused by exposure to organic solvents and their vapors (e.g. - washing various parts and components with trichloroethylene; dipping hands in kerosene and gasoline…)	**8**
	Difficulty in breathing resulting from exposure to organic solvents, or when working in confined places lacking oxygen or having reduced oxygen content, or due to exposure to various other chemicals	**2**

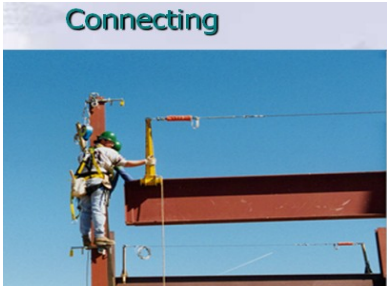
		
Biological Hazards	Respiratory infections caused by work outdoors, in a cold and windy atmosphere	**2**
	Contracting various diseases, such as dermatitis caused by touching birds secretions, or due to contact with parasites residing in birds nests; by mosquito bites; by other insects and pests	**2**
Ergonomic, psychosocial and Organizational factors	Back pains and other musculoskeletal problems caused by over-exertion, inconvenient work position (including prolonged work in a squatting position, working in a bent posture, overstraining in order to reach something above, ...) and from wrong work postures while lifting or moving heavy loads; the carrying of loads may result in back pains and injury of the discs separating the spinal column vertebrae	**3**
	Injury as a result of repetitive movements or excessive effort	**3**
	Psychosocial factors relevant to the type or place of workplace, such as human relations, work organization, being exposed to violence or crime at the workplace, shift work, and similar problems	**9**

Preventive measures

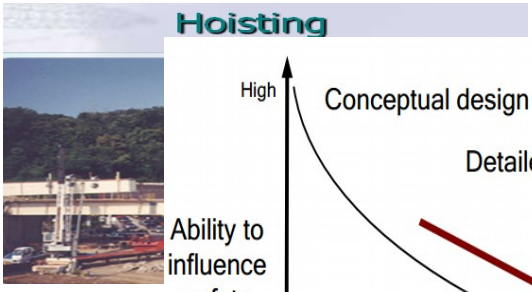
1. Use only a ladder that is in a good condition; it should be placed in a safe manner that will prevent slipping; wear isolating safety shoes with non slip soles; ladders and scaffolding must be well tied, and the worker should be harnessed into them and also to other firm harnessing points, depending upon work needs and conditions
2. Use personal protection equipment, fit for the specific type of work (it may include a crash helmet, safety shoes with a protective cup or shoes with non-slip soles, work gloves, safety goggles, welding masks, respirators, gas masks, ear-plugs); if necessary – use a safety-screen that protects against ricochets and sparks
3. Adopt safe techniques for raising and lowering loads; use lifting aids when necessary
4. Do not use defective portable power tools or those with improper isolation
5. Work clothes should be fitted to the climatic conditions of the workplace (such as proper clothing and headcover that constitute good protection against bad weather)
6. All the components of the scaffolding must be examined with regard to their safety, prior to the beginning of work; use correct equipment for fall prevention (safety belts, harnesses, fall protection nets, canvas sheets, protective railings) when standing on the scaffolding
7. Elimination of injuries resulting from hand-arm vibrations requires adoption of the relevant medical, technical and administrative procedures (see ISO 1986)
8. Avoid direct contact between your skin and/or other body organs with allergenic materials, acids and strong bases
9. In severe cases, consult with an occupational psychologist.

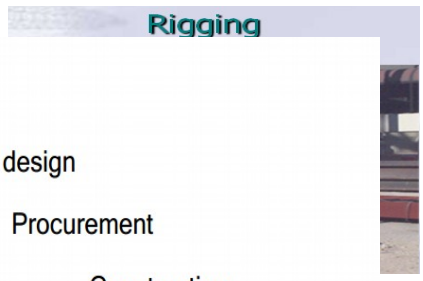


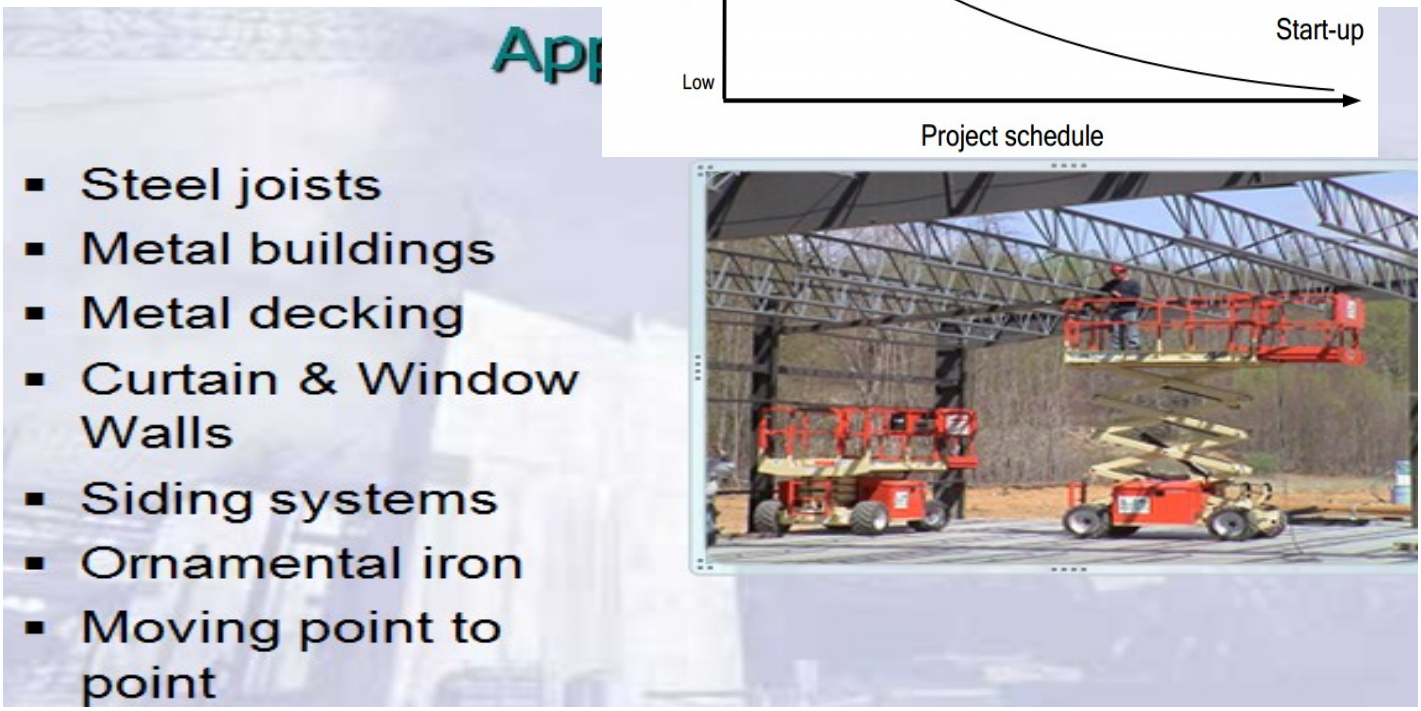
Steel erection activities include hoisting, connecting, welding, bolting and rigging structural steel











Safety Payoff during Design

PtD (Prevention through Design) Process Tasks

- Perform a hazard analysis
- Incorporate safety into the design documents
- Make a CAD model for member labeling and erection sequencing

Designer Tools

- Checklists for construction

- Design for construction safety toolbox
- Construction safety tools from Australia

– Construction Hazard Assessment Implication Review, known as CHAIR

Why Prevention through Design?

- Ethical reasons
- Construction dangers
- Design-related safety issues
- Financial and nonfinancial benefits
- Practical benefits

Three Entities Associated with Design

- Engineer
- Detailer
- Fabricator

CHEMICAL HEALTH HAZARD

Examples of chemical hazards found in construction work

- **asbestos**
- **lead**
- **silica**
- **cadmium**
- **carbon Monoxide**
- **welding fumes**
- **spray paints**
- **cutting oil mists**
- **xylene vapor**



Examples of health conditions and illnesses from exposure to chemical hazards

A health hazard can affect the entire body or many organs, or affect only specific tissues, organs, or parts of the body.

- Headaches
- Confusion
- Loss of consciousness
- Dermatitis
- Lung irritation

- Asbestosis
- Silicosis
- Cancer
- Liver damage
- Sterility

❑ The degree of hazard associated with a particular chemical will depend on:

- Its physical properties
- Its toxicity
- The way it is used

❑ The environment in which it is encountered

- Chemicals may be found in solid, liquid, aerosol, or gas and vapor form.
- The degree of danger varies according to the form of the chemical and the factors discussed above

a. Solids

- **Lead-** Lead can become a human health hazard if the pipe is sanded

or welded, producing lead dust or fumes resulting in fatigue, anemia.

- **Asbestos-** The demolition of buildings with asbestos insulation or lagging has the potential for the release of massive amounts of lagging has the potential for the release of massive amounts of asbestos fiber when inhaled leads to asbestoses, lung cancer, mesothelioma-a type of lung cancer.
- **Cement-** The reaction of cement with water produces large amounts of heat as well as CO2. If proper care is not taken, this can lead to choking of the workers in congested area where mixing is done.

b. Liquids

- ❑ Many liquids are hazardous in contact with the skin. They either damage the skin or they are easily absorbed through the skin
- ❑ Paints, varnishes etc generally get deposited on workers. The chemical ingredients like Isocyanates invariably get absorbed through the skin leading to dermatitis..
- ❑ Lead based paints constitute absorption of lead through skin.
- ❑ The contact with these liquids should be avoided. Use of protective clothing should be encouraged to counter these hazards
- ❑ In case the contact is unavoidable, adequate shower facilities should be provided

c. Aerosols/Vapors/gas

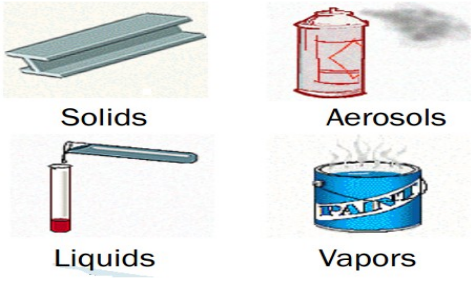
- Silica dust can cause silicosis (scarring of lungs).

- Cement particles when inhaled cause asthma, and other lung diseases
- Exposure to saw fumes containing terpenes, a constituent of wood also causes chronic obstructive impairment in lung function
- Chronic exposure to wood dust can cause impaired nasal mucociliary clearance and nasal cancer.
- Liquids with a low vapor pressure may create a low airborne concentration and those with a high vapor pressure may produce high airborne concentrations.
- Almost all types of solvents used in paints, paint removing solutions, industrial coatings etc. evaporate and their inhalation also causes similar breathing related diseases.
- Carbon dioxide occurs in chalk and limestone. It results in oxygen deficiency. Fatal accidents may occur when workers enter manholes in surface water drainage system
- Hydrogen sulphide is highly present in sewers. High concentration
- causes death while low level causes irritation to eyes, nose, causes death while low level causes irritation to eyes, nose headache etc
- Nitrous fumes generally emerge with the use of explosives used during demolition or excavation (Blasting). Low concentration can cause bronchitis

- Gas masks depending upon the type of exposure are very suitable against these types of chemical hazards
- Harmful chemicals in the form of solid, liquid, gases, mists, dusts, fumes and vapours exert toxic effects by inhalation(breathing), absorption(through direct contact with the skin), or ingestion(eating and drinking).

Airborne chemical hazards/contaminants exist as concentrated:

- Dusts – formed from mechanical action
- Smoke – formed from combustion
- Fumes – formed from volatilizing metal
- Mists – tiny water droplets
- Vapors – evaporate of liquid
- Gases – particles without defined shape or volume
- Aerosols – atomized particulate or solids



HAZARDOUS CHEMICAL EXPOSURES

- Are employees trained in the safe handling practices of hazardous chemicals ?

- Are employees aware of the potential hazards involving various chemicals stored or used in the workplace?
- Is employee exposure to chemicals kept within acceptable levels?
- Are eye wash fountains and safety showers provided in areas where corrosive chemicals are handled?
- Are all containers, such as vats and storage tanks labeled as to their contents--e.g.
- Are all employees required to use personal protective clothing and equipment when handling chemicals?
- Are flammable or toxic chemicals kept in closed containers when not in use?
- Are chemical piping systems clearly marked as to their content?
- Where corrosive liquids are frequently handled in open containers or drawn from storage vessels or pipelines; is adequate means readily available for neutralizing or disposing of spills or overflows properly and safely?
- Have standard operating procedures been established and are they being followed when cleaning up chemical spills?
- Where needed for emergency use, are respirators stored in a convenient, clean and sanitary location?
- Are employees prohibited from eating in areas where hazardous chemicals are present?

- Is personal protective equipment provided, used and maintained whenever necessary?
- If hazardous substances are used in your processes, do you have a medical or biological monitoring system in operation?
- Is there a Material Safety Data Sheet readily available for each hazardous substance used?
- Etc…, must get appropriate answers.