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ABSTRACT

This handbook presents some general guidelines that may be used to increase the safety of public playgrounds. Information is provided about hazards associated with the use of public playground equipment, and suggestions are made to reduce the frequency and severity of injuries. A discussion is presented on playground-related injuries and the common accident patterns associated with children's play. Measures are suggested for designing playgrounds which take into account children's use of equipment. A section is included which offers ways to make existing playgrounds safer. The handbook concludes with a series of checklists which may be helpful in maintaining playground safety. (JD)

A HANDBOOK FOR
PUBLIC PLAYGROUND SAFETY

Volume I: General Guidelines for New and Existing Playgrounds

U.S. CONSUMER PRODUCT SAFETY COMMISSION
WASHINGTON, D.C. 20207

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1. Introduction

There are many kinds of public playgrounds in use today, and a wide variety of equipment available. Playgrounds with traditional slides, swings, and jungle gyms have been used and enjoyed for years. The most recent trends toward innovative play spaces—adventure or developmental playgrounds, for example—have inspired unique and unconventional equipment. Some communities have constructed playgrounds with components such as railroad ties and tires; others have chosen new equipment from manufacturers' catalogues.

While this handbook does not cover all the different types of equipment which exist, it does present some general guidelines that responsible officials and parents may use to increase the safety of public playgrounds for our children. The handbook is intended to provide information about hazards associated with the use of public playground equipment and suggestions for helping to reduce the frequency and severity of injuries.

Children use playground equipment in many diverse, yet predictable, ways. This booklet begins with a discussion of playground related injuries and the common accident patterns associated with children's play. The next section, devoted to planning new playgrounds, suggests measures for designing playgrounds which take into account children's reasonably foreseeable use of equipment. In addition, we have included a section which suggests ways to make existing playgrounds safer. Because the life of equipment can range from 15-20 years, updating and maintaining playgrounds and equipment are essential for continued safety. The handbook concludes with a series of checklists which may be helpful in maintaining playground safety.

The Consumer Product Safety Commission (CPSC) has also developed a companion handbook that suggests technical guidelines and test procedures to help manufacturers and installers assure the structural integrity and safety of the equipment. Manufacturers, playground planners and designers, installers, and equipment purchasers, such as park and recreation and school system officials, may be interested in the more technical guidelines presented in companion Volume II: *Technical Guidelines for Equipment and Surfacing.* Copies of both volumes can be obtained by writing the Consumer Product Safety Commission, Washington, D.C. 20207.

2. Background

The CPSC has been studying public playground equipment for a number of years in an attempt to reduce playground injuries. In 1977 alone, for example, an estimated 93,000 injuries associated with public playground equipment were treated in hospital emergency rooms.

The Commission first became involved with playground safety in 1974, when a consumer petitioned CPSC to develop mandatory safety standards for public playground equipment. The National Recreation and Park Association (NRPA) was selected by the Commission to develop a draft standard. In 1976, when the NRPA draft standard was completed, the Commission contracted with the National Bureau of Standards for additional technical work needed to revise the NRPA recommended standard. Because surfaces under equipment appeared to play a major role in equipment injuries, the Commission also asked NBS to develop a method for testing various surfaces commonly used under playground equipment. The results of the NBS studies and research provide the basis for this two-volume handbook for public playground safety.

While the Commission's initial work was clearly oriented toward developing mandatory safety standards for equipment, the Commission decided not to issue such a mandatory standard. Over the years, its evaluation of playground safety led the Commission to conclude that a mandatory specification rule by itself would not adequately address the problem of playground injuries. Such factors as the diverse ways equipment is used, the varying quality of supervision on equipment, equipment placement, and equipment maintenance all play a part in playground injuries. In addition, most injuries associated with playground equipment involved falls, which would not be addressed by equipment specifications alone.

The Commission believes, however, that the results of the studies and research conducted by the NRPA and NBS can serve as **guidelines** for the design of public playground equipment, and can be used by people involved with playground safety to help reduce the frequency and severity of injuries associated with equipment. Technical rationale is provided to explain each guideline. The guidelines are not a CPSC standard and are not mandatory requirements.

Since the guidelines are not a CPSC standard, the Commission is not endorsing them as the exclusive method of safe playground equipment construction. The Commission believes, however, that the safety features in many of the guidelines, such as those addressing protrusions, slip-resistant surfaces, durability and stability, and so forth, will contribute to greater equipment safety, and that publication of the guidelines as a whole will promote greater safety consciousness among manufacturers and purchasers of equipment.

The guidelines are recommended for playground equipment intended for use in play areas of parks, schools, institutions, multiple family dwellings, private resorts and recreation developments, and other areas of public institutional use. The guidelines are not intended to apply to amusement park equipment, equipment normally intended for sports' use or to home playground equipment. Components of equipment intended solely for use by the handicapped and necessarily modified to accommodate such users safely are also not covered by these guidelines.

3. Playground Injuries

The Commission became concerned about the safety of public playground equipment after examining the number and kinds of injuries associated with use of the equipment. A December 1978 CPSC *Hazard Analysis*, for example, estimates that in 1977 about 93,000 people were treated in hospital emergency rooms for injuries associated with public playground equipment. Children 10 years of age or younger suffered 4 out of 5 of the injuries. Some of these injuries were caused when children were struck by moving pieces of equipment such as swings and gliders. Other children were injured when they caught an extremity such as a finger at a pivot or pinch point, or ran or fell against protruding bolts, screws or other hardware on the equipment. Seven out of every ten injuries, however, were caused by falls—the most common playground accident.

The type of surface on the playground was a major factor affecting the number and severity of injuries associated with falls. Falls onto paved surfaces resulted in a disproportionately high number of severe injuries. While protective surfaces such as wood chips, shredded tires, sand, etc. may not have reduced the number of injuries from falls, these materials may have reduced the severity of the injuries.

The following table[1] presents the estimated percentage of public playground equipment related injuries according to the manner in which the injuries occurred:

Falls to surface	59%
Falls - struck same piece of equipment	11%
Falls - from one piece of equipment and struck another piece of equipment	2%
Falls-subtotal	72%
Impact with moving equipment	7%
Contact with protrusions, pinch points, sharp edges and sharp points	5%
Fell against, onto or into stationary equipment	8%
Unknown	8%
Total	100%

(1) Source: NEISS emergency room based special study April 10, 1978 - May 1, 1978, U.S. Consumer Product Safety Commission, Directorate for Hazard Identification and Analysis.

Hazards Relating to the Most Common Types of Public Playground Equipment

Traditional categories of playground equipment— swings, slides, seesaws, climbers, and merry-go-rounds— are used in many playgrounds throughout the country. The following table[2] compares the estimated percentage of injuries related to a particular type of equipment with the percentage of that equipment in use:

	INJURIES	EQUIPMENT IN USE
Climbers	42%	51%
Swings	23%	20%
Slides	16%	12%
Merry-go-rounds	8%	5%
Seesaws	5%	6%
All other	6%	6%
	100%	100%

Typical accident patterns associated with these conventional types of public playground equipment are described below.

Climbing Apparatus. Falls accounted for 72 percent of the injuries from climbing apparatus such as monkey bars, chinning bars, etc. Victims fell when they slipped, lost their grip or lost their balance. Falls occurred when children were swinging from rung to rung, performing stunts and jumping on, or from, bars.

Swings. Sixty-nine percent of the injuries related to swings occurred when children fell or jumped from the swings. Twenty-six percent of the injuries resulted when the children were struck by a moving swing.

Slides. Seventy-eight percent of the injuries on slides were the result of falls over the side, from the platform, and from the ladder. Falls were caused by roughhousing, walking up and down the slide, losing one's grip, slipping, and

(2) Source: NEISS emergency room based special study, April 10, 1978 - May 1, 1978 and Consumer Deputy Study of Playground Surfaces, September 13, 1978 - October 16, 1978, U.S. Consumer Product Safety Commission, Directorate for Hazard Identification and Analysis.

losing balance. Other victims hit protruding bolts, struck the slide rim and edge, or slipped on the ladder and struck the steps.

Merry-go-rounds. Most of the injuries associated with merry-go-rounds resulted from falls when children either lost their grip and were thrown from the merry-go-round, fell down while pushing it, or fell while riding it. In some instances those who were pushing were struck by the device. Those who fell while on the merry-go-round either struck or were struck by other gripping bars, or struck the base itself.

Seesaws. Although about one out of every six injuries occurred when the victim was hit by a moving seesaw, most injuries resulted from falls. In some cases, the victims were punctured by long splinters from worn, poorly maintained or damaged wooden seesaws.

Other. Other types of equipment involved in injuries were spring action riding equipment, rope or tire swings, etc. Typically, falls contributed to over half of the injuries associated with this equipment.

4. Planning a New Playground

Surfacing

As indicated in the preceding chapter on playground injuries, falls are the most common type of playground accident. Commission studies show that the majority (from 60 to 70 percent) of playground-related injuries are caused when children fall from the equipment and strike the underlying surface. Nearly half the injuries that result from falls are to the head, and range in severity from minor bruises to skull fractures, concussions, brain damage, and even death.

Until recently, little information was available on the relative ability of surfacing materials to protect children from head injuries resulting from falls. Therefore, the Commission sponsored research by the National Bureau of Standards to develop a method for assessing the energy absorbing characteristics of playground surfaces and to test several commonly used surfaces.

Analyses of the test results indicate that, while they may require little maintenance or repair, **hard surfacing materials such as asphalt and concrete do not provide injury protection from accidental fall impacts and are therefore unsuitable for use under public playground equipment.** More resilient surfacing materials such as bark, wood chips, or shredded tires, for example, appear to provide greater protection to a child in the event of a fall. However, these materials require continuous maintenance to retain their optimum cushioning effectiveness.

The choice of surfacing material will, of course, be based in part upon local conditions and financial considerations. The following descriptions of some surfacing materials and the environmental conditions which affect them are offered to help planners in weighing the advantages and disadvantages of various surfaces.

Organic Loose Materials (Pine Bark Nuggets, Pine Bark Mulch, Shredded Hardwood Bark, Cocoa Shell Mulch). The cushioning potential of these materials depends upon the air trapped within and between the individual particles. Therefore, if materials decompose and become pulverized over a period of time, or mix with dirt, they will tend to lose their cushioning properties. Cushioning protection is also decreased in rainy or humid weather when the materials absorb moisture and tend to pack down, or if the temperature drops and the wet

materials freeze. Moisture can also promote the growth of various types of microorganisms which might allow transmission of communicable diseases.

Because strong winds can erode these materials, reducing the thickness required to protect against injury, and because the playing action of children can push the protective materials away from fall areas, frequent grading and leveling are necessary to maintain a suggested 6 inch depth. Careful maintenance is also necessary to eliminate insects, animal excrement and other trash or litter such as broken glass, nails, metal tabs from cans, pencils or other sharp objects which can be concealed by loose material. The cushioning protection that the materials provide against injuries from falls, however, makes the extra care worth the effort.

Inorganic Loose Materials (Sand, Pea Gravel, Shredded Tires, etc.). Like organic loose materials, these materials also require frequent leveling to replace material that is pushed or blown away from fall areas, and grading or sifting to remove foreign matter. Under conditions of constant use, the materials may combine with dirt or other matter, thus reducing their cushioning properties. Again, moisture tends to make the materials more cohesive, therefore less cushioning. When sand, for example, is thoroughly wet, it loses its resiliency. In wet, freezing conditions, some materials solidify into hard, packed ice. Other types, such as pea gravel, may be difficult to run or walk on. Inorganic, like organic loose fill materials, may be blown or thrown into children's eyes. Some types of rock can also release dust which can irritate the skin or nose and mouth.

Compact Materials (Outdoor Rubber Mats, Indoor Gym Mats, Synthetic Turf, etc.). While the cushioning properties of these materials will depend upon the foundation or surface over which the material is installed, unitary or whole materials such as rubber mats generally do provide protection from falls from 5 feet or less. The materials should always be used on essentially level, uniform surfaces. Compact materials require little maintenance; however, they may be attractive targets for defacing, ignition, or other vandalism.

Soil. In general, soils appear to offer more protection from injuries than do asphalt or concrete, but less than do loose surfacing materials. Grass may provide additional cushioning, but is difficult to maintain in areas of heavy use. Soil will be influenced by many of the environmental factors described above.

Concrete, Asphalt and Paved Surfaces. Although paved surfaces require little or no maintenance, they are major contributors to playground injuries. **Concrete, asphalt and similar materials are not recommended for use under playground equipment because of their hard, unyielding characteristics.**

Layout and Design

To encourage a child's perceptual and motor development, a well-planned playground should offer a wide variety of play opportunities. Activities which involve running, walking, climbing, dodging, swinging, sliding, catching and throwing, or pulling and pushing, for example, help children learn to move confidently, gain muscle strength and control, and refine their coordination. Of course, many playgrounds are used by different age groups whose interests and abilities vary greatly. To allow the space appropriate to both the child and the activity, therefore, some planners set aside sections of the playground for special use.

For example, playgrounds might include:

- an open field for ball games, tag, kite-flying, etc. where children will have the freedom to run without jeopardizing the safety of others playing nearby;
- an area for pre-school children, equipped with appropriately sized swings, low slides, sand boxes, etc.;
- an apparatus area for conventional playground equipment;
- a free play area for activities such as tether tennis or hopscotch;
- a paved, multiple use area for court games, dancing, general play;
- an area for quiet activities or individual play such as arts and crafts, music, drama, solitary games; and
- other options such as wading pools, shelter houses, and landscaped areas.

Apart from the creative play opportunities which these special use areas can provide, the separation of play spaces will contribute to playground safety. Young children can be protected from the more active play of older children. Thought may also be given to separate

but adjoining play areas for handicapped children. Because of their disabilities, handicapped children may respond more slowly, either physically or mentally, to hazardous situations. Some newer playgrounds have been designed to provide activities which all children can share, and equipment which all can use safely and creatively.

No matter how play areas are organized, however, it is essential to provide adequate space around each piece of playground equipment. Planning should take into account the equipment's "use zone," that is, any activity or movement which can be expected around the equipment. For example, sufficient space should be allotted for swing sets to accommodate the largest arc through which the swing travels, including a child's extended legs. Adequate room must also be provided for children to exit slides, jump from swings, and "spin-off" from merry-go-rounds. Buildings, paths and walkways, gates, fences, and other play areas such as sand boxes should be located at least 8 feet away from the estimated use zone associated with a piece of playground equipment.

Equipment should also be arranged to accommodate the traffic of children at play. For example, playground apparatus should be placed away from ball fields or other areas where running children, intent upon their games, may accidentally move in front of swings, exit areas of slides, etc. Also, equipment should be placed so that one area is not overcrowded while another area remains underused. Poorly placed equipment can lead to misuse and accidents.

Generally, mapping out playground space before purchasing or installing permanent pieces of play equipment can encourage varied and safe activity. As areas are mapped out, planners should consider the traffic patterns which will result. Ample pathways should link activity areas, provide easy access from one piece of equipment to another and offer unobstructed vision from a child's height. Smoothly flowing traffic will eliminate many accidents such as collisions between children and equipment and between children and other children.

Planners should try to keep the site free from major visual barriers which would hamper supervision of the entire space. A fence or a relatively impenetrable border such as shrubbery or trees should enclose the entire site to keep children within the grounds and prevent them from running into the street. The playground should be designed to permit maximum drainage so it can dry out as quickly as possible.

Whenever space and resources permit, consideration should be given to providing restroom facilities and pay telephones with permanently posted emergency numbers. Benches or other seating are usually appreciated by both children and adults.

Equipment

While manufacturers of public playground equipment conduct extensive tests of design and structural integrity, purchasers of equipment can help further playground safety by carefully reading and following information supplied with the equipment. Instructions for properly assembling equipment, including drawings, photos and other illustrations provided with each piece of playground equipment, should be followed carefully. To assure that equipment is properly installed, all directions, such as specifications for tightening nuts and bolts, must be adhered to.

Equipment selected should be constructed of materials which have proved durable in a playground or other outdoor setting. Metals should be painted or galvanized to prevent rust, and wood surfaces treated to prevent wood rot. No substances should be used in the material or treatment processes that, if released from equipment, could injure children if ingested, inhaled, or absorbed through the skin.

Purchasers should heed the manufacturers' recommendations for equipment spacing, as well as any warnings which caution against installing playground equipment over hard or unyielding surfaces. Many promotional materials and installation instructions will warn against placing equipment over paved surfaces such as concrete and asphalt because falls to these surfaces result in more severe injuries than do falls to more resilient surfaces.

Manufacturers should also provide instructions for anchoring equipment securely to the ground and directions for maintenance and general upkeep. Whenever possible, a permanent, durable label should appear on each unit identifying the manufacturer, unit model, month and year of manufacture. This data will allow purchasers to reach the manufacturer for additional information or to order parts for repairs.

The following guidelines for equipment safety were suggested by studies conducted by the National Bureau of Standards for the CPSC. These guidelines are not mandatory requirements for the design and construction of public playground equipment, and the Commission is not endorsing particular specifications in the guidelines. However, the Commission believes that publishing guidelines in this fashion will promote safer equipment.

General Hazards

Entrapment. No component or group of components should form angles or openings that could trap any part of a child's body or a child's head. If part of an accessible opening is too small to allow children to withdraw their heads easily and the children are unable to support their weight by means other than their heads or necks, strangulation may result. Swinging exercise rings (See Figure 1) with diameters of 5 to 10 inches, for example, could present such an entrapment hazard and should be removed.

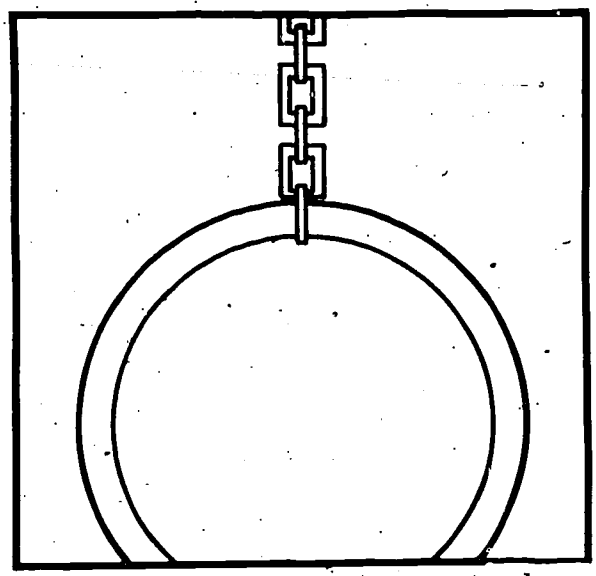


FIGURE 1

Similarly, children might become caught while trying to climb between narrowly spaced horizontal bars. If the distance between the bars is less than the height of a child's head, children will have difficulty rotating their heads backward to free them.

Clothing Entanglement. In general, accessible parts of moving apparatus and components next to sliding surfaces—ladders and uprights, protective barriers, handrails, etc.—should be designed so they cannot catch a child's clothing. If clothing is entangled, the equipment's or child's momentum is often great enough to cause loss of balance or an injury.

Sharp points, corners, and edges; pinch and crush points; protrusions and projections. Playground equipment should present no accessible sharp edges or protruding points or ends that could cut or puncture children's skin or catch their clothing (See Figures 2 and 3).

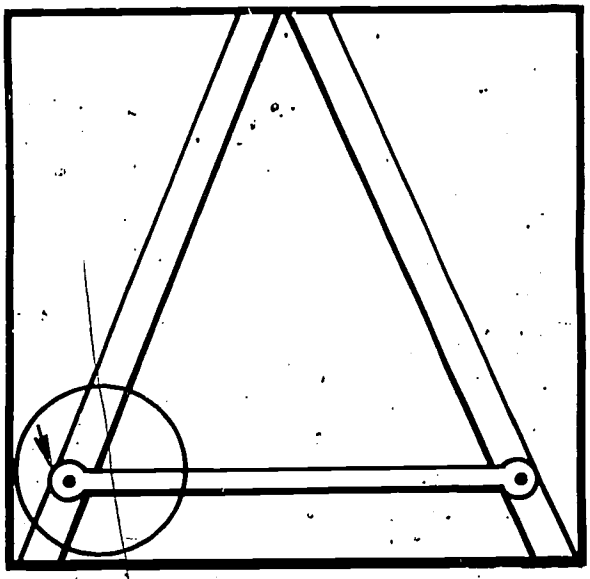


FIGURE 2

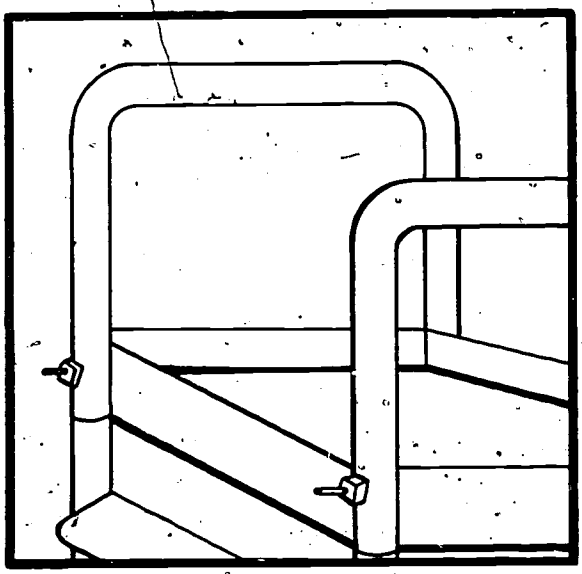


FIGURE 3

Manufacturers usually provide self-locking nuts or other devices to prevent nut and bolt assemblies from coming apart; these fasteners and exposed ends of bolts should be covered with smoothly finished protective caps which,

when correctly installed, are not removable by hand. Similarly, exposed ends of tubing which can lacerate or puncture a child's skin on impact should be covered with caps or plugs. Open ended "S" hooks (See Figure 4) that can catch clothing should also be avoided. If there are such open hooks, pinch the ends tightly closed.

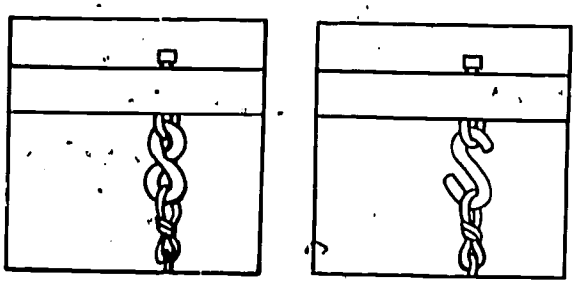


FIGURE 4

Whenever possible, avoid equipment with accessible pinch, crush, or scissor-like areas caused by adjacent moving components. Unprotected moving parts on gliders, merry-go-rounds, or seesaws, for example, could crush or pinch a child's fingers.

Guidelines for Specific Equipment

Climbing Equipment. Jungle gyms, monkey bars, geometric domes, and horizontal and arch ladders are popular types of climbing equipment. Other pieces may be designed to represent animals, ships, trains, etc. Regardless of configuration, the spacing of support members and climbing bars should be closely examined to ensure that it is neither too wide nor too tall to match children's arm or leg reaching abilities. Rungs of horizontal ladders, climbing bars, handrails, and other components intended to be gripped by the hands should be designed to be easily grasped by a child's hands. Preferably the components should be cylindrical and approximately 1¼ inches in diameter, a size which average five-year-old children can grip comfortably and securely.

Climbing equipment should not lure a child to make an easy climb to the top without providing a way for the child to descend as easily, or furnishing a way out to another platform or piece of equipment for descent. A simple arch ladder, for example, may not offer an easy "way out" option. A child who begins this activity is forced to complete it, especially if others are waiting a turn to use the equipment.

Using bright, contrasting colors on rungs or steps of climbing equipment can help children to perceive distances more accurately, thus improving their spatial judgment. Highly textured, slip resistant materials may enhance a child's gripping ability while at the same time increasing the amount of sensory feedback received while climbing.

Swings. Frequently swings stand as separate units on a playground. There may be from two to six or more swings in a series. A minimum clearance of 18 inches is recommended between the outside edges of swings and between the swings and nearby components such as frames or supporting structures. Clearance may need to be greater for tire swings or other swings that move in more than the traditional forward-backward direction. If the clearance is insufficient, swings may accidentally bump one another or other pieces of equipment. On the other hand, too wide a clearance might encourage a hazardous flow of traffic. Swings on swing sets should be located away from other activities or equipment to help prevent children from running into moving swings while chasing balls or when distracted by other activities.

A free swinging, empty swing seat can cause serious injury if it hits a child's head. Such an impact can result when children wander into the path of a swinging seat. To reduce the risk of serious injury, seats should be constructed of lightweight material such as plastic, canvas, or rubber. To help prevent cuts or scrapes, all seats should have smoothly finished or rounded edges. Tire swings are popular because they permit multiple occupancy and may provide less potential for harmful impact. Support frames for all swing sets should be designed to discourage climbing.

Slides. Sliding boards range from 4 to 16 feet in height and may be straight, spiral, wave or tubular (totally enclosed). Some short slides are wide enough to permit children to slide side by side.

To reduce the possibility of excessive speed, the average incline of the sliding surface should not exceed 30 degrees. Most slides available today have slide beds that are twice as long as they are high, with a resulting average incline of about 26 degrees. This design provides for a reasonably safe sliding speed.

Slides over 4 feet high should be equipped with sides at least 2½ inches in height for the

entire length of the sliding surface. These barriers also serve as hand and foot guides to help prevent falls off the edges of the slide.

Protective barriers for the area at the top of the slide help prevent falls while the child is changing from a climbing to a sliding position. As a safety precaution, slides over 4 feet high should have barriers at least 38 inches high. Solid barriers, or barriers with vertical rather than horizontal cross pieces, may discourage climbing. A horizontal platform at least 10 inches in length and as wide as the sliding surface at its entrance will help children easily make the transition from climbing to sliding.

Exit surfaces at the bottom of slides over 4 feet high should be at least 16 inches long and essentially parallel to the ground. To help children regain their upright posture and balance when their feet touch ground, the height of the exit should be between 9 and 15 inches above the ground. All slide exits should be located in uncongested areas out of the way of other play traffic.

Steps and rungs on slides and other equipment should be evenly spaced with at least 7 and not more than 11 inches between them to accommodate the arm and leg reaches of children. Steps and rungs should be at least 15 inches wide and horizontal to within plus or minus 2 degrees and corrugated, grooved or covered with a permanent slip resistant finish that is effective under both wet and dry conditions.

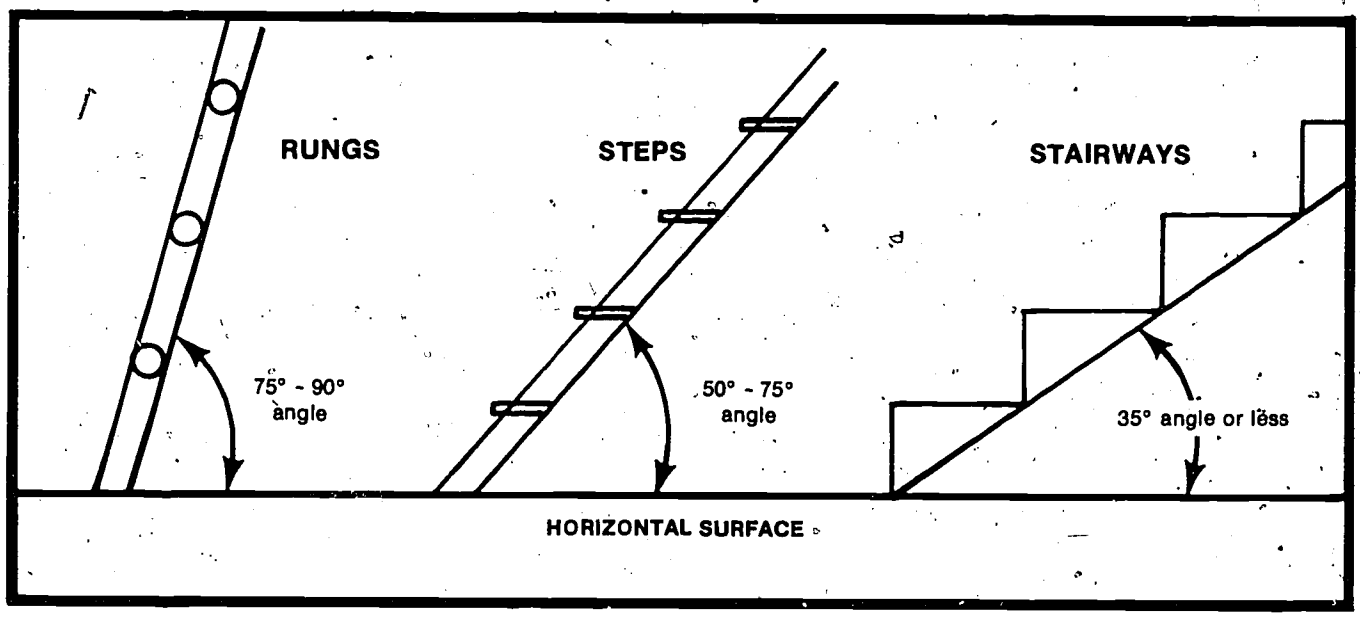
Stairways and ladders with steps should have continuous handrails on both sides. The handrails should be placed at a height which will allow the child to stand erect over each step.

To prevent unnatural or unusual climbing angles, ladders with rungs should have a slope between 75 and 90 degrees when measured from the horizontal. Ladders with steps should have a slope between 50 and 75 degrees and stairways should have a slope no greater than 35 degrees (See Figure 5).

Because metal slides left in the sun can cause burns, they should be placed in shaded areas or installed so that the sliding surface faces north whenever possible. Placing metal slides in a shaded location will also prevent them from reflecting the glare of the sun and interfering with children's vision.

Merry-Go-Rounds. The rotating portions of merry-go-rounds (the platform or base on which children stand or sit) should have an approximately circular shape. Handrails attached to the base to help prevent falls from the equipment should not protrude beyond the edge of the base. Such a design will reduce the risk of injury resulting from children walking into the path of the moving equipment. To ensure that no part of a child's body could pass through an opening and contact a stationary object beneath the apparatus, the rotating base of the equipment should have no spaces or openings that would permit penetration by a rod 3/10 of an inch in diameter.

FIGURE 5
(SIDE VIEW)



5. Making Existing Playgrounds Safer

Public playground equipment can generally be expected to last from 10 to 15 years. Although manufacturers continue to redesign equipment to make it more enjoyable and safer, many years may pass before new equipment reaches the nation's playgrounds and makes a substantial impact on playground injuries.

Thus retrofitting and maintaining existing playgrounds and equipment play a vital role in improving playground safety. While some of the following suggestions for retrofitting or modifying playgrounds have been discussed earlier in this handbook, they are worth repeating here:

- **Remove equipment from asphalt or concrete surfaces.** Vacated areas can then be used for other activities such as hopscotch or basketball. If removing equipment is not feasible, cover the areas under equipment with heavy duty mats, etc., or add shock absorbent surfacing material in trouble areas, especially around high slides or areas where falls frequently occur.
- If equipment is crowded together causing an uneven distribution of children, consider moving some pieces out of the densely populated area to ease traffic.
- Do not hesitate to eliminate a piece of equipment which has been associated with frequent injuries. Take special note of slides more than 10 to 12 feet high; they present the potential for serious injury in the event of a fall.
- Equipment should be firmly anchored in the ground by concrete. Place concrete footings below ground level (See Figure 6) to prevent tripping and to protect a child in case of a fall.
- If any exposed concrete footings do exist, cover them with earth or padding. Also consider recovering worn surfaces where rocks or other hazards may protrude.
- Consider installing fences or other barriers between areas for active play, such as ball fields, and the immediate playground area where equipment is installed. Areas for running games may be separated from areas for passive play, picnicking, etc. Playgrounds should always be separated from roadways by a fence, wall, or other barrier.

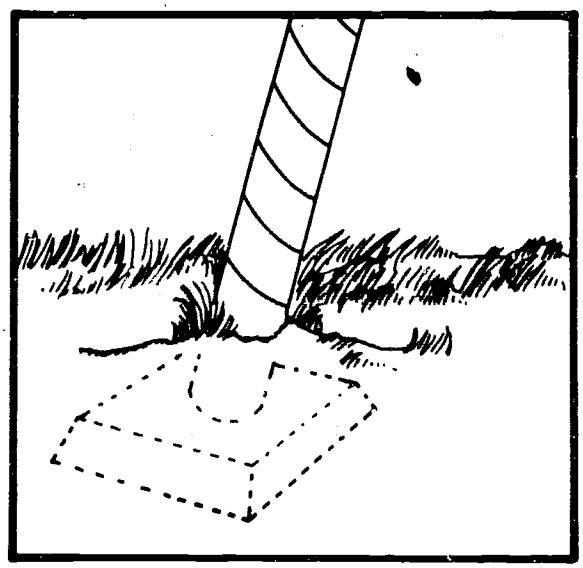


FIGURE 6

- Barriers may also be installed between traditional apparatus and discovery or adventure playgrounds where children may be using tools and similar equipment.
- Remove one or two swings to reduce overcrowding of swingsets.
- Replace heavy swing seats with lightweight seats, e.g. canvas or plastic. Add tire swings, because they permit safe use by several children at one time, and their safety record appears to be better than that of conventional swings. Drill holes in tire swings to assure water drainage.
- Remove single cables, wires, ropes, or similar obstructions between play units which a child might accidentally run into or trip over. (This recommendation is not intended to eliminate items such as guard railings or series of ropes and cables such as cargo nets and climbing grids.)
- Install, or paint on, slip resistant surfaces on climbing and gripping components.
- Consider color coding equipment for different age groups and posting explanatory signs in prominent locations. Bright colored paint or tape can also make a potentially hazardous protrusion on a piece of equipment more visible.
- When a playground leader is not present, consider restricting children aged 1 to 5 from playground equipment unless they are accompanied by an adult.
- Provide clearly marked pathways and en-

courage children to keep to the paths rather than cutting through areas where swings, merry-go-rounds, etc. are in motion.

- Homemade or community built equipment made of logs, railroad ties or landscape timber should receive special inspection and maintenance for splinters, rough edges, sharp corners, and loose or protruding nails, nuts, bolts, etc. Because cedar, redwood, and pressure treated lumber tend to resist deterioration, these materials are recommended in areas where the wood comes in contact with soil or in humid climates.
- Knowledge of first aid and accident prevention is very useful. In order to get help fast when needed, post emergency numbers in a prominent location—near a telephone, if one is available.
- Clean playgrounds regularly, being alert for hazards such as broken glass or sharp metal objects. Whenever possible, provide trash receptacles and empty them frequently.
- A regular inspection and maintenance schedule is essential to ensure the safety of the equipment and surrounding area. (See checklist on page 12 for suggestions.)

6. Summary

This handbook has provided some general guidelines for playground equipment and suggestions for the design, layout, surfacing and operation of public playgrounds which can help to make children's play safer.

Because children will use playground equipment in ways for which the equipment is not intended, however, even after design and mechanical hazards have been addressed and information and education programs undertaken, public playground equipment may still be associated with some accidents and injuries.

Thus, **close supervision** of children as they play and intensive classroom and home **instruction about safe behavior** on playground equipment make an important contribution to playground safety. Through the attention and care of parents, schools, and community organizations, the number and severity of playground injuries **can** be further reduced.

7. Playground Safety Checklists

Suggested Public Playground Maintenance Checklist

Inspections should be conducted on a frequent, regularly scheduled basis. Following are some of the danger points that should be checked on each tour:

- Visible cracks, bending, warping, rusting, or breakage of any component.
- Deformation of open hooks, shackles, rings, links, etc.
- Worn swing hangers and chains.
- Missing, damaged, or loose swing seats; heavy seats with sharp edges or corners.
- Broken supports/anchors.
- Footings exposed, cracked, loose in ground.
- Accessible sharp edges or points.
- Exposed ends of tubing that should be covered by plugs or caps.
- Protruding bolt ends that do not have smooth finished caps and covers.
- Loose bolts, nuts, etc.
- Splintered, cracked or otherwise deteriorated wood.
- Lack of lubrication on moving parts.
- Worn bearings.
- Broken or missing rails, steps, rungs, seats.
- Surfacing material worn or scattered (in landing pits, etc.).
- Hard surfaces, especially under swings, slides, etc.
- Chipped or peeling paint.
- Vandalism (broken glass, trash, etc.).
- Pinch or crush points (exposed mechanisms, junctures of moving components, e.g., axis of seesaw).
- Tripping hazards such as roots, rocks or other environmental obstacles.
- Poor drainage areas.

Suggested Public Playground Leader's Checklist

- Prepare written guidelines for playground operation, defining goals and procedures.
- Insist on first aid and accident training for playground leaders.
- Provide for constant supervision by establishing a written schedule.
- Instruct children and playground supervisors on how to use equipment. (Playground equipment safety should be taught in the classroom.)
- Conduct daily cleaning and check for broken glass and other litter.
- Do not permit children to use wet or damaged equipment.
- Do not permit too many children on the same piece of equipment at the same time; suggest that children take turns, or direct their attention toward other equipment or activities.
- Constantly observe play patterns to note possible hazards and suggest appropriate equipment or usage changes.
- Make periodic checkups, and request that worn or damaged pieces of equipment be replaced.
- Prepare written accident reports with special attention to surface conditions, type and extent of injury, age and sex of child, how the accident occurred, and weather conditions.

Suggested Public Playground Planners' and Installers' Checklist

- Separation of equipment for different age groups.
- Placement of swing(s) or swing sets away from other activities or equipment.
- Adequate space for children to exit equipment such as slides or merry-go-rounds.
- Layout designed to promote a safe flow of traffic between areas.
- Fencing or other barriers to separate the playground from adjacent streets.
- Clearly marked "danger" zones (e.g., those areas covered by swinging seats from swing sets and areas in front of sliding boards).
- No equipment installed over hard surfaces such as concrete or asphalt.
- Accessible components of equipment adjacent to sliding surfaces shaped so that a child's clothing cannot be caught as the child uses the slides.
- No component or group of components forming angles or openings that could trap a child's head or any part of a child's body.
- Protective barriers on surfaces which are elevated more than 30 inches from an underlying surface, assuring that the barriers do not create another hazard (i.e., horizontal cross pieces on which children can climb).
- Handgripping components of size and shape to make them easy for a child to grasp.
- Climbing and gripping surfaces which are slip resistant under both wet and dry conditions.
- Explanation signs where needed, e.g., in color coded areas.

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