NOVA SOUTHEASTERN UNIVERSITY	ENVIRONMENTAL HEALTH AND SAFETY
POLICY/PROCEDURE TITLE: **SLIPS, TRIPS AND FALLS**	POLICY/PROCEDURE NUMBER: 10

TABLE OF CONTENT

DOCUMENT HISTORY

OWNER:	NSU Facilities Management	Date:1 Sept 2011
APPROVED:	NSU Facilities Management/AIHS	Date:1 Sept 2013
IMPLEMENTED:		Date: 1Oct 2010
RETIRED:		Date:

Date:	**Revision No.**	**Review / Changes**	**Reviewer**
15 August 13	none		
6 October 21	none		

DOCUMENT DISTRIBUTION

Date:	**Distribution**	**# of Copies**

Distribution: The current version is available via NSU intranet. Paper copies of this document require prior approval before printing.

1. INTRODUCTION

Each year in the United States workplaces; slips, trips and fall incidents account for over 20% of all lost-time injuries. When thinking about these injuries, serious high elevation falls often come to mind but most workplace/campus falls, like slips and trips occur at the same level rather than from a height.

2. PURPOSE

To fulfill this NSU policy and to comply with OSHA Standard this Slip, Trip and Fall Guide has been developed to minimize injury, illness, or death associated from slip, trip and fall related incidents. Procedures include worksite evaluations, elimination of slip, trip and fall hazards, and employee, faculty and student training. This policy is designed to protect employees, students, and visitors from slips, trips and fall injuries.

3. SCOPE AND APPLICATION

This policy applies to all NSU employees, contractors, vendors, visitors, and students. The principal cause of falls is stepping on slippery surfaces, stepping onto material and debris, elevation changes on walkways, poor lighting, and carrying excessively large or heavy loads. Essentially the momentum of motion pushes the person off balance and a fall result.

There are four main categories of falls. (Note: There are <u>many</u> examples of falls under each category only a few examples for each type are listed.)

<u>Slipping (same level)</u>

- Wet, oil or grease on the floor
- Loose rugs on waxed (slick) floors
- Food on the floor after breaks and lunch
- Flooring or walking surfaces that do not have the same degree of traction in all areas
- Trash, debris on the floor

<u>Tripping (same level)</u>

- Irregular walking surfaces
- Lines, cords, hoses in walkways
- Inadequate lighting
- Poor housekeeping
- Rug edges not flat
- Shoes worn/in poor condition

<u>Collisions (same level)</u>

- Blind corners in hallways and warehouses
- Equipment, such as forklifts, which swing wide
- Low clearances

<u>Elevations (different levels)</u>

- Misjudging a step or handhold
- Over-reaching on ladders, scaffolds, and man-lifts
- Unstable ladders (top not secured, feet not prevented from slipping)
- Unguarded edges
- Not using fall arrest equipment properly/not hooked off

4. REGULATORY REQUIREMENTS

There are a few OSHA regulations that apply to slip, trip and fall prevention. OSHA Standard, 29 CFR 1910 Subpart D covers walking-working surfaces.

29 CFR 1910.22 "General requirements" specifies that:

- all areas of employment should be kept clean and sanitary
- the floors shall be kept clean and dry
- where wet processes are used, floors shall be kept dry as practical
- aisles and passageways shall be kept clear and in good repair
- permanent aisles and passageways shall be marked

29 CFR 1910.141 (a)(3) "Sanitation" further specifies that:

- the floor of every workroom shall remain as dry as practical
- if wet processes are used, proper drainage and dry standing places (mats, platforms) shall be provided where practicable, or appropriate waterproof footgear shall be provided

29 CFR 1910.23 "Guarding floor and well openings and holes" states that:

- every stairway floor opening shall be guarded by a standard railing constructed in accordance with paragraph (e) of 1910.23
- every ladder floor opening, or platform shall be guarded with a standard toeboard on all exposed sides (except at the entrance to opening)
- any floor hole that could be walked into must have a standard railing and toeboard surrounding it
- infrequently used floor holes, such as trapdoors, shall be guarded by a floor opening cover that is of standard strength and construction; when the cover is not in place, the opening shall be constantly attended by someone or shall be protected by removable standard railings

5. DEFINITIONS

Coefficient of friction — This is the measure of how slippery a floor is under dry conditions. Stated formally, it is the magnitude of the horizontal force required to start an object slipping divided by the weight of the object. The generally accepted value is 0.40 to 0.5 or more for most general use floors. The sliding COF is measured with the use of a meter designed to measure slip resistance. (A slip test) The number is lowest on slippery floors so if you do measure you want to increase the number to make it less slippery. The American Slip Meter is preferred.

Friction — The resistance between shoes and the walking surface. The loss of traction or increase in friction can result in a fall. Coulomb friction, named after Charles-Augustin de Coulomb, is an approximate model used to calculate the force of dry friction. It is governed by the equation: $F_{\mathrm{f}} \leq \mu F_{\mathrm{n}}$ where

- F_f is the force exerted by friction (in the case of equality, the maximum possible magnitude of this force).
- μ is the coefficient of friction, which is an empirical property of the contacting materials,
- F_n is the normal force exerted between the surfaces.

Handrail	Horizontal, sloping, or vertical member normally grasped by hand for support. It may be part of the railing system. Every set of steps having three treads and four or more risers shall be equipped with stair railing.
Hazardous location	These include any opening in the walking surface, open sided floors, and any location where a predictable walking routine may be interrupted. Principal hazards include uneven walking surfaces, holes, stairways, and wet areas.
Level or elevation changes	Unexpected changes in the elevation of walkways or sidewalks which create hazards for walkers.
Proper ladder use	Ladders are required to be maintained in good condition and appropriate for the job at hand. Makeshift ladders, stacks of materials, and ladders which are not suited for the job at hand should not be used.
Ramps	Should not be steeper than 30 degrees from the horizontal, and if steeper than 20 degrees, the ramp should be equipped with handrails.
Slip-fall	The loss of balance caused by insufficient friction between the feet and the walking surface.
Slip resistance	All treads and nosing shall be of slip resistant material. Employees are encouraged to wear shoes with slip resistant soles.
Slope	Fixed stairs and steps shall be installed at angles to the horizontal of 30 to 50 degrees, with the preferred slope being 30 to 35 degrees. Heavier use areas should have lower slopes to reduce the chance for stumbling.
Stair design	Standardization of steps and ramps is needed to prevent accidents. Pedestrians need to have stairs and steps which are predictable in construction to avoid falling. Walkways which change in slope and have unmarked single steps should be avoided. Risers and treads should be uniform and have uniform dimensions to avoid tripping.
Trip-Fall	A loss of balance caused by poor lighting, walking on loose surfaces, and uneven footing.
Uniformity of risers and treads	Riser height and tread depth shall be uniform throughout any flight of stairs or steps. Stairs should also be constructed to be comparatively uniform. Sidewalks should be free of unexpected level changes, holes, slopes, obstructions, and single steps.

6. ROLES AND RESPONSIBILITIES

The specific responsibilities outlined in this section must be followed by all employees, faculty, and students. The Environmental Health and Safety Office will educate all employees and students about the common causes of slips, trips and falls in the workplace.

6.1 Environmental Health and Safety Office (EH&S)

a. Will develop, implement, and maintain the Slip, Trip and Fall Prevention Policy
b. Will monitor slip, trip, and fall accident occurrences and determine which physical areas need improvement or modifications.
c. EH&S will assist departments in inspecting buildings for hazards and inform Facilities Management of hazards that are identified. Floor surfaces will be checked for friction to assure the surface is not slippery.
d. Make available training for employees and students on areas where slip, trip and fall hazards are prevalent.

6.2 Facilities Management

a. In common/shared areas, identify and eliminate hazards which can cause slips, trips and falls.
b. Correct floors that have less than a 0.5 coefficient of friction. Non-skid mats should be placed at entrances during inclement weather.
c. Areas which are being worked on and wet should have barricades and signs indicating "Wet Floor" that is visible from either end.

6.3 Employees and Students

a. Adhere to the recommended housekeeping practices and other safe work practices
b. General obligation to clean up spills, pick-up debris and take precautions that other persons are not injured on university property.
c. Report potential hazards to their supervisors immediately.

7. HAZARD CONDITIONS

There are numerous causes of slips and trips, so prevention takes various measures including housekeeping and storage measures, footwear requirements, appropriate work practices, maintenance of walking and working surfaces and employee, faculty and student education and awareness.

7.1 Slips and falls

Slips are primarily caused by slippery or wet surfaces and compounded by wearing the wrong or old footwear. There are two types of slips associated with normal walking; the first occurs when the forward foot contacts the walking surface which slips forward, and the person falls backward.

The second type of slip and fall occurs when the rear foot slips backward as the force to move forward is on the sole of the rear foot which when lifted changes the force to the front of the sole causing the foot to slip back and the person to fall.

Traction is the term used for the force that allows you to walk without slipping. Dry concrete surfaces have good traction while wet surfaces or freshly waxed floors could have low traction. Coefficient of friction (COF) is the measurement for traction which depends on two things: the quality of the walking surface and the condition of the soles of the shoes. The higher the coefficient of friction means there is more friction, resulting in more traction. A COF of 0.40 to 0.50 or more is required for excellent traction.

7.2 Trips, steps, and falls

Trips occur when the front of the foot strikes an object and the upper body is suddenly stopped, throwing it forward resulting in a fall.

A walkway with a slight rise of ⅜" can cause a person to "stub" their foot, trip and fall. This can also occur when going up stairs and a slight difference in the height of subsequent steps can cause a person to trip and fall.

Another occurrence is the "step and fall" when the front foot lands on a surface lower than expected such as stepping off a curb in the dark, the person normally falls forward. Alternately, a fall occurs when one steps forward and down and the foot lands on an object higher than the other side of the foot, causing the ankle to twist and the person to fall forward and sideways.

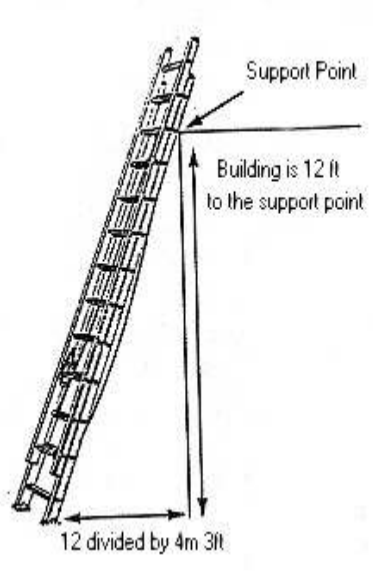
7.3 Falls

In the workplace there are various kinds of falls. Generally, elevated falls are less frequent but more severe than same-level falls.

a. Ladder falls

When an employee is required to use a ladder in the workplace, it should be long enough so it rests against the upper support so that the employee can work with their waist no higher than the top rung of the ladder or above the rung at which the siderails are resting against the upper support. The top three rungs of a straight ladder, or the top two steps of a step-ladder, should never be used for the feet.

Ladders should be set at or as near to a 4:1 angle as possible. The base of the ladder must be firmly set on the ground so that there is no possibility of slippage or sinking into soft ground. The top resting edge of the ladder should have both siderails in contact the building or tree. To prevent a ladder from slipping or sliding, it can be tied at the top to the supporting structure.



Ladders should be inspected for cracks, loose rungs, slivers, and sharp edges before use. Always face the ladder when climbing up and down and do not reach too far left or right of the ladder. A person's belt buckle should never extend beyond the siderails.

b. Vehicle and Equipment falls

Injuries occur in the simple process of climbing in and out of trucks, tractors, machinery, or truck beds. When the metal steps are wet, muddy, or oily, there is a very low COF which increases the risk of falls. When climbing or mounting a vehicle or machine, the employee should have a good handhold before stepping up; this will reduce the force between your shoe and the step thus reducing the danger of a slip and fall.

When stepping down from a truck or machine, step down backward, never "jump" or "fall" down forward, this will prevent the chance of sprains or worse.

c. Loading Dock falls

Loading docks and ramps are dangerous areas as they are frequently congested and heavy traffic areas with working and walking surfaces which are often wet. Loading docks with metal plates can wear smooth and become very slippery especially at the edge of the dock plate which invites trips and falls.

Accidental backward steps can result in falls from the dock. Proper housekeeping, well-designed traffic patterns and the use of skid-resistant surface coating will reduce the risk of slips, trips and falls.

d. Stair falls

Stairwells should be well-lighted with sturdy handrails on both sides. All steps should have the same rise and depth, with visible edges and kept free of oil, water, grease and obstacles which could cause slips, trips and falls.

8. PRACTICES AND PREVENTION

8.1 Housekeeping

Good housekeeping practices may be the most fundamental method in preventing slip, trip and fall incidents. Having a clean and organized University environment will not only help reduces the risk of injuries from these types of incidents, it will also help employees and students work more efficiently and increase morale.

Housekeeping may be delegated to custodial staff in most environments, but it is still everyone's job to keep their campus orderly and clean.

The following housekeeping and general safety procedures can prevent accidents associated with slip, trip and fall hazards:

a. Avoid running or walking too fast, especially in high-risk areas.
b. Avoid carrying items that will obstruct one's view of their walking pathway.
c. Use extra caution when traveling both outdoors and indoors during/following wet weather.
d. Clean up spills immediately, for oil and grease use a suitable cleaning agent.
e. Close file drawers and cabinets when not in use or leaving the area.
f. Electric cords should not be placed in walking areas. If necessary, purchase a rubber step over strip to cover the cords. Persons can fall when their feet become entangled in the cords.
g. Mats should be placed at the doors during rain and inclement weather so that moisture is not spread in the hallways.
h. Do not leave floors wet after cleaning, dry them completely if possible or use barriers and "wet floor" warning signs to keep people off the wet area,
i. Mats and non-slip coatings are recommended for food service preparation areas.
j. Floors, platforms, and walkways should be maintained in good repair and free of oil, grease or water.
k. Aisles should be marked in warehouse and storage areas and should be maintained free and clear of material.
l. Slip hazards must be identified and removed promptly.
m. Keep work areas and walkways well lit.

8.2 Walking Surfaces

Walking surfaces that do not offer adequate traction may need to be modified to reduce the potential for slips.

Practices for improving the slip resistance of walking surfaces include the following:

a. Floors in medical facilities should be finished with non-skid waxes and finishes. Slip-resistant cleaners and polishes can raise the coefficient of friction to 0.8 on dry flooring and 0.5 on wet flooring. The Americans with Disabilities Act recommends 0.6 coefficient of friction for floors and 0.8 for ramps.
b. Abrasive coatings can be applied to concrete, metal, and wood surfaces to increase the level of traction.
c. Various slip-resistant products can be purchased in strips or rolls. These are designed for easy application to stair treads, ramps, and other hazardous surfaces.
d. Another effective slip-resistant material is rubber or rubber-like mats. These can be placed at entrances, around equipment and in areas where contaminants such as water or dirt may accumulate.
e. Rainy season also brings an increased potential for slips. Considerable effort should be made to keep parking lots, sidewalks, and building entries free from water. Any problem areas should be reported promptly so that appropriate action can be taken.

Where wet processes are used, drainage shall be maintained and false floors, platforms, mats, or other dry standing places shall be provided, where practicable, or appropriate waterproof footgear shall be provided.

a. Floor mats **should** be placed in building entrances and higher risk areas where walking-working surfaces may encounter wetness or other slippery conditions.
   Examples of these areas include:
   - Areas adjacent to food counters and food preparation areas
   - Cooking areas
   - Dishwashing areas
   - Frying stations

b. The design of floor mats should have the following features:
   - Slip resistant surface on both top and bottom sides.
   - Mats with beveled or flat edges or a similar design help reduce the likelihood of workers and students tripping on the mat's edges.
   - To help promote drainage and prevent accumulation of water and grease, the use of slots or a similar design may prevent slips.
   - The use of antibacterial treatment or a similar design to help prevent the growth of mold and mildew.

c. Floor mats should not be installed and used in a way where the mat itself becomes a slip or trip hazard.

8.3 Footwear

On NSU campuses where the floors may frequently be oily or wet, prevention of fall incidents should include the selection of proper footwear. The material of the heel and sole of footwear is a major factor in its ability to be slip-resistant. In general, softer compounds are more slip-resistant than harder materials because they more effectively "grab" a floor surface.

Employees who work in potentially higher risk slippery areas must wear slip-resistant footwear.

The following should be considered when selecting slip-resistant footwear:

a. Design, tread hardness, and shape of sole and heel. (i.e. High elastic soles with raised-tread and crosshatch patterns are more slip-resistant compared to rough and flat soles. Tread patterns should cover the whole sole and heel area.)
b. Proper Level of slip-resistance (i.e. Polyurethane and microcellular urethane soles are more slip-resistant compared to nitrite and styrene rubber).
c. Tread support and comfort.
d. Crepe soles are recommended for wet or dry rough concrete, but are not suggested for tile, smooth concrete, or wood surfaces.
e. Leather soles can become slippery if wet and are not recommended for dry smooth concrete or tile.
f. Soft rubber soles are preferred for dry surfaces but are not suggested for wet surfaces or greasy concrete.
g. Hard rubber soles are best for greasy concrete and wood. They are not recommended for ceramic tile, dry or wet concrete and dry wood.

8.4 Changes in Elevation

Elevation changes are a source of trip accidents. Even a change in a walking surface of ¼ - ½" or greater will be sufficient to cause a trip. Curbs, cracks in the sidewalk, ramps and a single step are all examples of trip hazards.

Changes in elevation are sometimes unavoidable, but there are some simple ways to reduce accidents caused by these hazards:

a. Place signs to warn walkers of bumps or changes in elevation
b. Use adhesive caution tape to mark changes in elevation or paint curbs or steps yellow to warn walkers.
c. If changes in elevation are temporary, use barricades to create an alternative route to avoid the hazard.

8.5 Personal Factors

There are several personal factors that may increase an individual's risk of a slip, trip or fall.

- Age
- Body shape or mass
- Gait dynamics (the way an individual walks)
- Physical condition
- Perception
- Psychological and psychosocial factors (stress and distractions)

One must be a "defensive walker." Listed below are some ways to alter your behavior and avoid hazards:

a. Watch where you are going while walking—pay attention and look for slip, trip and fall hazards.
b. Walk, don't run. Make sure to give yourself enough time to get where you're going.
c. Don't engage in activities that may be distracting. For example, reading, writing or texting while walking.
d. Use handrails while climbing or descending stairs.
e. Check that your walkway is clear and that your view is not blocked before you lift anything.
f. Walk carefully and slowly when you transition from one walking surface to another.
g. Slow down and take small steps if the walking surface is cluttered, narrow, uneven, slippery or at an angle.
h. Wear stable shoes with non-slip soles.

8.6 Environmental Factors

Environmental factors to be aware of that could contribute to a slip, trip or fall accident include:

- Temperature and humidity
- Precipitation
- Type and volume of traffic in walking areas

- Walking surface
- Lighting conditions in walking area

Many of these conditions are out of an individual's control. Wear the right shoe for the weather and walking conditions. Walking cautiously will help prevent accidents.

9. RECORDKEEPING

Each department should keep records of health and safety training for at least three years.

10. TRAINING

All employees, faculty and students shall receive education and training on slip, trip and fall hazards and how to prevent accidents. The EH&S office will train all facilities staff on the procedures to maintain and ensure all campuses are safe from slip, trip and fall hazards.

11. SELF-INSPECTION, AUDITS

Inspections to identify slip, trip and fall hazards are recommended annually, ideally prior to the wet season. For areas that are at a higher risk, inspections should be performed more frequently.

Appendix A – Slip, Trip, and Fall Hazards Audit Checklist.

APPENDIX A

Slip, Trip, and Fall Hazards Audit Checklist						
Campus:		Building:				
Building Manager:		Area:				
General Work Environment		**Yes**	**No**	**N/A**	**Comments**	
1	Are all campus sites clean, sanitary, and orderly?					
2	Adequately lit?					
3	Work surfaces kept dry?					
4	Spills cleaned up immediately according to proper procedures?					
5	Regulated waste discarded according to federal, state and local regulations?					
6	Accumulations of combustible dust routinely removed from elevated surfaces?					
7	Oily and paint-soaked waste discarded in covered metal waste cans?					
Aisles and Walkways		**Yes**	**No**	**N/A**	**Comments**	
1	Aisles and walkways kept clear?					
2	Aisles and walkways are marked as appropriate?					
3	Aisles and walkways are adequately lit?					
4	Aisles and walkways are free of surface defects?					
5	Mats and carpets properly anchored with no worn, frayed or upturned edges?					
6	Wet surfaces covered with high-traction material?					
7	Walkway free of producing objects					
8	Walkway free of cords, cable wiring, open drawers, and other obstacles?					
9	Slight changes in elevation clearly identifiable?					
10	Adequate headroom?					
11	Guardrails provided when walkway is elevated?					
12	Bridges provided over conveyors and similar hazards?					
13	Are standard guardrails provided wherever aisle or walkway surfaces are elevated more than 30 inches above any adjacent floor or ground?					
Stairs, Stairways and Ramps		**Yes**	**No**	**N/A**	**Comments**	
1	Adequately lit?					
2	Generator or battery powered emergency lighting available?					
3	Are there handrails on all stairways with four or more risers and on ramps?					
4	Are stairways at least 22 inches wide?					
5	Do stairs that change direction have landing platforms?					

Slip, Trip, and Fall Hazards Audit Checklist						
Campus:		Building:				
Building Manager:		Area:				
Stairs, Stairways and Ramps		**Yes**	**No**	**N/A**	**Comments**	
6	Are stair angles between 30 and 50 degrees?					
7	Are the stairs of uniform size and shape?					
8	Do steps have slip-resistant surface and nosing?					
9	Are the handrails between 30 - 34" from the leading edge of the stair treads					
10	Are handrails located at least 3" from the wall they are mounted on?					
Floor and Wall Openings		**Yes**	**No**	**N/A**	**Comments**	
1	Are openings guarded by a cover, guardrail or equivalent					
2	Are toeboards installed the edges of permanent floor openings?					
3	Are grates or similar type covers over floor openings designed so that foot traffic or rolling equipment will not get caught?					
Elevated Surfaces		**Yes**	**No**	**N/A**	**Comments**	
1	Are signs posted showing elevated surface load capacity?					
2	Are guardrails on surfaces elevated more than 30" above the floor or ground?					
3	Are elevated surfaces provided with 4" toeboards?					
4	Is the required headroom provided?					
5	Is material placed on elevated surfaces, piled, stacked, or racked in a manner to prevent it from tipping, falling, collapsing, rolling or spreading?					
Ladders		**Yes**	**No**	**N/A**	**Comments**	
1	Are ladders free of cracks, loose rungs and sharp edges?					
2	Are ladders free of dirt and grease?					
3	Do ladders have slip resistant grips?					
Parking lots and Sidewalks		**Yes**	**No**	**N/A**	**Comments**	
1	Are kept clear of fallen timber/debris as well as loose gravel?					
2	Are curbs and ramps properly color coded?					
3	Adequately lit?					
4	Free of surface defects or breaks?					
5	Slight changes in elevation clearly identifiable?					
6	Are fluids cleaned up immediately?					

APPENDIX B

OSHA Standards:

Stairway railings and guards.

1910.23(d)(1)
Every flight of stairs having four or more risers shall be equipped with standard stair railings or standard handrails as specified in paragraphs (d)(1)(i) through (v) of this section, the width of the stair to be measured clear of all obstructions except handrails:

1910.23(d)(1)(i)
On stairways less than 44 inches wide having both sides enclosed, at least one handrail, preferably on the right-side descending.

1910.23(d)(1)(ii)
On stairways less than 44 inches wide having one side open, at least one stair railing on open side.

1910.23(d)(1)(iii)
On stairways less than 44 inches wide having both sides open, one stair railing on each side.

1910.23(d)(1)(iv)
On stairways more than 44 inches wide but less than 88 inches wide, one handrail on each enclosed side and one stair railing on each open side.

1910.23(d)(1)(v)
On stairways 88 or more inches wide, one handrail on each enclosed side, one stair railing on each open side, and one intermediate stair railing located approximately midway of the width.

1910.23(d)(2)
Winding stairs shall be equipped with a handrail offset to prevent walking on all portions of the treads having width less than 6 inches.

1910.23(e)
"Railing, toe boards, and cover specifications."

1910.23(e)(1)
A standard railing shall consist of top rail, intermediate rail, and posts, and shall have a vertical height of 42 inches nominal from upper surface of top rail to floor, platform, runway, or ramp level. The top rail shall be smooth-surfaced throughout the length of the railing. The intermediate rail shall be approximately halfway between the top rail and the floor, platform, runway, or ramp. The ends of the rails shall not overhang the terminal posts except where such overhang does not constitute a projection hazard.

1910.23(e)(2)

A stair railing shall be of construction similar to a standard railing, but the vertical height shall be not more than 34 inches nor less than 30 inches from upper surface of top rail to surface of tread in line with face of riser at forward edge of tread.

1910.23(e)(3)(i)
For wood railings, the posts shall be of at least 2-inch by 4-inch stock spaced not to exceed 6 feet; the top and intermediate rails shall be of at least 2-inch by 4-inch stock. If top rail is made of two right-angle pieces of 1-inch by 4-inch stock, posts may be spaced on 8-foot centers, with 2-inch b y 4-inch intermediate rail.

1910.23(e)(4)
A standard toeboard shall be 4 inches nominal in vertical height from its top edge to the level of the floor, platform, runway, or ramp. It shall be securely fastened in place and with not more than 1/4-inch clearance above floor level. It may be made of any substantial material either solid or with openings not over 1 inch in greatest dimension.
Where material is piled to such height that a standard toeboard does not provide protection, paneling from floor to intermediate rail, or to top rail shall be provided.

1910.23(e)(5)(i)
A handrail shall consist of a lengthwise member mounted directly on a wall or partition by means of brackets attached to the lower side of the handrail so as to offer no obstruction to a smooth surface along the top and both sides of the handrail. The handrail shall be of rounded or other section that will furnish an adequate handhold for anyone grasping it to avoid falling. The ends of the handrail should be turned in to the supporting wall or otherwise arranged so as not to constitute a projection hazard.

1910.23(e)(5)(ii)
The height of handrails shall be not more than 34 inches nor less than 30 inches from upper surface of handrail to surface of tread in line with face of riser or to surface of ramp.

1910.23(e)(5)(iii)
The size of handrails shall be: When of hardwood, at least 2 inches in diameter; when of metal pipe, at least 1 1/2 inches in diameter. The length of brackets shall be such as will give a clearance between handrail and wall or any projection thereon of at least 3 inches. The spacing of brackets shall not exceed 8 feet.

1910.23(e)(5)(iv)
The mounting of handrails shall be such that the completed structure is capable of withstanding a load of at least 200 pounds applied in any direction at any point on the rail.

1910.23(e)(6)
All handrails and railings shall be provided with a clearance of not less than 3 inches between the handrail or railing and any other object.

1910.23(e)(7)
Floor opening covers may be of any material that meets the following strength requirements:

Fixed stairs

1910.24(b)
"Where fixed stairs are required." Fixed stairs shall be provided for access from one structure level to another where operations necessitate regular travel between levels, and for access to operating platforms at any equipment which requires attention routinely during operations. Fixed stairs shall also be provided where access to elevations is daily or at each shift for such purposes as gauging, inspection, regular maintenance, etc., where such work may expose employees to acids, caustics, gases, or other harmful substances, or for which purposes the carrying of tools or equipment by hand is normally required. (It is not the intent of this section to preclude the use of fixed ladders for access to elevated tanks, towers, and similar structures, overhead traveling cranes, etc., where the use of fixed ladders is common practice.) Spiral stairways shall not be permitted except for special limited usage and secondary access situations where it is not practical to provide a conventional stairway. Winding stairways may be installed on tanks and similar round structures where the diameter of the structure is not less than five (5) feet.

1910.24(c)
"Stair strength." Fixed stairways shall be designed and constructed to carry a load of five times the normal live load anticipated but never of less strength than to carry safely a moving concentrated load of 1,000 pounds.

1910.24(d)
"Stair width." Fixed stairways shall have a minimum width of 22 inches.

1910.24(e)
"Angle of stairway rise." Fixed stairs shall be installed at angles to the horizontal of between 30 deg. and 50 deg. Any uniform combination of rise/tread dimensions may be used that will result in a stairway at an angle to the horizontal within the permissible range.

1910.24(f)
"Stair treads." All treads shall be reasonably slip-resistant and the nosings shall be of nonslip finish. Welded bar grating treads without nosings are acceptable providing the leading edge can be readily identified by personnel descending the stairway and provided the tread is serrated or is of definite nonslip design. Rise height and tread width shall be uniform throughout any flight of stairs including any foundation structure used as one or more treads of the stairs.

1910.24(g)
"Stairway platforms." Stairway platforms shall be no less than the width of a stairway and a minimum of 30 inches in length measured in the direction of travel.

1910.24(h)
"Railings and handrails." Standard railings shall be provided on the open sides of all exposed stairways and stair platforms. Handrails shall be provided on at least one side of closed stairways preferably on the right side descending. Stair railings and handrails shall be installed in accordance with the provisions of 1910.23.

1910.24(i)
"Vertical clearance." Vertical clearance above any stair tread to an overhead obstruction shall be at least 7 feet measured from the leading edge of the tread.