

Safety of tunnel propulsion work (high-place work/shaft)

(1) Vertical shaft work in the tunnel propulsion work

The vertical shaft work in a tunnel construction includes:

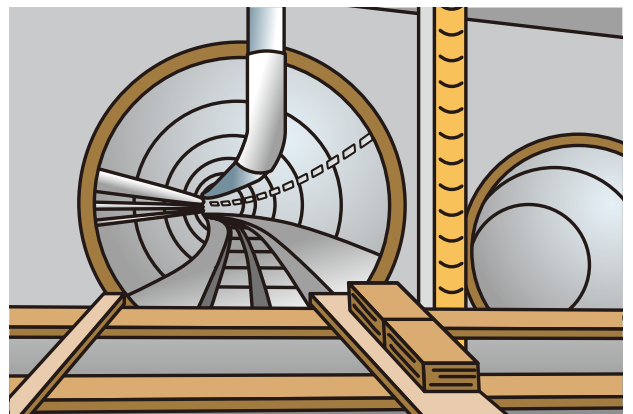
- Transporting equipment and materials into and out of the shaft
- Plant operation

The vertical shaft varies in size and work content depending on the scale and construction conditions. Safety measures against falling or falling of materials and equipment are very important.

Vertical shaft

The vertical shaft is used to transport materials and equipment necessary for a tunnel construction into the tunnel mine or to the road.

Heavy goods such as materials and equipment are carried in and out using the road and the shafts.

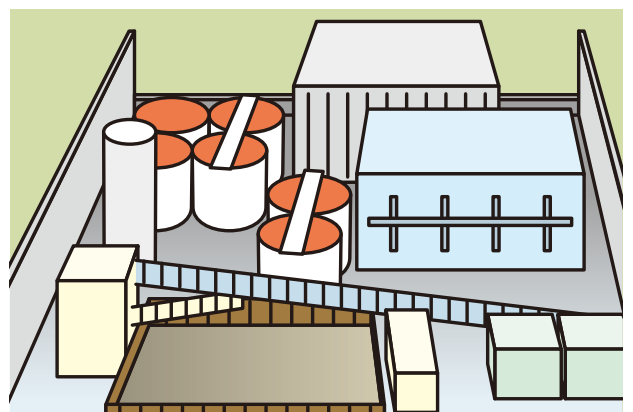


Plant facilities

The plant facilities are on-road facilities necessary for a tunnel construction.

There are disposal of excavated soil and storage place for tunnel lining members.

The installation and removal of these and the operation of equipment during a tunnel construction are carried out.



(2) Personal fall arrest systems (fall prevention harness)

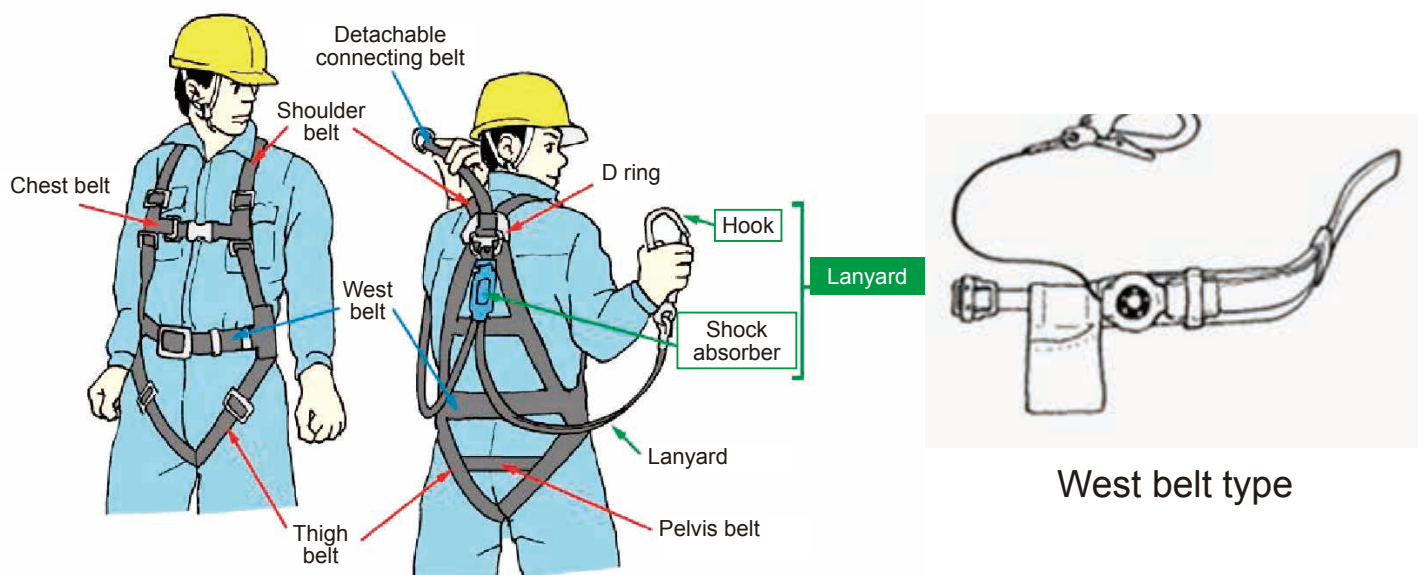
1. For the following situations:

When there is a risk of falling due to the work at a height of 2m or more, wear a personal fall arrest system (fall prevention harness).

2. Type of the personal fall arrest systems (fall prevention harness)

There are two types of the personal fall arrest systems (fall prevention harness): the west belt type and the full harness type. Since the west belt type gives a heavy shock on a body when dropped, the “full harness type” should be used in principle.

Personal fall arrest systems (full harness type fall prevention harness)

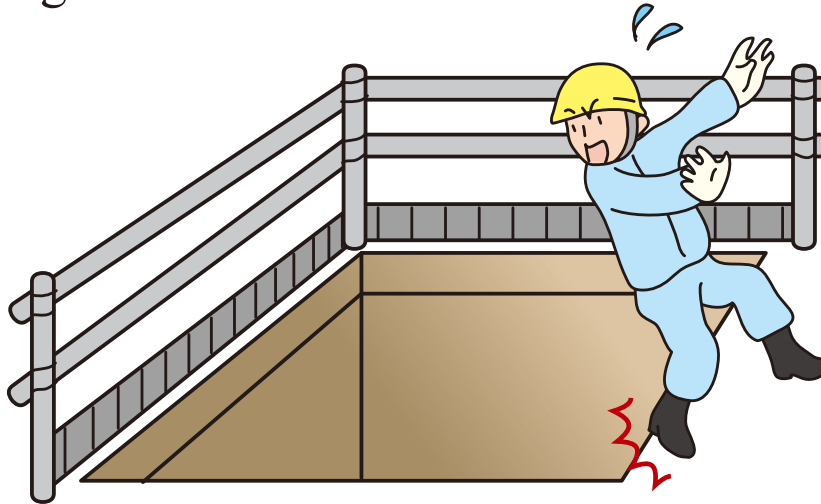


3. It is necessary to get the special education.

When using the personal fall arrest systems (full harness type fall prevention harness), it is necessary to get the special education including related laws and practical skills such as usage of devices.

(3) Safety in opening works

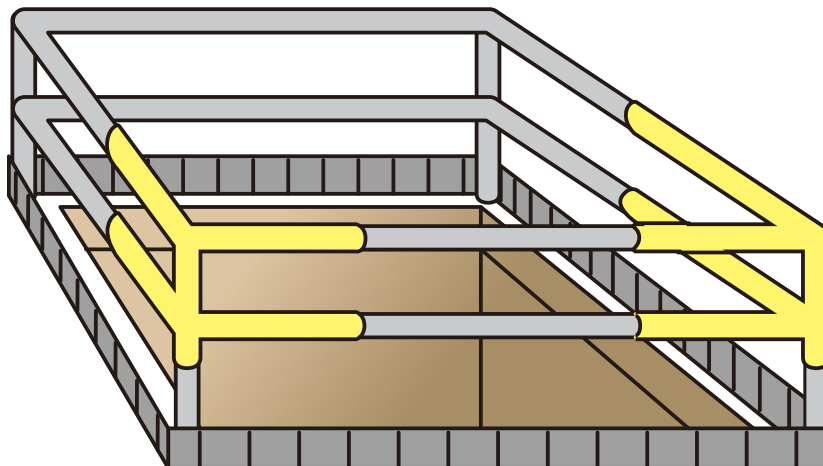
When working near a vertical shaft during loading and unloading materials and equipment, it is necessary to be careful of falling from the opening.



1. Fall prevention at openings

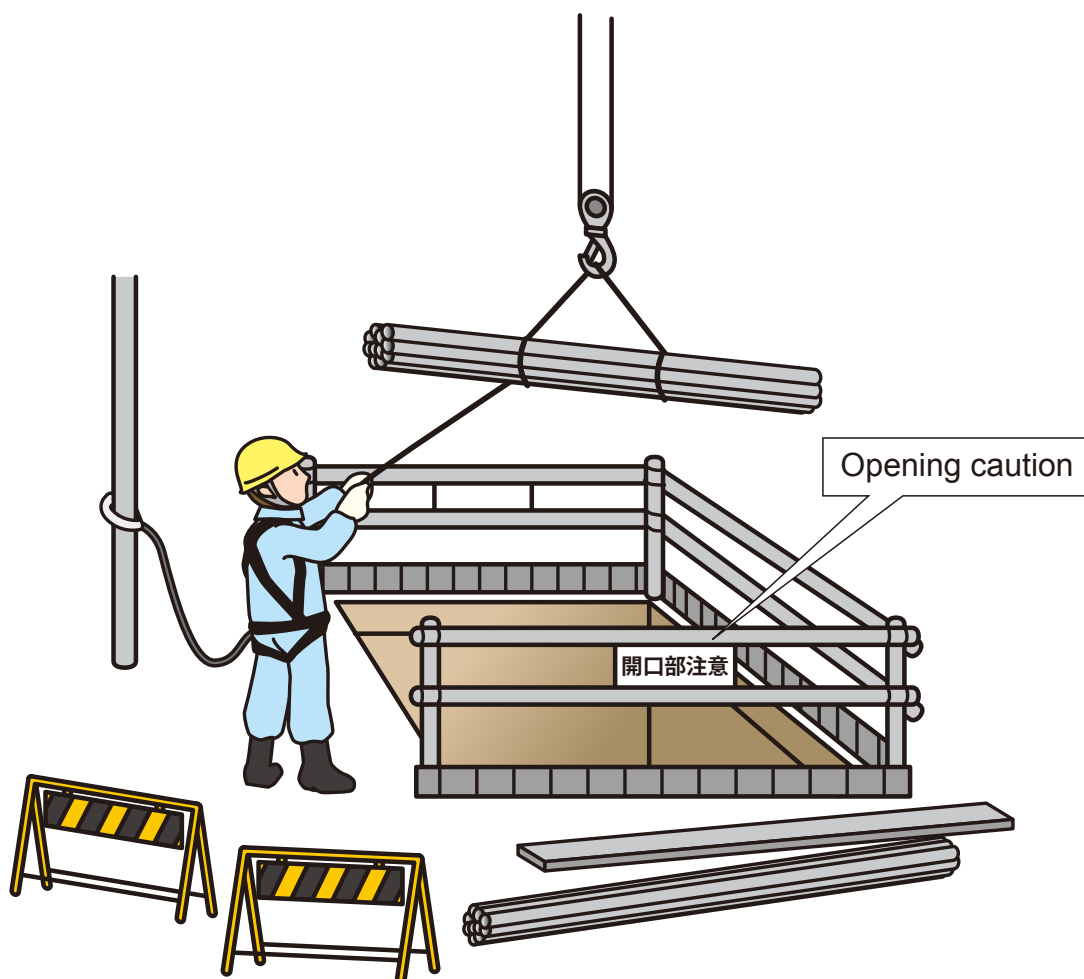
Enclosures, handrails, covers, etc. must be provided where there is a risk of crashing at an opening or the edges of a work platform with a height of 2m or more.

An opening is not limited to the above-ground part, but is also applicable to a work platform in a vertical shaft.



2. Point at openings

Do not remove handrails without a permission. If it is unavoidable to remove it for a work reason, obtain the permission of the foreman and immediately return it to its original state when it is no longer needed.



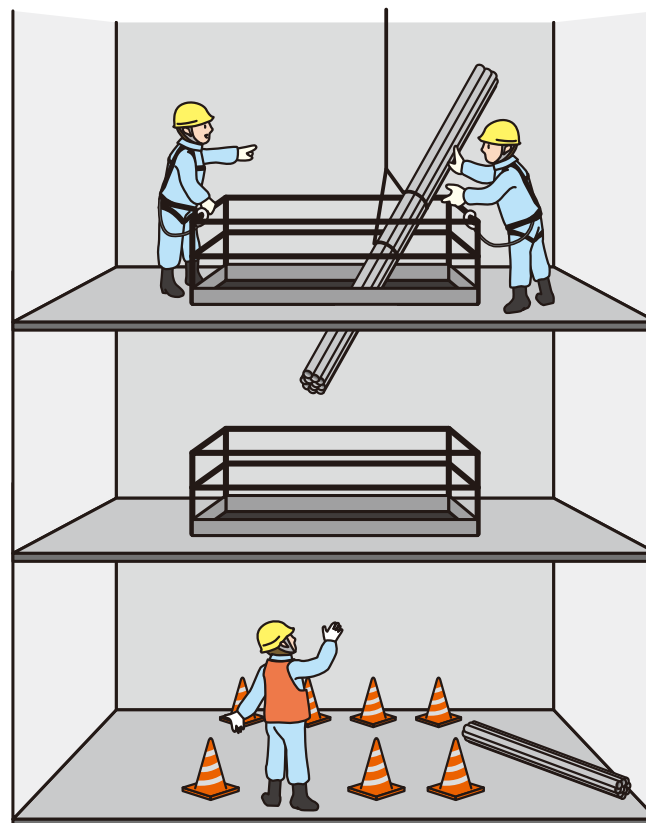
When removing handrails/middle bars of the openings, a personal fall arrest system (fall prevention harness) is required and never hook it to the handrail. In addition, do not go up and down by using a handrail or a middle rail as a step.

Safety of tunnel propulsion work (high-place work/shaft)

(4) Safety of dangerous work of flying or falling

Accidents have occurred, such as a material falling from an opening and hitting a worker at the bottom of the vertical shaft. In tunnel constructions, the materials and equipment handled are large and long, therefore, accidents may occur that the balance is lost due to contact with the opening and the suspended load falls.

Entry is prohibited while materials are loaded and unloaded, so never work at the upper and the lower levels simultaneously. For long objects, use an assist rope to prevent the load dropping to pieces. In addition, a personal fall arrest system (fall prevention harness) is used when taking in the loads at an opening.



(5) Safety in handling heavy items

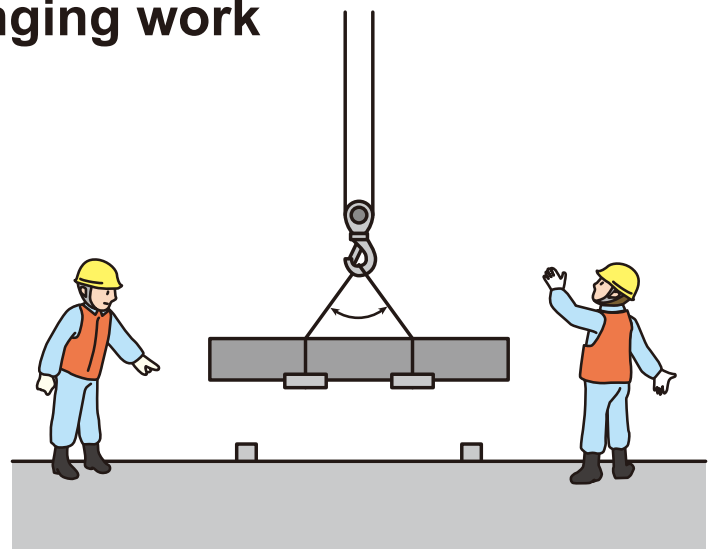
Many items handled in a tunnel construction are heavy objects.

- Moving of a tunnel boring machine and various equipment, and carrying them into a vertical shaft
- Carrying-in work of segments (tunnel lining member) and pipes
- Carrying-in and assembling of a steel timbering and steel members for a frame.
- Carrying-in/carrying-out of materials, and other works



1. The certification of the slinging work

When a suspension load of a crane is 1 ton or more, the worker must be a person who has completed the “Skill training course for slinging operation” for slinging and other works regardless of weight.



2. Cautions for slinging work

Never enter the area under the suspended load of a crane.

(6) Safety in a gas cutting work, etc.

The gas cutting is used to process steel parts.

In the gas cutting works, in addition to workers' safety, curing the surroundings is also important to prevent sparks generated during cutting works.



1. Gas cutting equipment

Gases such as oxygen, acetylene, and propane are filled in steel high-pressure gas containers. The color of the container is unified with black for oxygen and brown for acetylene.

2. protective equipment

Workers wear a safety helmet, protective goggles, a respiratory protective equipment, and work gloves.

3. Certification

In order to perform gas welding, cutting, etc. because mixture of flammable gas and oxygen are used, workers should have completed the “Skill training course for gas welding”.

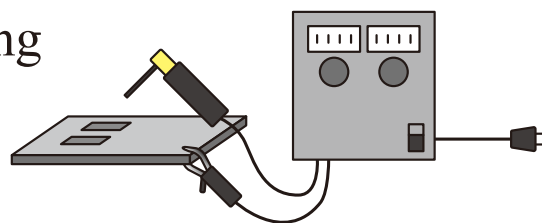
(7) Safety in the arc welding operation

Arc welding is often used in a tunnel construction to weld steel materials.



1. Arc welding apparatus

Arc welding equipment includes a welding machine, a torch, and a grounding.



2. Safety measures

Workers should wear a safety helmet, protective glasses, a respiratory protective equipment, work gloves, etc.

3. Certification

When performing arc welding works, the workers should have completed the “Special education for arc welding”.