REPORT OF THE
BOARD OF EDUCATION PREPARED BY THE
DEPARTMENT OF EDUCATION ON

Playground Safety Guidelines

TO THE GOVERNOR AND
THE GENERAL ASSEMBLY OF VIRGINIA

HOUSE DOCUMENT NO. 15

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DEPARTMENT OF EDUCATION
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Superintendent of Public Instruction

November 19, 1993

The Honorable Douglas L. Wilder
Governor of Virginia, and
The General Assembly of Virginia
3rd Floor, State Capital
Richmond, Virginia 23219

Dear Governor Wilder and Members of the General Assembly:

The report transmitted herewith is pursuant to House Joint Resolution 620 of the 1993 General Assembly of Virginia. This resolution requested the Department of Education to develop public school playground safety guidelines and report its findings and recommendations to the 1994 session of the General Assembly.

Respectfully submitted,

Joseph A. Spagnolo, Jr.
Superintendent of Public Instruction

PREFACE

The General Assembly of Virginia in 1993 requested the Board of Education, through House Joint Resolution (HJR) No. 620, to develop public school playground safety guidelines. The impetus to request these guidelines came from recommendations contained in Safety of School Playground Equipment, a product of HJR No. 473 approved by the General Assembly in 1991.

The project team, under the leadership of Dr. Helen R. Stiff, Division Chief, Pre and Early Adolescent Education, included the following members:

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EXECUTIVE SUMMARY

This Report on Playground Safety Guidelines responds to House Joint Resolution No. 620 agreed to by the 1993 Session of the General Assembly, which requested the Board of Education, with assistance from the Department of Conservation and Recreation, to develop public playground safety guidelines. An earlier report by the Department of Education in 1992 recommended that state guidelines be established for playground safety. This earlier report was requested by HJR No. 473, and was printed as House Document No. 26, Safety of School Playground Equipment.

The purposes of the 1993 report are to provide information and recommendations pertaining to playground safety guidelines and to examine the feasibility of a standard reporting procedure for injuries occurring on school playgrounds. Persons who are responsible for planning and developing playgrounds at schools, parks, and other areas should benefit from the information provided in this report.

In the preparation of this report, House Document No. 26, Safety of School Playground Equipment, was reviewed. Valuable information was obtained from House Document No. 26, Safety of School Playground Equipment, which contained recent survey data of school divisions and other state agencies.

Regulations of the Child Day-Care Council also were reviewed and are included in the report. These playground regulations were developed in response to legislation passed by the 1993 General Assembly. The regulations apply to licensed child care centers, nursery schools, camps not meeting licensure exemption, public entities other than schools that provide child care, and before-school and after-school child care programs. The Council approved the regulations on July 8, 1993, to become effective November 1, 1993.

The Handbook for Public Playground Safety issued by the U. S. Consumer Product Safety Commission (CPSC) was studied with other documents dealing with playground safety. These documents address critical issues such as surface, height, entanglement, design and layout, installation and maintenance, and information on age-appropriate equipment and design. The CPSC handbook exists for the public's protection and manufacturers are expected to comply with its provisions.

The Americans with Disabilities Act (ADA), defines an "accessible playground" as one "that when viewed in its entirety is readily accessible and usable by persons with various abilities." A section on compliance with ADA is included in the CSPC guidelines.

A review of playground safety regulations in other states disclosed that Kansas and Louisiana have established such regulations. A few states have varying degrees of regulations; however, the majority of states have none. Most states leave the development of playground safety policies to the local school district. The resource that is most used by the states is the CPSC's Handbook For Public Playground Safety.

The project team examined the feasibility of using standard reporting forms for playground injuries and concluded that collection and analysis of injury data would be beneficial in determining causes of playground injuries and developing prevention strategies; developing safer playgrounds at schools, child day care centers, parks, etc.; reducing school liability by identifying and correcting hazards; keeping manufacturers of playground equipment up-to-date on design and installation; and, providing feedback to insurance carriers on playground safety issues.

A standard form has been developed that could be used for collecting information on playground injuries. This form could be used to summarize data for the school, the school division, and an annual report by the Department of Education. As an option, a multi-use form has also been developed that could be used to collect information on all injuries to students, including injuries occurring on school playgrounds.

On the basis of the information examined, the project team makes the following recommendations:

- The U. S. Consumer Product Safety Commission's Handbook For Public Playground Safety should be adopted as the public school playground safety guidelines for Virginia. (Appendix D)

- Standard reporting forms and procedures should be adopted, including the Student Playground Injury Form, the School Playground Injury Summary Report, the School Division Playground Injury Summary Report, and the Virginia Student Injury Report Form. (Appendix C)

- Data collected on public school playground injuries at the school and school division level should be used by school divisions to develop strategies to improve safety.

- The Medical College of Virginia, Office of Childhood Injury Prevention Program, and the Department of Conservation and Recreation should be considered as additional resources for school officials responsible for playground safety conditions.

INTRODUCTION

This report has been prepared by the Department of Education in response to the House Joint Resolution No. 620, sponsored by Delegate Mary T. Christian. The survey data in House Document No. 26, Safety of School Playground Equipment, 1992, show that public school playground safety requirements vary considerably among the states. A review of states' regulations and guidelines revealed many interpretations of the term "regulations." Some states' regulations appeared to be guidelines, which other states had standards that were not enforced. Many states leave decisions affecting playground safety to school districts with state education personnel providing technical assistance upon request.

The members of the General Assembly, recognizing the lack of clarity in terminology and practice revealed in the report on Safety of School Playground Equipment, directed the Virginia Board of Education to develop public school playground safety guidelines and a standard reporting procedure for playground injuries.

The interagency project team reviewed the following sources of information:

- House Document No. 26, Safety of School Playground Equipment - to determine how much of the information would be helpful in developing the guidelines requested in HJR No. 620.

- Results from the surveys developed to gather information for House Document No. 26, Safety of School Playground Equipment, were used to obtain raw data on the frequency of playground injuries and the types of play equipment involved.

- The Regulations of the Virginia Child Day-Care Council (effective November 1, 1993) establishing playground regulations for licensed child care centers, nursery schools, camps not meeting licensure exemption, public entities other than schools that provide child care, and before-school and after-school child care programs.

- The Handbook for Public Playground Safety from the United States Consumer Product Safety Commission (CPSC), and playground safety information from other federal testing agencies to review elements such as surface, height, entanglement, design and layout, installation and maintenance, age-appropriate equipment, and accessibility.

- Report and Model Law on Public Play Equipment and Areas from the Consumer Federation of America was reviewed for additional information.

- Playground safety regulations and/or guidelines from other states were studied to gather information for inclusion in Virginia's public school playground safety guidelines.

- The provisions of the Americans with Disabilities Act were reviewed to ascertain the level of accessibility, and the lay-out, maintenance, and supervision of playgrounds.

- Playground injury reporting forms from other states were studied to assist in the development of Virginia's proposed standard reporting procedures for injuries.

This report emphasizes the importance of the adoption of playground safety guidelines and consistent playground injury reporting on a standardized form. These topics are addressed in the following chapters.

Chapter I: Review of House Document No. 26, Safety of School Playground Equipment Report

House Document No. 26, Safety of School Playground Equipment, 1992, was written in response to House Joint Resolution 473, agreed to by the General Assembly in 1991, requesting the Board of Education and the Department of Education to study the safety of school playground equipment and school playgrounds.

In preparing the report for the General Assembly, a Department of Education team studied current literature on school playground equipment, reviewed recommendations from the Virginia Physical Education Supervisors Committee, playground safety regulations from other agencies and consultants, and the the U. S. Consumer Product Safety Commission (CPSC) reports on playground safety, and reports and surveys by the National Safety Council.

Three surveys were developed, two for gathering information in Virginia and another for national distribution. Information collected from the surveys included the types of equipment used on school playgrounds, the types of injuries sustained on school playgrounds, injury reporting procedures, the prevalence of regulations and guidelines affecting playground safety, and schools reporting child care programs.

Summary of Virginia Surveys

In Virginia, a survey was sent to 57 randomly selected elementary schools and to all division superintendents asking for information on the types of play equipment used on school playgrounds, including equipment for students with disabilities. Another survey of all LEAs in June 1991 asked for information on the 65 reported playground accidents that required professional medical attention during the previous school year, the opinion of LEA personnel regarding standards for playground equipment, and the number of child day-care programs in public schools. Survey results included the following:

- Playground equipment and the underlying surfaces need to be evaluated for age appropriateness, safety, installation, physical placement, and supervision of use.

- Approximately 5,700 students in sixty-five school divisions were injured in varying degrees on playgrounds during the 1990-91 school year.

- For the 1989-90 and 1990-91 school years, less than 2 percent of school

children required professional medical attention after a school playground accident.

- Abrasions, cuts, and puncture wounds accounted for the most injuries, with sprains, strains, and head injuries following in frequency. Broken bones and eye injuries accounted for 8 percent of the injuries.

- Falls from equipment and collisions with stationary equipment were the major causes of injuries. Other causes include collisions with moving equipment, contact with equipment with sharp edges and protruding points, and playground debris. Equipment tip over and equipment failure occurred infrequently.

- Almost 30 percent of injuries were caused by other miscellaneous factors.

- 33 percent of the elementary school principals and 59 percent of the superintendents/designees reported that they planned to review playground equipment in accordance with the new guidelines developed by the CPSC.

- 81 percent of the elementary school principals and superintendents/designees indicated the need for uniform standards to ensure the safety of playground equipment and playgrounds.

- 77 percent of all the elementary school principals and 81 percent of the superintendents/designees saw the need for standards regarding the age-appropriateness of playground equipment.

- 79 percent of the sample elementary school principals and 72 percent of the superintendents/designees indicated a need for standards to ensure the repair and replacement of broken and obsolete equipment.

- In Virginia, 219 schools served 13,187 children in extended day child care programs and twenty-four (32 percent) of the LEAs responding to the survey had at least one child care site.

Summary of National Survey

A survey was sent to physical education directors in all states. The questions on playground safety elicited the following information from 33 states:

- Seven states had guidelines for playground surfaces.

- Two states had state guidelines for school playground safety.

- Four states followed guidelines of the U. S. Consumer Product Safety Commission (CSPC), The American Alliance of Health, Physical Education, Recreation and Dance, or Wausau Insurance Company.

Additional Information

The United States Consumer Product Safety Commission (CPSC) was in the process of publishing guidelines for playground safety, and the American Society of Testing Materials (ASTM) was developing standards for playground safety. The results of these surveys indicated that there was a need for guidelines to improve safety on school playgrounds.

The publication, Analysis of the State Regulations for Elementary Schools was also used as a source. Although this study indicated more states had guidelines, the study showed that listed "regulations" frequently appeared to be only recommended guidelines for playground equipment and surface review.

Input was also requested from several professional organizations, and their responses reflected concern regarding hasty purchase of playground equipment. The National Association for the Education of Young Children has published criteria for outdoor equipment and playground safety, and the National Safety Council has a comprehensive publication that includes a checklist for on-site surveys, surfacing, and a variety of playground equipment. Most manufacturers of playground equipment are members of the National Parks and Recreation Association, which follows the CPSC guidelines.

In summary, House Document 26 was prepared using a variety of sources including consultants, surveys, ERIC literature search, recommendations from Virginia Physical Education Supervisors committee, analysis and study of similar regulations from other agencies, the CPSC reports, and reports by the National Safety Council.

Chapter II: Review of the Regulations of the Child Day-Care Council

The Child Day-Care Council's regulations on outdoor areas apply to licensed child day centers, including child care centers, nursery schools, camps not meeting a licensure exemption, public entities other than schools that provide child care, and before-school and after-school child care programs. Child day centers, as defined in the law, must comply with the council's regulations and become licensed by the Department of Social Services.

Background

These playground regulations were developed in response to legislation passed during the 1993 General Assembly session (Section 63.1-202 of the Code of Virginia). The law provides additional protection to children in out-of-home care by requiring the licensure of programs not currently licensed. Three ad hoc committees, as well as a special subcommittee on playgrounds, provided guidance to the Council in developing the regulations. Public comments were received at seven public hearings across the commonwealth. Due to cost concerns expressed during the first public hearing, specificity on the depth and area of resilient surfacing was deleted from the regulations as a requirement for licensure. However, the Consumer Product Safety Commission's guidelines on resilient surfacing were included in the regulations to provide more detailed information and advice. The regulations were approved by the council on July 8, 1993, and they will become effective on November 1, 1993.

Content of the Regulations

The following standards are taken from Minimum Standards for Licensed Child Day Centers Serving Children of Preschool Age or Younger and Minimum Standards for Licensed Child Day Centers Serving School Age Children.

Playground Standards for Child Day Centers

Standard 1.1 - "Fall zone" means the area underneath and surrounding equipment that requires a resilient surface. It shall encompass sufficient area to include the child's trajectory in the event of a fall while the equipment is in use.

Standard 2.6.2 - To ensure that the center's activities, services, and facilities are maintained in compliance with these minimum standards; the terms of the current license issued by the department; other relevant

federal, state, and local laws and regulations including the Americans with Disabilities Act and state law regarding disabilities; and the center's own policies and procedures.

Standard 2.11 - The center shall develop a playground safety plan which shall include:

1. Provision for active supervision by staff;

2. Positioning of staff on the playground to help meet the safety needs of children; and

3. Method of maintaining resilient surface.

Standard 3.4.4 - All staff who work directly with children shall have the ability to provide a stimulating and safe environment for the age group to whom the staff person is assigned.

Standard 3.14 - Before assuming job responsibility, all staff shall receive the following training:

1. Job responsibilities and to whom they report;

2. The policies and procedures listed in subsections 2.14 and 2.15 that relate to the staff member's responsibility;

3. The center's playground safety plan unless the staff member will have no responsibility for playground activities or equipment;

4. Confidential treatment of personal information about children in care and their families; and

5. The minimum standards in this booklet which relate to the staff member's responsibilities.

Standard 4.3 - The facility's areas and equipment, inside and outside, shall be:

1. Maintained in clean and sanitary condition;

2. Maintained in conditions that are safe and free of hazards such as, but not limited to, sharp points or corners, splinters, protruding nails, loose rusty parts, and objects small enough to be swallowed; and

   Exception: Montessori preschools may meet the alternative requirements in the Montessori Module.

3. Maintained in operable condition.

Standard 4.8 - Hazardous substances and other harmful agents.

A. No center shall be located where conditions exist that would be hazardous to the health and safety of children.

B. Hazardous substances such as cleaning materials, insecticides, and pesticides shall be kept away from food preparation and storage areas and in a locked place using a safe locking method that prevents access by children. If a key is used, the key shall not be accessible to the children.

C. Hazardous substances shall be stored in the original container unless this container is of such a large size that its use would be impractical.

D. If hazardous substances are not kept in original containers, the substitute containers

shall clearly indicate their contents and shall not resemble food or beverage containers.

E. Cosmetics, medications, or other harmful agents of staff members shall not be stored in areas, purses, or pockets that are accessible to children.

F. Hazardous art and craft materials shall not be used with children.

Standard 4.9.1&2 -In areas used by children of preschool age and younger, the following shall apply:

1. Steps with three or more risers shall have:

   a. Handrails within the normal handgrasp of the children or

   b. A banister with vertical posts, between the handrail and each step, which can be safely grasped by the children. The distance between the posts shall be no greater than three and one half inches.

2. Poisonous plants shall not be allowed in the facility or the outdoor activity area. When children are away from the center site, staff shall take precautions to prevent children from being poisoned by ingestion of or contact with plants.

Standard 4.30 - Centers in operation before the effective date of these regulations and newly subject to licensure may have until July 1, 1996, to meet Standards 4.30 through 4.38.

Standard 4.31 - The outdoor play area shall provide a minimum of 75 square feet of space per child in the area at any one time.

Standard 4.32 - Playgrounds shall be located and designed in a way to protect children from hazardous situations.

Standard 4.33 - While Standard 6.36 addresses the variety and amount of materials and equipment available for children, the specific playground equipment the center shall have is not designated. If playground equipment is provided, resilient surfacing that helps absorb the shock if a child falls off the equipment shall be placed under all fixed playground equipment with moving parts or climbing apparatus to create a fall zone free of hazardous obstacles. Fall zones are defined as the area underneath and surrounding equipment that requires a resilient surface. It shall encompass sufficient area to include the child's trajectory in the event of a fall while the equipment is in use. For recommendations concerning resilient surfacing, please refer to the following information from the Handbook For Public Playground Safety, prepared by the U. S. Consumer Product Safety Commission:

Critical Heights (in feet) for Various Types and Depths of Resilient Material

Material	Uncompressed Depth 6 inch	Uncompressed Depth 9 inch	Compressed Depth 12 inch	Compressed Depth 9 inch
Wood Mulch	7 ft	10 ft	11 ft	10 ft
Double-Shredded Bark Mulch	6 ft	10 ft	11 ft	7 ft
Uniform Wood Chips	6 ft	7 ft	12 ft	6 ft
Fine Sand	5 ft	5 ft	9 ft	5 ft
Coarse Sand	5 ft	5 ft	6 ft	4 ft
Fine Gravel	5 ft	7 ft	10 ft	6 ft
Medium Gravel	5 ft	5 ft	6 ft	5 ft

Notes: Critical Height is defined as the maximum height from which an instrumented metal headform, upon impact, yields both a peak deceleration of no more than 200 G's and a HIC of no more than 1,000 when tested in accordance with the procedure described in ASTM F1292. Critical Height, therefore, can be considered as an approximation of the maximum fall height from which a life-threatening head injury would not be expected to occur. The surfacing material used under and around a particular piece of playground equipment should have a Critical Height value of at least the height of the highest accessible part of the equipment.

The table should be read as follows: If, for example, uncompressed wood mulch is used at a minimum depth of 6 inches, the Critical Height is 7 feet. If 9 inches of uncompressed wood mulch is used, the Critical Height is 10 feet. It should be noted that, for some materials, the Critical Height decreases when the material is compressed.

There may be other loose-fill materials, such as bark nuggets or shredded tires, that have shock absorbing properties equivalent to those in the above table. However, no tests have been conducted on these materials by Consumer Product Safety Commission staff. Persons installing rubber mats or similar material should request test data from the manufacturer on the Critical Height of the material.

Exception: Montessori preschools may meet the alternative requirements in the Montessori Module.

Standard 4.34 - Ground supports shall be covered with materials which would protect children from injury.

Standard 4.35 - Equipment used by children shall:

1. Have no accessible openings between three and one half inches and nine inches;

2. Have closed S-hooks when provided; and

3. Have no protrusions, sharp points, shearing points, or pinch points.

Standard 4.36 - All outdoor swing seats shall be made of flexible material except for infant swings if they are specifically designed to provide the necessary support required for infants and if the swings are located in a separate area where no other children can enter or walk around in the protected swing area.

Standard 4.37 - Sandboxes with bottoms which prevent drainage shall be covered when not in use.

Standard 4.38 - For activity areas, both inside and outside, that are used by toddlers and preschool children, the climbing portion of slides and climbing equipment shall not be more than seven feet high.

Standard 4.39 - Centers licensed for the care of infants and toddlers shall provide a separate playground area for these children which has at least 25 square feet of unpaved surface per infant/toddler on the outdoor area at any one time. This unpaved surface shall be suitable for crawling infants and for toddlers learning to walk. This space may be counted as part of the 75 square feet required in Standard 4.30.

Standard 5.10 - When the outdoor activity area is not adjacent to the center, there shall be at least two staff on the outdoor activity area whenever one or more children are present.

Standard 6.35 - All furnishings, equipment, and materials shall be of a developmentally appropriate size for the child using it.

Standard 6.36 - The amount and variety of materials and equipment available and the arrangement and use of the materials and equipment shall be developmentally appropriate for the children and shall include equipment and materials which:

1. Are in sufficient supply to avoid excessive competition among the children and to avoid long waits for use of the materials and equipment;

2. Provide for a variety of experiences and appeal to the individual interests and abilities of children;

3. Are accessible to children for the activities required by these standards;

4. Allow children to use small and large muscles for imaginative play and creative activities; and

5. Include multi-cultural materials.

Standard 6.70 - Pools and equipment.

A. When permanent swimming or wading pools are located on the premises of the center, the following shall apply:

1. The manufacturer's specifications for operating the pool shall be followed as well as any local ordinance and any Department of Health requirements for swimming pools;

2. All pools constructed, renovated, or remodeled after April 1, 1986, shall have a statement in writing of their inspection and approval from the local

building official when such appraisal is required;

3. Outdoor swimming pools shall be enclosed by safety fences and gates which shall be kept locked when the pool is not in use;

4. Entrances to swimming pools shall be locked when the pool is not in use; and

5. A whistle or other audible signaling device, a buoy or a lemon line, a reach pole and a backboard shall be available at the swimming/wading site.

B. If children are allowed to swim in a lake or places other than a pool, safe swimming areas shall be clearly marked.

C. All piers, floats, and platforms shall be in good repair and where used for diving, the minimum water depth shall be indicated on the deck or planking.

D. If children are allowed to swim at a lake or other bodies of water larger than a pool, there shall be a rescue boat available at all times which is equipped with a reach pole and a lemon line or buoy.

E. If portable wading pools are used, they shall be emptied of dirty water and filled with clean water for each day's use and more frequently as necessary.

Standard 6.71.A - The center shall have emergency procedures and written safety rules for swimming or wading that are:

1. Posted in the swimming area when the pool is located on the premises of the center;

2. Given to staff involved in swimming/wading activities;

3. Given to parents of children participating in swimming/wading activities; and

4. Explained to children participating in swimming/wading activities.

Standard 9.8 - The facilities of a Montessori preschool, inside and outside, shall be maintained in conditions that are safe and free of hazards, protruding points or sharp corners, splinters, protruding nails, and loose rusty parts.

Standard 9.11 - A Montessori preschool shall have a safe outdoor play area which allows for exploration of nature and provides a resilient surface in fall zones.

Implications of the Child-Day Care Council Regulations

The Council's regulations impact public schools in the following ways:

- Public school playgrounds used by licensed child day centers need to meet these standards.

- The Board of Education is required to develop accreditation regulations for certain education and child care programs provided by public schools.

- Certain education and child care programs operated by public schools need to meet the Board of Education's accreditation regulations, which must incorporate or exceed the Council's regulations.

The review of child day care standards inVirginia led to a study of various national playground standards which are addressed in the next chapter.

Chapter III: Review of the National Standards from Various Federal Testing Agencies and the U.S. Consumer Product Safety Commission (CPSC)

The review of the Virginia Child Day-Care Council's standards on playground safety led to a review of other national playground standards, mandated and voluntary, and guidelines.

Handbook for Public Playground Safety

In March 1990, the COMSIS Corporation, under contract to the CPSC, presented recommendations on playground equipment safety. These recommendations formed the basis for CPSC's Handbook for Public Playground Safety, 1991. The handbook provides guidelines on:

- surfacing materials, e.g., including a critical height table to determine the recommended depth of loose fill materials - mulch, wood chips, sand and gravel,
- equipment design, e.g., highlighting entanglement and entrapment hazards,
- design and layout of playgrounds, e.g., illustrating safe distances between equipment, and
- installation and maintenance, e.g., ensuring concrete footings are well below ground and covered with dirt.

While these guidelines are extremely beneficial in describing ways to make playgrounds safe, it is important to note that the CPSC does not claim the guidelines are "the sole method to minimize injuries associated with playground equipment." However, in Newsletter Health Link, Spring, 1993, the article *New Playgrounds Required* recommends "asking the seller and installer for a written statement that the playground and the recommended layout meet the 1991 CPSC Playground Safety Guidelines."

The Consumer Federation of America (CFA), 1992 The Report and Model Law on Public Play Equipment and Areas

This report published in January, 1992, is intended to be a blueprint for designing, building, and maintaining public playgrounds. The CFA report expands on the CPSC handbook, and in many instances, the CFA specifications are more stringent than the CPSC recommendations. The CFA report provides a good

rationale for most of its requirements. The report also addresses several play events and issues not covered in the CPSC handbook, e.g., equipment height limits for pre-school and school-age children. The information on age-appropriate equipment and design is especially helpful in this document.

The American Society of Testing and Materials (ASTM)

The ASTM, organized in 1898, has grown into one of the largest voluntary standards development systems in the world. ASTM is a not-for-profit organization that provides a forum for producers, users, ultimate consumers, and the public to meet on common ground and write standards for materials, products, systems, and services. "When the ASTM publishes a standard, by federal law, it becomes the national reference," (*New Playgrounds Required*, Newsletter Health Link, Spring 1993). ASTM standards are developed voluntarily and used voluntarily. Currently, there are two voluntary standards documents that address playground issues.

- ASTM Standard F1292, "Specification for Impact Attenuation of Surface Systems Under and Around Playground Equipment," addresses the test method used to determine the impact attenuation of surfacing materials.

- ASTM Standard F1148, "Specification for Consumer Safety Performance for Home Playground Equipment," addresses the requirements for the manufacturing of home playground equipment. Both documents are extremely technical and are more applicable to the manufacturers of surfacing materials and home playground equipment. A third standard addressing public playground equipment is to be published in the fall of 1993. Voluntary playground standards exist for the public's protection and manufacturers are expected to comply with them.

The Americans with Disabilities Act (1991)

After January 1992, this civil rights law requires all new or remodeled playgrounds to be accessible to citizens with disabilities. An Access Board is responsible to write guidelines for playground accessibility during 1994. Until the guidelines are available, the ASTM and responsible playground developers are using a working definition of accessibility. An accessible playground is one which, when viewed in its entirety, may be approached, entered, and used by persons with varied abilities. The sensations or activities that may result from play events (e.g., sliding, climbing, swinging) shall be available to all. (*New Playgrounds Required* Newsletter Health Link, Spring 1993) This article recommends that a letter be obtained from the manufacturer stating that the equipment is accessible and that, if working with a consultant or manufacturer's representative, the issue of accessibility should be discussed.

After reviewing national standards from several federal testing agencies and other organizations, a study of school playground safety standards used in other states was deemed necessary. This would provide additional guidance in developing guidelines for use in Virginia.

Chapter IV: Review of School Playground Safety Standards From Other States

In 1992, a review of school playground safety standards in other states was conducted by the project team that worked on House Document No. 26, Safety of School Playground Equipment. The interagency team for Playground Safety Guidelines reviewed the information in House Document No. 26 for relevance to this present study.

A letter and survey sent to state physical education directors in all fifty states, request statewide guidelines on playground safety, produced thirty-three replies. Two states, Kansas and Louisiana, indicated that state guidelines have been established. Four other states, Nevada, Iowa, New Mexico, and Wisconsin, reported that they follow guidelines established by the U. S. Consumer Product Safety Commission, the American Alliance of Health, Physical Education, and Recreation and Dance, or Wausau Insurance company.

A second source of information concerning playground safety initiatives in other states was the publication entitled, State Regulations Focused on Playgrounds and Supervision, in particular the section on "Analysis of the State Regulations for Elementary Schools." This document reports the results of a study that had been conducted by Frances Wallach, Ed.D., Project Director for Total Recreation Management Services, Inc., and Susan Edelstein, M.A., Chief Researcher at New York University. According to this study, nine states have guidelines for playground surfaces. However, after reviewing the guidelines submitted by these states for this report, it was found that there is a great deal of variability concerning the interpretations of the term "regulations." In several cases, regulations listed appeared to be only recommended guidelines for playground equipment and surface review.

Included below are several states' guidelines, standards, or regulations demonstrating a variety of responses to the playground safety issues of play equipment and surfacing.

CALIFORNIA

Play Equipment: Senate Bill 946 (8/16/84) restricts wood preservatives used for new wood playgrounds or recreational equipment and requires treatment if certain wood preservatives were used to treat existing wooden playground or recreational equipment.

DELAWARE

State Policy: Delaware policy is that each school district adopts a policy

statement that addresses installation, maintenance, operation, periodic self-inspection, and use of playgrounds and playground equipment with emphasis on safe use by students and the public. Each principal is responsible for forming an ad-hoc advisory committee to assist in implementing and monitoring established district policy concerning playground safety.

COLORADO

Play Equipment: Mechanical hazards should not be present for children. Playground equipment should be structurally stable and constructed of durable, weather resistant materials; there should be no projecting screws or bolts, sharp cutting edges, pinch points or splinters; should be free from rust and chipping paint; anchors for all equipment should be stable and buried below ground level; and, should be adequately fenced from nearby hazards.

Surfacing: A playground surface should be 8-12 inches of shock-absorbing material such as loose pea gravel or wood chips underneath all equipment. The surface should be free of projections, cracks, and depressions that can cause tripping injuries. Materials should be under all equipment and should extend 3 feet beyond it.

KANSAS

Play Equipment: All equipment guidelines established by the CPSC for swings, merry-go-rounds, teeter-totter, slides, climbers, and all cluster equipment should be followed.

Surfacing: Safe surfaces are mandatory under all manufactured equipment. Play surfaces include: turf, unmown rough areas suitable for use by crawling infants, and non-accessible erosion control areas. Surfacing should meet the under 200 G's CPSC impact attenuation standard. Fall absorbing surfaces must be installed in all equipment settings. Careful maintenance is required of all surfaces. Hard-surface pathways are needed for accessibility.

MARYLAND

Play Equipment: Play equipment must be constructed of materials which have proved durable in a playground or outdoor setting. Materials subject to corrosion or deterioration should be plated,

galvanized, painted, preserved, or otherwise treated to resist these effects. Equipment should be installed according to manufacturer's instructions. Legs of equipment should be set in concrete for stability. All types of anchoring devices should be placed below ground level to avoid a tripping hazard. Install swinging equipment a safe distance away from fences, building walls, walkways, and other play areas.

Surfacing: This state adheres to CPSC guidelines that installation of equipment should not occur over hard surfaces such as concrete, blacktop, or cinders.

MASSACHUSETTS

Play Area: Outdoor play areas should be accessible to children with special needs within a minimum space of 75 square feet per child. If in a hazardous area, the play area should be fenced by a barrier at least four-feet high. The play area should be checked daily for glass or other hazards.

Surfacing: Sufficient quantities of impact absorbent materials are used under climbers, slides, swings, or see-saws. Climbing equipment, swings, and very large or top-heavy pieces of indoor furniture are securely anchored.

NEW YORK

State Policy: The State Education Department requires that all new playground installations be in conformance with the CPSC guidelines. New York depends upon "voluntary compliance" rather than enforcement to maintain this requirement.

TENNESSEE

Play Equipment: There must be outdoor play equipment for children who are in care more than three daylight hours; all outdoor playground equipment must be sufficient in amount and variety so that children can take part in many kinds of play each day; all outdoor play equipment must be placed to avoid accidents, supported for climbers, swings, and other heavy equipment that could cause injury if toppled must be securely anchored to the ground, even if the equipment is designed to be portable; must be well made and safe.There should be no sharp edges, splinters, or nails sticking out and the equipment must be age-appropriate.

Surfacing: A resilient surface is required under climbers, including slides, and swings. A suitable and appropriate surface should be used under any piece of equipment which puts a school age child 2-1/2 feet off the ground. Any kind of climbing apparatus, the ladder or steps on a slide as well as the end of the slide, and seesaw, swings, and merry-go-round, all require resilient surfacing under and around them where a child might fall. The resilient surface should extend at least two feet beyond climbers and at least four feet from the end of the slide.

Acceptable "soft" surfaces are grass, coarse sand, pea gravel (medium-sized is best), wood chips, sawdust, straw, indoor/outdoor carpet, artificial turf, rubber matting. Other surfaces are not precluded if proper resilience is provided.

WEST VIRGINIA

Play Area: All schools with a kindergarten program are to contain a segregated blacktopped area and a large grassy area with climbing equipment and swings. The playground may be segregated by either time or space allocation.

Safety requirements vary considerably among the states. Most do not have guidelines and some have standards that are not enforced. Other states leave the issue of playground safety to the discretion of the local school districts, with state education offices providing technical assistance as requested. Despite the variance among states, a common characteristic appeared to be the use of the U. S. Consumer Product Safety Commission (CPSC) Handbook for Public Playground Safety.

The review of trends in other states' regarding playground safety standards provided the team assistance in the direction that should be taken in developing guidelines for public playgrounds in Virginia. The following chapters address the need for adopting consistent guidelines for playgrounds in Virginia.

Chapter V: Guidelines For Public School Playground Equipment And Safety

Purpose of Guidelines

The purpose of these guidelines is to provide a healthy and safe environment in which all children can play and have fun. These guidelines are a preventive measure. When adopted, they will help educate all people concerned about playground equipment, safety, and use. School divisions will save money as a result of lower liability insurance rates, fewer injuries, and loss of school days by children; the guidelines should also prevent parents from losing time from work to care for injured children.

Playground equipment in Virginia is located in a variety of settings including school playgrounds, parks, child care facilities, resorts, restaurants, apartment complexes and other areas. All of these settings should provide a safe play environment for children. It is equally important that safety guidelines for playground equipment be consistent. Therefore, guidelines for public school playground equipment and safety should be established. It is also recommended that these guidelines be applicable to playground equipment in other public settings as well.

Epidemiology of Playground Injuries

According to the Consumer Product Safety Commission (CPSC) report entitled Playground Equipment Related Injuries and Death, (April 1990), approximately 75 percent of all playground injuries are the result of falls, especially to the surface beneath the equipment. A 1991 National Electronic Injury Surveillance System (NEISS) Report indicated that of the approximately 270,000 playground related injuries, 100,649 were associated with swings or swing sets, 75,489 with monkey bars and climbing equipment, 53,219 with slides, 14,184 with other playground equipment such as rockers and merry-go-rounds, and the remaining with unidentified playground equipment. The most common injuries associated with falls were fractures of arms and hands.

The CPSC document, Analysis of Playground Equipment-Related Injuries Involving Falls to the Surface, (December 1989), indicated that 52 percent of falls involved grass or dirt surfaces and 12 percent asphalt or concrete surfaces. These figures show vary clearly that much work still needs to be done to make playgrounds safer for children. This report, also indicated that other injuries resulted from moving or stationary equipment and contact with protrusions, hard surfaces, and sharp edges.

According to the CPSC report, Playground Equipment Related Injuries and Deaths, (April 1990), 31 percent of reported fatalities involved falls, and 75 percent of fall-related fatalities involved head injuries. Another 13 percent of fatalities involved equipment tip overs and failures.

Other than falls from equipment, children can be fatally injured by becoming trapped or entangled in playground equipment. Entrapment is caused by the inability to withdraw the body or body part from an opening; entanglement is caused by clothing getting caught on protruding hardware, open hooks, or other protrusions. The CPSC recommends that openings on playground equipment be smaller than 3 1/2 inches or larger than 9 inches to prevent head entrapment and possible strangulation.

Approximately 5,700 students in seventy-five school divisions in Virginia were injured on school playgrounds during the 1990-91 school year. The most common injuries were cuts, abrasions, puncture wounds, sprains and strains, and the most common causes of injuries were falls from equipment, bumping into stationary equipment, and impact with moving equipment.

According to data collected from September 1991 to August 1992 at the Medical College of Virginia, of the 46 children treated for playground injuries at the Children's Medical Center, the most in juries were caused by falls from equipment. They resulted in fractured arms, lacerations, mild head injuries, and soft tissue injuries. The report by MCV, if projected for the entire state, emphasizes the magnitude of the problem.

Americans with Disabilities Act

The Americans with Disabilities Act requires all new playgrounds or those remodeled after January 1992, to be accessible to persons with disabilities. Only private clubs and church organizations are exempt from this law. An Access Board has the responsibility for writing guidelines for playground accessibility. Until these guidelines are available, other general standards, design guidelines, and a working definition of accessibility are being used. An accessible playground is one that, when viewed in its entirety, is readily accessible and available to everyone.

Accessibility should be factored into the design, maintenance, and management of the playground. Also, it should be considered in the purchase and installation of equipment. Specific design elements to consider in planning for accessibility include accessible parking, entrances, routes/paths, location on site, surfacing, signage, and equipment/activity areas.

Playground Supervision

Children need guidance on how to use playground equipment safely. Active supervision promotes safe play and will help children learn appropriate behavior and use of equipment. Unsupervised use of playground equipment may expose children to risk of injury from using equipment in unintended ways. Active adult supervision should include ability to supervise the entire playground visually, to identify safety hazards, and the authority to correct potentially dangerous behavior. All playgrounds present some risk, and an adult should be present to respond quickly should an injury occur. Active supervision will promote a healthy and fun play area for children.

Surfacing

The placement of appropriate amounts of surfacing materials beneath and around play equipment is critical in minimizing playground injuries. The main factors in choosing surfacing materials are cost, height of equipment, and impact-absorbing qualities of the material.

Appropriate surfacing materials include loose-fill organic materials such as wood mulch, bark mulch and wood chips; loose-fill inorganic materials such as sand and gravel; and synthetic material such as rubber mats and foam mats. The CPSC report entitled Impact Attenuation Performance of Playground Surfacing Materials, (March 1990), examined the impact-absorbing capabilities of playground surfacing materials and found that wood mulch, under controlled laboratory conditions, outperformed other materials tested. The 1991 CPSC Handbook for Public Playground Safety provides a Critical Height Table that may be used in estimating the depth of surfacing material to be placed beneath and around playground equipment.

A material's cushioning or impact-absorbing capability, according to the CPSC, is dependent on air being trapped between particles or aggregate material. Therefore, compacting, decomposition, and mixing with dirt can cause a loss of this cushioning effect. Regular maintenance such as raking, or replacement of the surfacing materials is necessary to maintain the impact-absorbing capability. Rubber matting, another surfacing option, is usually more expensive but requires less maintenance and lasts longer.

Maintenance

It is essential that playground equipment be adequately maintained. Rust on metal equipment or deterioration of wood can undermine the structural integrity and stability of playground equipment. Maintenance schedules should be obtained from the equipment manufacturers and regular maintenance schedules should be

developed, based on conditions of equipment and frequency of use. Equipment identified as hazardous or defective should not be used until corrective measures have been taken. All defects and maintenance work should be documented.

Design and Layout

Equipment selection for playgrounds should conform to the CPSC Handbook for Public Playground Safety. Location of equipment on playgrounds plays an important role in minimizing injuries. The design of the playground should provide for future expansion and addition or deletion of equipment.

Appropriate Playground Equipment

Section 3 of the Consumer Federation of America manual, Report and Model Law on Public Play Equipment and Areas, discusses "Developmental Issues for Playground Designers". It suggests that a well-designed playground should provide an environment for physical development and safe learning where cognitive, social, and emotional growth take place. Physical development in children differs substantially. Play equipment suitable for different age groups should address this factor, and also allow children of different ages to test and practice their skills at their own pace.

In addition to helping both preschool and school-age children develop physical skills, play equipment should also help them develop spacial awareness, perceptual skills, and other developmental skills.

The outdoor play area should provide opportunities for children to climb, swing, slide, walk, crawl, run, hop, skip, jump, bounce, balance, reach, chin, hang, push, pull, throw, and catch. Some equipment scaled to appropriate size that can be used by children three years of age or older is:

balance beam	platforms	chinning bars
log structures	tunnels	conventional swings
spring rockers	suspension bridges	slides
ramps	arch ladders	infant/tot swings
stairways	net climbers	tire swings
stepladders	tire climbers	

The size of equipment for older children should be large enough to match their physical age and strength; however, excessive height is not necessary for play value and only increases the potential for severe injuries. Rotating equipment (merry-go-round) and seesaws provide opportunities for some sensory stimulation and balancing activities, but they also present hazards to children. Close supervision should be provided wherever such equipment is used, and see-saws for pre-school age children should be spring-loaded.

Some play equipment and materials should allow for nonstructured exploration. Nature provides many appropriate opportunities for children of all ages to derive fun from playing and exploring. Landscape features such as shrubs, large rocks, gentle slopes, streams, and garden areas all provide opportunities for play. Playing with materials such as sand and water is an excellent and safe means to build cognitive and social skills. Sand boxes can be specially designed, or indoor sand and water tables may be provided. Having a hose accessible to a play area provides an easy way to support water play.

However, even with the best designed playground equipment, good adult supervision is a critical safety factor both from a developmental perspective and also as a means of preventing injuries.

In summary, the team studied the possible factors affecting safety on playgrounds; means to make the playgrounds safer; types, causes, and number of injuries on school playgrounds in Virginia; and ways to bring an awareness of the issues involved in using, designing, and maintaining playground equipment. The following is a list of some of the factors to be considered in making play areas a safer place for all children:

- Age appropriateness of play equipment.
- Supervision (type of) for playgrounds.
- Depth of surfacing materials under and around play equipment relative to the height of the equipment.
- A guide for maintenance of the play equipment and instructions for setting up a maintenance schedule.
- A checklist for the general upkeep of the playground.
- Identification of potential hazards in the play equipment and the playground.

The team, upon reviewing existing guidelines in other states and federal standards available, concluded that the CPSC Handbook for Public Playground Safety be adopted as public playground safety guidelines for Virginia. Further, it is recommended that the CFA manual, Report and Model Law on Public Play Equipment and Areas be used as an additional resource on playground safety. The documents are included in this report as Appendix D and E. Additional sources of information on playground safety are included in Appendix G.The absence of any standardized method of reporting playground injuries in Virginia made it necessary to explore the feasibility of a standard reporting form and procedures for the state. Considerations given to this endeavor are addressed in the following chapter.

Chapter VI: Feasibility of Standardized Reporting Forms and Reporting Procedures

The feasibility of standardized reporting forms and reporting procedures for collecting information on playground injuries was considered from the following perspectives:

- **Manageability of the forms in the individual schools, at the division level, and at the state level.** It was determined that information is already recorded in some format, and the time taken to fill out a standardized form would be minimal for most schools. The time required for statistical compilation would depend on the number of playground injuries at the school and the number of primary and elementary schools in the school division. Only school division totals would be reported to the Department of Education.

- **Liability to schools.** Thorough and accurate playground injury documentation could decrease school liability by pinpointing playground hazards that can be corrected.

- **Hours of collection.** Data on injuries occurring on playgrounds would be collected during a school's normal operating hours and during school-related functions.

- **Reporting structure.** The data collected and the data collection procedures vary considerably among schools.

- **Who would benefit from the standardized collection of data and the resulting safety hazards?**

  * **Children** whose play environment would be made safer.
  * **Local Education Agencies** could reduce injuries by correcting problem areas, making the environment safer for students and reduction of liability.
  * **Playground manufacturers** could use the information to make play equipment safer.
  * **Day care centers** could take action to reduce injury risks on playgrounds.
  * **The Department of Conservation and Recreation** would be supported in their initiative to adopt playground safety guidelines.
  * **Insurance carriers** would have actuarial data.
  * **Injury prevention programs** could ascertain injury patterns based on the data and develop strategies for prevention.

- **Review of forms used in other states and feedback from those states on their usefulness.** Arizona and Utah's injury report forms were useful models in developing Virginia's forms. (Appendix B)

- **Development of single use (playground) or multiple-use (all school) injury data forms.** Use of a separate form to collect individual (each occurrence) information on only playground-related injuries (single use) was thought to be more directly responsive to the team's charge. It was perceived that individual schools might prefer the brevity and direct bearing to the summary playground injury form. A separate form for collecting only playground injury data, however, may be a short-sighted approach. One form could be used in schools to collect data on injuries wherever they occur. Those occurring on playgrounds could easily be sorted for tabulation. One form would also facilitate tabulations of data on other areas of student safety that need to be addressed. (Appendix C)

Upon reviewing the information on options, the team proceeded to draft a multiple-use reporting form and a single-use reporting form from which data on playground or school-related injuries could be compiled into a school summary and a school division summary. Directions for completing the forms and reporting procedures were written.

The team decided that drafts of individual form options and of summary report forms could be studied by focus/stakeholder groups comprised of parents, teachers, principals, and superintendents. The focus stakeholder group would decide which type of form is most effective in:

- Showing where injuries occur,
- Pinpointing problems,
- Developing strategies to solve problems based on data, and
- Determining if safety strategies make a difference.

After recommended revisions, a form or set of forms will be field tested for one year. A data analysis plan should be developed to ensure the integrity of conclusions, drawn from the field test. Modifications to the forms would be made, based on the results of the field test.

After studying the feasibility of a standard reporting form(s), the team proceeded with the development of proposed forms.

Chapter VII: Development of Standard Reporting Forms and Procedures for Collecting Information Concerning Playground Injuries

Currently, in Virginia, there are no standardized forms or procedures for collecting and reporting information about injuries for accidents occurring on school property including playgrounds. If school injury data were collected in a uniform format across school divisions, problem areas could be pinpointed and strategies developed to prevent further occurrence. Additionally, needed information about numbers of children injured on playgrounds, or as a result of other activities occurring on school grounds, would be readily available.

The health departments in Utah and Arizona were contacted to obtain copies of the standard injury reporting forms used in their schools (Appendix B). The Utah Department of Health's program for student injury report was implemented in 1984 with a 100 percent compliance rate among school districts by 1989. The Arizona Department of Health developed its reporting procedures based on the Utah form in 1991. The information obtained from both of these states suggests that filling out the form raised the awareness of playground injuries and contributed to the promotion of playground safety. Using the forms from Utah and Arizona, as resources, the project team developed Virginia's proposed forms.

Form Development

Student Playground Injury Form

The Student Playground Injury Form was developed to collect data on playground injuries (Appendix C). In developing this form, House Document No. 26 (1992) Safety of School Playground Equipment, and the CPSC publication, Handbook for Public Playground Safety, were reviewed. Several categories of information about playground injuries were needed to collect data regarding student playground injuries. The cause of an injury is important in understanding how injuries can be prevented, e.g., in a fall, the type of surface onto which a child falls has an impact on the severity of an injury. Information about the type and severity of injury resulting from a playground incident should be collected. The CPSC's handbook also makes a distinction between children ages 2-5 and older.

Procedures for the using the form:

- Schools could collect and report information on every serious playground injury occurring on the school grounds during the normal operating hours of the school or during school-related functions. Serious playground injuries are designated as those injuries requiring professional medical attention beyond that normally provided by school personnel.

- The school building principal and/or designee would be responsible for completing the Student Playground Injury Form.

School Playground Injury Summary Report

The School Playground Injury Summary Report was developed to summarize the total number of playground injuries by cause, type of surface involved in a fall, type of injury and age group (Appendix C). Statistics on the number of students who were hospitalized, or who were fatally injured as a result of incidents on playgrounds are also collected.

Procedures for using the form:

- Individual schools could use this form to tabulate specific summary information about serious playground injuries from their routine injury/accident report forms, or from the Student Playground Injury Form.

- This form would be sent by the schools to the division superintendent to be used in developing a school division report.

School Division Playground Injury Summary Report

The School Division Playground Injury Summary Report could be used by a school division to report to the Department of Education the total number of injuries on school playgrounds (Appendix C).

Procedures for using the form:

- Injuries occurring on all playgrounds in the school division during the normal school hours, or during school-related functions, which were considered to be serious would be included. Serious injuries are designated as those injuries requiring professional medical attention beyond that normally provided by school personnel.

- These reports could be requested annually by the Department of Education.

- If necessary, a state-level report could be produced. Information from the report would be used to develop strategies to make playgrounds safer in Virginia schools.

Another Option For Collecting Student Injury Data

Virginia Student Injury Report Form

A Virginia Student Injury Report Form has been developed to enable schools in each school division to record information about **any injury** occurring on school grounds (Appendix C). The categories selected for the form were based on a review of the forms used in Utah and Arizona, as well as discussions with Department of Education team members, members of the Childhood Injuries Subcommittee, the coordinator of the Virginia Statewide Trauma Registry, and a faculty member at Virginia Commonwealth University with expertise in data management and form design. Each category describes a specific aspect of the injury event. Comparing the information categories could reveal patterns that may help in developing strategies for reducing the number of injuries.

All possible injury occurrences were considered so that the form could be used to collect correct information. Using data available about the leading causes of playground injuries, categories and choices under each category were selected and refined.

Procedure for using the form:

- Schools could use the form to collect and report information about serious injuries occurring on the school grounds during the normal operating hours of the school or during school-related functions. Serious injuries are designated as those injuries requiring professional medical attention beyond that normally provided by school personnel.

- The building principal and/or designee would be responsible for completing the Virginia Student Injury Report Form.

In conclusion, the use of standardized forms will provide consistent reporting for school playground injuries. Further, to achieve greater playground safety in Virginia schools, it has been determined that certain measures be adopted. These are discussed as recommendations in the concluding chapter.

Chapter VIII : Recommendations

The recommendations of this report are based on the availability of recently published and nationally recognized and accepted guidelines for playground safety. The recommendations also are based on the need for playground injury data to be collected and analyzed at the local school level where playgrounds are managed. No other state requires that playground safety injury data be collected and processed by its department of education. House Document 26, Safety of School Playground Equipment, includes a survey of Virginia students during the 1990-91 school year in which 5,700 students in 75 school divisions were injured in varying degrees of severity as a result of playground injuries. It is important that all possible preventive measures be pursued to reduce school playground injuries.

Accordingly, the team makes the following recommendations:

- The U. S. Consumer Product Safety Commission's Handbook For Public Playground Safety, should be adopted as the public school playground safety guidelines for Virginia. (Appendix D)

- Standard reporting forms and procedures should be adopted, including the Student Playground Injury Form, the School Playground Injury Summary Report, the School Division Playground Injury Summary Report, and the Virginia Student Injury Report Form. (Appendix C)

- Data collected on public school playground injuries at the school and school division level should be used by school divisions to develop strategies to improve safety.

- The Medical College of Virginia, Office of Childhood Injury Prevention Program, and the Department of Conservation and Recreation should be considered as additional resources to those responsible for playground safety.

APPENDIX A

House Joint Resolution 620

GENERAL ASSEMBLY OF VIRGINIA--1993 SESSION

HOUSE JOINT RESOLUTION NO. 620

Requesting the Board of Education to develop playground safety guidelines.

Agreed to by the House of Delegates, February 7, 1993
Agreed to by the Senate, February 16, 1993

WHEREAS, House Joint Resolution 473 (1991) directed the Department of Education to study the issue of safety of school playgrounds to determine whether there is a need for statewide guidelines to ensure the safety of school playgrounds; and

WHEREAS, a review of the results of surveys of local school divisions in Virginia indicate that the majority of those responding feel there is a need for uniform, research-based guidelines to ensure the safety of school playgrounds and equipment; and

WHEREAS, a review of injuries sustained on public school playgrounds in the Commonwealth shows a significant number of injuries requiring medical attention reported each year; and

WHEREAS, there was a total of 12,734 accidents on playgrounds in Virginia reported for the 1990-91 school year; and

WHEREAS, reports indicate that the prevalence of fall-related injuries, especially those resulting in a head injury, demonstrate the need for resilient playground surfaces with regular maintenance; and

WHEREAS, a review of playground safety initiatives in other states revealed that nine states have guidelines for playground equipment and seven states have guidelines for playground surfaces; and

WHEREAS, national standards exist from various federal testing agencies and the U.S. Consumer Product Safety Commission; and

WHEREAS, while significant progress has been made in accommodating children with disabilities in school buildings, school playgrounds remain largely unchanged and unmodified for disabled students; and

WHEREAS, the Department of Education study recommended state guidelines should be established; now, therefore, be it

RESOLVED by the House of Delegates, the Senate concurring, That the Board of Education is requested to develop playground safety guidelines. The Board shall base such guidelines on the playground safety standards under development by the U.S. Consumer Product Safety Commission, and shall correlate the standards with the regulations of the Child Day-Care Council established for licensing day care and before and after school program facilities. In developing these guidelines, the Board shall seek the assistance of the Department of Conservation and Recreation. The guidelines should include recommendations for establishing separate play areas with appropriate playground equipment, resilient surfaces, and proper maintenance for the various age groups and categories of disabled students that are housed at each school.

The Department of Education is requested to develop a standard reporting form and procedures for collecting information concerning playground injuries to be reported by local school boards to the Department annually.

The Board shall complete its work in time to submit its report to the Governor and the 1994 Session of the General Assembly in accordance with the procedures of the Division of Legislative Automated Systems for the processing of legislative documents.

APPENDIX B

Arizona and Utah Injury Report Forms

ARIZONA STUDENT INJURY REPORT FORM

1. Child's Name_____ 2. ( ) Male ( ) Female 3. Date of Birth_____ 4. Grade_____
5. Parent's Name_____ 6. Address_____
7. District Name_____ 8. Date of Accident_____ 9. Time_____ 10. Date Reported_____
11. School Name_____ 12. School Insurance Yes___ No
13. School Address_____ City_____ 14. Phone_____

15. DAYS ABSENT: (Check number of DAYS absent from school related to this injury.)

☐ a) 1/2 ☐ b) 1 ☐ c) 1 1/2 ☐ d) 2 ☐ e) 2 1/2 ☐ f) 3 ☐ If more than 3 days, then specify #_____

COMMENTS:_____

16. ACTION TAKEN: (if any action was taken after the incident, please CHECK AND COMPLETE ALL THAT APPLY)

BY SCHOOL

1. ( ) First aid administered _____ ( ) am ( ) pm ___ Specify name_____
2. ( ) Parent or guardian notified _____ ( ) am ( ) pm ___ Specify name_____
3. ( ) Unable to contact parent/guardian _____ ( ) am ( ) pm 5. ( ) Supervisory Adult_____
4. ( ) Remained in or returned to class _____ ( ) am ( ) pm Title_____
6. ( ) Sent/Taken home _____ ( ) am ( ) pm 7. ( ) Other student involved_____
8. ( ) Checked by school nurse 9. ( ) Checked by Paramedics/ EMT's
10. ( ) Taken to emergency facility or physician. Diagnosis_____ 11. ( ) Other - Specify_____

BY PARENT

1. ( ) Parents deemed no medical action necessary 2. ( ) Taken to physician or health care provider. Diagnosis_____
3. ( ) Taken to emergency care facility or hospital. Diagnosis_____ 4. ( ) Hospitalized. Specify length:_____
5. ( ) Restricted school activity. Specify length:_____

APPARENT TYPE OF INJURY: (Circle applicable numbers)

1. Abrasion	5. Burn 1°/2°/3°	9. Dislocation	13. Hematoma	17. Puncture Wound
2. Amputation	6. Concussion	10. Fracture (Compound)	14. Laceration/Cut	18. Sprain
3. Bite (Specify Below)	7. Contusion	11. Fracture (Greenstick)	15. Other (Specify Below)	19. Strain
4. Bruise	8. Crush Wound	12. Fracture (Simple)	16. Poison (Ingested)	20. Teeth (Chipped/Knocked Out)

PART OF BODY INJURED: (Circle applicable number. Indicate right or left)

1. Head	7. Jaw	13. Humerus	19. Hand	25. Genitals/Rectum	31. Calf
2. Eyes/Ears/Nose	8. Chin	14. Elbow	20. Fingernail	26. Pelvis/Hip	32. Ankle
3. Mouth/Lips	9. Neck	15. Forearm	21. Thumb	27. Leg	33. Foot/Toe
4. Teeth	10. Clavicle	16. Radius	22. Chest/Ribs	28. Knee	34. Multiple Injury (Specify Below)
5. Gums	11. Shoulder	17. Ulna	23. Back	29. Tibia	35. Other (Specify Below)
6. Face	12. Arm	18. Wrist	24. Abdomen/Groin	30. Fibula	

PERIOD: (Circle period during which injury occurred.)

1. After school	4. Class change	7. Interschool competition	10. Lunch recess	13. Unauthorized (Skipping Class)
2. Assembly	5. Class time	8. Intraschool competition	11. P.E. Class	14. Other_____
3. Before school	6. Field Trip	9. Lunch	12. Recess	

SURFACE: (Circle surface on which injury occurred.)

1. Blacktop/Concrete	3. Dirt/Gravel	5. Lawn/Grass	7. Synthetic Surface	9. Other_____
2. Carpet/Mats	4. Ice/Snow	6. Sand	8. Tile/Wood	

PLAYGROUND EQUIPMENT: (Circle equipment on which injury occurred.)

1. Slide	4. Horizontal ladder	7. Balance Beam	10. Three level bars	13. Spring animal
2. Rocking platform	5. Fence climber	8. Pole climb	11. Tire	14. Other (Specify Below)
3. Climbing tower	6. Concrete pipe	9. Swing	12. Turn bar	

LOCATION: (Circle location at which injury occurred.)

1. Athletic field	5. Corridor (stairs)	9. Parking area/Driveway	13. Sidewalk/Steps
2. Auditorium/Multipurpose	6. Gymnasium	10. Playground/field	14. Swimming Pool
3. Bus loading area	7. Lab-Home Ec. etc.	11. School Bus	15. Bathroom/Shower
4. Classroom	8. Lunchroom/Kitchen	12. Shop - Indust Arts	16. Other:_____

ACTIVITY CODES: (Circle activity during which injury occurred.)

1. Baseball/Softball	7. Dodgeball/War ball	13. Playing on bars (monkey,big toy, etc.)	19. Throwing Rocks/Snowballs
2. Basketball	8. Fighting/Roughhousing	14. Running/Jumping	20. Track & Field
3. Bicycling	9. Football	15. Sliding on ice	21. Volleyball
4. Changing Equipment	10. Gymnastics/Tumbling	16. Skateboarding	22. Weight training
5. Classroom Activity	11. Kickball	17. Soccer	23. Wrestling
6. Dancing	12. Lab/Shop Activities	18. Swimming	24. Other:_____

COMMENTS: (Describe Incident/Treatment/Follow up/Preventive Measures)

_____

_____

_____

_____ _____ _____

Signature of Person Making Report Title Telephone Number

89352

UTAH DEPARTMENT OF HEALTH
DIVISION OF FAMILY HEALTH SERVICES
STUDENT INJURY REPORT FORM

This form is to be completed immediately following the occurrence of any injury that is severe enough to: (a) cause the loss of one-half day or more of school, (b) warrant medical attention and treatment (i.e. school nurse, M.D., E.R., etc.) and/or (c) require reporting according to School District policy.

1. Child's Name _____ 2. ( ) Male ( ) Female 3. Date of Accident ___/___/___
mo day yr
4. Parent's Name _____ 5. DATE of Birth ___/___/___
mo day yr
6. District Name _____ # _____ 7. Grade _____ 8. Fatal ( ) Yes ( ) No
9. School Name _____ # _____ 10. TIME of Accident _____ ( ) am ( ) pm

11. DAYS ABSENT: Check number of DAYS absent from school related to this injury.
___ a) Less than 1/2 ___ c) 1 ___ e) 2 ___ g) 3 ___ If more than 3 1/2 days, then
___ b) 1/2 ___ d) 1 1/2 ___ f) 2 1/2 ___ h) 3 1/2 specify # _____

12. ACTION TAKEN: (If any action was taken after the incident, please CHECK AND COMPLETE ALL THAT APPLY.)

BY SCHOOL	TIME:	BY WHOM (List title code)
1. ( ) First aid administered	____ ( ) am ( ) pm	____ Specify name _____
2. ( ) Parent or guardian notified	____ ( ) am ( ) pm	____ Specify name _____
3. ( ) Unable to contact parent/guardian	____ ( ) am ( ) pm	
4. ( ) Remained in or returned to class		
5. ( ) Sent/taken home		
6. ( ) Checked by school nurse		
7. ( ) Checked by Paramedics/EMTs		
8. ( ) Taken to physician or health care provider. Diagnosis: _____		
9. ( ) Taken to emergency care facility or hospital. Diagnosis: _____		
10. ( ) Other–Specify _____		

BY PARENT
11. ( ) Parents deemed no medical action necessary
12. ( ) Taken to physician or health care provider. Diagnosis: _____
13. ( ) Taken to emergency care facility or hospital. Diagnosis: _____
14. ( ) Hospitalized. Specify length: _____
15. ( ) Restricted school activity. Specify length: _____

TITLE CODES
1. Advisor/Counselor
2. Assistant Principal
3. Bus driver
4. Coach
5. Paramedics/EMTs
6. Playground supervisor
7. Principal
8. School nurse
9. Secretary/Office aid
10. Substitute Teacher
11. Teacher (excluding Coach)
12. Teacher's/Playgd. aide
13. Other

NATURE OF INJURY: Of the injuries incurred, list the injuries/symptoms in decreasing order of severity.

ENTER INJURY/SYMPTOM CODES (see # 13 of code sheet on back) — #1 MOST SEVERE _____ #2 LESS SEVERE _____ #3 LEAST SEVERE _____

14. AREA AFFECTED: List area affected for the corresponding area of injury for each injury/symptom code listed.

ENTER CODE FOR CORRESPONDING AREA AFFECTED (see # 14 of code sheet on back) — #1 MOST SEVERE _____ #2 LESS SEVERE _____ #3 LEAST SEVERE _____

	ENTER ONE CODE	(SPECIFY, if other)
15. CONTRIBUTING FACTOR: List factor which may have led to the injury.	____	_____
16. PERIOD: List period during which injury occurred.	____	_____
17. SURFACE: List surface on which injury occurred.	____	_____
18. LOCATION: List location at which injury occurred.	____	_____
19. ACTIVITY: List activity during which injury occurred.	____	_____

20. EQUIPMENT: Was equipment or apparatus involved in accident? ( ) Yes ( ) No Specify _____
IF YES, (1) Did equipment appear to be used appropriately? ( ) Yes ( ) No
(2) Was there any apparent malfunction of equipment? ( ) Yes ( ) No

21. DESCRIPTION: Describe specifically how the accident/injury happened. _____

continue on back of original only

22. _____ Title code _____ 23. _____
Signature of person making report — Principal's signature

Retain original in the school; send one copy to School District Office; and one copy to Child Injury Prevention Program
P.O. Box 16650
Salt Lake City, Utah 84116-0650
Telephone: 538-6140

Code Sheet on Back

UTAH DEPARTMENT OF HEALTH
DIVISION OF FAMILY HEALTH SERVICES
STUDENT INJURY REPORT FORM

CODE SHEET

13. CODES FOR INJURY AND SYMPTOMS

1. Abrasion/Scrape
2. Bump/Bruise/Contusion
3. Burn/Scald
4. Concussion (possible)
5. Cut/Laceration
6. Dislocation (possible)
7. Fracture/Broken(possible)
8. Loss of Consciousness
9. Nosebleed
10. No Pulse
11. Not Breathing
12. Pain/Tenderness
13. Puncture
14. Shortness of Breath
15. Sprain/Strain/Tear
16. Swelling/Inflammation
17. Other

14. CODES FOR AREA AFFECTED

HEAD
1. Chin/Cheek
2. Ear
3. Eye
4. Forehead
5. Mouth/Tongue/Lip
6. Neck/Throat
7. Nose
8. Scalp/Skull
9. Tooth/Teeth

TRUNK
10. Stomach
11. Back
12. Buttocks
13. Chest/Ribs
14. Collarbone
15. Genitalia
16. Internal
17. Pelvis/Hip
18. Shoulder

EXTREMITIES
19. Ankle
20. Arm
21. Elbow
22. Finger/Thumb
23. Foot
24. Hand/Wrist
25. Knee
26. Leg
27. Toe

15. CODES FOR CONTRIBUTING FACTORS

1. Animal bite (Dog bite etc.)
2. Chemical contact or inhalation
3. Collision with object or person
4. Compression/pinch
5. Contact with equipment (Shop, Home Ec., etc.)
6. Contact with fire or flame
7. Contact with hot liquid or object
8. Drug or other substance consumption
9. Fall
10. Fighting/Roughhousing
11. Foreign body/Object
12. Hit with thrown object
13. Human bite
13. Human bite
14. Insect bite/Sting
15. Overexertion/Twisted
16. Seizure disorder
17. Tripped/Slipped
18. Unknown
19. Other

16. PERIOD CODES

1. After school
2. Assembly
3. Before school
4. Class change
5. Class time (exclud. PE)
6. Field trip
7. Interschool competition
8. Intraschool competition
9. Lunch
10. Lunch recess
11. P. E. class
12. Recess
13. Unauthorized (skipping class)
14. Other

17. SURFACE CODES

1. Black top
2. Carpet
3. Concrete
4. Dirt
5. Gravel
6. Ice/Snow
7. Lawn/Grass
8. Mats
9. Sand
10. Synthetic surface (i.e Tartan surface)
11. Tile
12. Wood (waxed)
13. Non-applicable
14. Other

18. LOCATION CODES

1. Athletic field
2. Auditorium/Multipurpose
3. Bus loading area
4. Classroom
5. Corridor (exclud. stairs)
6. Doorway
7. Gymnasium
8. Lab — Home Ec., etc.
9. Lunchroom/Kitchen
10. Parking area/Driveway
11. Playground/playfield
12. Relocatable/Portable classrooms
13. School bus/public bus
14. Shop — Indust. Arts, etc.
15. Shower/dressing rooms
16. Sidewalk/Steps/Ramp
17. Stairs/Ramp
18. Street/Highway/Road
19. Swimming pool
20. Washroom/Lavatory
21. Other

19. ACTIVITY CODES

1. Baseball/Softball
2. Basketball
3. Bicycling
4. Classroom activity
5. Climbing
6. Dancing
7. Dodge ball/war ball
8. Fighting/Roughhousing
9. Flag/Touch football
10. Football
11. Gymnastics/Tumbling
12. Jumping
13. Kickball
14. Lab/Shop Activities
15. Playing on bars (monkey bars, big toy, etc.)
16. Riding
17. Running
18. Setting up/Taking down/ Moving equipment
19. Sliding
20. Sliding on ice
21. Sitting
22. Skateboarding
23. Soccer
24. Standing
25. Swimming
26. Swinging
27. Throwing rocks/ Snowballs
28. Track and field
29. Volleyball
30. Walking
31. Weight training
32. Wrestling
33. Other

#21 Description (continued)_____

APPENDIX C

Proposed Report Forms

PROPOSED FORM

Student Playground Injury Form
19xx-yy School Year

NOTE: DO NOT RETURN THIS FORM TO THE DEPARTMENT OF EDUCATION.

Date of Incident: _____/_____/_____

Student Name: _____

Student Age at time of Incident: _____

Instructions:

This form is to be used to record individual incidents of student injury which occurred on school playgrounds. Record only incidents which:

- resulted in serious injury (an injury which required professional medical attention beyond that normally provided by school personnel - DO not report minor scrapes, bumps and bruises)
- occurred on the school playground
- occurred during the normal operating hours of the school or during school-related functions.

Cause of Injury	Check the box which best describes the cause of the injury (check only one box).
A) Falling from playground equipment on to a surface:	
Asphalt or Concrete	
Dirt or Grass	
Gravel	
Sand	
Wood Chips or Mulch	
Matting or other synthetic surface	
Other Surfaces	
B) Other falls, tripping.	
C) Impact by swings or other moving equipment.	
D) Bumping into stationary equipment.	
E) Contact with protrusions, sharp edges, pinch points, hot surfaces, or playground debris.	
F) Entanglement or entrapment in equipment.	
G) Equipment tipover.	
H) Structural failure of equipment.	
I) OTHER OR UNKNOWN REASONS	

PROPOSED FORM

Student Playground Injury Form -19xx-yy School Year

Type of Injury	**Check the boxes which best describe the type of injury and its outcome.**
Abrasion, Cut, Puncture Wound	
Eye Injury	
Sprain/Strain	
Broken Bones	
Head Injury	
Injury required hospitalization	
Injury was fatal	
Other:_____	

Name of person completing this report: _____

PROPOSED FORM

School Playground Injury Summary Report
19xx-yy School Year

NOTE: THIS FORM MAY BE USEFUL TO YOU IN SUMMARIZING DATA FOR THE DIVISION SUMMARY REPORT. DO NOT RETURN THIS FORM TO THE DEPARTMENT OF EDUCATION.

Name of School:_____

Instructions:

This form is to be used to report the total number of incidents of injury which occurred on school playgrounds. Include in the totals only incidents which:

- resulted in serious injury (an injury which required professional medical attention beyond that normally provided by school personnel - DO not include minor scrapes, bumps and bruises in the totals)
- occurred on the school playground
- occurred during the normal operating hours of the school or during school-related functions.

TABLE I Number of incidents resulting in injury from:	Number of incidents involving children Ages 2-5	Number of incidents involving children Ages 6 and above	Total Number of Incidents
A) Falling from playground equipment on to a surface:			
Asphalt or Concrete			
Dirt or Grass			
Gravel			
Sand			
Wood Chips or Mulch			
Matting or other synthetic surface			
Other Surfaces			
B) Other falls, tripping.			
C) Impact by swings or other moving equipment.			
D) Bumping into stationary equipment.			
E) Contact with protrusions, sharp edges, pinch points, hot surfaces, or playground debris.			
F) Entanglement or entrapment in equipment.			
G) Equipment tipover.			
H) Structural failure of equipment.			
I) OTHER OR UNKNOWN REASONS			
TOTAL			

ADDITIONAL INFORMATION REQUESTED ON PAGE 2

PROPOSED FORM

School Playground Injury Summary Report - 19xx-yy School Year

Name of School:_____

TABLE II Type of Injury	Number of incidents resulting in this type of injury **
Abrasions, Cuts, Puncture Wounds	
Eye Injuries	
Sprains/Strains	
Broken Bones	
Head Injuries	
Injuries requiring hospitalization	
Fatalities	
Other	

** NOTE: Since an incident may involve more than one type of injury, the total number of incidents in this chart will not necessarily match the total number of incidents reported in Table I.

Name of person completing this report:

_____

Telephone Number: (_____)_____

RETURN BOTH PAGES OF THIS FORM TO:

_____

_____

_____

_____

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PROPOSED FORM

School Division Playground Injury Summary Report
19xx-yy School Year

School Division Number:_____ Division Name:_____

Instructions:

This form is to be used to report the total number of incidents of injury which occurred on school playgrounds. Include in the totals only incidents which:

- resulted in serious injury (an injury which required professional medical attention beyond that normally provided by school personnel - DO not include minor scrapes, bumps and bruises in the totals)
- occurred on the school playground
- occurred during the normal operating hours of the school or during school-related functions.

TABLE I **Number of incidents resulting in injury from:**	**Number of incidents involving children Ages 2-5**	**Number of incidents involving children Ages 6 and above**	**Total Number of Incidents**
A) Falling from playground equipment on to a surface:			
Asphalt or Concrete			
Dirt or Grass			
Gravel			
Sand			
Wood Chips or Mulch			
Matting or other synthetic surface			
Other Surfaces			
B) Other falls, tripping.			
C) Impact by swings or other moving equipment.			
D) Bumping into stationary equipment.			
E) Contact with protrusions, sharp edges, pinch points, hot surfaces, or playground debris.			
F) Entanglement or entrapment in equipment.			
G) Equipment tipover.			
H) Structural failure of equipment.			
I) OTHER OR UNKNOWN REASONS			
TOTAL			

ADDITIONAL INFORMATION REQUESTED ON PAGE 2

PROPOSED FORM

School Division Playground Injury Summary Report
19xx-yy School Year

School Division Number:_____ Division:_____
Name:_____

TABLE II Type of Injury	Number of incidents resulting in this type of injury **
Abrasions, Cuts, Puncture Wounds	
Eye Injuries	
Sprains/Strains	
Broken Bones	
Head Injuries	
Injuries requiring hospitalization	
Fatalities	
Other	

** NOTE: Since an incident may involve more than one type of injury, the total number of incidents in this chart will not necessarily match the total number of incidents reported in Table I.

Name of person completing this report:

_____

Telephone Number: (_____)_____

RETURN BOTH PAGES OF THIS FORM TO:

_____

_____

_____

_____

\playgrn2.frm

VIRGINIA STUDENT INJURY FORM

This form is to be completed by the school principal or designee on any injury occurring on school grounds, during the normal operating hours of the school or during school-related functions, that is serious enough to require professional medical attention beyond that normally provided by school personnel.
Do not include minor scrapes, bumps or bruises on this form.

School Name_____School Division Number___ ___ ___

Child's Name_____ _____ _____
Last First Middle

Date of Injury___/___/___
MM DD YY

Time of Injury Event **(Use 24 hour clock)** ___ ___:___ ___

DEMOGRAPHIC INFORMATION

Age_____
Ethnicity (1)Asian (2)Black (3)Hispanic (4)White (5)American Indian
Gender (1)Male (2)Female
Grade (Pre-K - 12)___ ___

LOCATION OF INJURY INCIDENT

1. Playground
2. Athletic field
3. Gymnasium
4. Bus loading area
5. Classroom
6. Corridor
7. Stairs/Steps
8. Auditorium
9. Lunchroom
10. Bathroom
11. Parking area/driveway
12. School Bus
13. Sidewalk
14. Shower Area
15. Locker Room
16. Swimming Pool
98. Other (Specify)_____
99. Unknown

CAUSE OF INJURY **(Please circle all that apply.)**

1. Fall (e.g. due to running, tripping, etc.)
2. Fall from playground equipment
3. Fall from other equipment
4. Bumping into stationary object/equipment
5. Impact with moving object/equipment (e.g. swings)
6. Collision with person
7. Contact with hot liquids
8. Contact with hot objects/surfaces
9. Sunburn
10. Electrical
11. Fire
12. Chemical
13. Entanglement/entrapment
14. Equipment failure
15. Equipment tipover
16. Assault/abuse
17. Contact with protrusions, sharp edges/objects, pinch points, etc.
18. Obstruction of food/object
19. Ingestion
20. Inhalation
21. Struck by object (e.g. baseball, football, etc.)
22. Bite/sting
23. Motor Vehicle Crash
24. Alcohol/drugs
98. Other (Specify)_____
99. Unknown

NATURE OF INJURY (Please circle all that apply.)

1. Foreign body in orifice (e.g. nose,ear)
2. Other foreign body
3. Head injury (e.g. concussion)
4. Burn
5. Asphyxiation/suffocation
6. Abrasion
7. Contusion (bruise)
8. Fracture/possible fracture
9. Dislocation
10. Puncture
11. Strain/sprain
12. Laceration
13. Bite/sting
14. Submersion
15. Dental (e.g. teeth)
16. Eye Injury
17. Metabolic/toxic (e.g. poison)
18. Internal injury (e.g. abdomen)
19. None
98. Other (Specify)_____
99. Unknown

Student's Name_____

BODY PART AFFECTED (Please circle all that apply.)

1. Scalp/Skull
2. Forehead
3. Eyes ____Right____Left
4. Ears ____Right____Left
5. Nose
6. Mouth/Tongue/Lips
7. Teeth/Gums
8. Face
9. Jaw
10. Chin/Cheek
11. Neck/Throat
12. Collarbone
13. Shoulder ____Right____Left
14. Abdomen
15. Chest/Ribs
16. Back
17. Buttocks
18. Genitalia/Rectum
19. Pelvis
20. Hip ____Right____Left
21. Leg ____Right____Left
22. Knee ____Right____Left
23. Ankle ____Right____Left
24. Foot ____Right____Left
25. Toe ____Right____Left
26. Arm ____Right____Left
27. Wrist ____Right____Left
28. Elbow ____Right____Left
29. Hand ____Right____Left
30. Finger/Thumb____Right____Left
31. None
98. Other (specify)_____
99. Unknown

PERIOD OF DAY IN WHICH INJURY OCCURRED (Please circle only one.)

1. Before School
2. During PE Class
3. During Class Other Than PE Class
4. Assembly
5. During Lunch
6. Recess
7. After School
8. Unauthorized (skipping class)
98. Other (specify)_____
99. Unknown

ACTIVITY AT TIME OF INJURY INCIDENT (Please circle all that apply.)

1. Baseball/softball
2. Basketball
3. Bicycling
4. Classroom activity
5. Cheerleading
6. Dancing
7. Dodgeball
   Fighting/roughhousing
   Football
21. Skateboarding
22. Soccer
23. Swimming
24. Track/field
25. Volleyball
26. Weight training
27. Wrestling
98. Other (Specify)
99. Unknown

10. Gymnastics/Tumbling
11. Kickball
12. Lab/shop activities
13. Playing on climbing equipment (e.g. monkey bars)
14. Playing on PE equipment (e.g. horizontal overhead ladder)
15. Playing on slide(s)
16. Playing on seesaws
17. Playing on swings
18. Playing on rocking equipment
19. Playing on merry-go-round
20. Running/jumping

88. NA

SURFACE (Please circle all that apply.)

1. Asphalt/blacktop
2. Carpet
3. Concrete
4. Dirt/grass
5. Gravel
6. Ice/snow
7. Synthetic surface (e.g. rubber matting, etc.)
8. Sand
9. Tile
10. Wood (e.g. flooring)
11. Wood chips/wood mulch
98. Other (specify)_____
99. Unknown
88. NA

Student's Name_____

ACTION TAKEN BY SCHOOL (Please complete all that apply.) (24 hour Clock)

1. Parent or guardian notified; ; By whom_____Time__:__
2. Unable to contact parent or guardian ; By whom_____Time__:__
3. Remained in or returned to class ; By whom_____Time__:__
4. Sent/taken home ; By whom_____Time__:__
5. Checked by school nurse ; Name_____Time__:__
6. Checked by EMT or paramedic ; Name_____Time__:__
7. Taken to emergency facility or physician ; By whom_____Time__:__

ACTION TAKEN BY PARENT

1. Parents deemed no medical attention necessary. Check if yes only_____
2. Taken to physician or health care provider? ___Yes___No___Unknown
3. Taken to emergency facility or hospital? ___Yes___No___Unknown
4. Admitted to hospital? ___Yes___No___Unknown
5. Unknown

AMOUNT OF TIME ABSENT FROM SCHOOL DUE TO INJURY EVENT

1. None
2. Less than 1/2 day
3. 1/2 day
4. 1 day
5. 1 1/2 days
6. 2 days
7. 2 1/2 days
8. 3 days
9. If more than 3 days (Please specify number of days.)_____
10. Unknown

INJURY EVENT FATAL?

_____Yes____No

ADDITIONAL COMMENTS REGARDING THIS INJURY EVENT

_____

_____

_____

_____

_____

_____

_____

SIGNATURE OF PERSON MAKING REPORT_____

TITLE OF PERSON MAKING REPORT_____

PRINCIPAL'S SIGNATURE_____

_____

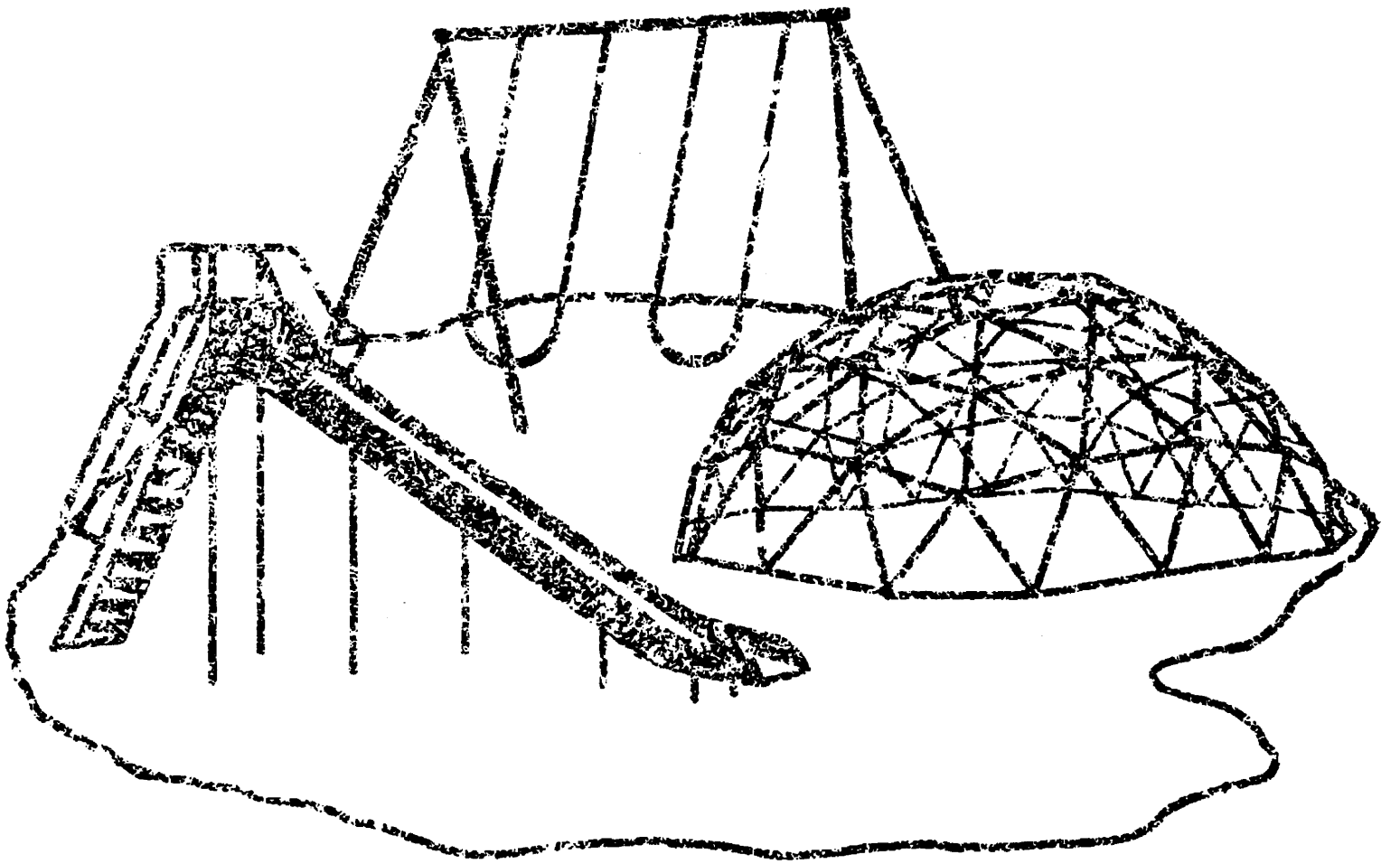
Date___/___/___

MM DD YY

APPENDIX D

CPSC Handbook for Public Playground Safety

HANDBOOK FOR PUBLIC PLAYGROUND SAFETY



U.S. CONSUMER PRODUCT SAFETY COMMISSION, WASHINGTON, DC 20207

CONTENTS

APPENDICES

1. INTRODUCTION

This handbook presents playground equipment safety information in the form of guidelines. Because many factors may affect playground safety, the U.S. Consumer Product Safety Commission (CPSC) believes that guidelines, rather than a mandatory rule, are appropriate. The safety guidelines for equipment are based on recommendations provided to the CPSC by COMSIS Corporation in a March 1990, report [1].

The handbook is intended for use by parks and recreation personnel, school officials, equipment purchasers and installers, and any other members of the general public concerned with public playground safety such as parents and school groups. A voluntary standard, to be published by ASTM, will contain more extensive requirements for manufacturers of public playground equipment.

"Public" playground equipment refers to equipment intended for use in the play areas of parks, schools, child care facilities, institutions, multiple family dwellings, restaurants, resorts and recreational developments, and other areas of public use. The guidelines are not intended to apply to amusement park equipment, equipment normally intended for sports use, or to home playground equipment. Equipment components intended solely for use by the handicapped and necessarily modified to accommodate such users safely are also not covered by these guidelines.

The safety of each individual piece of playground equipment as well as the layout of the entire play area should be considered when evaluating a playground for safety. The installation of protective surfacing under and around all equipment is crucial.

Because all playgrounds present some challenge and because children can be expected to use equipment in unintended and unanticipated ways, adult supervision is recommended. However, it is recognized that this may not be possible for some playgrounds. Equipment design, layout, and maintenance, as discussed in this handbook, are essential for increasing public playground safety.

A playground should allow children to develop progressively and test their skills by providing a series of graduated challenges. The challenges presented should be appropriate for age-related abilities and should be ones that children can perceive and choose to undertake.

Numbers in brackets indicate references that are listed at the end of this handbook.

Preschool and school-age children differ dramatically not only in physical size and ability, but also in their cognitive and social skills. Therefore, age-appropriate playground designs should accommodate these differences with regard to the type, scale, and the layout of equipment. Recommendations throughout this handbook address the different needs of preschool and school-age children; "preschool" refers to children 2 to 5 years old, and "school-age" refers to children 5 to 12 years old.

These guidelines are not a CPSC standard and are not mandatory requirements. Therefore, the Commission is not endorsing them as the sole method to minimize injuries associated with playground equipment. The Commission believes, however, that the safety features in many of the recommendations in this handbook will contribute to greater equipment safety. Publication of the handbook is expected to promote greater safety awareness among those who purchase, install, and maintain public playground equipment.

2. PLAYGROUND INJURIES

The Consumer Product Safety Commission has long recognized the potential hazards that exist with the use of public playground equipment. A Commission study [2] of playground equipment-related injuries treated in U.S. hospital emergency rooms indicated that the majority resulted from falls from equipment. These were primarily falls to the ground surface below the equipment rather than falls from one part of the equipment to another part.

Other hazard patterns involved impact by swings and other moving equipment, colliding with stationary equipment, and contact with such hazards as protrusions, pinch points, sharp edges, hot surfaces, and playground debris. Fatal injuries reported to the Commission involved falls, entanglement of clothing or other items on equipment such as slides, entanglement in ropes tied to or caught on equipment, head entrapment in openings, impact from equipment tipover or structural failure, and impact by moving swings.

The recommendations in this handbook have been developed to address the hazards that resulted in these playground-related injuries and deaths. The recommendations include those which address the potential for falls from and impact with equipment, the need for protective surfacing under and around equipment, openings with the potential for head entrapment, the scale of equipment and other design features related to user age, layout of equipment on a playground, installation and maintenance

procedures, and general hazards presented by protrusions, sharp edges, and pinch points.

3. DEFINITIONS

Composite Structure - Two or more play structures, attached or directly adjacent, to create one integral unit that provides more than one play activity (e.g. combination climber, slide, and horizontal ladder).

Entrapment - Any condition that impedes withdrawal of a body or body part that has penetrated an opening.

Fall Zone - The surface under and around a piece of equipment onto which a child falling from or exiting from the equipment would be expected to land.

Footing - A means for anchoring playground equipment to the ground.

Guardrail - An enclosing device around an elevated platform that is intended to prevent inadvertent falls from the platform.

Infill - Material(s) used in a protective barrier to prevent a user from passing through the barrier.

Non-Rigid Component - A component of playground equipment that significantly deforms or deflects during the normal use of the equipment.

Preschool Age Children - Children from 2 years of age to not more than 5 years of age.

Protective Barrier - An enclosing device around an elevated platform that is intended to prevent both inadvertent and deliberate attempts to pass through the barrier.

Protective surfacing - Surfacing material in the fall zone that conforms to the recommendations in Section 10.2 of this handbook.

Roller Slide - A slide that has a bed consisting of a series of individual rollers over which the user travels.

School-Age Children - Children over 5 years of age but not over 12 years of age.

Tube Slide - A slide in which the sliding section consists of a totally enclosed tube or tunnel.

Upper Body Equipment - A device designed to support a child by the hands only (e.g. horizontal ladder, overhead swinging rings).

4. LAYOUT AND DESIGN OF PLAYGROUNDS

4.1 Choosing a Site

When planning a new playground, it is important to consider hazards or obstacles to children traveling to or from the playground. A barrier, surrounding the playground, is recommended to prevent children from inadvertently running into a street. Such a barrier should not preclude supervision.

4.2 Locating Equipment

The playground should be organized into different areas to prevent injuries caused by conflicting activities and children running between activities. Active, physical activities should be separate from more passive or quiet activities: areas for play equipment, open fields, and sand boxes should be located in different sections of the playground.

In addition, popular, heavy-use pieces of equipment or activities should be dispersed to avoid crowding in any one area. The layout of equipment and activity areas should be without visual barriers so that there are clear sight lines everywhere on the playground to facilitate supervision.

Moving equipment, such as swings and merry-go-rounds should be located toward a corner or edge of the play area. Slide exits should also be located in an uncongested area of the playground.

Composite equipment has become increasingly popular on public playgrounds. Care should be taken to ensure that the play and traffic patterns of children using adjacent components of composite equipment are complementary.

4.3 Age Separation of Equipment

It is recommended that playgrounds have separate areas for younger children with appropriately sized equipment and materials to serve their less advanced developmental levels. It is also important to recognize that preschoolers require more attentive supervision on playgrounds. Throughout this handbook, consideration is given to specific recommendations for equipment designed for preschool-age children (2 to 5 years).

The design and scale of equipment should make the intended user group obvious. Some playgrounds, often referred to as "tot lots," are designed only for younger children, so separation is not an issue.

In playgrounds intended to serve children of all ages the layout of pathways and the landscaping of the playground should show the two distinct areas for the two age groups. The areas should be separated at least by a buffer zone of ample physical space. Signs posted in the playground area can be used to give some guidance to adults as to the age appropriateness of the equipment.

5. INSTALLATION AND MAINTENANCE OF EQUIPMENT

5.1 Assembly and Installation

Proper assembly and installation of playground equipment are crucial for structural integrity, stability, and overall safety. The people who assemble and install playground equipment should not deviate from the manufacturer's instructions. After assembly, equipment should be thoroughly inspected before its first use.

As a precaution, the manufacturer's assembly and installation instructions, and all other materials collected concerning the equipment should be kept in a permanent file.

5.1.1 Stability

When properly installed as directed by the manufacturer's instructions and specifications, equipment should withstand the maximum anticipated forces generated by active use which might cause it to overturn, tip, slide, or move in any way. Secure anchoring is a key factor to stable installation, and because the required footing sizes and depths may vary according to equipment type, the anchoring process should be completed in strict accordance with the manufacturer's specifications.

5.2 Maintenance

Inadequate maintenance of equipment can lead to injuries on the playground. Because the safety of playground equipment and its suitability for use depend on good inspection and maintenance, the manufacturer's maintenance instructions and recommended inspection schedules should be strictly followed.

A comprehensive maintenance program should be developed for each playground as a whole. Generally, all equipment should be inspected frequently for any potential hazards, for corrosion or deterioration from rot, insects, or weathering. The playground area should also be checked frequently for broken glass or other dangerous debris.

For each piece of equipment, the frequency of thorough inspections will depend on the type of equipment, the amount of use, and the local climate. Based on the manufacturer's recommendations regarding maintenance schedules for each piece of equipment, a maintenance schedule for the entire playground can be created. The detailed inspections should give special attention to moving parts and other components which can be expected to wear. Inspections should be carried out in a systematic manner by trained personnel.

One possible procedure is the use of checklists. Some manufacturers supply checklists, for general or detailed inspections, with their maintenance instructions. These can be used to ensure that inspections are in compliance with the manufacturer's specifications. Inspections alone do not constitute a comprehensive maintenance program. All hazards or defects identified during inspections should be repaired promptly. All repairs and replacements of equipment parts should be completed in accordance with the manufacturer's instructions. A general checklist that may be used as a guide for frequent routine inspections of public playgrounds is included at Appendix A.

In addition to this general maintenance inspection, more detailed inspections should be conducted on a regular basis. The procedures and schedules for these detailed inspections will depend on the types and amount of equipment on the playground, the level of use, and the local climate, as well as the maintenance instructions provided by equipment manufacturers. Therefore, this checklist is only one of many elements which should be considered in the development of a comprehensive inspection schedule and system of maintenance. Any damage or hazards detected during inspections should be repaired immediately, in accordance with the manufacturer's instructions for repair and replacement of parts.

The checklist at Appendix A is intended to address only general maintenance concerns. It does not provide a complete safety evaluation of equipment design and layout. For example, it does not address the risk of falls from equipment, moving impact incidents, or head entrapment. Therefore, it is essential to use this checklist only for general maintenance purposes. The detailed design recommendations contained in the Handbook should be used to evaluate the safety of each piece of equipment and the playground as a whole.

Complete documentation of all maintenance inspections and repairs should be retained, including the manufacturer's maintenance instructions and any checklists used. A record of any accidents and injuries reported to have occurred on the playground should also be collected. This will help identify potential hazards or dangerous design features which warrant attention.

6. MATERIALS OF MANUFACTURE AND CONSTRUCTION

6.1 Durability and finish

Purchasers should be sure that the equipment is manufactured and constructed only of materials which have a demonstrated record of durability in the playground or similar outdoor setting.

A major concern for playground equipment materials is corrosion or deterioration. Ferrous metals should be painted, galvanized, or otherwise treated to prevent rust.

All paints and other similar finishes must meet the current CPSC regulation for lead in paint [3] (0.06% maximum lead by dry weight). Regardless of the material or treatment process, the manufacturer should ensure that the users of playground equipment cannot ingest, inhale, or absorb potentially hazardous amounts of substances as a result of contact with equipment. Purchasers and installers of playground equipment should obtain documentation from the manufacturer that the preservatives or other treatments applied to the equipment would not present a hazard to the consumer.

Wood should either be naturally rot and insect-resistant or treated to avoid such deterioration. The most common wood treatments used in playground equipment are the inorganic arsenicals. Chromated copper arsenate (CCA) is acceptable for use as a treatment of playground equipment wood, if the dislodgeable arsenic on the surface of the wood is minimized. Inorganic arsenicals should be applied by the manufacturer or wood preserver in accordance with the specifications of the American Wood Preservers Association C17 standard. This standard states that the treated wood should be visibly free of residues which may contain high levels of arsenic (the greenish coloration of CCA treated wood is acceptable). Wood preservers and playground equipment manufacturers should practice technologies and procedures that minimize the level of dislodgeable arsenic (arsenic that might be removable from the wood surface by skin contact or wiping with testing materials). CPSC staff has found that technology exists to treat playground equipment wood with CCA so that dislodgeable arsenic is below detectable levels using a protocol designed to detect dislodgeable arsenic [4].

Installers, builders, and consumers who perform woodworking operations, such as sanding, sawing, sawdust disposal, on pressure treated wood should read the consumer information sheet often available at the point of sale [5]. The sheet contains important health precautions and disposal information.

Creosote, pentachlorophenol, and tributyl tin oxide are too toxic or irritating and should not be used as preservatives for playground equipment wood. Pesticide-containing finishes should also not be used. Other preservatives that have low toxicity and may be suitable for playground equipment wood are copper or zinc naphthenates, and borates.

6.2 Hardware

When installed and tightened in accordance with the manufacturer's instructions, all fasteners, connecting, and covering devices should not loosen or be removable without the use of tools. Lock washers, self-locking nuts, or other locking means should be provided for all nuts and bolts to protect them from detachment. Hardware in moving joints should also be secured against unintentional or unauthorized loosening. In addition, all fasteners should be corrosion resistant and be selected to minimize the likelihood of corrosion to the materials they connect. Bearings used in moving joints should be easy to lubricate or be self-lubricating. All hooks, including S-hooks, should be closed as tightly as possible (see also Section 9.2.1).

6.3 Metal Surfaces

To avoid the risk of contact burn injury in geographical regions where intense sunlight can be expected, bare or painted metal surfaces on platforms and slide beds should be avoided unless they can be located out of the direct rays of the sun. As an alternative to bare or painted metal, platforms may be fabricated from wood or vinyl coated metal and slide beds may be fabricated from plastic (see also Slides, paragraph 9.1.4).

7. GENERAL HAZARDS

There are a variety of general hazards common to many types of playground equipment. The guidelines in this section apply to all elements of the playground.

7.1 Sharp Points, Corners, and Edges

There should be no sharp points, corners, or edges on any components of playground equipment which could cut or puncture children's skin. Frequent inspections are important in order to prevent injuries caused by the exposure of sharp points, corners, or edges due to wear and tear on the equipment.

Wood parts should be smooth and free from splinters. All corners, metal and wood, should be rounded. All metal edges should be rolled or have rounded capping. Special attention to sharp edges on slides, especially metal edges, is warranted. The exit end and the sides along a slide bed can be particularly dangerous if protective measures are not taken (see also Section 9.1.5).

7.2 Protrusions and Projections

Protrusions or projections on playground equipment should not be capable of entangling children's clothing, because such entanglement can cause serious injuries or death by strangulation. Particular attention should be given to avoiding protrusions or projections at the top of slides to minimize the risk of entanglement with clothing. Jackets with hoods and/or drawstrings have been implicated in such entanglement/strangulation incidents.

When tested in accordance with the procedure in Paragraph 7.2.1, no protrusion should extend beyond the face of any of the three gauges having dimensions shown in Figure 1.

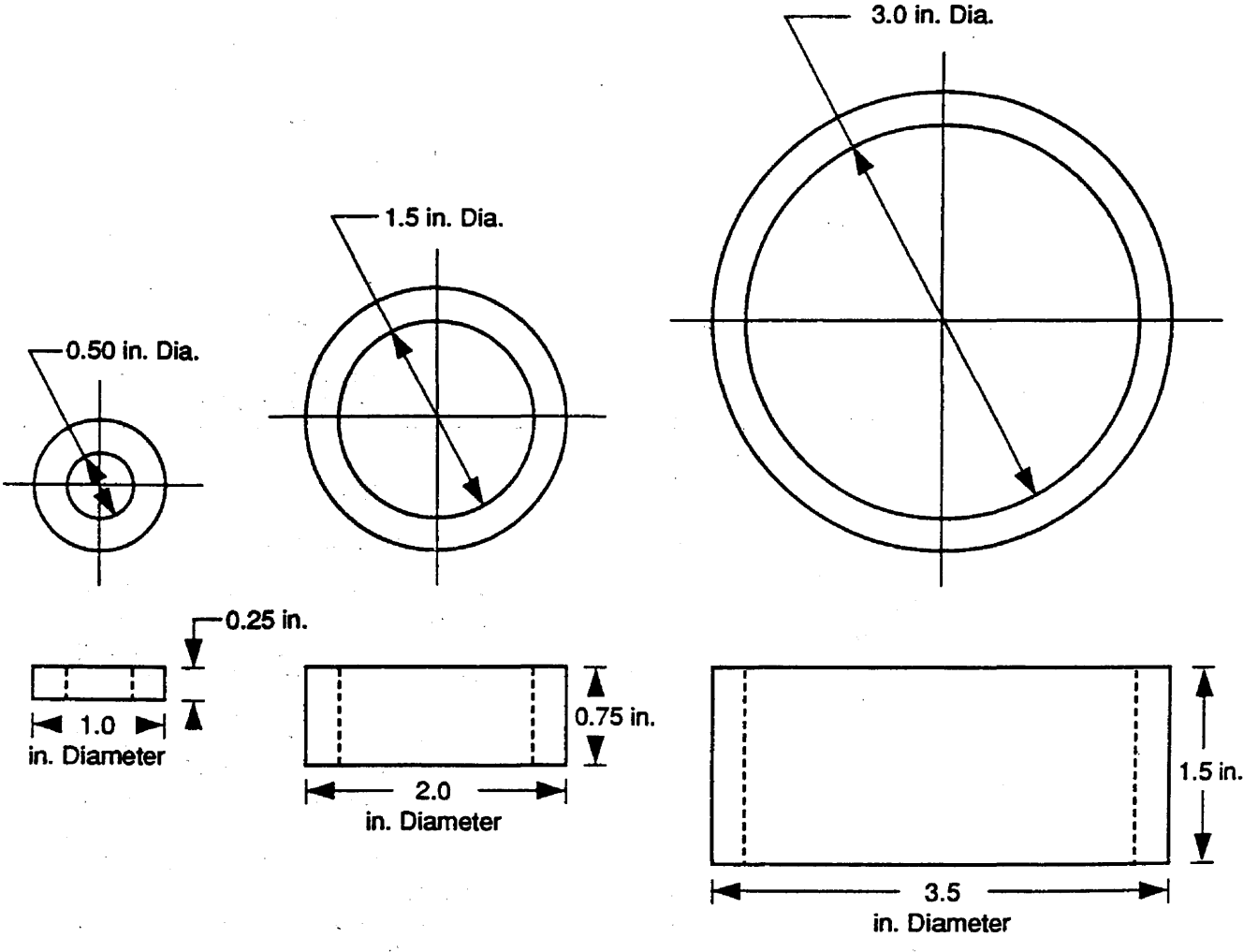


Figure 1 Protrusion Test Gauges

7.2.1 Protrusion Test Procedure

Successively place each gauge (see Figure 1) over any protrusion or projection and determine if it projects beyond the face of the Gauge (see Figure 2).

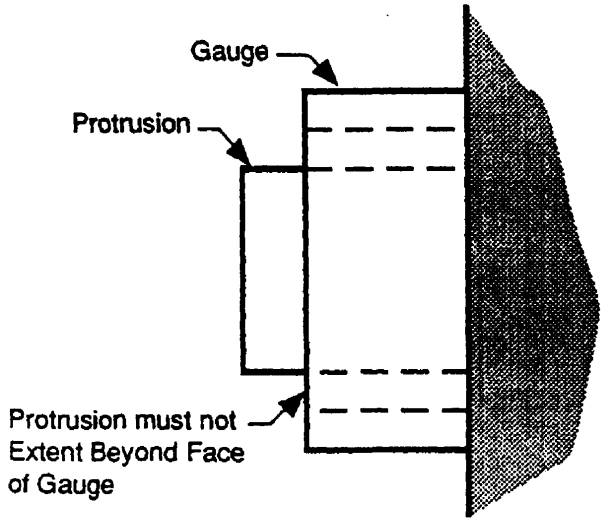


Figure 2 Protrusion Test

7.3 Protrusions on Suspended Members of Swing Assemblies

These form a special case because they can be extremely hazardous, given the potential for impact incidents; therefore, a special test gauge (see Figure 3) and procedure are recommended. No surface in the potential impact region on suspended members should protrude through the hole beyond the face of the specified gauge, when tested in accordance with the following method.

Conduct the test with the suspended member in its rest position. Place the gauge over any protrusion on the front or rear surface of the suspended member such that the axis of the hole in the gauge is parallel to both the intended path of the suspended member and a horizontal plane. Visually determine if the protrusion penetrates through the hole and beyond the face of the gauge.

7.4 Pinch, Crush, and Shearing Points

There should be no accessible pinch, crush, or shearing points on playground equipment that could injure children or catch their clothing. Such points can be caused by components moving relative to each other or to a fixed component when the equipment moves through its anticipated use cycle. To determine if there is a possible pinch, crush or shear point, consider the likelihood of entrapping a body part and the configuration and closing force of the components. Additional information on pinch, crush, and shear points is provided in the recommendations addressing specific pieces of equipment in Section 9.

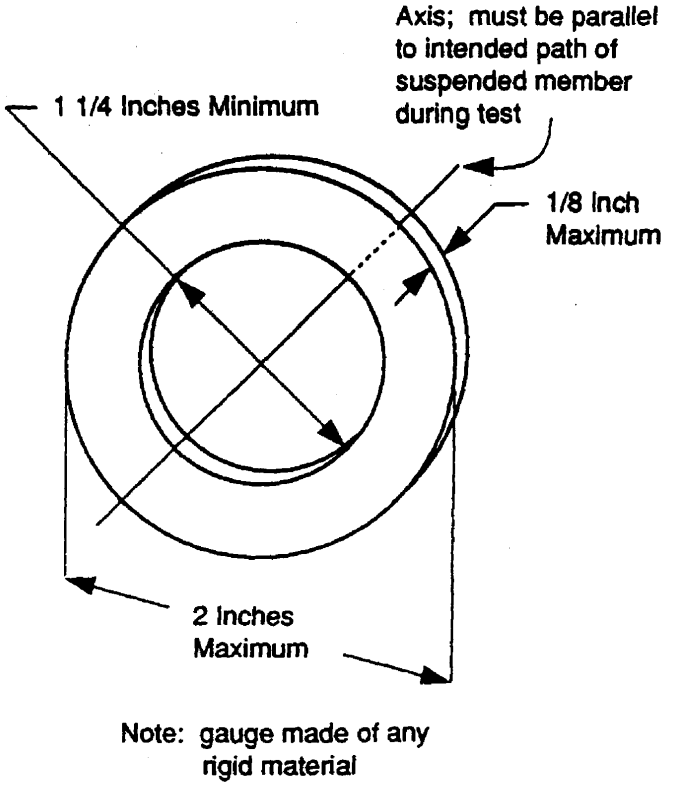


Figure 3 Protrusion Test Gauge for Suspended Swing Assemblies

7.5 Entrapment

7.5.1 Head entrapment

A component or a group of components should not form openings that could trap a child's head. A child's head may become entrapped if the child attempts to enter an opening either feet first or head first. Head entrapment by head-first entry generally occurs when children place their heads through an opening in one orientation, then, after turning their heads to a different orientation, they are unable to withdraw from the opening. Head entrapment by feet-first entry involves children who are generally sitting or lying down and slide their feet into an opening that is large enough to permit passage of their bodies but is not large enough to permit passage of their heads which then become entrapped.

In general, an opening may present an entrapment hazard if the distance between any interior opposing surfaces is greater than 3.5 inches and less than 9 inches. When one dimension of an opening is within this potentially hazardous range, all dimensions of the opening must be considered together to fully evaluate the possibility of entrapment. This recommendation applies to all completely-bounded openings (see Figure B-1 in Appendix B) except where the ground serves as an opening's lower boundary. Further, it applies to all openings regardless of their height above the ground. Even those openings that are low enough to permit children to touch the ground with their feet can present a risk of strangulation for an entrapped child, because younger children may not have the necessary cognitive ability and motor skills to extricate their heads, especially if scared or panicked.

The most appropriate way to determine whether an opening is hazardous is to use test fixtures. Recommended test fixtures, performance requirements, and test methods, are described in Appendix B. These recommendations apply to all playground equipment, both for preschool-age and school-age children. Fixed equipment as well as moving equipment (in its stationary position) should be tested for entrapment hazards. There are two special cases for which separate procedures are given: completely bounded openings where depth of penetration is a critical issue, and openings formed by non-rigid climbing components.

7.5.2 Angles

The angle of any vertex formed by adjacent components should not be less than 55 degrees, unless the lower leg is horizontal or projects downwards (see Figure 4). An exception to this recommendation can be made if a rigid shield is attached to the vertex between adjacent components and the shield is of sufficient size to prevent a 9 inch diameter circular template from simultaneously touching components on either side of the vertex (see Figure 5).

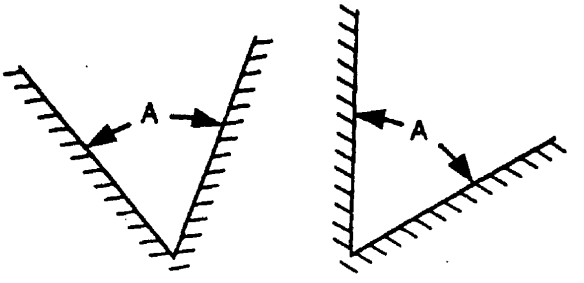
7.6 Tripping Hazards

All anchoring devices for playground equipment, such as concrete footings or horizontal bars at the bottom of flexible climbers, should be installed below the playing surface to eliminate the hazard of tripping. This will also prevent children who may fall from sustaining additional injuries due to exposed footings. In addition, attention should be given to environmental obstacles in the play area, including rocks, roots, and other protrusions from the ground that may cause children to trip.

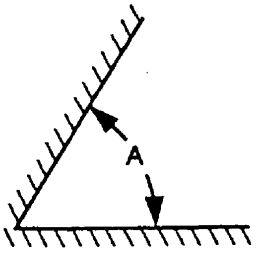
Retaining walls are commonly used to help contain loose surfacing materials. In order to minimize the trip hazard, retaining walls should be highly visible and any change of elevation should be obvious. The use of bright colors can contribute to better visibility.

7.7 Suspended Hazards

Cables, wires, ropes, or similar flexible components suspended between play units or from the ground to a play unit within 45 degrees of horizontal should not be located in areas of high traffic because they may cause



Angle A should exceed 55°



Angle A is exempt if one leg of the vee is horizontal or slopes downward from the apex

Figure 4 Recommendations for Angles

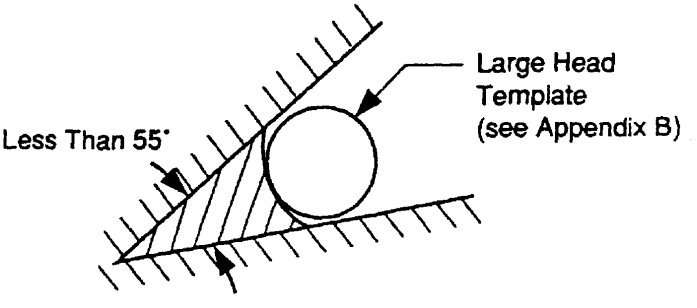


Figure 5 Shield for Angle Less than 55°

injuries to a running child. It is recommended that these suspended members be either brightly colored or contrast with surrounding equipment to add to their visibility. This recommendation does not apply to suspended members that are located 7 feet or more above the playground surface.

8. ACCESS AND PLATFORMS

8.1 General

Access to playground equipment can take many forms, such as conventional ramps, stairways with steps, and ladders with steps or rungs. Access may also be by means of climbing components, such as climbing nets, arch climbers, and tire climbers (see Figure 6). Such climbing components are typically designed to be more challenging than stairways and stepladders, and so require better balance and coordination of the children. Rung ladders are generally considered to present a level of challenge intermediate between stairways or stepladders and climbing components.

Rung ladders and climbing components such as climbing nets, arch climbers, and tire climbers, should not be used as the sole means of access to equipment intended for preschoolers.

Platforms over 6 feet in height (with the exception of free standing slides) should provide an intermediate standing surface where a decision can be made to halt the ascent and to pursue an alternative means of descent.

8.2 Stairways and Ladders

Stairways, stepladders, and rung ladders are distinguished by the range of slopes permitted for each of these types of access. However, in all cases the steps or rungs should be evenly spaced, including the spacing between the top step or rung and the surface of the platform. Table 1 contains recommended dimensions for: access slope, tread or rung width, tread depth, rung diameter, and vertical rise for rung ladders, stepladders, and stairways. Table 1 also contains slope and width recommendations for ramps. However, these recommendations are not intended to address ramps designed for access by wheelchairs.

Openings between adjacent steps or rungs and between the top step or rung and underside of a platform should preclude the possibility of entrapment. Risers on stairways and stepladders should be closed if the distance between opposing interior surfaces of consecutive steps is between 3.5 and 9 inches (see Section 7.5). Since the design of rung ladders does not permit risers to be closed the space between consecutive rungs should not be between 3.5 and 9 inches.

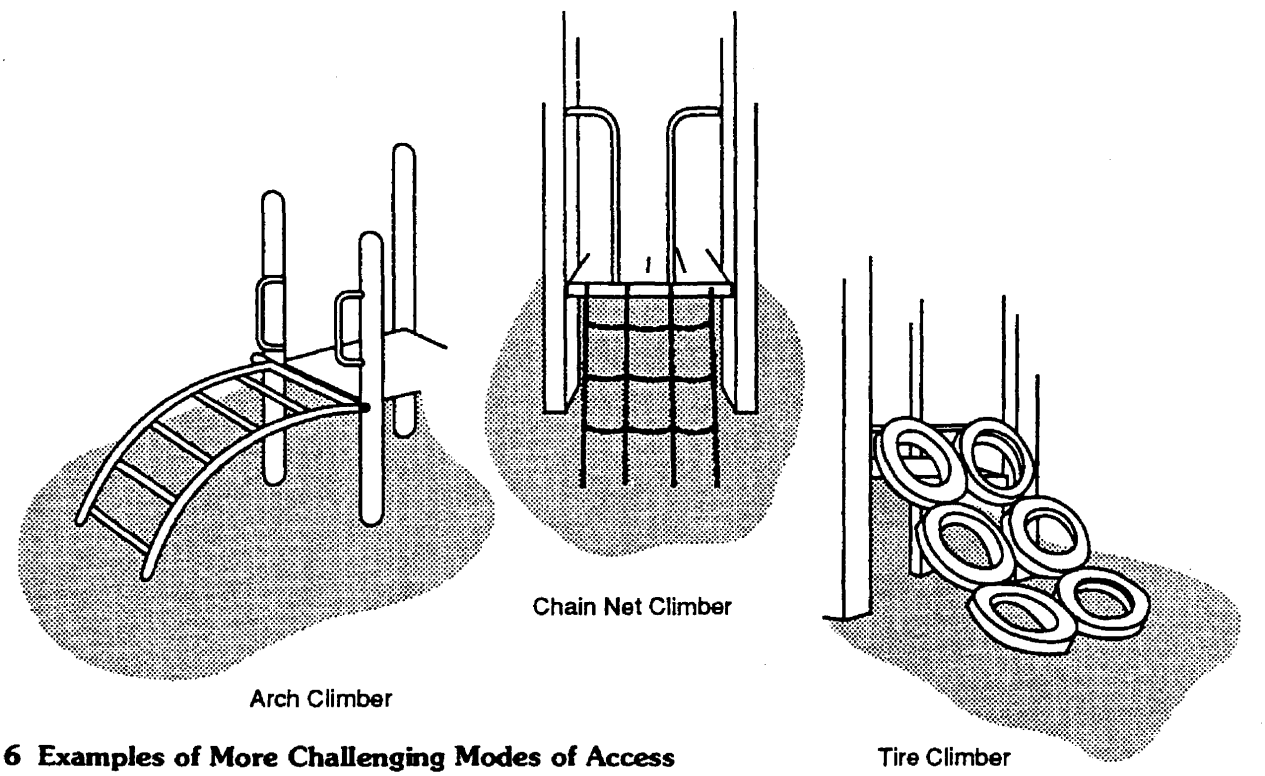


Figure 6 Examples of More Challenging Modes of Access

When risers are closed, treads of stairways and ladders should prevent the accumulation of sand, water, or other materials on or between steps.

8.2.1 Rungs and Other Handgripping Components

Whereas the steps of stairways and stepladders are used only for foot support, the rungs of rung ladders are used for both foot support and for hand support by a climbing child since rung ladders generally do not have handrails.

Rungs are generally round in cross section and should have a diameter or maximum cross sectional dimension between 1 and 1.67 inches. Other components intended to be grasped by the hands such as the bars of climbers should also have a diameter or maximum cross sectional dimension between 1 and 1.67 inches.

Rungs or other handgripping components that are intended to be grasped in a manner such that users will support their entire body weight by their hands should be generally round in cross section with a diameter between 1 and 1.55 inches. To benefit the weakest child in each age group, a diameter of 1.25 inches is preferred.

8.3 Handrails

Handrails on stairways and stepladders are typically intended to provide hand support and to steady the user. Continuous handrails extending over the full length of the access should be provided on both sides of all stairways and stepladders, regardless of the height of the access. Rung ladders do not require handrails since rungs or side supports provide hand support on these more steeply inclined accesses.

TABLE 1

Recommended Dimensions for Access Slope, Tread or Rung Width, Tread Depth, Rung Diameter, and Vertical Rise for Rung Ladders, Stepladders, Stairways, and Ramps.

Type of Access		Age of Intended User 2-5 Years	5-12 Years
Rung Ladders	Slope	75°-90°	75°-90°
	Rung Width	≥ 12"	≥ 16"
	Vertical rise (tread to tread)	≤ 12"**	≤ 12"**
	Rung Diameter	1"-1.67"	1"-1.67"
Stepladders	Slope	50°-75°	50°-75°
	Tread Width - Single File	12"-21"	≥ 16"
	- Two-Abreast	*	≥ 40"
	Tread Depth - Open Riser	≥ 7"	≥ 3"
	- Closed Riser	≥ 7"	≥ 6"
	Vertical Rise (tread to tread)	≤ 9"**	≤ 12"**
Stairways	Slope	≤ 35°	≤ 35°
	Tread Width - Single File	≥ 12"	≥ 16"
	- Two-Abreast	≥ 30"	≥ 40"
	Tread Depth - Open Riser	≥ 7"	≥ 8"
	- Closed Riser	≥ 7"	≥ 8"
	Vertical Rise (tread to tread)	≤ 9"**	≤ 12"**
Ramps (not intended for access by the disabled)	Slope (vertical:horizontal)	≤ 1:8	≤ 1:8
	Width - Single File	≥ 12"	≥ 16"
	- Two-Abreast	≥ 30"	≥ 40"

* Not recommended for preschoolers

** Entrapment provisions apply

8.3.1 Handrail Height

Handrails should be available for use at the appropriate height, beginning with the first step. The vertical distance between the top front edge of a step (tread nosing) and the top surface of the handrail above it should be no less than 22 and no more than 38 inches.

8.3.2 Handrail Diameter

The diameter or maximum cross-sectional dimension of handrails should be between 1 and 1.67 inches.

8.4 Transition from Access to Platform

On any transition from an access mode to a platform, handrails or handholds should be adequate to provide support until the child has fully achieved the desired posture on the platform. Any opening between a handrail and an adjacent vertical structure (e.g., vertical support post for a platform or vertical slat of a protective barrier) should not pose an entrapment hazard (see Section 7.5).

On accesses that do not typically have side handrails, such as rung ladders, flexible climbers, arch climbers, and tire climbers, special attention should be given to providing hand support to facilitate the transition between the top of the access and the platform. Options include vertical handrails and loop handgrips which may extend over the top of the access.

8.5 Platforms

8.5.1 Design Considerations

Platforms should be within $\pm 2°$ of a horizontal plane and openings should be provided to allow for drainage.

8.5.2 Guardrails and Protective Barriers

Either guardrails or protective barriers may be used to prevent inadvertent or unintentional falls off elevated platforms. Protective barriers, however, provide a greater degree of protection in that they should be designed to prevent intentional attempts by children seeking to defeat the barrier either by climbing over or through the barrier.

For example, guardrails may have horizontal rails with openings that are greater than 9 inches. Such openings would not present an entrapment hazard but would not prevent a child from deliberately attempting to climb over or through the openings. On the other hand, a protective barrier should be designed to preclude passage of a child during both inadvertent and intentional attempts to defeat the barrier. Therefore, any openings between uprights or between the platform surface and lower edge of a protective barrier should preclude passage of small torso template (see Appendix B).

8.5.3 Minimum Elevation Requiring Guardrails and Protective Barriers

Guardrails or protective barriers should be provided on platforms, walkways, landings, and transitional surfaces in accordance with the following minimum elevation recommendations.

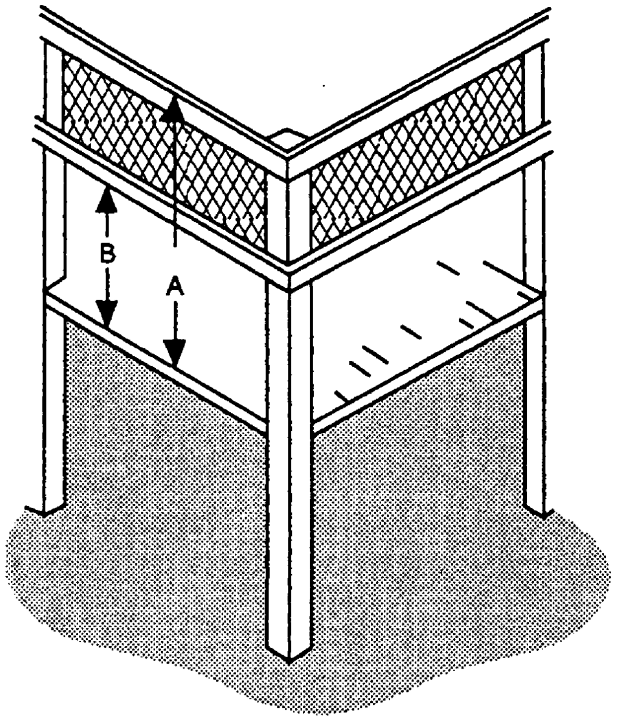
Pre-School Age Children: Since younger children have poorer coordination and balance and are more vulnerable to injury than school-age children, guardrails or protective barriers are warranted at lower elevations. An elevated surface that is more than 20 inches above the underlying surface should have a guardrail or protective barrier to prevent falls. Guardrails are acceptable for platforms greater than 20 inches and less than or equal to 30 inches high, but a full protective barrier may be preferable for this age group since it affords a greater degree of protection from falls. Protective barriers should always be used for platforms that exceed 30 inches in height.

School-Age Children: An elevated surface that is more than 30 inches above the underlying surface should have a guardrail or protective barrier to prevent falls. For platforms greater than 30 inches and less than or equal to 48 inches high, guardrails are acceptable although a full protective barrier always provides greater protection. Platforms that exceed 48 inches in height should always have a protective barrier.

An elevated surface is exempt from these recommendations if a guardrail or protective barrier would interfere with the intended use of the equipment; this includes most climbing equipment, and platforms that are layered so that fall height does not exceed 20 inches on equipment intended for preschool-age children or 30 inches on equipment intended for school-age children.

8.5.4 Minimum Height of Guardrails

The minimum height should prevent the largest child from inadvertently falling over the guardrail. In addition, the guardrail should extend low enough to prevent the smallest child from inadvertently stepping under it (see Figure 7). Infill may be used between the top and intermediate rails to minimize the likelihood of climbing. When solid panels are used as infill, it is recommended that there be some transparent areas to facilitate supervision and to permit viewing from the platform. To prevent head entrapment, guardrails should conform to the entrapment requirements in Section 7.5.



A = 38" minimum for older children
or
29" minimum for younger children

B = 26" maximum for older children
or
23" maximum for younger children

Note: Guardrails should be designed to prevent inadvertent or unintentional falls off the platform, to discourage climbing on the barrier, to preclude the possibility of entrapment, and to facilitate supervision. Refer to text for detailed recommendations regarding infill.

Figure 7 Guardrails on Elevated Surfaces

Pre-School Age Children: the top surface of guardrails should be at least 29 inches high and the lower edge should be no more than 23 inches above the platform.

School Age Children: the top surface of guardrails should be at least 38 inches high and the lower edge should be no more than 26 inches above the platform.

8.5.5 Minimum Height of Protective Barriers

The minimum height should prevent the largest child from inadvertently falling over the protective barrier. In addition, because the protective barrier should not permit children to climb through or under it, openings in the barrier should preclude passage of the small torso template (see Appendix B).

Pre-School Age Children: the top surface of protective barriers should be at least 29 inches high. Vertical infill for protective barriers may be preferable for younger children because the vertical components can be grasped at whatever height a child chooses as a handhold.

School Age Children: the top surface of protective barriers should be at least 38 inches high.

8.5.6 Other Design Considerations for Guardrails and Protective Barriers

Both guardrails and protective barriers should be designed to prevent inadvertent or unintentional falls off the platform, preclude the possibility of entrapment, and facilitate supervision. Horizontal cross-pieces should not be used as infill for the space below the top rail because they provide footholds for climbing.

8.6 Stepped Platforms

On some composite structures, platforms are layered or tiered, so that falls from a higher platform can be terminated by a lower platform rather than by the ground surface.

Unless there is an alternate means of access/egress, the maximum difference in height between stepped platforms should be:

Pre-School Age Children: 12 inches.
School Age Children: 18 inches.

The space between the stepped platforms should follow the recommendations for entrapment in enclosed openings in Section 7.5. If the space exceeds 9 inches and the height of the lower platform exceeds 30 inches for preschool equipment or 48 inches for school-age equipment, infill should be used to reduce the space to less than 3.5 inches.

9. MAJOR TYPES OF PLAYGROUND EQUIPMENT

9.1 Slides

9.1.1 General

Although children under 6 years of age may be more likely to play on slides, older children will still use slides depending on their availability relative to other types of equipment. Children can be expected to descend slide chutes in many different positions, rather than always sitting and facing forward as they slide. They will slide down facing backward, on their knees, lying on their backs, and will walk both up and down the chute. Younger children in particular often slide down on their stomachs, either head or feet first.

Slides may provide a straight, wavy, or spiral descent either by means of a tube or an open slide bed. They may be either free standing (see Figure 8), part of a composite structure, or built on the grade of a natural or man-made slope (embankment slide). The recommendations in this section do not apply to water slides or swimming pool slides.

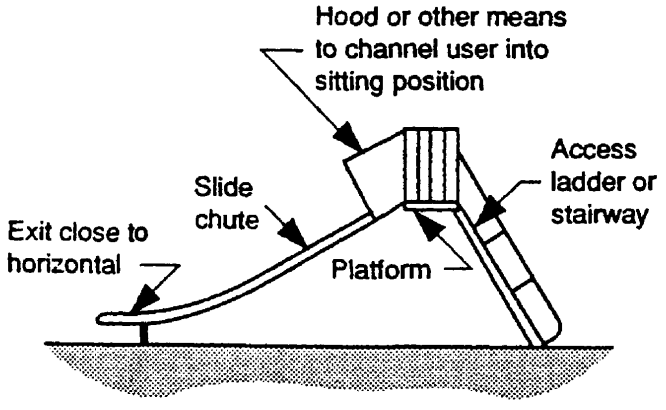


Figure 8 Typical Free-Standing Straight Slide

9.1.2 Slide Access

With the exception of embankment slides, access to a slide may be by means of a ladder with rungs or steps, a stairway with steps, or the slide may be a component of a composite play structure to which access is provided by other means. Whatever means of access is provided to a slide, it should conform to the guidelines specified in the general discussion of access to all playground equipment (see Section 8).

9.1.3 Slide Platform

All slides should be provided with a platform with sufficient length to facilitate the transition from standing to sitting at the top of the inclined sliding surface. The length of the platform will usually not be an issue when the slide is attached to the deck of a composite structure, because decks are typically at least 3 feet square. However, in the case of a free-standing slide, it is recommended that the platform have a minimum length of at least 22 inches.

The platform should be horizontal and have a width at least equal to the width of the slide.

Guardrails or protective barriers should surround a slide platform and should conform to the guidelines specified in the general discussion of platforms (see Section 8.5).

Slides should not have any spaces or gaps between the platform and the start of the sliding surface.

With the exception of tube slides, handholds should be provided at the entrance to all slides to facilitate the transition from standing to sitting and decrease the risk of falls. These should extend high enough to provide hand support for the largest child in a standing position, and low enough to provide hand support for the smallest child in a sitting position.

At the entrance to the chute there should be a means to channel a user into a sitting position. This may be a guardrail, a hood, or other device. Whatever means is provided, it should be of a design that does not encourage climbing.

9.1.4 Sliding Section of Straight Slides

It is recommended that the average incline of the sliding surface should not exceed 30° and any change in the slope of the slide chute (wave slide) should not allow a child to lose contact with the sliding surface

Straight slides with flat open chutes should have sides with a 4 inch minimum height extending along both sides of the chute for the entire length of the inclined sliding surface.

The sides should be an integral part of the chute, without any gaps between the sides and the sliding surface.

Slides may have an open chute with a circular cross section providing that the height of the sides, measured from the lowest point on the chute is no less than half the width of the slide.

Metal slides should either be in shaded areas or face north
› prevent burns and glare problems caused by direct sun
.› the slide chute.

9.1.5 Exit Region

All slides should have an exit region to help children maintain their balance and facilitate a smooth transition from sitting to standing when exiting.

The exit region should be essentially horizontal and parallel to the ground and have a minimum length of 11 inches.

For slides that are no more than 4 feet in height, the height of the exit region should be no more than 11 inches from the protective surface.

For slides that are over four feet in height the exit region should be at least 7 inches but not more than 15 inches above the protective surface.

Slide exit edges should be rounded or curved, to prevent lacerations or other injuries which could result from impact with a sharp or straight edge.

All slide exits should be located in uncongested areas of
› playground.

9.1.6 Embankment Slides

The design of embankment slides basically eliminates the hazard of falls from height. Embankment slides should follow all of the recommendations given for straight slides (where applicable). It is important that some means be provided at the slide chute entrance to minimize the likelihood that they will be used by children riding skateboards or bicycles.

9.1.7 Spiral Slides

It is recommended that spiral slides follow the recommendations for straight slides (where applicable), with special attention given to design features which may present problems unique to spiral slides, such as lateral discharge of the user.

Preschool-Age Children: Because younger children have less ability to maintain balance and postural control, only short spiral slides are recommended for this age group.

9.1.8 Tube Slides

e slides should meet all the applicable requirements
›or other slides.

Barriers should be provided or surfaces treated to prevent sliding on the top of the tube.

The minimum internal diameter of the tube should be no less than 23 inches.

It should be noted that children using tube slides are not visible to a supervisor. Consideration should be given to extra supervision on playgrounds having tube slides.

9.1.9 Roller Slides

These are not recommended for public playgrounds unless frequent maintenance can be guaranteed.

9.2 Swings

9.2.1 General

Children of all ages generally enjoy the sensations created while swinging. Most often, they sit on the swings, and it is common to see children jumping off swings. Younger children tend to also swing on their stomachs, and older children may stand on the seats.

Swings may be divided into two distinct types, single axis of motion and multiple axes of motion. A single axis swing is intended to swing back-and-forth in a single plane and generally consists of a seat supported by at least two suspending members each of which is connected to a separate pivot on an overhead structure. A multiple-axis swing consists of a seat (generally a tire) suspended from a single pivot that permits it to swing in any direction.

Hardware used to secure the suspending elements to the swing seat and to the supporting structure should not be removable without the use of tools. S-hooks are often part of a swing's suspension system, either attaching the suspending elements to the overhead support bar or to the swing seat. Open S-hooks are hazardous because they can catch a child's clothing and result in strangulation. S-hooks should be pinched closed as tightly as possible.

Swings should be suspended from support structures that discourage climbing. A-frame support structures should not have horizontal cross-bars.

9.2.2 Single Axis Swings

To help prevent young children from inadvertently running into the path of moving swings, swing structures should be located away from other equipment or activities. Additional protection can be provided by means of a low barrier, such as a fence or hedge. Such barriers

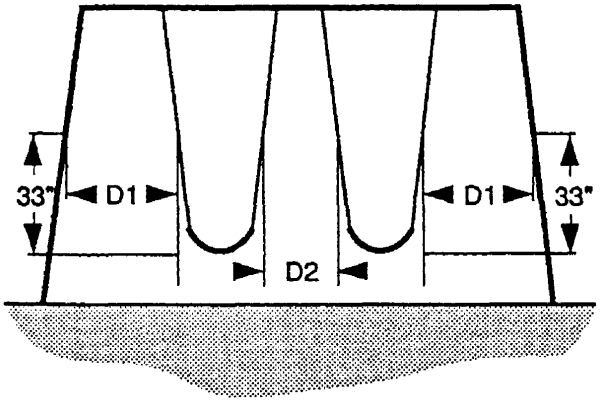
should not be an obstacle within the use zone of a swing structure or hamper supervision by blocking visibility.

To minimize the likelihood of children being struck by a moving swing, it is recommended that no more than two single axis swings be hung in each bay of the supporting structure.

Attaching single-axis swings to composite structures is not recommended.

Swing seats should be designed to accommodate no more than one user at any time. To help reduce the severity of impact injuries, wood or metal swing seats are not recommended. Edges of seats should have smoothly finished or rounded edges and should conform to the protrusion recommendations in Section 7.3.

To minimize collisions between swings or between a swing and the supporting structure, the clearances shown in Figure 9 are recommended. In addition, to reduce side-to-side motion, swing hangers should be spaced wider than the width of the swing seat.



D1 = Minimum 30"
D2 = Minimum 24"

Figure 9 Minimum Clearances for Swings

9.2.3 Tot Swings

These are single axis swings intended for very young children to use with adult assistance. The seats and suspension systems of these swings, including the related hardware, should follow all of the other criteria for conventional single axis swings.

Tot swing seats should provide support on all sides of a child (see Figure 10). It is important that such supports do not present a strangulation hazard. Openings in tot swing seats should conform to the entrapment criteria in Section 7.5.

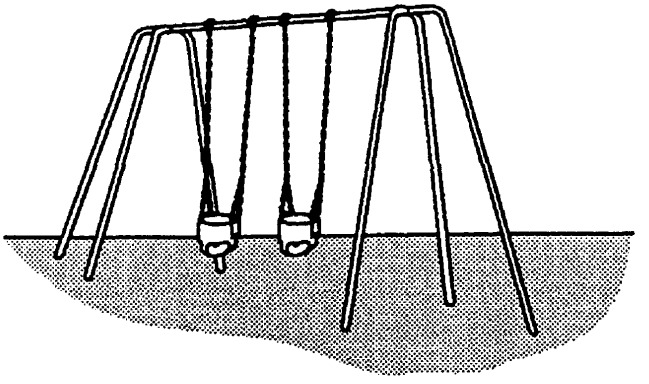


Figure 10 Examples of Tot Swings

It is recommended that tot swings be suspended from structures which are separate from those for other swings, or at least suspended from a separate bay of the same structure.

9.2.4 Multi-Axis Tire Swings

Tire swings are typically suspended in a horizontal orientation using three suspension chains or cables connected to a single swivel mechanism that permits both rotation and a swinging motion in any axis.

A multi-axis tire swing should not be suspended from a structure having other swings in the same bay.

To minimize the hazard of impact, heavy truck tires should be avoided. Further, if steel-belted radials are used, they should be closely examined to ensure that there are no exposed steel belts that could be a potential protrusion or laceration hazard. Plastic materials can be used as an alternative to simulate actual automobile tires. Drainage holes should be provided in the underside of the tire.

The likelihood of hanger mechanism failure is increased for tire swings, due to the added stress of rotational

movement and multiple occupancy. Special attention to maintenance is warranted. The hanger mechanisms for multi-axis tire swings should not have any accessible pinch points.

The minimum clearance between the seating surface of a tire swing and the uprights of the supporting structure should be 30 inches when the tire is in a position closest to the support structure (see Figure 11).

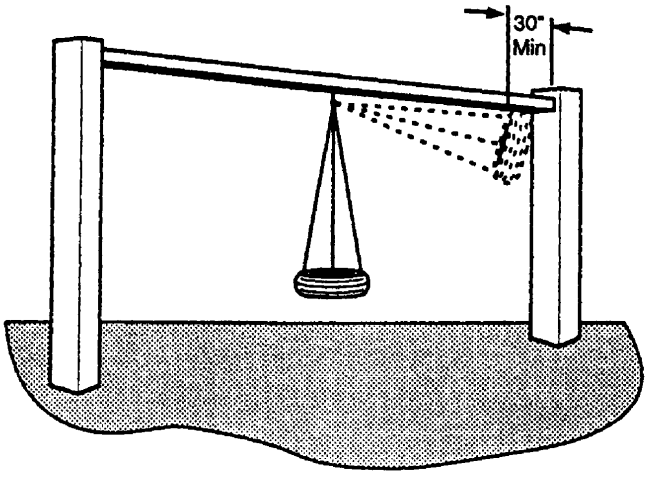


Figure 11 Multi-Axis Tire Swing Clearance

9.2.5 Swings Not Recommended for Public Playgrounds

The following types of swings are not recommended for use in public playgrounds:

Multiple Occupancy Swings - With the exception of tire swings, swings that are intended for more than one user are not recommended because their greater mass, as compared to single occupancy swings, presents a risk of impact injury.

Animal Figure Swings - These are not recommended because their rigid metal framework results in a high mass presenting a risk of impact injury.

Rope Swings - Free swinging ropes that may fray or otherwise form a loop are not recommended because they present a potential strangulation hazard.

Swinging Exercise Rings and Trapeze Bars - These are generally considered to be items of athletic equipment and are not recommended for public playgrounds. NOTE: The recommendation against the use of exercise rings does not apply to overhead hanging rings (see Figure 12).

9.3 Climbing Equipment

9.3.1 General

Climbers refer to a wide variety of equipment including arch climbers, sliding poles, chain or net climbers, upper body devices (overhead horizontal ladders, overhead rings), dome climbers, parallel bars, balance beams, cable walks, suspension bridges, and spiral climbers, as well as composite structures with linked platforms (see Figure 12 for examples). Climbing equipment is generally designed to present a greater degree of physical challenge than other equipment on public playgrounds.

Older children tend to use climbing equipment more frequently and proficiently than younger ones. Because very young children have not yet developed some of the physical skills necessary for certain climbing activities (including balance, coordination, and upper body strength), they may have difficulty using more challenging climbing components such as rung ladders, non-rigid climbers, arch climbers, and upper body devices.

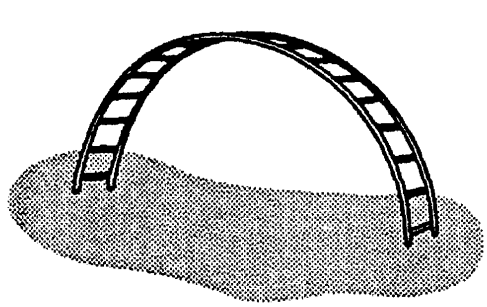
9.3.2 Design Considerations

Since the more challenging modes of access discussed in Section 8 are also intended to be used as climbing devices, the recommendations for the size of handgripping components and stepped platforms covered in that section are applicable to climbing equipment.

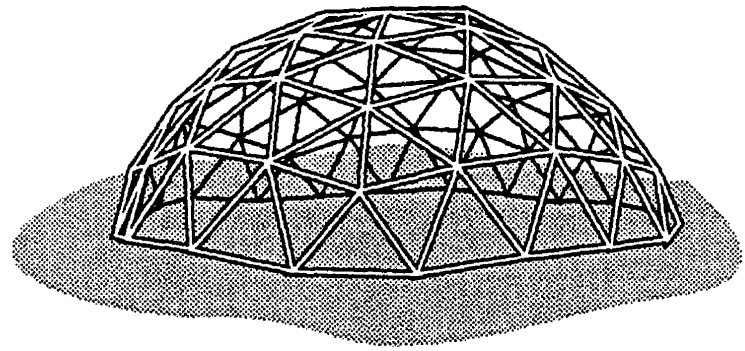
Climbers should not have climbing bars or other structural components in the interior of the structure onto which a child may fall from a height of greater than 18 inches.

Climbing equipment should allow children to descend as easily as they ascend. One way of implementing this recommendation is to provide an easier, alternate means of descent, such as another mode of access, platform, or piece of equipment. For example, a stairway can be added to provide a less challenging mode of descent than a vertical rung ladder or flexible climbing device. The levels of challenge that characterize different types of accesses are discussed in Section 8.

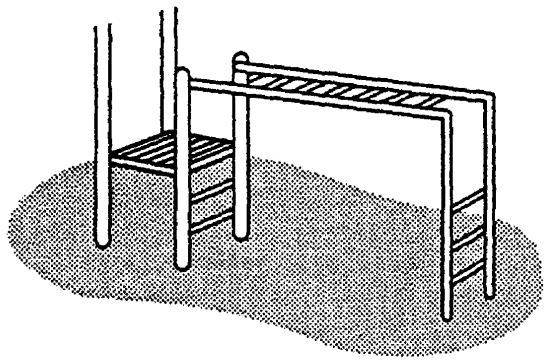
Preschool-Age Children Offering an easy way out is particularly important on climbing devices intended for preschoolers, since their ability to descend climbing components emerges later than their ability to climb up the same components.



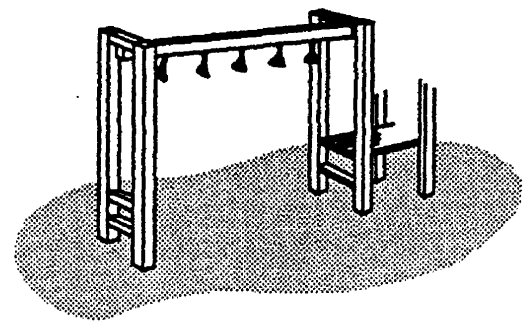
Simple Arch Climber



Geodesic Dome Climber



*Overhead Horizontal Ladder



*Overhead Hanging Rings

*Note: This design shows how upper body equipment is typically integrated with multi-use equipment.

Figure 12 Typical Climbing Equipment

9.3.3 Climbers With Non-Rigid Components

Net and chain climbers use a flexible grid of ropes or chains for climbing. Tire climbers are also described as flexible climbers. These may have the tires secured tread-to-tread in the form of a sloping grid or the tires may be suspended individually by chains or other means to provide access to an elevated platform. Since net, chain, and tire climbers have flexible components that do not provide a steady means of support, and therefore require more advanced balance abilities than conventional ladders, they require special consideration.

Flexible grid climbing devices which provide access to platforms should be securely anchored at both ends. When one end is connected to the ground, the anchoring devices shall be below the level of the playing surface.

Connections between ropes, cables, or chains within the climbing grid or between tires should be securely fixed. Spacing between the horizontal and vertical components of a climbing grid should satisfy all entrapment criteria (see Section 7.5).

Flexible grid climbing devices are not recommended as the sole means of access to equipment intended for pre-school-age children.

9.3.4 Arch Climbers

Arch climbers consist of metal or wood rungs attached to convex side supports. They may be free standing (see Figure 12) or be provided as a more challenging means of access to other equipment (see Figure 6). Because of this extra challenge, they should not be used as the sole means of access to other equipment. A less challenging option will ensure that children use the arch climber because they are willing to assume the challenge and not because they are forced to use it. Free standing arch climbers are not recommended for preschool-age children.

The rung diameter and spacing of rungs on arch climbers should follow the recommendations for rung ladders in Table 1.

9.3.5 Horizontal Ladders and Overhead Rings

our year-olds are generally the youngest children capable of using upper body devices such as these. The recommendations below are, therefore, designed to accommodate children 4 through 12 years of age.

The space between adjacent rungs of overhead ladders should be greater than 9 inches to satisfy the entrapment requirements (see Section 7.5). The center-to-center spacing of horizontal ladder rungs should not exceed 15 inches. This does not apply to the spacing of overhead rings because, during use, the gripped ring swings through an arc and reduces the distance to the gripping surface of the next ring.

The first handhold on either end of upper body equipment should not be placed directly above the platform or climbing rung used for mount or dismount. This minimizes the risk of children impacting rigid access structures if they fall from the first handhold during mount or dismount.

9.3.6 Sliding Poles

Vertical sliding poles are designed to be more challenging than some other types of climbing equipment. They are ot recommended for preschool-age children who may ck the requisite upper body strength and coordination to successfully slide down the pole. Furthermore, once younger children have grasped the pole, they would be forced to slide down it since there is no alternative option.

Sliding poles should be continuous with no protruding welds or seams along the sliding surface and the pole should not change direction along the sliding portion.

The horizontal distance between a sliding pole and the edge of the platform or other structure used for access to the sliding pole should be at least 18 inches. This minimum distance applies to all points down the sliding pole.

All points on the sliding pole at or above the level of the access structure, where a child is likely to reach for the pole, should not be more than 20 inches away from the edge of the access structure.

The pole should extend at least 38 inches above the level of the platform or other structure used for access to the sliding pole.

The diameter of sliding poles should be no greater than 9 inches.

The design of the access structure should minimize the possibility of interference from surrounding traffic that may be out of the line of sight of a user during descent.

9.3.7 Climbing Ropes

Individual vertically suspended climbing ropes are recommended only if they are securely anchored to a footing at the lower end to prevent the rope from being looped back on itself and forming a noose.

9.3.8 Balance Beams

To avoid groin injuries during falls, balance beams should be no higher than 12 inches.

9.3.9 Layout of Climbing Components

When climbing components are part of a composite structure, their level of challenge and mode of use should be compatible with the traffic flow from adjacent components.

The swinging movements generated on upper body devices warrant special precautions to reduce the risk of impact with children on adjacent structures. Upper body devices should be placed so that swinging children cannot interfere with the movement of children on adjacent structures, particularly with their descent on slides.

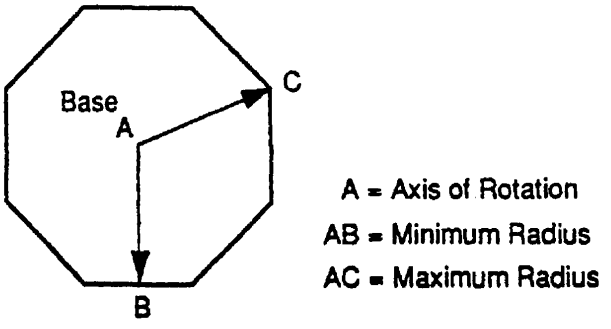
The design of adjacent play structures should not facilitate climbing to the top support bars of upper body equipment.

9.4 Merry-Go-Rounds

Merry-go-rounds are the most common type of rotating equipment found on public playgrounds. Children usually sit or stand on the platform while other children or adults push the merry-go-round to make it rotate. In addition, children often get on and off the merry-go-round while it is in motion.

Merry-go-rounds may present a physical hazard to preschool-age children who have little or no control over such products once they are in motion. Merry-go-rounds are not recommended unless the following are observed:

The rotating platform should be continuous and approximately circular. The difference between the minimum and maximum radii of a non-circular platform should not exceed 2.0 inches (see Figure 13). No components of the apparatus, including handgrips, should extend beyond the perimeter of the platform.



The difference between dimensions AC and AB should not exceed 2.0 inches.

Figure 13 Minimum and Maximum Radii of Non-Circular Merry-Go-Round Platform

Children should be provided with a secure means of holding on. Where handgrips are provided, they should conform to the general requirements for handgripping components in Section 8.2.1.

There should not be any accessible shearing or crushing mechanisms in the undercarriage of the equipment. The rotating platform of a merry-go-round should not have any sharp edges. The surface of the platform should be continuous with no openings between the axis and the periphery that permit a rod having a diameter of 5/16 inch to penetrate completely through the surface.

A means should be provided to limit the peripheral speed of rotation to a maximum of 13 ft/sec.

Merry-go-round platforms should not be provided with an oscillatory (up and down) motion.

9.5 Seesaws

The typical seesaw (also known as a "teeter totter") consists of a board or pole supported at the center by a fulcrum and having a seat at each end (see Figure 14). Seesaw use is quite complex because it requires two children to cooperate and combine their actions. Younger children do not generally have the skills required to effectively use fulcrum seesaws. Therefore, they are not recommended on public playgrounds for preschool-age children unless they are equipped with a spring centering device to prevent abrupt contact with the ground should one child elect to dismount.

There is a trend to replace fulcrum seesaws on public playgrounds with spring-loaded seesaws, which have the advantage of not requiring two children to coordinate their actions in order to play safely (see discussion of Spring Rocking Equipment in Section 9.6).

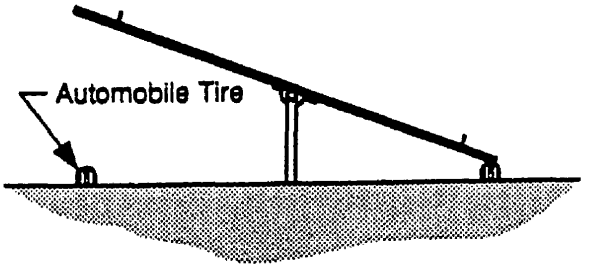


Figure 14 Typical Fulcrum Seesaw

The fulcrum of fulcrum seesaws should not present a pinch or crush hazard.

Partial car tires, or some other shock-absorbing material, should be embedded in the ground underneath the seats of fulcrum seesaws, or secured on the underside of the seats. This will help prevent limbs from being crushed between the seat and the ground, as well as cushion the impact. Fulcrum see-saws may also be equipped with a spring centering mechanism to minimize the risk of injury due to impact with the ground.

Handholds should be provided at each seating position for gripping with both hands and should not turn when grasped. Handholds should not protrude beyond the sides of the seat. Footrests should not be provided on fulcrum see-saws unless they are equipped with a spring centering mechanism to minimize the likelihood of impact with the ground.

9.6 Spring Rocking Equipment

Younger children enjoy the bouncing and rocking activities presented by this equipment, but older children typically do not find it challenging enough.

Examples of spring rockers are shown in Figure 15. Preschoolers are the primary users of such rocking equipment. Therefore, the recommendations in this section address only preschool-age children.

Seat design should minimize the likelihood of the rocker being used by more than the intended number of users.

Each seating position should be equipped with handgrips and footrests. The diameter of handgrips should follow the general recommendations for handgripping components in Section 8.5.2.

The springs of rocking equipment should minimize the possibility of children pinching either their hands or their feet between coils or between the spring and a part of the rocker.

9.7 Trampolines

Trampolines are not recommended for use on public playgrounds.

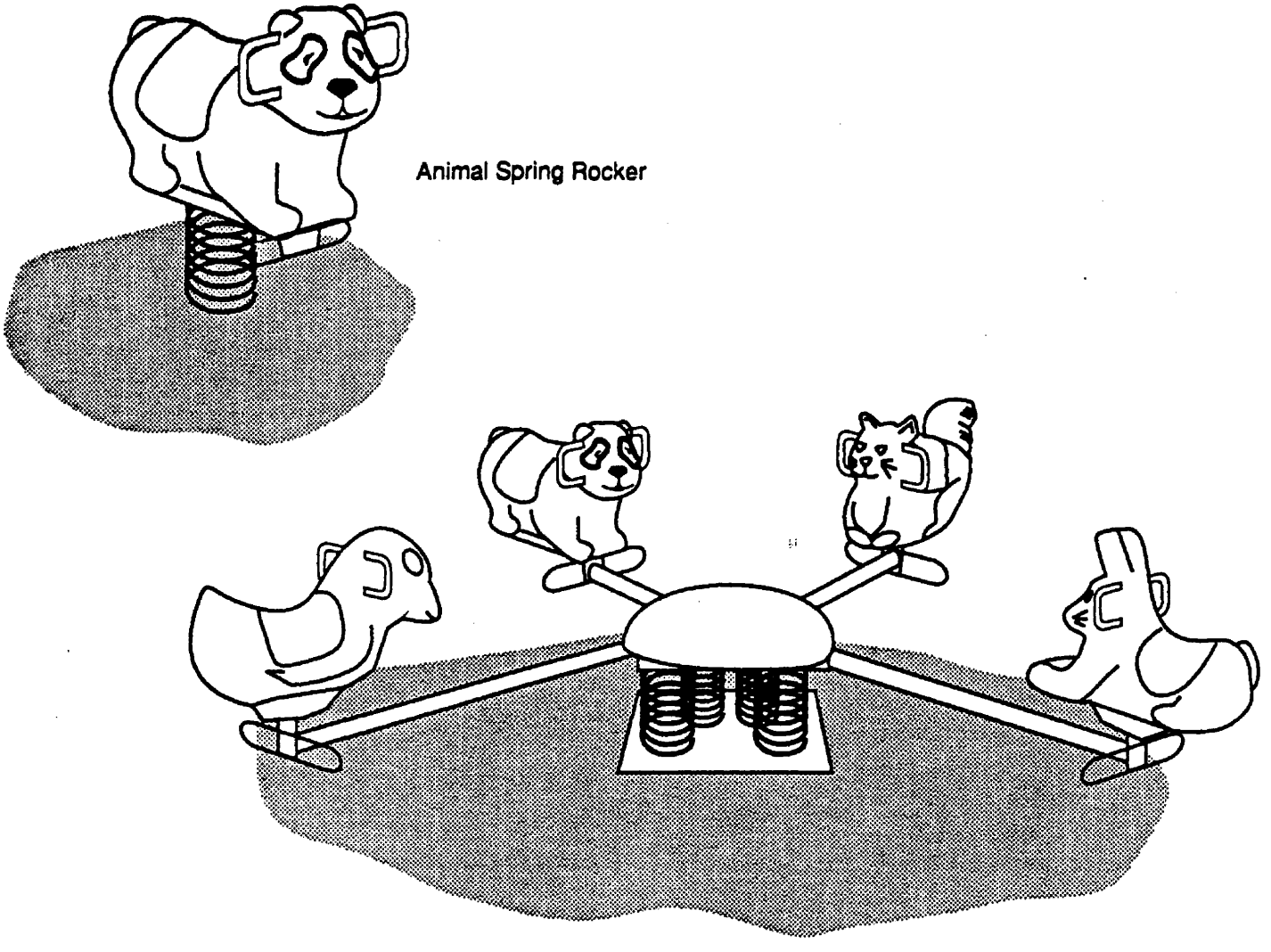


Figure 15 Typical Spring Rocking Equipment

10. SURFACING

The surface under and around playground equipment can be a major factor in determining the injury-causing potential of a fall. It is self evident that a fall onto a shock absorbing surface is less likely to cause a serious injury than a fall onto a hard surface. Because head impact injuries from a fall have the potential for being life threatening, the more shock absorbing a surface can be made, the more is the likelihood that the severity of the injury will be reduced. However, it should be recognized that all injuries due to falls cannot be prevented no matter what playground surfacing material is used.

10.1 Determining Shock Absorbency of a Surfacing Material

No data are available to predict precisely the threshold tolerance of the human head to an impact injury. However, biomedical researchers have established two methods that may be used to determine when such an injury may be life threatening.

One method holds that if the peak deceleration of the head during impact does not exceed 200 times the acceleration due to gravity (200 G's), a life threatening head injury is not likely to occur. The second method holds that both the deceleration of the head during impact and the time duration over which the head decelerates to a halt are significant in assessing head impact injury. This latter method uses a mathematical formula to derive a value known as Head Injury Criteria (HIC) [6]. Head impact injuries are not believed to be life threatening if the HIC does not exceed a value of 1,000.

The most widely used test method for evaluating the shock absorbing properties of a playground surfacing material is to drop an instrumented metal headform onto a sample of the material and record the acceleration/time pulse during the impact. Such a method is described in an ASTM Standard Specification for Impact Attenuation of Surface Systems Under and Around Playground Equipment, ASTM F1292 [7].

10.2 Critical Height

This is a term originating from Europe and is used to describe the shock absorbing performance of a surfacing material. As it is used in this publication, the Critical Height for a surfacing material is defined as **the maximum height from which the instrumented metal headform, upon impact, yields both a peak deceleration of no more than 200 G's and a HIC of no more than 1,000 when tested in accordance with the procedure described in ASTM F1292.** Critical Height, therefore, can be considered as an approximation of the maximum fall height from which a life-threatening head injury would not be expected to occur.

The surfacing material used under and around a particular piece of playground equipment should have a Critical Height value of at least the height of the highest accessible part of the equipment.

10.3 Highest Accessible Part of Equipment

Recommendations for the "highest accessible part" for various pieces of playground equipment are as follows.

Swings - Since children may fall from a swing seat at its maximum attainable angle (assumed to be 90° from the "at rest" position), the highest accessible part of a swing structure is the height of the pivot point where the swing's suspending elements connect to the supporting structure.

Elevated Platforms Including Slide Platforms - Since children may climb onto or over guardrails, the highest accessible part of a platform surrounded by guardrails is the height above the playing surface of the top of the guardrail . Since protective barriers are designed to minimize the likelihood of climbing, the highest accessible part of a platform surrounded by protective barriers is the height of the platform surface above the ground.

Climbers and Horizontal Ladders - For structures that are intended to be climbed upon, the highest accessible part is the maximum height of the structure.

Merry-Go-Rounds - The highest accessible part is the height above the ground of any part at the perimeter on which a child may sit or stand.

See-Saws - The highest accessible part is the maximum height attainable by any part of the see-saw.

Spring Rockers - The highest accessible part is the maximum height above the ground of the seat or designated play surface.

10.4 Acceptability of Various Surfacing Materials

Hard surfacing materials, such as asphalt or concrete, are unsuitable for use under and around playground equipment of any height unless they are required as a base for a shock absorbing unitary material such as a rubber mat. Earth surfaces such as soils and hard packed dirt are also not recommended because their shock absorbing properties can vary considerably depending on climatic conditions such as moisture and temperature. Similarly, grass

and turf are not recommended because their effectiveness n absorbing shock during a fall can be reduced considerably due to wear and environmental conditions.

Acceptable playground surfacing materials are available in two basic types, **unitary** or **loose-fill**.

Unitary Materials - are generally rubber mats or a combination of rubberlike materials held in place by a binder that may be poured in place at the playground site and cures to form a unitary shock absorbing surface. Unitary materials are available from a number of different manufacturers many of whom have a range of materials with differing shock absorbing properties. Persons wishing to install a unitary material as a playground surface should request test data from the manufacturer that should identify the Critical Height of the desired material. In addition, site requirements should be obtained from the manufacturer because, as stated above, some unitary materials require installation over a hard surface while for others this is not required.

Loose-Fill Materials - can also have acceptable shock absorbing properties when installed at a sufficient depth. These materials include, but are not confined to, sand, gravel, and shredded wood products. Loose-fill materials should not be installed over hard surfaces such as asphalt or concrete.

Because loose-fill materials are generally sold for purposes other than playground surfacing, many vendors are unlikely to be able to provide information on their shock absorbing performance. For that reason, CPSC staff has conducted tests to determine the relative shock absorbing properties of some loose-fill materials commonly used as surfaces under and around playground equipment. Appendix D contains a description of the tested materials. The tests were conducted in accordance with the procedure in the voluntary standard for playground surfacing systems, ASTM F1292. Table 2, below, lists the critical height (expressed in feet) for each of seven materials when tested in an uncompressed state at depths of 6, 9, and 12 inches. The table also reports the critical height when a 9 inch depth of each material was tested in a compressed state.

The table should be read as follows: If, for example, uncompressed wood mulch is used at a minimum depth of 6 inches, the Critical Height is 7 feet. If 9 inches of uncompressed wood mulch is used, the Critical height is 10 feet. It should be noted that, for some materials, the Critical Height decreases when the material is compressed.

TABLE 2
Critical Heights (in feet)
of Tested Materials

	Uncompressed depth			Compressed depth
Material	**6 inch**	**9 inch**	**12 inch**	**9 inch**
Wood Mulch	7	10	11	10
Double Shredded Bark Mulch	6	10	11	7
Uniform Wood Chips	6	7	>12	6
Fine Sand	5	5	9	5
Coarse Sand	5	5	6	4
Fine Gravel	6	7	10	6
Medium Gravel	5	5	6	5

The Critical Heights shown in the above table may be used as a guide in selecting the type and depth of loose-fill materials that will provide the necessary safety for equipment of various heights. There may be other loose-fill materials such as bark nuggets or shredded tires that have shock absorbing properties equivalent to those in the above table. However, no tests have been conducted on these materials by CPSC staff.

The depth of any loose fill material could be reduced during use resulting in different shock-absorbing properties. For this reason, a margin of safety should be considered in selecting a type and depth of material for a specific use.

10.5 Accessibility to the Disabled

The Americans with Disabilities Act of 1990 (ADA) prohibits discrimination on the basis of disability in employment, public services, transportation, public accommodations - including many services operated by private entities, - and telecommunications. Title III of the legislation includes within the definition of public accommodation: "a park, zoo, amusement park, or other place of recreation"; a school, including nursery schools; a day care center; and a gymnasium, health spa, or "other places of exercise or recreation."

Specific Federal requirements for accessibility to playgrounds by the disabled are expected to be published.

The Department of Parks and Recreation in the State of California has advised that after January 1, 1991, regulations requiring that all types of play activity in new and redone play areas must be accessible to the disabled. Other states may similarly issue accessibility requirements. Playground designers, installers and operators are reminded that they should determine what Federal and State requirements for accessibility are in effect. These requirements could necessitate changes to existing playgrounds as well as when new playgrounds are planned or existing playgrounds refurbished.

10.6 Other Characteristics of Surfacing Materials

Selection of a surfacing material for a specific location may be governed by the environmental conditions at that location. Appendix C lists some characteristics of surfacing materials that may influence the choice for a particular playground.

USE ZONES FOR EQUIPMENT

The use zone for each piece of equipment is made up of two parts:

(1) the Fall Zone: an area under and around the equipment where protective surfacing is required, and,

(2) the No-Encroachment Zone: an additional area beyond the fall zone where children using the equipment can be expected to move about and should have no encroaching obstacles.

With the exception of spring rocking equipment, equipment under 24 inches in height, and the zone between adjacent swings (see below), the fall zones of adjacent pieces of equipment should not overlap. However, adjacent pieces of equipment may share a single no-encroachment zone.

Regardless of the type of equipment, the use zone should be free of obstacles that children could run into or fall on top of and thus be injured. For example, there should not be any vertical posts or other objects protruding from the ground onto which a child may fall.

11.1 Recommendations for Fall Zone

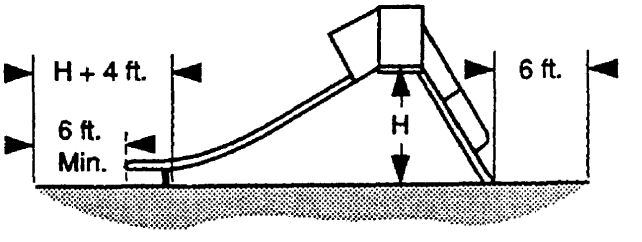
11.1.1 Stationary Equipment

The fall zone should extend a minimum of 6 feet in all directions from the perimeter of the equipment.

11.1.2 Slides

The fall zone in front of the access and to the sides of a slide shall extend a minimum of 6 feet from the perimeter of the equipment. Note: This does not apply to embankment slides.

The fall zone in front of the exit of a slide shall extend a minimum distance of 6 feet from the end of the slide chute or for a distance of H + 4 feet whichever is the greater. H is the height of the slide platform and the H + 4 foot measurement is made from a point on the slide chute where the gradient has been reduced to 5° from the horizontal (see Figure 16).



Denotes Fall Zone with Protective Surfacing

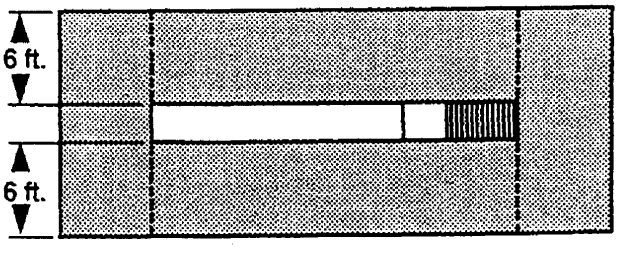


Figure 16 Fall Zone for Slides

11.1.3 Single Axis Swings

Because children may deliberately attempt to exit from a single axis swing while it is in motion, the fall zone in front of and behind the swing should be greater than to the sides of such a swing. It is recommended that the fall zone extend to the front and rear of a single axis swing a minimum distance of 2 times the height of the pivot point above the surfacing material measured from a point directly beneath the pivot on the supporting structure (see Figure 17). The fall zone to the sides of a single axis swing should follow the general recommendation and extend a minimum of 6 feet from the perimeter of the swing structure in accordance with the general recommendation for fall zones. This 6 foot zone may overlap that of an adjacent swing structure.

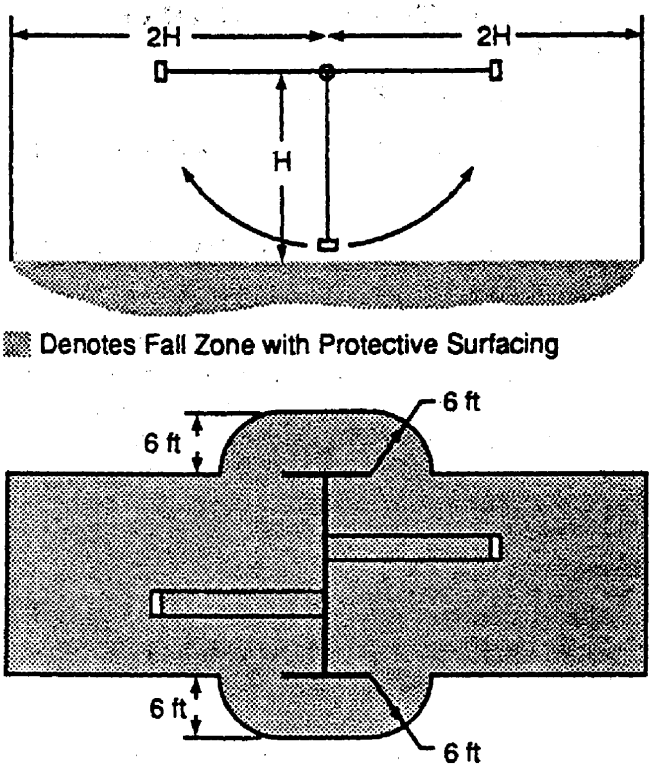


Figure 17 Fall Zone for Single Axis Swings

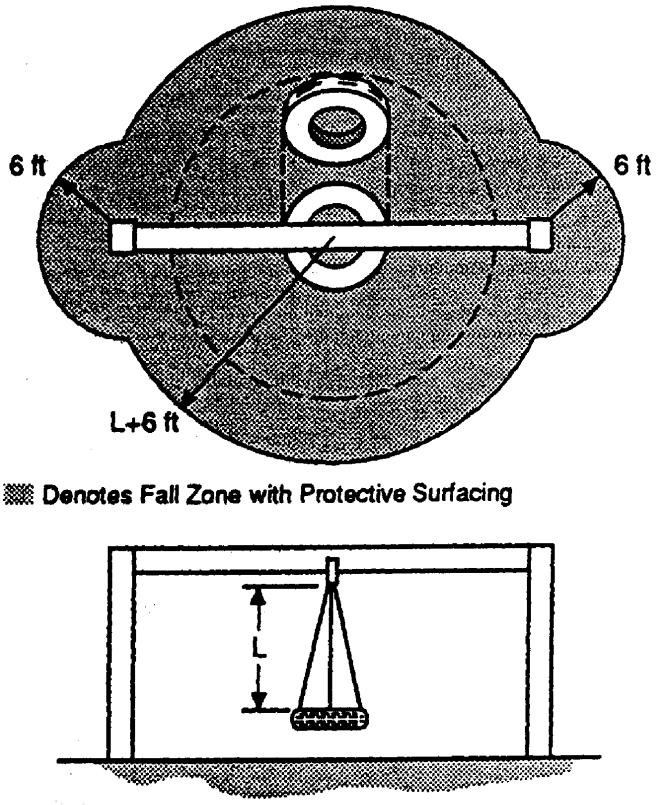


Figure 18 Fall Zone for Multi Axis Tire Swings

11.1.4 Multi Axis Swings

The fall zone should extend in any direction from a point directly beneath the pivot point for a minimum distance of 6 feet + the length of the suspending members (see Figure 18). In addition, the fall zone shall extend a minimum of 6 feet from the perimeter of the supporting structure. This 6 foot zone may overlap that of an adjacent swing structure.

11.1.5 Merry-Go-Rounds

The fall zone should extend 6 feet beyond the perimeter of the platform.

11.1.6 Spring Rocking Equipment

The fall zone should extend a minimum of 6 feet from the "at rest" perimeter of the equipment but adjacent spring rockers with a maximum seat height of 24 inches may share the same fall zone.

11.1.7 Composite Equipment

The above recommendations for individual pieces of equipment should be used as a guide in establishing the zones around pieces of composite playground equipment. Note that in Section 9.2.2 it was recommended that single axis swings not be a part of a composite structure.

11.2 Recommendations for No-Encroachment Zone

No specific dimensions can be recommended for the no-encroachment zone around individual pieces of playground equipment. These dimensions will vary according to the types of adjacent pieces of equipment and their orientation with respect to one another.

For example, the recommended fall zone at the side of both a slide and a swing is 6 feet. Since fall zones should not overlap (with the exception of certain adjacent spring rockers), a slide could be placed with its side no closer than 12 feet to the side of a swing. Therefore, there may be no need to add an additional no-encroachment zone. Conversely, it would not be desirable to have a slide exit facing the front or rear of single axis swing.

No-encroachment zones extending beyond the fall zones are recommended for moving equipment or equipment from which the child is in motion as he or she exits. This

allows more space for children to regain their balance upon exiting the equipment and also provides added protection against other children running into a moving part.

For a single axis swing, it is recommended that there be a barrier beyond the fall zone in front of the swing if it is located in a playground facing other pieces of equipment.

REFERENCES

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2.Tinsworth, Deborah Kale, Kramer, John T., *Playground Equipment-Related Injuries and Deaths;* U. S. Consumer Product Safety Commission, Washington D.C. 20207, April 1990.

3.Title 16, Code of Federal Regulations, Part 1303; *Ban of Lead-Containing Paint and Certain Consumer Products Bearing Lead-Containing Paint;* Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

4.Lee, Brian C., *Estimate of Risk of Skin Cancer from Dislodgeable Arsenic on Pressure Treated Wood Playground Equipment;* U.S. Consumer Product Safety Commission, Washington, D.C. 20207, January 1990.

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6.Collantes, Margarita, *Evaluation of the Importance of Using Head Injury Criterion (HIC) to Estimate the Likelihood of Head Impact Injury as a Result of a Fall Onto Playground Surface Materials;* U.S. Consumer Product Safety Commission, Washington, D.C. 20207, October 1990.

7.*Standard Specification for Impact Attenuation of Surface Systems Under and Around Playground Equipment, ASTM F1292;* ASTM, 1916 Race Street, Philadelphia, PA 19103.

APPENDIX A

SUGGESTED GENERAL MAINTENANCE CHECKLIST

General Upkeep of Playgrounds

Check the entire playground area for miscellaneous debris or litter.

Check for missing trash receptacles and for those which are full.

Check for any damage (i.e., any broken or missing components) to equipment or other playground features caused by vandalism or wear; for example, check for any broken or missing handrails, guardrails, protective barriers, or steps or rungs on ladders, and for damage to any fences, benches, or signs on the playground.

Surfacing

Check for equipment which does not have adequate protective surfacing under and around it and for surfacing materials that have deteriorated.

Check loose surfacing materials for foreign objects or debris.

Check loose surfacing materials for compaction and reduced depth, with special attention to heavy use areas such as those under swings and slide exit regions.

General hazards

Check all equipment and other playground features for any hazards which may have emerged.

Check for sharp points, corners, and edges; for example check the sides and sliding surface of slide chutes for sharp or rough edges caused by deterioration.

Check for protrusions and projections.

Check for missing or damaged protective caps or plugs.

Check for potential clothing entanglement hazards, such as open S-hooks.

Check for pinch, crush, and shearing points or exposed moving parts.

Check for trip hazards, such as exposed footings on anchoring devices and rocks, roots, or any other environmental obstacles in the play area.

Deterioration of Equipment

Check all equipment and other playground features for rust, rot, cracks, and splinters, with special attention to possible corrosion where structures come in contact with the ground.

Check for unstable anchoring of equipment.

Security of hardware

Check for any loose or worn connecting,covering, or fastening hardware devices: for example, check the S-hooks at both ends of suspending elements of swings and all connection points on flexible climbing devices for wear.

Check all moving parts, such as swing bearing hangers, for wear.

Equipment use zones

Check for obstacles in equipment use zones.

Drainage systems

Check the entire play area for drainage problems, with special attention to heavy use areas such as those under swings and slide exit regions.

APPENDIX B

ENTRAPMENT REQUIREMENTS AND TEST METHODS

B1. General

Any completely-bounded opening (see Figure B-1) may be a potential head entrapment hazard and should conform to the recommendations in this appendix. One exception to these recommendations is an opening where the ground serves as the lower boundary. Openings in both horizontal and vertical planes present a risk of entrapment. Even those openings which are low enough to permit a child's feet to touch the ground present a risk of strangulation to an entrapped child, because younger children may not have the necessary cognitive ability and motor skills to extricate their heads, especially if scared or panicked.

An opening may present an entrapment hazard if the distance between any interior opposing surfaces is greater than 3.5 inches or less than 9 inches; when one dimension of an opening is within this potentially hazardous range, all dimensions of the opening must be considered together to fully evaluate the possibility of entrapment. The most appropriate method to determine whether an opening is hazardous is to test it using the following fixtures, methods, and performance criteria.

These recommendations apply to all playground equipment, both for preschool-age and school-age children; fixed equipment as well as moving equipment (in its stationary position) should be tested for entrapment hazards. There are two special cases for which separate procedures are given: completely-bounded openings where depth of penetration is a critical issue (see Figure B-2); and openings formed by non-rigid climbing components.

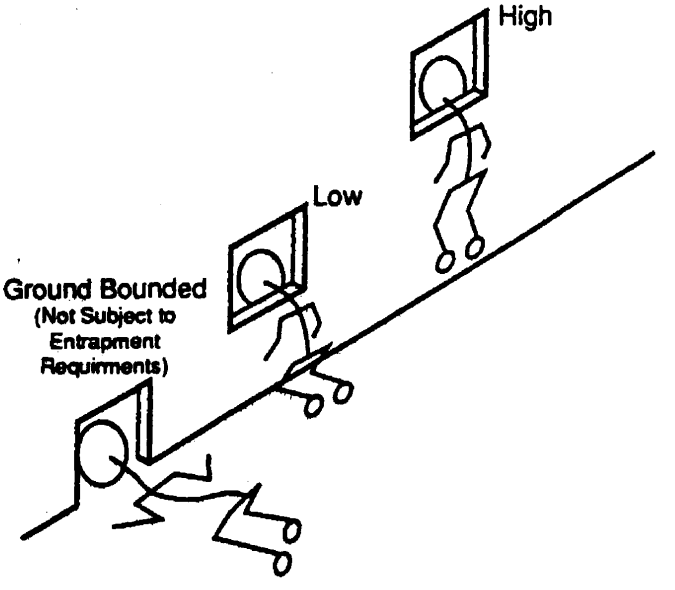


Figure B-1 Examples of Completely Bounded Openings

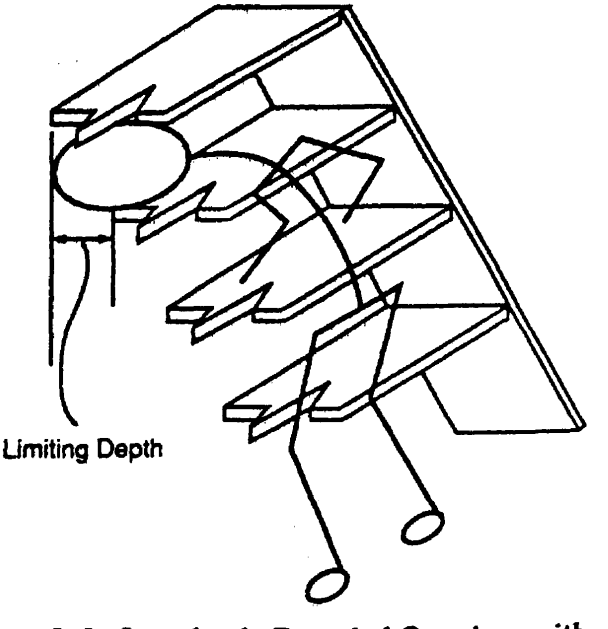


Figure B-2 Completely Bounded Openings with Limited Depth

B2. Test fixtures

Two templates are required to determine if completely bounded openings in rigid structures present an entrapment hazard.

B2.1 Small Torso Template

The dimensions (see Figure B-3) of this template are based on the size of the torso of the smallest user at risk. If an opening is too small to admit the template, it is also too small to permit feet first entry by a child. Because children's heads are larger than their torsos, an opening that does not admit the small torso probe will also prevent head first entry into an opening by a child.

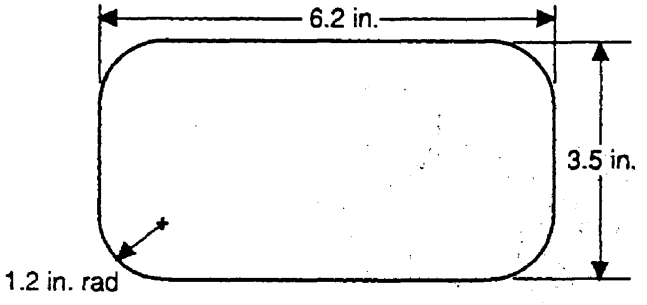


Figure B-3 Small Torso Template

B2.2 Large Head Template

The dimensions (see Figure B-4) of this template are based on the largest dimension on the head of the largest child at risk. If an opening is large enough to permit free passage of the template, it is large enough to permit free passage of the head of the largest child at risk in any orientation. In addition, openings large enough to permit free passage of the Large Head Template also will not entrap the chest of the largest child at risk.

B3. Requirement

When tested in accordance with the procedure in B4. below, an opening conforms to the requirement if:

(1) the opening does not admit the Small Torso Template,

or

(2) the opening admits the Small Torso Template and also admits the Large Head Template.

An opening fails to conform to the requirement if it admits the Small Torso Template but does not admit the Large Head Template.

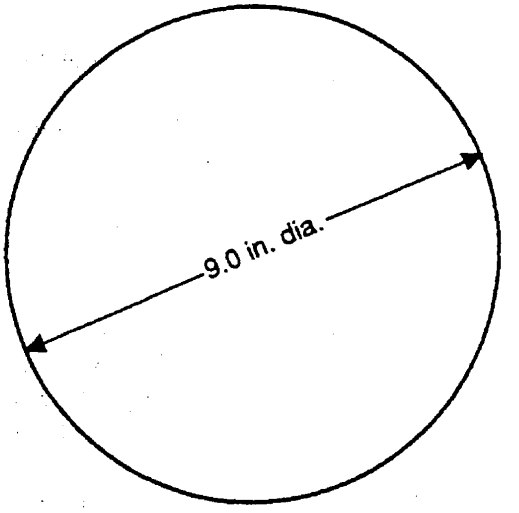


Figure B-4 Large Head Template

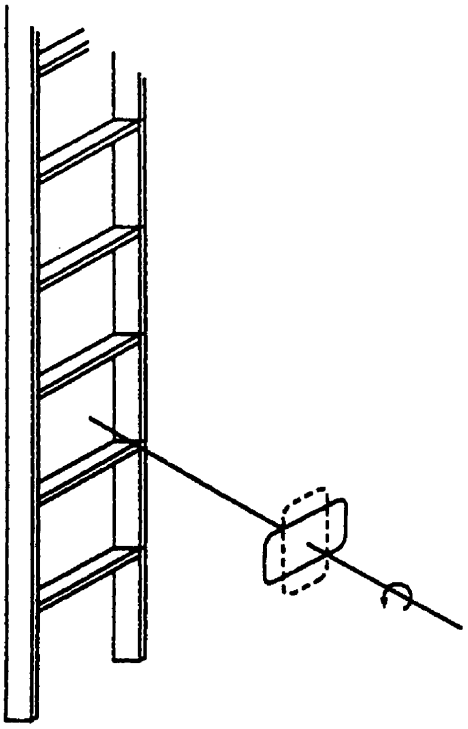
B4. Test Procedure

Attempt to place the Small Torso Template in the opening with the plane of the template parallel to the plane of the opening. While keeping it parallel to the plane of the opening, the template should be rotated to its most adverse orientation i.e. major axis of template oriented parallel to the major axis of the opening. If the Small Torso Template can be freely inserted through the opening, place the Large Head Template in the opening, again with the plane of the template parallel to the plane of the opening, and attempt to freely insert it through the opening. The test procedure is illustrated in Figure B-5.

B5. Completely-bounded openings where depth of penetration is a critical issue

The configuration of some openings may be such that the depth of penetration is a critical issue for determining the entrapment potential. This is a special case for which separate test procedures are necessary.

For example, consider a vertical wall or some other barrier behind a stepladder. The entrapment potential depends not only on the dimensions of the opening between adjacent steps but also on the horizontal space between the lower boundary of the opening and the barrier. A child may enter the opening between adjacent steps feet first and may proceed to pass through the space between the rear of the lower step and the barrier and become entrapped when the child's head is unable to pass through either of these two openings. In effect, there are openings in two different planes each of which has the potential for head entrapment and must, therefore, be tested.



Test procedures and performance criteria for completely-bounded openings.

Place the Small Torso Template in the opening with the plane of the template parallel to the plane of the opening. Rotate the template while keeping it parallel to the opening.

If the Small Torso Template can be inserted into the opening, place the Large Head Template into the opening so its plane is parallel to the plane of the opening.

An opening can pass this test when tested in accordance with the above procedures in one of two ways. 1) the opening does not admit the Small Torso Template when it is rotated to any orientation about its own axis, or 2) the opening admits the Small Torso Template and also admits the Large Head Template. An opening fails the test under the following conditions: the opening admits the Small Torso Template but does not admit the Large Head Template.

Figure B-5 Entrapment Test for Completely-Bounded Openings

Figure B-6 illustrates these two planes for a stepladder as well as for a generic opening. Plane A is the plane of the completely bounded opening in question and Plane B is the plane of the opening encompassing the horizontal space between the lower boundary of the opening in Plane A and the barrier that must also be tested for conformance to the entrapment requirements.

The procedures and performance criteria for testing openings where the depth of penetration is a critical issue depend on a series of questions, as described below.

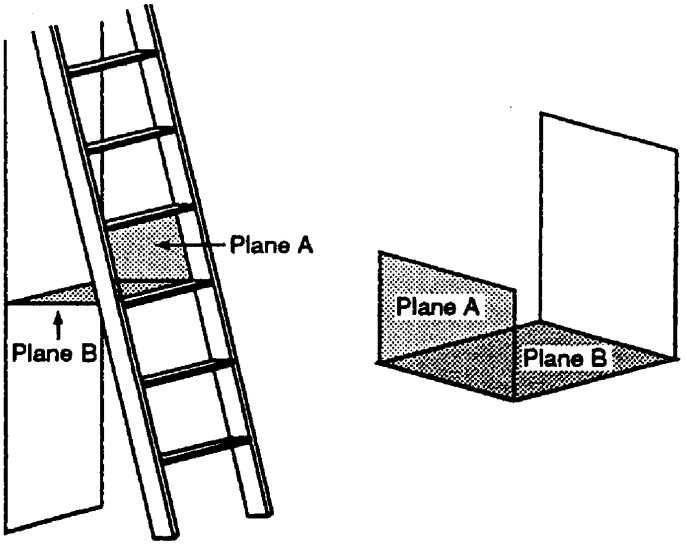


Figure B-6 Examples of Completely-Bounded Openings Where Depth of Penetration is a Critical Issue

The first step is to determine whether or not the smallest user at risk can enter the opening in Plane A. The Small Torso Template is used to test this opening as follows:

Place the Small Torso Template in the opening in Plane A with its plane parallel to Plane A; rotate the template to its most adverse orientation with respect to the opening while keeping it parallel to Plane A. Does the opening in Plane A admit the Small Torso Template in any orientation when rotated about its own axis?

NO - If the opening in Plane A does not admit the Small Torso Template in any orientation, then the opening is small enough to prevent either head first or feet first entry by the smallest user at risk and is not an entrapment hazard. The opening conforms to the requirements.

YES - If the opening in Plane A admits the Small Torso Template, then the smallest user at risk can enter the opening in Plane A. The entrapment potential depends on whether or not the smallest user at risk can also enter the opening in Plane B. The Small Torso Template is again used to test this opening as follows:

With the plane of the Small Torso Template parallel to the opening in Plane B and with the template's major axis (i.e., the 6.2-inch dimension) parallel to Plane A, does the opening in Plane B admit the the Small Torso Template?

NO - If the opening in Plane B does not admit the Small Torso Template, then it is small enough to prevent head or feet first entry by the smallest user at risk. Therefore the depth of penetration into the opening in plane A is insufficient to result in entrapment of the smallest user at risk. The opening conforms to the requirements.

YES - If the opening in Plane B admits the Small Torso Template, then the smallest user at risk can enter the opening in Plane B feet first. The entrapment potential depends on whether or not the Large Head Template can exit the opening in Plane A when tested as follows:

Place the Large Head Template in the opening in Plane A with its plane parallel to Plane A. Does the opening in Plane A admit the Large Head Template?

NO - If the opening in Plane A does not admit the Large Head Template, then a child whose torso can enter the opening in Plane A as well as the opening in Plane B, may become entrapped by the head in the opening in Plane A. The opening fails to conform to the requirements.

YES - If the opening in Plane A admits the Large Head Template, then the largest user at risk can exit the opening in Plane A. The entrapment potential depends on whether or not the largest user at risk can also exit the opening in Plane B. The Large Head Template is used to test this as follows:

With the plane of the Large Head Template parallel to the opening in Plane B, does the opening in Plane B admit the Large Head Template?

NO - If the opening in Plane B does not admit the Large Head Template, then the largest user at risk cannot exit the opening in Plane B. This presents an entrapment hazard because a child's torso may enter the openings in Plane A and Plane B, and a child's head may pass through the opening in Plane A but become entrapped in the opening in Plane B. The opening fails to conform to the requirements.

YES - If the opening in Plane B admits the Large Head Template, then the largest user at risk can exit the opening in Plane B so there is no entrapment hazard. The openings in Plane A and Plane B conform to the requirements.

B6. Non-rigid openings

Climbing components such as flexible nets are also a special case for the entrapment tests because the size and shape of openings on this equipment can be altered when force is applied, either intentionally or simply when a chil climbs on or falls through the openings. Children are then potentially at risk of entrapment in these distorted openings.

B6.1 Test Fixtures

The procedure for determining conformance to the entrapment requirements for non-rigid openings requires two three-dimensional test probes which are illustrated in Figures B-7 and B-8 and are applied to an opening in a non-rigid component with a force of up to 50 pounds.

B6.2 Requirements

When tested in accordance with the procedure in B6.3 below, a non-rigid opening may conform to the requirements in one of two ways:

(1) The opening does not permit complete passage of the Small Torso Probe when tested in accordance with the prodedure in B6.3 below.

(2) The opening allows complete passage of the Small Torso Probe and the Large Head Probe when tested in accordance with the procedure in B6.3 below.

A non-rigid opening does not conform to the entrapment requirements if it allows complete passage of the Small Torso Probe but does not allow complete passage of the Large Head Probe.

B6.3 Test Procedure

Place the Small Torso Probe in the opening, tapered end first, with the plane of its base parallel to the plane of the opening. While keeping its base parallel to the plane of the opening, rotate the probe to its most adverse orientation (major axis of probe parallel to major axis of opening). Determine whether the probe can be pushed or pulled through the opening by a force no greater than 50 pounds. If the Small Torso Probe cannot pass completely through the opening, it conforms to the requirements.

If the Small Torso Probe passes completely through the opening, place the Large Head Probe in the opening with the plane of its base parallel to the plane of the opening. Again attempt to push or pull the probe through the opening with a force no greater than 50 pounds. If the Large Head Probe can pass completely through the opening, it conforms to the requirements.

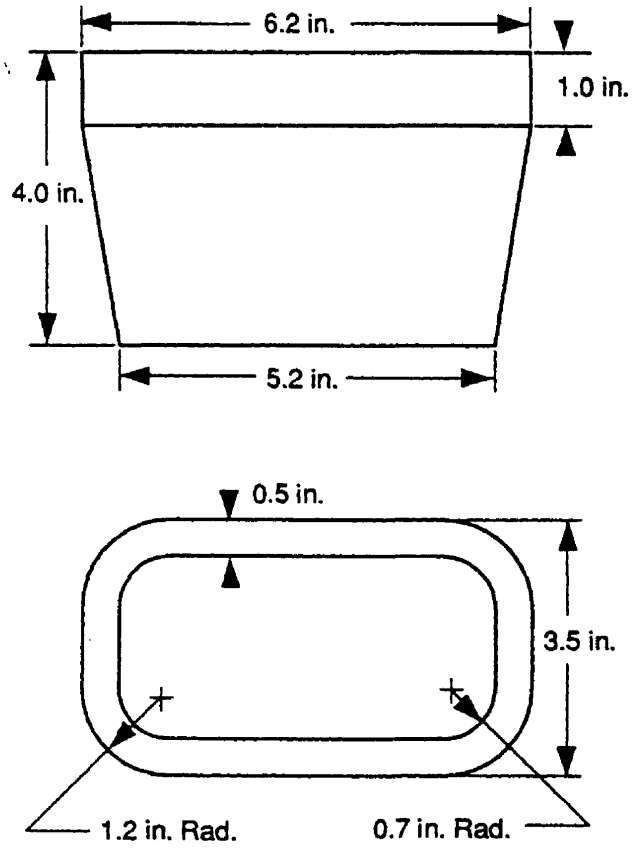


Figure B-7 Small Torso Probe

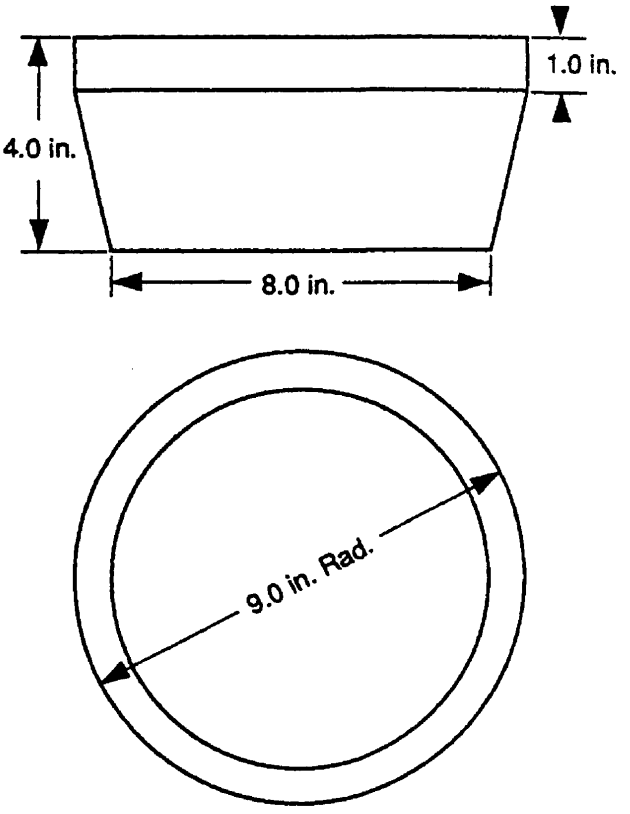


Figure B-8 Large Head Probe

APPENDIX C

SUMMARY CHARACTERISTICS OF ORGANIC AND INORGANIC LOOSE-FILL MATERIALS, AND UNITARY SYNTHETIC MATERIALS

ORGANIC LOOSE MATERIAL

wood chips, bark mulch, etc.

Fall Absorbing Characteristics

Cushioning effect depends on air trapped within and between individual particles, and presupposes an adequate depth of material. See Table 2 for performance data.

Installation/Maintenance

Should not be installed over existing hard surfaces (e.g., asphalt, concrete).
Requires a method of containment (e.g.,retaining barrier, excavated pit).
Requires good drainage underneath material.
Requires periodic renewal or replacement and continuous maintenance (e.g., leveling, grading, sifting, raking) to maintain appropriate depth and remove foreign matter.

Advantages

Low initial cost.
Ease of installation.
Good drainage.
Less abrasive than sand.
Less attractive to cats and dogs (compared to sand).
Attractive appearance.
Readily available.

Disadvantages

The following conditions may reduce cushioning potential:

1. Environmental conditions: rainy weather, high humidity, freezing temperatures.
2. With normal use over time, combines with dirt and other foreign materials.
3. Over time, decomposes, is pulverized, and compacts.
4. Depth may be reduced by displacement due to children's activities or by material being blown by wind.

Can be blown or thrown into children's eyes.
Subject to microbial growth when wet.
Conceals animal excrement and trash (e.g., broken glass, nails, pencils, and other sharp objects that can cause cut and puncture wounds).
Spreads easily outside of containment area.
Can be flammable.
Subject to theft by neighborhood residents for use as mulch.

INORGANIC LOOSE MATERIAL

sand and gravel

Fall Absorbing Characteristics

See Table 2 for performance data.

Installation/Maintenance

Should not be installed over existing hard surfaces (e.g., asphalt, rock).
Method of containment needed (e.g., retaining barrier, excavated pit).
Good drainage required underneath material.
Requires periodic renewal or replacement and continuous maintenance (e.g., leveling, grading, sifting, raking) to maintain appropriate depth and remove foreign matter.
Compacted sand should periodically be turned over, loosened, and cleaned.
Gravel may require periodic break up and removal of hard pan.

Advantages

Low initial cost.
Ease of installation.
Does not pulverize.
Not ideal for microbial growth.
Nonflammable.
Materials are readily available.
Not susceptible to vandalism except by contamination.
Gravel is less attractive to animals than sand.

Disadvantages

The following conditions reduce cushioning potential:

1. Environmental conditions: rainy weather, high humidity, freezing temperatures.

2. With normal use, combines with dirt and other foreign materials.

3. Depth may be reduced due to displacement by children's activities and sand may be blown by wind.

May be blown or thrown into children's eyes.
May be swallowed.
Conceals animal excrement and trash (e.g., broken glass, nails, pencils, and other sharp objects that can cause cut and puncture wounds).

Sand:

Spreads easily outside of containment area.
Small particles bind together and become less cushioning when wet; when thoroughly wet, sand reacts as a rigid material.
May be tracked out of play area on shoes; abrasive to floor surfaces when tracked indoors; abrasive to plastic materials.
Adheres to clothing.
Susceptible to fouling by animals.

Gravel:

Difficult to walk on.
If displaced onto nearby hard surface pathways, could present a fall hazard.
Hard pan may form under heavily traveled areas.

UNITARY SYNTHETIC MATERIALS

rubber or rubber over foam mats or tiles,
poured in place urethane and rubber compositions

Fall Absorbing Characteristics

Manufacturer should be contacted for information on Critical Height of materials when tested according to ASTM F1292.

Installation/Maintenance

Some unitary materials can be laid directly on hard surfaces such as asphalt or concrete.
Others may require expert under-surface preparation and installation by the manufacturer or a local contractor.
Materials generally require no additional means of containment.
Once installed, the materials require minimal maintenance.

Advantages

Low maintenance.
Easy to clean.
Consistent shock absorbency.
Material not displaced by children during play activities.
Generally low life cycle costs.
Good footing (depends on surface texture).
Harbor few foreign objects.
Generally no retaining edges needed.
Is accessible to the handicapped.

Disadvantages

.tial cost relatively high.
Undersurfacing may be critical for thinner materials.
Often must be used on almost level uniform surfaces.
May be flammable.
Subject to vandalism (e.g., ignited, defaced, cut).
Full rubber tiles may curl up and cause tripping.
Some designs susceptible to frost damage.

APPENDIX D

DESCRIPTION OF LOOSE FILL SURFACING MATERIALS IN TABLE 2

1. Wood Mulch - Random sized wood chips, twigs, and leaves collected from a wood chipper being fed tree limbs, branches, and brush.

2. Double Shredded Bark Mulch - Similar to shredded mulch commonly used by homeowners to mulch shrubs and flower beds.

3. Uniform Wood Chips - Relatively uniform sized shredded wood fibers from recognized hardwoods. Sample contained no bark or leaves.

Fine Sand - Particles of white sand purchased in bags marked "play sand." The material was passed through wire-cloth screens of different sizes in accordance with ASTM Standard Method C136-84a and yielded the following results:

Screen Size	Percent Passing Through Screen
#16	100
#30	98
#50	62
#100	17
#200	0-1

5. Coarse Sand - Sample was obtained from a supplier to the landscaping and construction trades. ASTM C136-84a test results were:

Screen Size	Percent Passing Through Screen
#4	98
#8	73
#16	4
#30	1
#50	0-1

6. Fine Gravel - Sample was obtained from a supplier to the residential landscaping market. Gravel particles were rounded and were generally less than 3/8 inch in diameter. ASTM C136-84a test results were:

Screen Size	Percent Passing Through Screen
3/8 inch	100
#3 1/2	93
#4	65
#8	8
#16	5
#30	4

7. Medium Gravel - Particles were rounded as found in river washed or tumbled stone. ASTM C136-84a test results were:

Screen Size	Percent Passing Through Screen
1/2 inch	100
3/8 inch	80
5/16 inch	58
#3 1/2	20
#4	8
#8	7
#16	3

For further information, write:

U.S. Consumer Product Safety Commission
Washington, D.C. 20207

To report a product hazard or a product-related injury, write to the U.S. Consumer Product Safety Commission, Washington, D.C. 20207, or call the toll-free hotline: 800-638-2772. A teletypewriter for the deaf is available on the following numbers: National 800-638-8270, Maryland only 800-492-8104.

*U.S. Government Printing Office: 1991 — 305-724

The U.S. Consumer Product Safety Commission (CPSC) is an independent regulatory agency charged with reducing unreasonable risks of injury associated with consumer products.

APPENDIX E

CFA Manual, The Report and Model Law on Public Play Equipment and Areas

Consumer Federation of America

REPORT AND MODEL LAW

ON

PUBLIC PLAY EQUIPMENT AND AREAS

Melanie L. Morrison

and

Mary Ellen Fise

May, 1992

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Author Notes

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Mary Ellen Fise is Product Safety Director of Consumer Federation of America, a national non-profit consumer advocacy group. An attorney, Fise represents consumers before the Congress and the U. S. Consumer Product Safety Commission (CPSC), as well as other health and safety agencies. She is co-author of *The Childwise Catalog: A Consumer Guide to Buying the Safest and Best Products for Your Children* (Harper & Row, 1990). Fise has a Bachelor of Science degree in Consumer Economics from the University of Maryland and a law degree from the University of Baltimore.

Acknowledgements

This document is based primarily on research that Ms. Morrison conducted with former colleagues at Comsis Corporation, under contract to the CPSC, to examine playground equipment safety and design (Ratté, Morrison, and Lerner, 1990). It is also based in large part on various CPSC reports, including studies of playground injuries (Tinsworth and Kramer, 1990), studies of playground surfacing materials (Collantes, 1990; CPSC, 1990; Ramsey and Preston, 1990), and the revised *Handbook for Public Playground Safety* (CPSC, 1991).

Table of Contents

MODEL LAW PROVISIONS

Section 1

INTRODUCTION

Children love to play -- especially outdoors. And the outdoor environment provides unique opportunities for play and, therefore, for learning. But children can only benefit from play in an outdoor environment if it is safe. Outdoor play equipment, in particular, has the potential to present hazards to children when it is not carefully designed or maintained.

Greater attention must be given to the safety of our nation's playgrounds because too many children are getting hurt. An estimated 120,000 children were treated in emergency rooms for injuries related to public playground equipment in 1988 alone, according to the U. S. Consumer Product Safety Commission (CPSC). More and more children are injured on playgrounds each year. Using CPSC data, Consumer Federation of America (CFA) estimates that nearly 150,000 children were injured seriously enough to require emergency room treatment in 1990. It is also estimated that at least 17 children die each year as a result of playground-related incidents.

Unfortunately, the federal government has not done enough. There are no national standards for the design and construction of outdoor play equipment. Although the CPSC recently published a new *Handbook for Public Playground Safety* (November, 1991), this handbook is only a set of guidelines -- not a standard. Compliance with the CPSC recommendations is not mandatory.

The ten years that passed between the CPSC's first set of guidelines (their 1981 handbook) and their current effort underscore the fact that voluntary compliance with recommendations is not good enough.[1] The number of injuries continue to increase, and deaths related to public playground equipment -- deaths that could be prevented -- continue to occur. For children under the age of six, the injury rate in our country has doubled in the past decade. The United States lags far behind other industrialized nations in its development of playground equipment standards. Our children deserve the same level of protection.

This CFA *Report and Model Law on Public Play Equipment and Areas* is intended to be a blueprint for designing, building, and maintaining public playgrounds. The goal is to educate those who are responsible for and care about playgrounds -- including parents, school administrators, child care providers, parks personnel, and designers -- so that they can make informed, safe choices about play equipment and the layout of play areas.

In addition, CFA presents safety and design criteria in the form of model law provisions that can be adopted by states, cities, counties, recreation and parks departments, child care licensing agencies, or other entities responsible for public outdoor play spaces. These requirements

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[1] In addition to the CPSC handbook, ASTM, a private standards development organization, is developing a very detailed, technical voluntary standard for public playground equipment. The ASTM standard has been under development for more than three years, and it is not likely to be completed and approved until sometime in 1993. When ASTM publishes its document, playground safety will take a big step forward, but there still will not be anything mandating compliance. Moreover, the technical specifications included by ASTM are geared more toward equipment manufacturers than playground designers or operators.

are separated into three sections.

- Requirements applicable to all play areas and equipment (Section 4)
- Requirements applicable to play areas and equipment intended for use by preschool-age children, aged 2 through 5 years (Section 5)
- Requirements applicable to play areas and equipment intended for use by school-age children, aged 5 through 12 years (Section 6)

It should be noted that the model law provisions contained herein are only substantive in nature and do not include any administrative requirements or provisions. For example, there are no enforcement provisions, such as penalties for non-compliance. Additionally, the administering agency is not delineated, allowing the legislative or regulatory body adopting the model to specify its preference in this regard.

In order to obtain the greatest level of safety, it is recommended that all applicable provisions in the model law be adopted. However, it is possible for a section or subsection to be adopted depending upon need. A child care licensing entity, for example, might adopt only Sections 4 and 5 (general and preschool-age requirements), if they only regulate centers serving children five and under. The protective surfacing provisions in Section 4.1 are also suitable for adoption alone.

The CFA model law represents what we believe is, at the time of publication, the state of the art in safety and design for public play equipment and areas. As more testing is completed and injury data collected, these provisions may at some future point become outdated. It is important that entities adopting these provisions incorporate into their requirements a system of review to assure that these provisions are updated as necessary.

The information included in this report addresses play areas and equipment associated with schools, child care centers, parks, residential developments, institutions, and other public recreation places. Further, it addresses equipment which is fixed (i.e., anchored to the ground), not portable. The requirements *do not apply* to play equipment designed for home, backyard use, amusement park equipment, sports equipment, or swimming pools.

The requirements applicable to an individual play area will depend on the age of children for whom it is designed. A child care center for children five and under, for example, should meet the requirements of Section 4 as well as Section 5. An elementary school, on the other hand, should meet the requirements of Sections 4 and 6. Play areas intended for use by children as young as two and as old as twelve should meet the requirements of Section 4 and include equipment, grouped by age, that meets the requirements of Section 5 or 6, as applicable.

None of the requirements presented by CFA conflicts with the CPSC recommendations. In fact, some of the CPSC recommendations simply appear here as requirements. The CFA report, however, expands on the CPSC handbook. In many cases, the CFA specification is more stringent -- requiring a higher level of safety precaution -- than its corresponding CPSC recommendation. The CFA document also includes more detailed information in most areas and addresses several play events and issues not covered in the CPSC handbook.

A crucial difference between the CPSC and CFA documents is the level of attention given to developmental issues. Although the CPSC handbook does include some recommendations for preschool-age versus school-age children, this distinction is not made consistently or often enough. This distinction is extremely important since children are frequently injured while playing on equipment designed for a different age group. Younger children, in particular, are at an increased risk of injury when they play on equipment that is not appropriately sized.

The CFA report presents a detailed look at developmental issues as they relate to the design of play areas and equipment (Section 3). Attention is given to the physical, cognitive, social, and emotional skills of children of different ages. This section also addresses various types of equipment which are developmentally appropriate for different ages. Developmentally appropriate playgrounds are not only safer but also promote growth and learning.

The CFA report begins with a presentation of injury data (Section 2) to establish common injury scenarios for both younger and older children. Recognizing injury patterns as well as children's developmental levels -- capabilities and limitations -- will help designers create equipment less likely to present hazards to its users. No play area or piece of equipment can be made completely safe. Careful design from a human factors and developmental perspective, however, can help minimize the potential for injury.

No level of precaution will prevent children from playing on equipment in unintended, often hazardous, ways. Attentive adult supervision is, therefore, a necessity for all play areas, in addition to careful design and maintenance. The level of adult supervision should be determined by the number and ages of children involved. Adults can and should help children direct their energies toward safe play.

Section 2

PLAYGROUND INJURIES

Public playground equipment continues to be a major cause of injury for children. The CPSC estimates that 120,000 children under the age of 12 were treated in hospital emergency rooms in 1988 for injuries related to public playground equipment.[2] Using CPSC data, CFA estimates that nearly 150,000 children required emergency room treatment for playground injuries in 1990. Play equipment also causes childhood fatalities. It is estimated that at least 17 deaths related to playground equipment occur each year.

Falls -- usually to the ground surface below equipment -- account for approximately 75 percent of all injuries related to public playground equipment. Not only are falls the most common mode of injury for children of all ages, they are also related to the most severe injuries. Nine out of ten serious injuries (mainly head injuries and fractures) are caused by falls to the surface. Further, the CPSC estimates that at least one-third of fatalities associated with playground equipment involve falls. Of all fatalities caused by falls, 75 percent involve head injuries.

Other causes of injury involve impact with moving equipment, running into stationary equipment, sharp edges, protrusions, pinch points, hot surfaces, and debris in the play area.

Other causes of death involve strangulation, impact with moving equipment, and equipment failures or tipovers. Strangulation accounts for almost half of all fatalities related to playground equipment. Most strangulation incidents involve entanglement. The typical entanglement scenario occurs because something a child is wearing gets caught on equipment – very often on slides or swings. Clothing, scarves, mittens, jacket strings, and jacket hoods have become entangled in narrow gaps between equipment components, on vertical posts, and on open connecting links such as "S" hooks, causing death by strangulation. Ropes, jump ropes, and leashes, either attached to equipment or being worn around a child's neck, have also been implicated in strangulation deaths. Similarly, free hanging ropes are also a cause of playground fatalities. The other major cause of strangulation is head entrapment. The fatalities resulting from impact with moving equipment generally involve head injuries resulting from swing impact; children under the age of six are almost always the victims in these cases.

While there are no significant gender differences in the injury data, different patterns of injury emerge for children of different ages (see Figure 2-1 and Figure 2-2). Children under the age of six suffer approximately 37 percent of all public playground equipment-related injuries, children between the ages of six and eight are involved in another 40 percent, and children over the age of eight are involved in another 23 percent. Children between the ages of 6 and 8 years thus have the highest rate of injury on public playground equipment. But the frequency of injury to children under the age of six has doubled in the past decade.

Slides are the most frequent cause of injury for *children under the age of six*. Superficial facial injuries (i.e., lacerations and contusions) and serious head injuries (i.e., skull fractures, concussions, and internal head injuries) are the two predominant patterns of injury for young children on slides, swings, and climbers.

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[2] The injury data presented here are based on CPSC estimates of playground equipment-related injuries (Tinsworth and Kramer, 1990) as well as a comprehensive review of data from both national and international sources (Ratté et al., 1990).

Although falls are the most common mode of injury for both younger and older children, younger children are more likely to sustain injuries to the head and face. When young children fall to the surface from play equipment, they are more susceptible to head injuries since they often do not have the motor coordination or cognitive skills necessary to protect their heads by breaking a fall with their arms. In addition, young children are at greater risk for head and facial injuries caused by impact with moving equipment such as swings.

Climbers are the most frequent cause of injury for *children six and older*. Upper limb fracture is the predominant pattern of injury for older children on climbers, swings, and slides.

Because older children's cognitive and perceptual skills are more refined, they better anticipate and avoid moving swings. They are also better able to react to a fall, typically using their arms to break their landing. Consequently, older children reduce the risk of head injury, but they simultaneously increase the risk of upper limb fracture.

Climber Injuries

Approximately 32 percent of all injuries associated with public playground equipment involve climbers. Almost all climber-related injuries are due to falls; 75 percent are attributed to falls to the surface. Falls often occur as children are making transitions between access/egress components and platforms or other play events.

Of all injuries on climbers, 80 percent are sustained by children over the age of six. In fact, climbers are the type of equipment most frequently implicated in playground injuries for children six and older – which may be explained in part by older children's boldness to experiment with creative climbing techniques. Within this age group, climbers account for 41 percent of all equipment-related injuries.

Slide Injuries

Slides account for almost 30 percent of all public playground equipment-related injuries. Of all injuries sustained on slides, one-half are associated with falls to the surface below the equipment, and another one-fourth involve falls onto other parts of the equipment. Falls from the platform, from the top of the slide, and from the top portion of the slide chute are most common. Falls also often occur as children climb ladders that access slide structures. When compared to other types of equipment, slides tend to have higher rates of serious head injuries.

Children under the age of six incur over half of the slide-related injuries. Moreover, slides are the type of equipment most frequently implicated in playground injuries for children under the age of six. Within this age group, slides are involved in 43 percent of all equipment-related injuries. This high rate of slide injuries among young children may be due to their heavy use of this type of equipment in combination with their less developed balance and coordination skills. Maintaining an upright seated position while sliding down the chute may be rather difficult for many young children. Younger children also tend to slide down the chute face first. Because older children are not as likely to have trouble balancing on slides and because they are not as likely to play on slides as younger children, they tend not to suffer as many injuries.

Swing Injuries

Swings are involved in about 26 percent of all injuries related to public playground equipment. Falls account for approximately two-thirds of swing injuries, most being falls to the surface. Impact with moving swings, however, causes one-fourth of all swing injuries. Children

under the age of six are those most often injured during moving impact incidents. The typical scenario involves a young child walking in front of or behind a moving swing and getting hit, either by the seat itself or by a child in the seat. Injuries to the head and face are, therefore, common. Overall, the younger age group sustains two-thirds of swing-related injuries. When older children suffer injuries on swings, it is usually because they fell while standing on or jumping from the seats.

Seesaw Injuries

Seesaws account for about 6 percent of all injuries related to public playground equipment. Impact with moving equipment (typically wooden seats) is the most common mode of seesaw injuries, accounting for about two-thirds of these injuries. Falls to the surface are involved in most other seesaw injuries, but splinters on worn or damaged wooden seesaw seats have caused puncture wounds. More than two-thirds of seesaw injuries are lacerations to the head and face. When compared to other types of equipment, however, seesaws are involved in trunk fractures and spinal injuries more frequently. Children six and older sustain 54 percent of seesaw-related injuries.

Merry-Go-Round Injuries

Injuries related to merry-go-rounds occur when children fall while getting off or while pushing the equipment and when children are hit by the moving undercarriage. Serious injuries (i.e., fractures) as well as superficial injuries (i.e., lacerations and contusions) to the arm, leg, and head have been reported for merry-go-round incidents. Both younger and older children suffer injuries while playing on merry-go-rounds.

Spring Rocking Equipment Injuries

Spring rocking equipment has been implicated in fall injuries as well as injuries caused by impact with the equipment. The most common scenario involves a child getting hit in the face while pushing a spring rocker up and down.

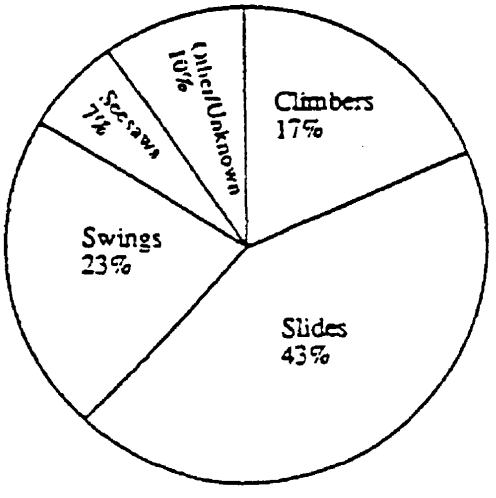


Figure 2-1: Playground Equipment-Related Injuries Sustained by Children Under 6

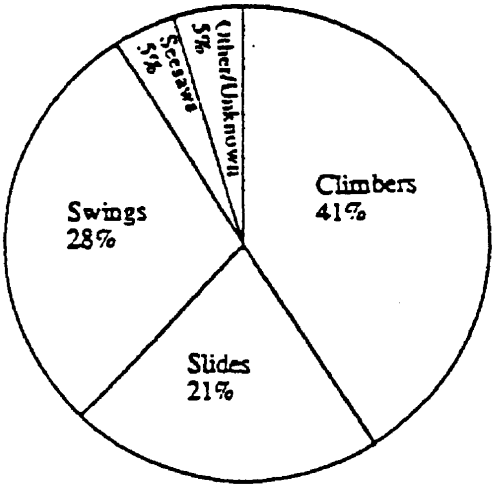


Figure 2-2: Playground Equipment-Related Injuries Sustained by Children 6 and Over

Section 3

DEVELOPMENTAL ISSUES FOR PLAYGROUND DESIGNERS

Children's primary task is to make sense of the world around them -- to learn. Children's primary concern is to have fun. Through play and exploration of the physical and social environments, children have fun learning. Given a stimulating environment, children will keep themselves happy by exploring and making up games since they are naturally inquisitive and creative. Adults must ensure that the environments in which children play and learn are safe.

The most basic safety consideration for designers of play equipment and areas is to eliminate hazards. Challenge is desirable because children learn and increase their skills through challenge. But the challenges presented must be ones that children can perceive and choose to undertake. When taking a risk involves a dangerous outcome that the child cannot foresee, a challenge becomes a hazard. Such hazards are what cause playground-related injuries and sometimes even death.

A carefully designed playground provides a setting where safe learning -- not just physical development -- can take place. Cognitive, social, and emotional growth are all supported by outdoor play. This section presents strategies to increase the safety as well as the play value of outdoor areas by providing a wide range of play equipment and other stimulating activities. Ideas addressing developmental issues in playground design are drawn from Moore, Goltsman, and Iacofano (1987), Dodge and Colker (1992), as well as the research base developed by Comsis Corporation for the CPSC (Ratté et al., 1990).

Children's Sizes and Skills

To present safe challenges that are appealing to children, equipment and materials must be developmentally appropriate, which requires attention to the age of the intended players as well as to individual differences (Bredekamp, 1987). Children's individual rates of physical development differ substantially. Moreover, physical growth for a single child is not necessarily uniform; different physical attributes and skills develop at different times. Consideration of cognitive, social, and emotional development further expands the range of individual differences which relate to safe outdoor play. To address these individual differences adequately, play areas should include a variety of equipment and materials suited to the range of skills expected within a given age group. Ideally, the play activities available will present a series of graduated challenges, allowing individual children to practice and test the limits of their skills at their own pace.

In the realm of physical skills, both preschool-age and school-age children are working to develop large and small muscles, to improve balance, and to coordinate eye-hand movements. They also face the tasks of increasing spatial awareness and refining perceptual skills. Other important developmental tasks for young children include the following: building self-esteem; exhibiting independence; developing positive styles of social interaction such as sharing, cooperating, and helping; taking other points of view; expressing creativity; improving decision-making and problem-solving skills; identifying cause and effect relationships; and using basic symbols and representational abilities. Older children continue to work on these same tasks at higher levels while also integrating some new ones, such as learning to reason logically, to operate according to complex rules, and to manipulate symbols in their heads without physical action.

Appropriate Playground Equipment for Different Ages

For very young children, play equipment must be quite simple to be safe. Children under the age of two are not ready to play independently on most climbing equipment. They do, however, like practice stepping and climbing on logs and low structures built of railroad ties, and such play does not expose them to any significant hazards. Short slides accessed by a few steps or a ramp are also manageable for toddlers. Some may enjoy the sensation of swinging in infant/tot seats when assisted by an adult. The simple experience of being outdoors -- with all of its sensory stimulation -- is important developmentally for infants and toddlers.

With increasing age -- and the accompanying increases in balance, coordination, and strength -- children can safely explore a much wider range of play equipment. The outdoor play area should provide varied opportunities to climb, swing, slide, walk, run, crawl, hop, skip, jump, bounce, balance, reach, chin, hang, push, pull, throw, and catch. Play events should support children's growing spatial awareness with experiences to explore under-over, up-down, in-out, left-right, depth, length, and height. Beginning around 2 1/2 to 3 years, children can negotiate the following types of equipment, provided that the equipment is scaled to the appropriate size.

Balance Beams	Platforms	Chinning Bars
Log Structures	Tunnels	Conventional Swings
Spring Rockers	Suspension Bridges	Infant/tot Swings
Ramps	Arch Ladders	Tire Swings
Stairways	Net Climbers	Slides
Stepladders	Tire Climbers	

Older children may not be as attracted to some of the less challenging components listed above, such as balance beams, ramps, and spring rockers, but will play happily on the others. Playground equipment designed specifically for older children should, however, be larger to correspond to their larger physical dimensions. Although the height of equipment can be somewhat greater and still be relatively safe, excessive height is not necessary for play value or challenge and serves only to increase the potential for severe injuries.

In addition to the above climbing components, more challenging alternatives can be added to equipment for older children, such as vertical rung ladders, overhead rings and horizontal ladders, and sliding poles. Equipment structures can also be more complex, offering more choices and decision points.

All of the play equipment components listed above provide positive play and developmental value and can be designed safely. Certain other types of equipment are also commonly available but do not address children's developmental needs as well, including rotating equipment and seesaws. Although both rotating equipment and seesaws do present opportunities for inner ear stimulation and balancing activities, their designs present inherent hazards to children.

Rotating equipment is difficult for young children to control and is a prime target for unintended, hazardous patterns of use, especially by older children. Young children will often find themselves on a fast-spinning merry-go-round, for example, but not be able to get off. Getting stuck in a scary situation obviously is not optimal from a developmental standpoint. Other equipment can provide similar sensory and spatial stimulation more safely.

Seesaws require the cooperation and coordination of two children to be used safely. Most younger children do not have the requisite social or physical skills to effectively control fulcrum seesaws. Older children can work together to safely negotiate a seesaw, if they want to. The problem, however, is that one child often decides to jump off, causing the other to experience an

uncontrollable drop to and impact with ground surface below. Further, the developmental value of seesaws is not very relevant to older children's needs or skill levels. The only advantage of seesaw use by older children is that it is a vehicle for prolonged discussion, but there are many other, safer ways to promote social interaction.

Some of the factors related to the safe design of developmentally appropriate equipment are discussed below.

Factors that Influence Safe Design

Injuries are less likely to occur when equipment is designed to match the size of the children who play on it. When certain equipment dimensions are not comparable to the children's physical dimensions, children are exposed to unwarranted risks and hazards. For example, if the distance between steps on a ladder is much greater than the step height of the youngest intended user, children may have difficulty climbing the ladder and will then be at greater risk for falls. Consideration of anthropometric data is, therefore, crucial for the design of safe equipment. Many of the design details presented in this document are based on anthropometrics.

Other developmental factors also directly influence the design of safer equipment. Given certain cognitive and perceptual limitations, young children may unknowingly put themselves in a dangerous position. Young children often do not attend to peripheral stimuli. A moving swing, for example, that is outside of direct sight lines may go unnoticed. Further, young children commonly center on a single idea or event. As a result, injuries often occur because young children inadvertently walk into the path of a moving swing while concentrating on other activities. Locating swings away from other equipment reduces the risk of moving impact incidents.

Another information processing skill many preschoolers have not yet fully developed is the evaluation of spatial relations. Children may climb higher than they intend to -- exposing themselves to greater fall hazards -- since they often estimate height incorrectly. To address unrecognized fall heights, there should be protective barriers on all high platforms. Design techniques such as stepped or layered platforms also improve safety by limiting fall heights. In addition, on accesses to higher play events, there should be an intermediate landing where children can stop and consider whether or not to continue their climb.

Because young children focus on the "here and now," they can think critically only about their current actions; they cannot reverse their thinking or think ahead. Consequently, children may find themselves in a frightening situation without a manageable way to get down from equipment. In addition, the ability to descend typically lags behind the ability to ascend the same or similar structures, so even when children can climb up a particular component they may not be able to climb down safely. Designers of play equipment can help reduce this problem by providing at least one easy means of access to and egress from each piece of equipment. Larger platforms also help because a child is less likely to feel rushed to complete a play event if there is enough space to stand and watch others.

Safety is increased when children have options and, consequently, are not forced to complete an activity which is beyond their capabilities. Play structures should have multiple means of access/egress, allowing children to choose among play components of varying degrees of difficulty. Children should also be able to choose from different types of equipment offering different levels of challenge for similar skills. Balance beams, suspension bridges, and swings challenge various balance skills, for example. A key point to remember is that while increasing height does not necessarily increase challenge, it always increases hazard. Both challenge and complexity can be added to play equipment horizontally and within a limited height. Providing a range of diverse challenges on play equipment is an important factor in addressing individual

developmental differences and, therefore, in reducing injuries caused by children playing on equipment beyond their size and skill levels.

Children's Developmental Needs and Interests

Children's developmental needs and interests can be linked to equipment and materials that will promote fun as well as safe learning experiences within a given age group. When children can explore a wide range of interesting possibilities, they are less likely to get bored. On playgrounds which offer only standard equipment, children do tend to get bored so they experiment to find novel -- and often dangerous -- ways of using the equipment. This type of experimentation raises the risk of injury. In contrast, when a playground includes several play options, children can move around to different activities.

Crowding on the equipment, which often leads to rough housing and, consequently, injuries, may be less frequent if there are other areas to investigate. In addition, fun alternatives should be available for children who may be afraid of certain equipment or do not have the requisite skills. Although playground equipment is a primary means of fun outdoor play, fewer injuries are likely to occur when children are encouraged to challenge themselves through other activities as well. Materials relevant to children's interests and developmental tasks will stimulate thinking and arouse curiosity.

An important characteristic of all play equipment and materials is open-endedness. Less realistic and more generic structures or toys encourage children to use their imaginations. A fire engine replica is limited in its use, but an undefined climber can be anything a child wants it to be.

Nature is one open-ended, flexible material that children of all ages will have fun with and benefit from exploring -- nature is not only developmentally appropriate but is also a vehicle for safe outdoor activities. Exploration of nature supports the construction of early scientific knowledge as well as small and large muscle development. Landscape features including trees, shrubs, large rocks, dirt mounds, gentle hills, trickling streams, and garden areas are all appropriate. Trees and vegetation provide props for dramatic play and materials for art and other construction projects. In addition, children love to make collections of small objects found in nature. Garden settings, in particular, promote self-esteem because children feel good about caring for living things. The natural outdoor environment can provide children with a variety of sensory experiences, given its many sights, sounds, smells, textures, shapes, and sizes.

Play with fluid materials such as sand and water can be a terrific, and safe, way for children to build cognitive and social skills and also to refine small muscle coordination. Children are endlessly intrigued by the sounds, sights, and feeling of water as it moves and changes. Sand too is fascinating for young children, especially its textures. Mixing sand and water opens up a whole new world for constructive play. Play areas, such as sand boxes, can be specially designed, or indoor sand/water tables can be brought outside. Having a hose accessible to the play area is an easy way to support water play.

Constructive play in areas geared toward sand and/or water activities may be either solitary or social and either quiet or boisterous. A variety of props complement sand or water (or snow or dirt or mud) and enhance children's experiences. The list of appropriate loose materials is virtually endless, but start with objects such as buckets, bowls, shovels, scoops, funnels, blocks, small plastic people, animal figures, and small cars or trucks. All should be of a size that will not be easily lost in the sand or dirt and which do not pose a choking hazard to children who still mouth small objects. Although most preschoolers love sand and water play, children often begin to lose interest as they grow older.

Safety is also increased when children have options for quiet play. Most children will need a retreat from active play at some point. Often, these retreats become a time for smaller group, creative activities. Younger children especially enjoy being able to escape to semi-enclosed spaces like a small playhouse. Such areas promote dramatic play alone or in small groups, which is an critical aspect of early childhood experiences. In addition, children often like to withdraw from active play and observe others. Semi-enclosed seating areas or large rocks, for example, can provide this type of hide-away and still give children a view of others in the play area.

Older children benefit from large open spaces including grassy fields for group activities and games with rules. Grassy areas for younger children to run freely and play games such as tag are also important but need not be as large. A hardtop area can also provide a welcome break from play equipment for children of all ages: younger children enjoy riding tricycles and pulling wagons while older children may skateboard, roller skate, or play certain ball games.

Children of all ages enjoy opportunities to bring indoor activities outdoors. For example, children love being able to eat lunch or take art projects outside on a spring day. To support this type of continuity between the indoor and outdoor environments, provide horizontal work/play/eating surfaces by means of child-sized tables and chairs, picnic tables, or natural features such as tree stumps or large flat rocks.

Most alternatives to play equipment involve extra equipment and materials as well as extra space. In child care, preschool, and school environments, equipment and materials such as wheeled toys, sand and water props, art supplies, and gardening tools should be available to children as part of the program. Storing these items in an outdoor shed or a closet near the door makes them much easier to use. For public use of playgrounds, designers should provide activity areas; children and their parents are responsible for providing the necessary equipment and materials.

To promote safe use of the different play areas, activity zones should be well-defined. Further, pathways among them should be easy to follow and encourage safe traffic patterns. Wherever play equipment is designed for younger and older children, the two different equipment areas should be separated by at least a buffer zone of ample physical space.

Because children are children, however, good adult supervision is a critical safety factor from a developmental perspective. Adult guidance, steering children away from potential hazards on play equipment and in play areas, is an effective and essential means of preventing injuries.

Section 4

SAFETY AND DESIGN REQUIREMENTS FOR ALL PLAY AREAS

Note: The numbered sections above contain requirements that could be adopted as law. In some cases, these requirements are followed by italicized text that is the rationale for the requirement. Where appropriate, additional recommendations are included. CFA views these provisions as those that will help achieve an even safer outdoor play environment. Also where appropriate, introductory explanations are given at the beginning of major sections.

An asterisk (*) follows all requirements that are the same as a recommendation contained in the CPSC *Handbook for Public Playground Safety.*

4.1 Protective Surfacing

Protective surfacing under and around all play equipment is ***the most critical safety measure*** on playgrounds.

Falls from play equipment have the potential to cause life-threatening head impact injuries. The surfacing on which a falling child lands is a major determinant of the injury-causing potential of the fall. Protective surfacing cannot prevent all injuries due to falls, but it can help reduce both the frequency and severity of injuries. Falls onto a resilient surface are less likely to result in a life-threatening injury. The greater the resiliency of the surface, the greater the safety (Collantes, 1990; CPSC, 1990).

The goal of installing protective surfacing is to prevent serious head injuries. Although there are no data available which can exactly predict the human head's tolerance for impact, biomedical researchers have described two methods to determine when impact is likely to cause a life-threatening head injury (Collantes, 1990; CPSC, 1990).

One method suggests that the threshold for a life-threatening head injury is achieved when the peak deceleration of the head during impact exceeds 200 times the force of gravity (i.e., 200 G's). The second method suggests that the threshold for a life-threatening head injury is achieved when the value of the Head Injury Criterion (HIC) exceeds 1,000. HIC is a mathematical formula which assesses the deceleration of the head during impact together with the time duration over which the head decelerates to a halt (Collantes, 1990; CPSC, 1990).

The Peak G method measures the impact attenuation qualities of the surfacing material, but the HIC method provides a better estimate of the severity of injury. Safety and protection from serious head injuries can be maximized by considering both the Peak G and HIC measures when evaluating playground surfacing materials (Collantes, 1990; CPSC, 1990).

4.1.1 GENERAL REQUIREMENTS

4.1.1.1 Protective surfacing which has a Critical Height value of at least the highest accessible point (i.e., fall height) of the play event shall be provided under and around all play equipment.*

Installation of protective surfacing is critical, because falls account for approximately 75% of all injuries related to public playground equipment. Surfacing materials, even though they may be resilient, will not provide adequate protection unless their impact-absorbing qualities are sufficient for the highest accessible part of the play event.

4.1.1.2 The Critical Height value of a playground surfacing material is defined as the maximum height from which an instrumented metal headform, upon impact, yields both a peak deceleration of no more than 200 G's and an HIC value of no more than 1,000 when tested in accordance with the procedure described in ASTM F1292.*

Given limited empirical data, Critical Height is the best estimate of the maximum height at which a playground surface is not likely to impart a life-threatening head impact injury.

Additional Recommendations:

- It is recommended that the Critical Height of a surfacing material exceed the fall height of the equipment under which it is being installed by at least 2 feet, as an added precaution against serious and potentially life-threatening injuries and injuries, such as limb fracture, which may occur with less impact.

4.1.2 PAVED AND EARTH SURFACE MATERIALS

Hard, paved surfaces including asphalt and concrete as well as earth surfaces including grass, soil, and hard packed dirt ***are not acceptable*** under and around play equipment.*

None of these materials provides adequate protection against head injuries. Paved surfaces can impart peak decelerations exceeding 200 G's from heights as low as 2 inches. Earth surfaces are not acceptable because their shock-absorbing, protective qualities vary widely with changes in weather and environmental conditions as well as with wear.

4.1.3 LOOSE SURFACING MATERIALS

4.1.3.1 Loose organic and inorganic materials shall be acceptable for use under and around play equipment provided that they meet the requirements for Critical Height (see Section 4.1.1). Table 4-1 reports data collected by the CPSC on the Critical Heights of various organic and inorganic loose materials at different depths. [Many loose-fill surfacing materials are both available and acceptable for use as playground surfaces when installed at sufficient depths; acceptable surfacing materials include but are not necessarily limited to hardwood chips, wood mulch, pea gravel, sand, and shredded tires.]*

4.1.3.2 Loose surfacing materials shall not be installed over hard surfaces such as asphalt or concrete.*

Installation of acceptable loose-fill materials over hard surfaces may reduce or eliminate their impact-absorbing qualities.

4.1.3.3 Loose surfacing materials shall be installed with a method of containment and also shall be frequently inspected and then maintained at the depth required to achieve the necessary Critical Height.

The resiliency, and therefore the Critical Height, of loose surfacing materials is reduced when adequate depths are not maintained. Displacement of loose surfacing materials commonly causes reductions in depth. Providing a method of containment, such as building a retaining wall or excavating a pit, helps prevent excessive displacement. Further, good maintenance is required to ensure that proper depths exist.

Additional Recommendations:

- It is recommended that all loose surfacing materials be installed at depths of at least 9 but preferably 12 inches.
- Various climatic and environmental conditions are related to the impact-absorbing qualities of both organic and inorganic loose-fill surfacing materials. The advantages and disadvantages described in Table 4-2 should be carefully evaluated before selecting protective surfacing.

Table 4-1

Critical Heights of Tested Loose-Fill Surfacing Materials[3]

Material	6-inch Depth Uncompressed	9-inch Depth Uncompressed	12-inch Depth Uncompressed	9-inch Depth Compressed
Wood Mulch	7 feet	10 feet	11 feet	10 feet
Double Shredded Bark Mulch	6 feet	10 feet	11 feet	7 feet
Uniform Wood Chips	6 feet	7 feet	>12 feet	6 feet
Fine Sand	5 feet	5 feet	9 feet	5 feet
Coarse Sand	5 feet	5 feet	6 feet	4 feet
Fine Gravel	6 feet	7 feet	10 feet	6 feet
Medium Gravel	5 feet	5 feet	6 feet	5 feet

This table indicates the Critical Height (as defined in Section 4.1.1.2) of various loose-fill surfacing materials that were tested by the CPSC.[4] These values are approximate and relative, rather than absolute. This table is intended to serve only as a guide in evaluating different surfacing materials.

To use this table, select a surfacing material and read the data across the table; the data indicate the approximate maximum fall height for which the surfacing material meets the criteria for adequate impact absorption at three uncompressed depths and one compressed depth. For example, uniform wood chips, when they are installed at a depth of 9 inches and when they are not compressed, provide adequate protection for equipment with a fall height of up to 7 feet. When a 9-inch depth of uniform wood chips has become compressed, however, the Critical Height is reduced to 6 feet.

Because the Critical Height of each of these materials is reduced when compressed, it is important to allow an extra margin of safety when determining the depth at which the materials should be installed. Further, to ensure that the required level of protection against head impact injuries is not compromised, frequent maintenance is necessary to retain a proper depth of loose surfacing materials under and around all play equipment.

[3] Table 4-1 is an adaptation of a table in the CPSC *Handbook for Public Playground Safety.*

[4] Detailed descriptions of the materials tested and procedures used are available in the CPSC test reports (Collantes, 1990; CPSC, 1990; Ramsey and Preston, 1990).

Table 4-2

Issues to Consider for Loose-Fill Surfacing Materials

Advantages

- Various loose-fill surfacing materials are available which can satisfy requirements regarding impact attenuation and protection against serious head impact injuries, when installed at sufficient depth.
- Because loose materials will spread to conform to the shape of a falling body, these surfacing materials may further reduce the potential for injury, particularly to the arms and legs.
- When compared to unitary synthetic surfacing materials, the cost of loose-fill materials is substantially lower.
- Installation is quite easy, but loose-fill materials cannot be installed over paved surfaces and do require a method of containment.
- Organic loose-fill materials (i.e., hardwood chips, wood mulch, etc.) tend to be less abrasive than inorganic loose-fill materials (i.e., sand, pea gravel) and also do not attract cats or dogs.
- Hardwood chips and gravel provide better drainage than wood mulch or sand.

Disadvantages

- Frequent maintenance is required for all loose-fill materials to ensure that an adequate depth is retained. Periodic replacement of materials will most likely be necessary. Maintenance should include raking to minimize compaction of materials, particularly for organic materials, and to remove debris.
- The impact attenuation characteristics of loose-fill materials may vary with changes in environmental conditions. The Critical Height values for sand and wood mulch, in particular, can be significantly reduced when these materials get wet and/or freeze. Sand, for example, acts as a hard, rigid surface when wet. Wood mulch retains water and, therefore, decomposes more quickly and can be reduced to a soil-like compost that does not provide adequate protection against fall injuries.
- With extended use, gravel materials may develop a hard pan surface under heavy-use areas. Periodic break-up and removal of this hard pan is important to maintain impact attenuation properties.
- All loose-fill materials can get thrown around by children. Wood chips are preferable from this standpoint, however. Wood mulch tends to create dust, which may irritate some children. Sand and pea gravel can both cause eye injuries. In addition, children tend to put gravel in their noses, ears, and mouths.
- Although sand can meet Critical Height requirements and it also has play value, separate areas should be provided for sand play. Children, especially younger ones, are at increased risk of injury if they are focused on sand play and, consequnetly, inattentive to surrounding play patterns.
- Shredded tires may be able to meet the Critical Height requirement if installed at sufficient depths, but this material not only deteriorates with wear (thus losing impact attenuation) it is also flammable. Shredded tires are, therefore, not recommended for use as a protective surface.
- Loose-fill materials, particularly gravel, are more difficult to walk on, and are not very accessible to disabled children.

4.1.4 UNITARY SYNTHETIC SURFACING MATERIALS

4.1.4.1 Manufactured unitary synthetic surfaces shall be acceptable for use under and around play equipment, provided that they meet the requirements for Critical Height (see Section 4.1.1). [Various rubber and rubber-like surfacing materials which do satisfy the Critical Height requirements are available.]*

4.1.4.2 All manufactured surfaces shall be tested for their impact attenuation performance in accordance with ASTM F1292, and data indicating the Critical Height of all manufactured surfaces shall be made available to purchasers by the manufacturer.*

Additional Recommendations:

- The advantages and disadvantages of unitary synthetic surfaces described in Table 4-3 should be carefully evaluated before selecting protective surfacing.

Table 4-3

Issues to Consider for Unitary Synthetic Surfacing Materials

Advantages

- Various unitary synthetic surfacing materials -- both in the form of premolded tiles and pour-in-place systems -- are available that can satisfy requirements regarding impact attenuation and protection against serious head impact injuries
- Following initial installation, very little maintenance is required for most unitary synthetic surfaces. This type of protective surfacing is quite easy to keep clean and free of debris and does not require any raking or replacement.
- Unitary synthetic materials generally provide better footing than loose-fill materials. This type of surface is easily accessible to disabled children.
- Many unitary synthetic materials come with warranties. Check with the manufacturer.
- Unitary synthetic materials often come in a variety of colors. Check with the manufacturer.

Disadvantages

- The impact attenuation performance of unitary synthetic surfacing materials varies widely. Purchasers must obtain test data regarding the Critical Height of each surface from its manufacturer. Be sure to ask about the surface's HIC values for different drop heights, because some unitary synthetic materials do not perform as well as when both the Peak G and HIC measures are used (as compared to Peak G alone).
- The initial cost of unitary synthetic materials is high, as compared to loose-fill materials.
- Some unitary synthetic materials require special conditions and/or procedures for proper installation. Check with the manufacturer.
- Some unitary synthetic materials do not allow good water drainage. Check with the manufacturer.
- Some unitary synthetic materials may not be slip-resistant. Check with the manufacturer.

4.1.5 MAXIMUM HEIGHT OF EQUIPMENT

Limiting the height of play equipment is an essential means of preventing severe fall-related injuries. Heights greater than the fall heights specified below are not necessary for play value and serve only to increase the risk of injury.

4.1.5.1 The fall heights of various types of equipment, which is the highest accessible point of the play event, shall be defined as follows:

- For climbing equipment, the fall height is the height of the highest climbing member, such as a rung or platform, above the protective surfacing.
- For slides, the fall height is the height of the slide chute entrance above the protective surfacing.
- For swings, the fall height is the height of the swing's pivot point above the protective surfacing.
- For rotating equipment, the fall height is the height of the top of the rotating component.
- For seesaws, the fall height is the highest attainable position of the seats.
- For spring rocking equipment, the fall height is the height of the seat assembly or platform which rocks.
- The top surfaces of guardrails or protective barriers are not considered an accessible play surface for the purpose of defining fall height.

4.1.5.2 The fall height of each play event shall not be higher than the Critical Height of the protective surfacing installed under and around the equipment.

4.1.5.3 The fall height of climbing equipment and slides shall not exceed

- 7 feet above the protective surfacing when designed for school-age children.
- 6 feet above the protective surfacing when designed for preschool-age children.

4.1.5.4 The fall height of swing structures with conventional to-fro seats shall not exceed

- 12 feet above the protective surfacing when designed for school-age children.
- 10 feet above the protective surfacing when designed for preschool-age children.

4.1.5.5 The fall height of swing structures with infant/tot seats shall not exceed 8 feet above the protective surfacing.

4.1.5.6 The fall height of swing structures with tire swings shall not exceed 8 feet above the protective surfacing.

4.1.5.7 The fall height of rotating equipment , with the exception of merry-go-rounds, shall not exceed 2 feet above the protective surfacing.

The standing surface of merry-go-rounds shall not exceed 1 foot above the protective surfacing.

4.1.5.8 The fall height of seesaws shall not exceed 5 feet above the protective surfacing.

4.1.5.9 The fall height of spring rocking equipment shall not exceed 24 inches above the protective surfacing.

Additional Recommendations:

- It is recommended that the fall height of climbing equipment and slides not exceed 6 feet above the protective surfacing when designed for school-age children or 5 feet above the protective surfacing when designed for preschool-age children, as an added precaution against serious fall injuries.
- It is recommended that the fall height of swing structures with conventional, to-fro seats not exceed 10 feet above the protective surfacing when designed for school-age children or 8 feet above the protective surfacing when designed for preschool-age children, as an added precaution against serious fall injuries.

4.1.6 FALL ZONES

4.1.6.1 The fall zone is the area under and around play equipment in which protective surfacing shall be installed.*

Fall zone requirements are intended to ensure that children will land on protective surfacing if they fall to the ground below while playing on equipment. In addition, the fall zones provide adequate space for children to use various play events without interfering with the play of other children on different events.

4.1.6.2 The fall zone shall be free of structural and environmental obstacles which children could run into or fall on. For example, there shall not be any vertical posts or other objects protruding from the ground within the fall zone surrounding a piece of equipment.*

4.1.6.3 The fall zone for stationary climbing equipment shall extend a minimum of 8 feet in all directions from the perimeter of the equipment, except where there is no entrance to or exit from the structure. A minimum fall zone of 6 feet from the perimeter of equipment is acceptable where there is no entrance to or exit from the structure.

4.1.6.4 Composite play structures, which consist of modular designs linking various play events, shall have one total fall zone designed to incorporate a fall zone for each of the attached components; the individual fall zones of adjacent play events may overlap.

4.1.6.5 The fall zone for slides (see Figure 4-1)shall extend a minimum of 8 feet from the perimeter of the structure behind and on each side of the slide. In front of the exit end of the sliding surface, the fall zone shall extend a minimum of 8 feet for slides with an entrance height of 4 feet or less above the protective surfacing or a minimum of 10 feet for slides with an entrance height greater than 4 feet above the protective surfacing.

4.1.6.6 The fall zone for swings with conventional seats (see Figure 4-2) shall extend a minimum of 6 feet from the perimeter of the support structure on each side as well as a minimum distance of twice the height of the pivot point in front of and behind the swing seats. The fall zone on the sides of a swing structure may overlap with that of an adjacent swing structure.*

4.1.6.7 The fall zone for swings with a tire swing (see Figure 4-3) shall extend a minimum of 6 feet from the perimeter of the support structure on each side as well as a minimum distance of twice the height of the pivot point in all directions of motion when measured from a point directly beneath the pivot point. The fall zone on the sides of a tire swing structure may overlap that of an adjacent swing structure or that of an attached composite play structure.

4.1.6.8 The fall zone for rotating equipment shall extend a minimum of 8 feet in all directions from the perimeter of the rotating base.

4.1.6.9 The fall zone for seesaws shall extend a minimum of 8 feet in all directions from their perimeter.

The fall zone on either side of a seesaw may overlap with that of an adjacent seesaw.

4.1.6.10 The fall zone for spring rocking equipment shall extend 8 feet in all directions from its perimeter.

The fall zone of an individual spring rocker may overlap with that of an adjacent individual spring rocker.

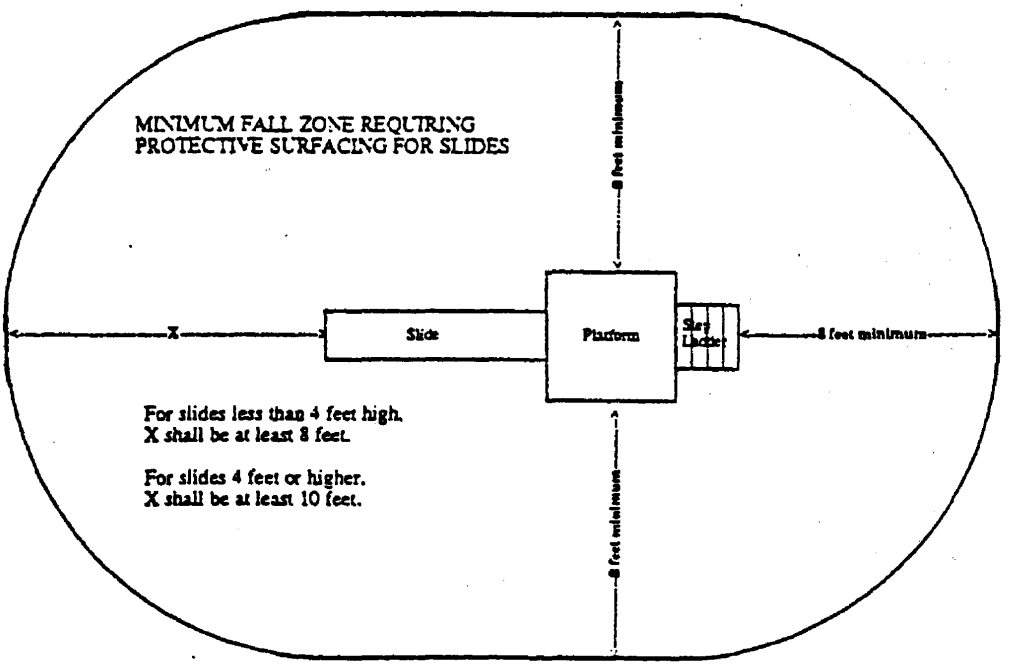


Figure 4-1: Fall Zone for Slides

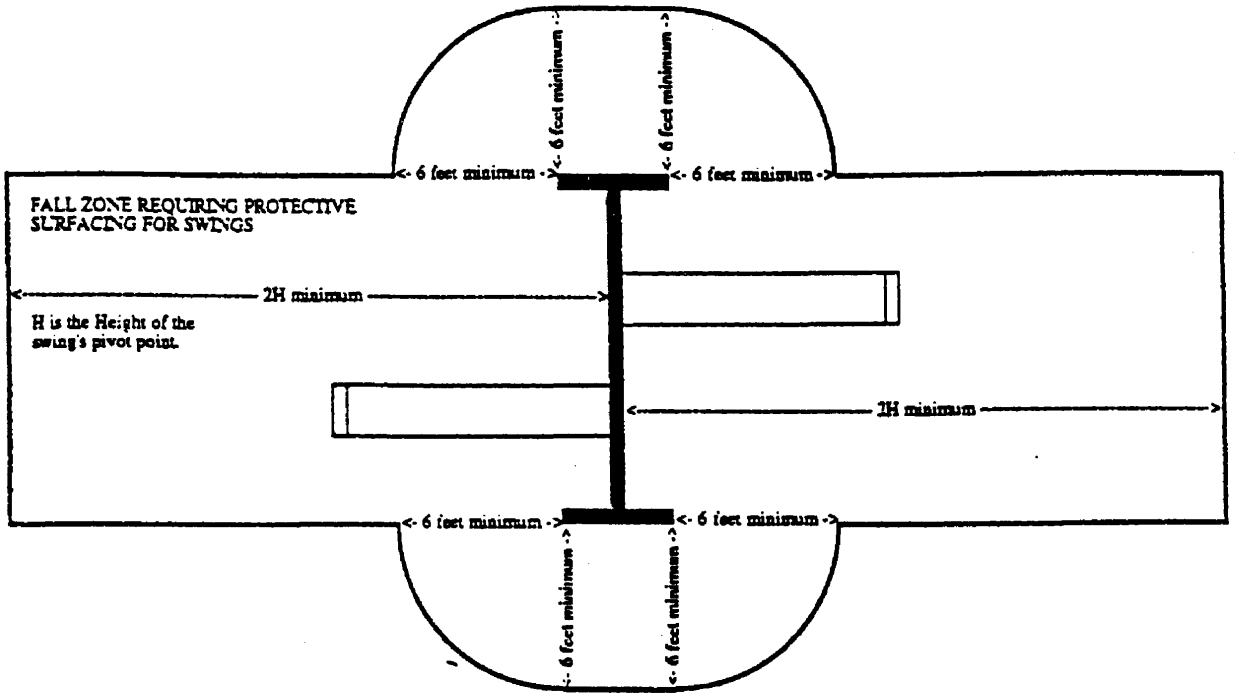


Figure 4-2: Fall Zone for Swings*

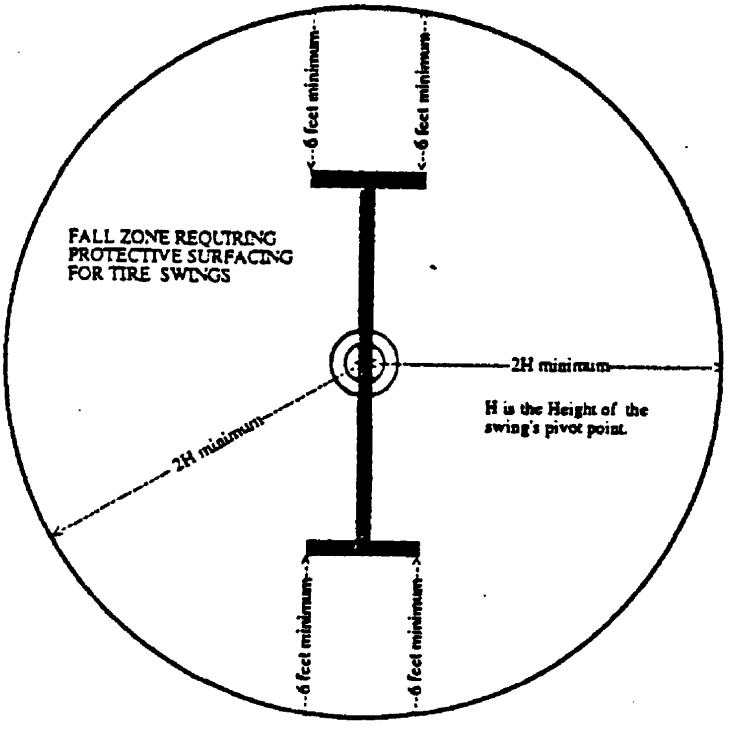


Figure 4-3: Fall Zone for Tire Swings

* This Figure is an adapation of a Figure in the CPSC *Handbook for Public Playground Safety.*

4.2 Layout of the Play Area

4.2.1 BUFFER ZONES

4.2.1.1 To supplement the fall zones of moving equipment, an additional buffer or no-encroachment zone shall be provided for moving equipment and play events from which children exit in motion.*

Buffer zones are required to ensure that children have extra space to regain their balance and momentum while exiting play equipment in motion without interference from other children. Further, buffer zones provide added protection against injuries caused by impact with moving equipment, which are often quite serious.

4.2.1.2 The buffer zone shall be a clear area free of other equipment and activities, but it need not contain protective surfacing.

4.2.1.3 The buffer zone shall extend a minimum of 3 feet from the fall zone in all directions of motion.

Additional Recommendations:

- For slides, it is recommended that the buffer zone extend at least 6 feet in front of the fall zone at the exit end of the sliding surface.
- For swings, it is recommended that the buffer zone extend at least 6 feet from the fall zone in front of and behind swings.
- For rotating equipment, it is recommended that the buffer zone extend at least 6 feet from the fall zone in all directions of motion.

4.2.2 LOCATION OF EQUIPMENT AND ACTIVITIES

4.2.2.1 Areas for play equipment, open fields, and sand boxes, for example, shall be located in different sections of the overall play area so that more active, physical activities are located away from more passive, quiet activities.*

*Organizing the play area into different areas suited for different levels of activity helps prevent injuries caused by conflicting play patterns.**

4.2.2.2 Popular, heavy-use pieces of equipment shall be dispersed to avoid crowding.*

4.2.2.3 Swings and rotating equipment shall be located away from other equipment, preferably toward an edge of the play area.*

4.2.2.4 The exit end of all slides shall be located in uncongested sections of the play area.*

4.2.2.5 Metal slides shall face North or be located in shaded areas.*

4.2.2.6 When several play events are linked together on a composite structure, designers shall carefully evaluate the relative positions of the different events to ensure that all play patterns are complementary.*

4.2.2.7 The overall layout of the play area shall be without visual barriers that may hamper adult supervision of all equipment and of the total play space.*

4.2.2.8 Play areas designed to serve children of all ages shall include separate areas with appropriately sized equipment for preschool- and school-age children. These areas shall be distinct and separated by at least a buffer zone of ample physical space.*

Additional Recommendations:

- The use of a low hedge or shrubs can be an effective means of defining play equipment areas intended for different skill and developmental levels.
- Boundaries for different areas can be defined with visual and tactile edges. Further, short walls and other edge treatments may support social play (i.e., they can be sitting and gathering places) and provide opportunities for balancing and climbing.
- It is recommended that pathways be used to direct children along easy travel routes from one piece of equipment to another and between activity areas, because providing some means to control the play and traffic patterns of playing children helps prevent injuries. Defining different play spaces with pathways helps children recognize what activities are appropriate in different areas and will also reduce interference between play in different areas. Good circulation of children around the play area is likely to promote greater use of a wider range of the equipment available.
- Pathways should allow for multi-directional travel which is unobstructed visually.
- Paved surfaces should be provided to support play with wheeled toys. A large open, paved area allows for riding as well as circle and ball games. A greater variety of riding experiences, however, can be provided on meandering paths which include curves, straight sections, slight undulations, and flat and textured portions.

4.2.3 SIGNS

Play area owners/operators can use signs to convey important information.

Recommendations:

- It is strongly recommended that a sign be posted in each play area identifying the age of children for whom the equipment is designed. Where a play area includes equipment for both preschool- and school-age children in separate sections, the sign should make this distinction.* Many injuries are caused by children playing on equipment that is designed for a different age group. Adults who accompany children, especially younger children, to the play area should be informed of the intended user age group so that they do not promote inappropriate use.
- Other possible information to convey on signs in play areas includes but is not limited to: any restrictions regarding use of the play area, how and where to get help in case of emergency, and how and where to report hazards detected or injuries incurred.

4.3 Site and Equipment Selection

Selecting a good play area site and appropriate equipment requires careful planning and attention to neighborhood and climatic conditions.

4.3.1 SITE CHARACTERISTICS AND NATURAL FEATURES

4.3.1.1 The site shall be selected and located such that children can travel to and from the play area site safely, on foot or by bicycle.*

4.3.1.2 The site itself shall not present hazards or obstacles to children, such as nearby vehicular traffic. A barrier designed to prevent play from spilling over into dangerous areas shall surround the play area; such barriers shall not preclude or impede supervision.*

Possible barriers include a low fence or hedge. In more urban sites, however, a higher degree of protection may be warranted; if so, consider a barrier that will prevent children from intentionally climbing over the enclosure and out of the intended play area.

The purpose of a perimeter barrier is to protect preoccupied, playing children from running inadvertently into the street.

4.3.1.3 The site and design of the play area shall provide a mix of sun and shade as well as protection from heavy wind, rain, or snow.

4.3.1.4 Plant materials shall not present any hazards such as thorns and shall not be poisonous or toxic.

4.3.1.5 The play area shall not have any steep slopes or sudden drop-offs.

4.3.1.6 The site and design of the play area shall provide maximum drainage.

4.3.1.7 For play areas where portable, loose materials are available to support play and learning, such as at schools and child care centers, sufficient storage facilities shall be easily accessible.

4.3.1.8 Seating, such as benches or picnic tables, shall be available to accommodate adults who accompany children to the play area. Seating shall be oriented to facilitate supervision of children in all sections of the play area.

4.3.1.9 Trash receptacles shall be easily accessible from the play area but located so as not to interfere with the normal traffic patterns of playing children. Preferably, trash receptacles will be located at the periphery of the play area away from equipment and activities. Trash receptacles shall be firmly anchored to the ground.

Additional Recommendations:

- It is strongly recommended that all outdoor play areas be planned with the advice of a professional designer of play equipment as well as a landscape architect. Further, it is recommended that this planning include a full evaluation of the site by a landscape architect. These designs should then be implemented in coordination with a reputable manufacturer of play equipment (see Section 4.3.2).

- Consider including a wide variety of natural features – such as changes in topography as well as trees and vegetation – in all play areas. Natural features can add a wide variety of multisensory and spatial stimulation while promoting positive play and development for all ages. Because the selection and location of different types of trees and other vegetation is crucial, it is strongly recommended that a landscape architect be consulted.
- Hills, berms, and stepping logs and stones allow for active play on different levels without exposing children to excessive fall heights. Climbing rocks and trees are also options for play areas with good adult supervision.
- Trees and vegetation provide an excellent source of open-ended, manipulative materials (sticks, leaves, fruits, buds, etc.) which support constructive, dramatic, and creative outdoor play. Further, exploration of nature supports cognitive as well as emotional growth.
- Avoid placing trees where children can climb and jump from trees to play equipment.
- Sand play is especially important for young children. It is recommended that only clean washed play sand be used in public play areas. Areas for sand play should be large enough to support parallel play by several children as well as larger construction projects by small groups. Sand boxes or pits should be deep enough to allow for digging. The design of sand boxes or pits should also ensure that there is adequate ventilation and drainage.
- A source of water for play, such as a hose hook-up, to complement other fluid materials (e.g., sand, dirt, or snow), is recommended.
- Natural features such as tree stumps, large flat rocks, or flat logs can also be used to provide a table-like space for children's play and art projects.
- Effective wind breaks and screening can be designed using trees and vegetation; and deciduous trees allow for shade in summer and sun in winter.
- A clean source of drinking water should be easily accessible from the play area but located so as not to interfere with the normal traffic patterns of playing children. Water fountains should be provided at heights comfortable for both children and adults. Murdock water fountains are recommended, given their outstanding record of durability for outdoor settings.
- Restrooms should be easily accessible from the play area.
- The provision of bike racks should be considered for all public play areas. When bike racks are provided, they should be firmly anchored to the ground. Bike racks should be located near an entrance to the site, in an area that does not interfere with the normal traffic patterns of playing children; further, they shall be visible from the actual play area.
- The provision of telephones that can be reached by children and with permanently affixed emergency numbers should be considered for all public play areas.
- The provision of sheltered areas, such as a gazebo or other roofed areas, should be considered for all public play areas.

4.3.2 CHOOSING PLAY EQUIPMENT

Recommendations:

- Purchasers should carefully evaluate equipment from different manufacturers.
- It is strongly recommended that play equipment be purchased from a reputable manufacturer who carries product liability insurance and provides a warranty of at least 10 years.
- When evaluating proposals for play equipment, it is strongly recommended that purchasers evaluate bids on the basis of safety and developmental appropriateness rather than price alone.

4.4 Materials

4.4.1 GENERAL REQUIREMENTS

4.4.1.1 All materials shall have a demonstrated record of durability for use in outdoor settings.*

4.4.1.2 All paints and other similar finishes shall meet the federal regulation, 16 CFR Part 1303, Ban of Lead-Containing Paint and Certain Consumer Products Bearing Lead-Containing Paint.*

4.4.1.3 Manufacturers shall ensure that users of play equipment cannot ingest, inhale, or absorb potentially hazardous amounts of substances as a result of contact with the equipment, regardless of the equipment's material or treatment process.* Manufacturer's shall make documentation available to consumers specifying that preservatives or treatments do not present hazards to users.*

4.4.1.4 All materials and hardware shall comply with applicable Federal and ASTM standards.

Additional Recommendations:

- It is recommended that all materials and components of play equipment be made in the USA.
- It is recommended that the detailed specifications for structural integrity being developed by ASTM be adopted here as requirements, when the ASTM document is available.

4.4.2 METAL

4.4.2.1 Metal components subject to structural degradation shall be deburred, cleaned, and primed, then painted, galvanized, or otherwise treated to prevent rust or other corrosion.

4.4.2.2 Metal slides shall be constructed of at least 16 gauge stainless steel.

4.4.2.3 All metal components shall conform to the requirements regarding sharp points, corners, and edges in Section 4.7.1.

Additional Recommendations:

- It is recommended that metal support posts, climbing members, handholds, and other rails be protected with an electrostatically applied powder coating finish or be galvanized steel tubing coated with an acrylic polymer.
- It is recommended that metal decks and steps be protected with a durable vinyl coating, because bare or painted metal surfaces can become hot enough in direct sunlight to cause burns.*

4.4.3 WOOD

4.4.3.1 Wood used to construct play equipment shall be either naturally rot- and insect-resistant or be pressure treated to avoid such deterioration.

4.4.3.2 Creosote, pentachlorophenol, tributyl tin oxide, and any finishes which contain pesticides shall not be used as preservatives for play equipment.*

These treatments are too toxic and irritating.

4.4.3.3 All pressure-treating of wood shall comply with the latest recommendations of the American Wood Preservers Association.*

Pressure-treated timbers shall bear the mark of an approved treating inspection agency.

4.4.3.4 The level of dislodgeable toxin on all pressure-treated wood shall be minimized.*

4.4.3.5 All wood members shall be free of checks greater than 3/4-inch in width.

4.4.3.6 All wood support posts shall be at least 6" x 6" nominal construction, or have comparable structural characteristics.

4.4.3.7 All wood deck, bridge, and step material shall be at least 4" x 6" nominal construction, or have comparable structural characteristics.

4.4.3.8 All wood members shall conform to the requirements regarding sharp points, corners, and edges in Section 4.7.1.

Additional Recommendations:

- It is recommended that all wood members be either pressure-treated Southern Yellow Pine, which is graded select or better by an approved industry agency, or Redwood, which is all heart construction grade or better.
- The most widely accepted method of pressure treating is to achieve a ground contact retention level of at least 40 lbs./cu.ft. with chromated copper arsenate (CCA), because it is fire retardant.
- It is recommended that all wood members be sealed with Raincoat® or a comparable coating as a extra precaution against severe checking and other deterioration.

4.4.4 PLASTIC

4.4.4.1 All plastic components shall be stabilized against ultraviolet degradation.

4.4.4.2 All plastic components shall have their color molded in.

Additional Recommendations:

- It is recommended that all plastic parts be molded polyethylene.

4.4.5 HARDWARE

4.4.5.1 All hardware shall be secured against unintentional or unauthorized loosening.*

4.4.5.2 All hardware shall be galvanized steel, zinc plated, or other non-corrosive material.

4.4.5.3 All hardware shall comply with the requirement regarding protrusions and projections in Section 4.7.2.

4.4.5.4 All swing hangers, including tire swivels, and other moving parts shall be commercial grade and designed to reduce wear.

4.4.5.5 All moving parts shall comply with the requirements regarding pinch, crush, and shearing points in Section 4.7.3.

4.4.5.6 Chains used to suspend swings or as climbing components shall be at least 4/0 welded link, proof coil steel chain and be hot-dipped galvanized, zinc plated, vinyl-coated, or otherwise protected against corrosion.

Additional Recommendations:

- It is recommended that lock nuts, lock washers, or some other means of locking be used to protect hardware against detachment.*
- It is recommended that swing hangers have self-lubricating bearings.
- It is recommended that tire swing hangers have grease fittings.

4.4.6 SWING SEATS

4.4.6.1 All swing seats shall be lightweight, impact-absorbing materials, such as rubber, plastic, or canvas.

Swing seats shall not be constructed of wood, metal, or other rigid materials.*

4.4.6.2 Swing seats shall be slash-proof.

Additional Recommendations:

- Flexible, strap-type seats and bucket-style, two-sided infant/tot seats constructed of molded rubber with a steel insert bonded into the rubber or of polyethylene are recommended for strength, durability, and vandal-resistance.

4.4.7 TIRES

4.4.7.1 If automobile tires are used as components of play equipment, they shall not have any exposed steel belts.*

4.4.7.2 Tires shall allow for proper drainage.* Drainage holes shall preclude finger entrapment and pinching.

Additional Recommendations:

- It is recommended that all tire swings be provided with a steel insert to increase the security of anchoring and to distribute stress evenly and thus reduce wear.

4.4.8 WINDOWS AND BUBBLE PANELS

Windows and bubble panels shall be shatter-proof.

Additional Recommendations:

- It is recommended that Lexan® be used for all window and bubble panels given the strength and durability of this material.

4.5 Assembly and Installation

Proper assembly and installation are crucial to the structural integrity, stability, and overall safety of play equipment. If the assembly and installation procedures specified by the manufacturer are not followed, the safety of play equipment may be jeopardized.

4.5.1 Manufacturers of play equipment shall provide a parts list as well as detailed instructions for assembly and installation, including specifications on the required footing sizes and depths necessary for secure anchoring. These instructions shall include requirements for proper protective surfacing under and around all play equipment. Warnings regarding the risks of deviating from these instructions shall also be included.

4.5.2 All play equipment shall be carefully assembled and installed according to the manufacturer's instructions.*

4.5.3 When properly installed as directed by the manufacturer's instructions and specifications, all play equipment shall be able to withstand the maximum anticipated forces generated by active play which might cause it to overturn, tip, slide, or move in any way.*

4.5.4 All play equipment shall be anchored in concrete (3,000 psi), and all concrete footings shall be installed at least 4 inches below grade.

Dry packing of concrete shall not be permitted.

4.5.5 The owner/operator of the play area shall retain all documentation relevant to the purchase, design, assembly, and installation of play equipment.*

4.5.6 All play equipment shall identify its manufacturer and/or custom designer. This identification shall be durable and permanently affixed to each structure.

4.5.7 All play equipment shall be thoroughly inspected prior to its first use.*

Additional Recommendations:

- It is strongly recommended that all assembly and installation be completed by a qualified contractor. When choosing an installer, select one that has experience working with the type of play equipment being installed. If the manufacturer has a program to certify installers or retains its own installers, it is recommended that they install the equipment.
- The installer should be identified at least in the owner/operator's documentation file, so that they can be reached in case of any problems.

4.6 Maintenance

The safety of play equipment and areas depends on a good maintenance program. Infrequent or inadequate maintenance may result in injuries caused by damaged or worn equipment or surfacing.

4.6.1 Manufacturers and/or designers of play equipment shall provide detailed information on inspections, preventive maintenance, and repairs. These instructions shall include at least the following:

- Recommendations regarding the a frequency of or a schedule for inspections and preventive maintenance.
- Recommendations as to what needs to be inspected and how to inspect those parts.
- Recommendations regarding any parts which require special maintenance or which are subject to excessive wear (e.g., swing hangers).
- Recommendations as to how preventive maintenance and repairs should be completed.
- Instructions how to contact the manufacturer/designer for further information or for repair assistance.

4.6.2 The owner/operator and all maintenance or repair personnel shall strictly follow the manufacturer's and/or designer's recommendations for inspection schedules and maintenance instructions.*

4.6.3 The owner/operator shall develop a comprehensive inspection schedule and a related system of maintenance for each play area. This program shall include routine inspections on a regular basis which address the basic safety of the play area and all equipment as well as more thorough inspections which address the construction details of each play component. The frequency of the routine and more detailed inspections will depend on variables such as the level of use, type of equipment, and climatic conditions.*

4.6.4 All inspections shall be conducted in a systematic manner by trained personnel.*

4.6.5 All inspections shall address the provision of protective surfacing under and around all play equipment, checking to ensure that the protective surfacing continues to meet the criteria specified in Section 4.1.

4.6.6 All hazards or damage detected during inspections shall be repaired promptly and in accordance with the manufacturer's and/or designer's instructions for repairs or replacement of parts.*

4.6.7 The owner/operator of the play area shall retain documentation of inspections, maintenance, and repairs for all equipment.*

Additional Recommendations:

- It is recommended that routine inspections of the play area be conducted on a weekly basis. Sites with heavy use may warrant routine inspections every other day or even every day. Routine inspections should address items such as those presented in Table 4-4 as well as all manufacturer/designer recommendations for maintenance.
- It is recommended that detailed inspections of each play equipment component be conducted at least 4 times a year. Sites with heavy use may warrant detailed inspections every other month or even every month. Because the detailed inspections vary according to the individual design and construction of each component, these inspections should carefully follow all manufacturer/designer recommendations for maintenance.

Table 4-4

Sample Checklist for Routine Play Area Inspections

This table presents suggestions for a routine inspection checklist for play areas. Owners/operators should use this sample to supplement the manufacturer's and/or designer's recommendations in developing a site-specific checklist. Items such as those listed below should be checked on a weekly basis. Sites with heavy use may warrant routine inspections every other day or even every day.

1. Check play equipment for a lack of proper protective surfacing under and around it.*
   Adequate protective surfacing must be maintained throughout the minimum fall zone for each piece of equipment.
   - For loose surfacing materials, check for any compaction or displacement of materials as well as any potentially hazardous debris that may be hidden beneath the top layer of materials. Adequate depth of loose materials must be maintained to meet the criteria for protective surfacing. Special attention is warranted for heavily used areas where compaction and displacement is likely, such as areas under swings, the exit end of slides, sliding poles, overhead horizontal ladders, and merry-go-rounds.
   - For unitary synthetic materials, check for any damage to the surfacing such as missing, loose, or frayed tiles. Also look for raised edges or other emerging trip hazards.

2. Check for standing water which may indicate a drainage problem.

3. Check play equipment for deterioration and corrosion.*
   - Look for loose splinters, checks greater than 3/4-inch wide, and decay on wood components.
   - Look for rust and chipped paint on metal components.
   - Look for splitting or cracking on plastic components.
   - Special attention is warranted for deterioration and corrosion on structural components which contact the ground; look for any emerging anchoring problems that may cause instability.*

4. Check for any emerging sharp or rough points, corners, or edges.*

5. Check for any emerging protrusions or projections.*
   Special attention is warranted for missing or damaged protective caps or plugs on hardware and pipe ends.

6. Check for any exposed moving parts and any pinch, crush or shearing hazards.*

7. Check for loose or worn connecting, covering, or fastening devices.*
   Special attention is warranted for swing hangers since they are more susceptible to wear.

8. Check for potential entanglement hazards, such as open "S" hooks.*

9. Check for any emerging entrapment hazards which may be caused, for example, by a missing or damaged component.*

10. Check for emerging trip hazards, such as exposed footings or rocks, roots, and other environmental obstacles.*

11. Check the play area for damage or possible vandalism.*
    Look for things such as missing handholds, broken guardrails, missing swing seats, or damaged benches.

12. Check the entire play area for miscellaneous debris or litter as well as any hazardous obstacles in the play area.*

4.7 General Hazards

Attention to eliminating general hazards on play equipment through both design and maintenance can drastically reduce the frequency of common injuries.

4.7.1 SHARP POINTS, CORNERS, AND EDGES

4.7.1.1 All play equipment shall be free of sharp points, corners, and edges which could cause cut or puncture injuries.*

4.7.1.2 All corners and edges shall have a 1/4-inch minimum radius of curvature.

4.7.1.3 All metal edges shall be rolled or have rounded capping.*

4.7.1.4 All wood parts shall be sanded four sides, preferably with 1/2-inch eased edges.

Additional Recommendations:

- Because sharp points, corners, and edges -- especially loose splinters -- may be exposed due to wear and tear or weather conditions, frequent inspections to check for any emerging hazards are strongly recommended.*
- Special attention is warranted for metal slides, since sharp edges along the sides of the slide chute or at the exit end can be extremely hazardous.*
- Special attention is warranted for merry-go-rounds, since sharp edges along the outer edge of the base can be extremely hazardous.

4.7.2 PROTRUSIONS AND PROJECTIONS; CONNECTING HARDWARE

4.7.2.1 All play equipment shall be free of protrusions and projections which could cause cut or puncture injuries or entanglement incidents.*

4.7.2.2 Protrusions shall not increase in diameter from the surface to the exposed end.

4.7.2.3 Exposed fasteners shall not extend more than two threads beyond the face of their nut. All such extensions shall be level, smooth, free of burrs, and peened over.

4.7.2.4 When connecting hardware is covered with caps or any other protective means, the covering device shall extend the length of the hardware and fit flush against the surface or nut.

4.7.2.5 Exposed ends of tubing shall be covered with caps or plugs which are not removeable without the use of tools.

4.7.2.6 Connecting links such as "S" hooks, "C" hooks, or "Pelican" hooks shall be pinched closed as tightly as possible and shall not present any entanglement hazards. [Note: ASTM is developing a measurement and test procedure for connecting hardware which should be adopted upon release.]

Additional Recommendations:

- Many protrusions and projections can be eliminated through the design of the equipment or by recessing or countersinking all potential hazards such as connecting hardware.

- Special attention to protrusions and projections which may present entanglement hazards at the top of slides is warranted.*
- The use of shackle-type appliances for connecting links is recommended.

4.7.2.7 General Protrusion Requirements

All protrusions and projections, covered or not, shall conform to the performance criterion below, when tested in accordance with the following procedure.*

Performance criterion: No protrusion may extend beyond the face of any of the three gauges having the dimensions shown in Figure 4-4.*

Test Procedure: Successively place each gauge (as shown in Figure 4-4) over any protrusion or projection and determine if it projects beyond the face of the gauge (as shown in Figure 4-5).*

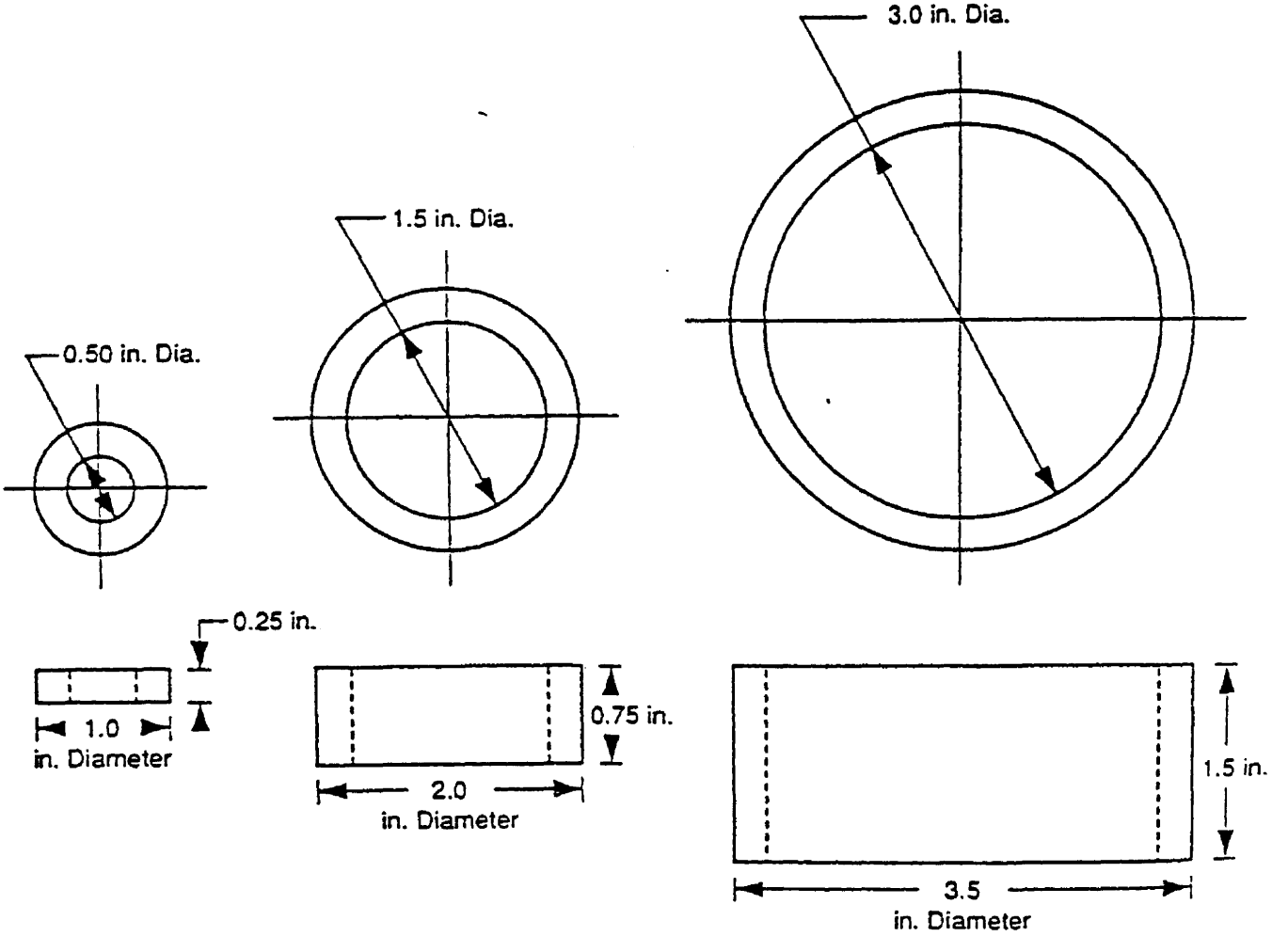


Figure 4-4: Test Gauges for Protrusions and Projections*

* This Figure is an adapation of a Figure in the CPSC *Handbook for Public Playground Safety*.

Successively place each test guage over any protrusion or projection and determine if it extends beyond the face of the gauge.

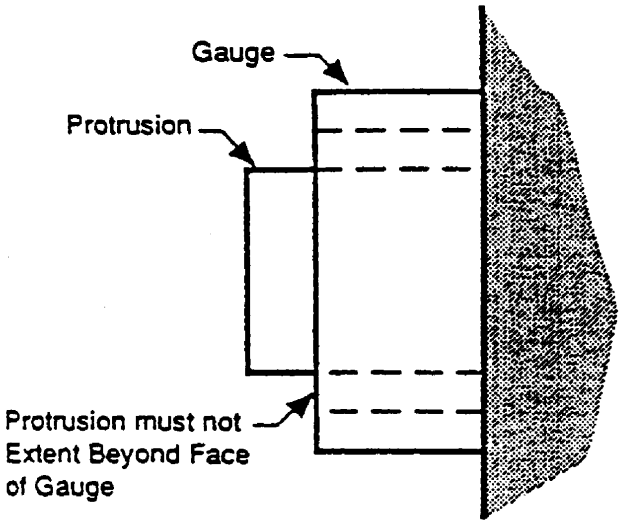


Figure 4-5: Test Procedure for Protrusions and Projections*

4.7.2.8 Protrusion Requirements for Swings

All protrusions and projections on the suspended members of swing assemblies shall conform to the performance criterion below, when tested in accordance with the following procedure.*

> **Performance criterion:** No surface in the potential impact region on suspended members may protrude through the hole beyond the face of a gauge having the dimensions shown in Figure 4-6.*
>
> **Test Procedure:** Conduct the test with the suspended member in its rest position. Place the gauge over any protrusion on the front and rear surface of the suspended member such that the axis of the hole in the gauge is parallel to both the intended path of the suspended member and a horizontal plane. Visually determine if the protrusion penetrates through the hole and beyond the face of the gauge.*

Protrusions on the suspended members of swing assemblies are a special case due to their potential hazards in case of impact incidents.

* This Figure is an adapation of a Figure in the CPSC *Handbook for Public Playground Safety.*

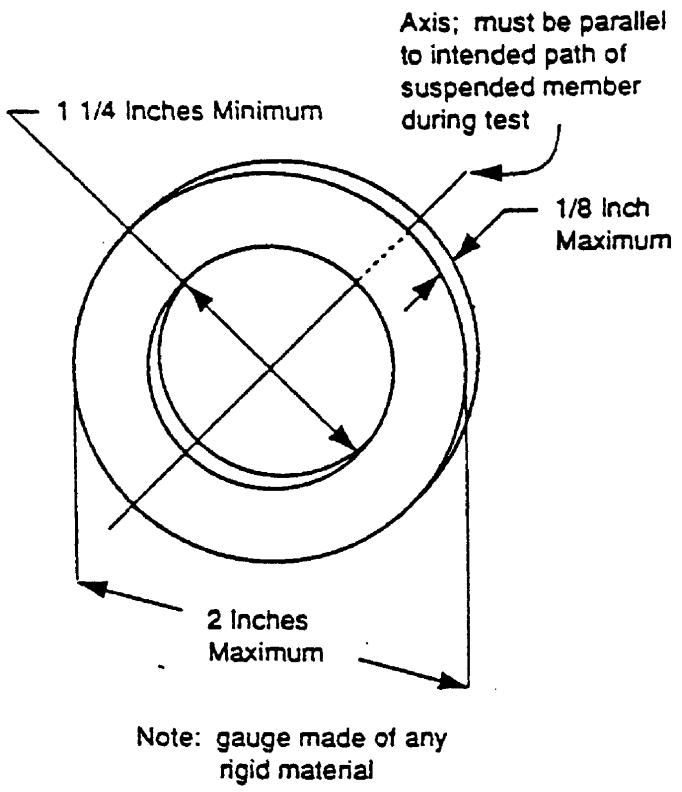


Figure 4-6: Test Gauge and Procedure for Protrusions and Projections on Swings+

4.7.3 PINCH, CRUSH, AND SHEARING POINTS; MOVING PARTS

4.7.3.1 All play equipment shall be free of accessible pinch, crush, and shearing points that could injure children or cause an entanglement incident.* [Note: ASTM is developing a measurement and test procedure to evaluate potential pinch, crush, and shearing points which should be adopted upon release.]

Such points can be caused by components moving relative to each other or to a fixed component when the equipment moves through its anticipated use cycle. To determine if there is a possible pinch, crush, or shearing point, consider the likelihood of entrapping a body part of the smallest intended user together with the configuration and closing force of the components.*

4.7.3.2 All moving parts shall be designed to prevent pinch, crush, and shearing points or be enclosed to prevent access.

Additional Recommendations:

- Special attention to potential pinch, crush, and shearing hazards on suspension bridges, merry-go-rounds, seesaws, and spring rocking equipment is warranted.

+ This Figure is an adapation of a Figure in the CPSC *Handbook for Public Playground Safety.*

4.7.4 HEAD AND NECK ENTRAPMENT

4.7.4.1 A component or group of components shall not form openings that could trap a child's head. In general, an opening may present an entrapment hazard if the distance between any interior opposing surfaces is greater than 3.5 inches and less than 9 inches. When one dimension of an opening is within the potentially hazardous range, all dimensions of the opening shall be considered together to fully evaluate the possibility of entrapment.*

This requirement applies to all completely-bounded openings (see Figure 4-7) except where the ground serves as an opening's lower boundary. Further, this requirement applies to all openings in either the horizontal or vertical plane regardless of their height above ground.*

All play equipment, whether designed for preschool-age or school-age children are subject to the entrapment requirements. Both stationary equipment and moving equipment (in its stationary position) shall be tested.*

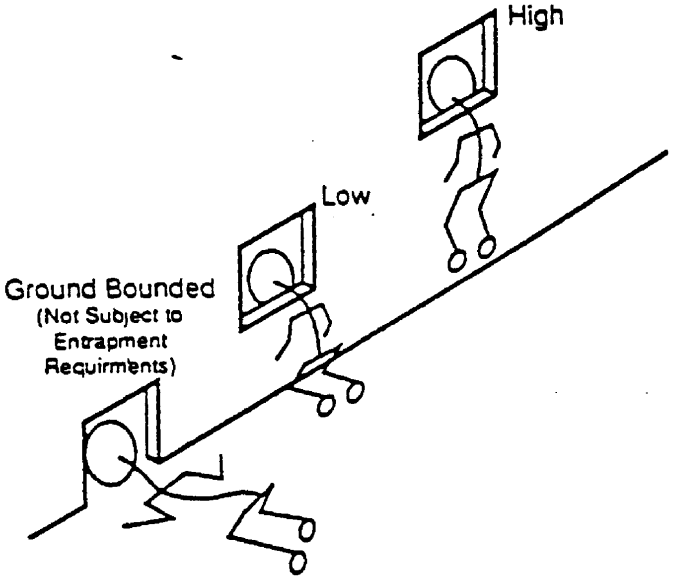


Figure 4-7: Examples of Completely-Bounded Openings*

Head and neck entrapment presents a very serious risk of death by strangulation for young children and, therefore, warrants extra precaution.

Entrapment may occur when a child attempts to enter an opening either head first or feet first. Entrapment by head first entry generally occurs when children place their heads through an opening in one orientation, then, after turning their heads to a different orientation, they are unable to withdraw from the opening. Entrapment by feet first entry generally occurs when children who are sitting or lying down slide

* This Figure is an adapation of a Figure in the CPSC *Handbook for Public Playground Safety.*

*their feet into an opening that is large enough to permit passage of their bodies but is not large enough to permit passage of their heads.**

*The entrapment criteria apply to all openings regardless of their height above ground, because even if young children can reach the ground they may not have the cognitive or motor abilities necessary to extricate their heads, particularly if they are scared or panicked, and are, therefore, still at risk of strangulation**.

4.7.4.2 General Entrapment Requirements

The most appropriate way to determine whether an opening presents an entrapment hazard is to evaluate it using the test fixtures, performance criteria, and test procedure described below.*

Test Fixtures*
- The Small Torso Template is illustrated in Figure 4-8.
- The Large Head Template is illustrated in Figure 4-9.

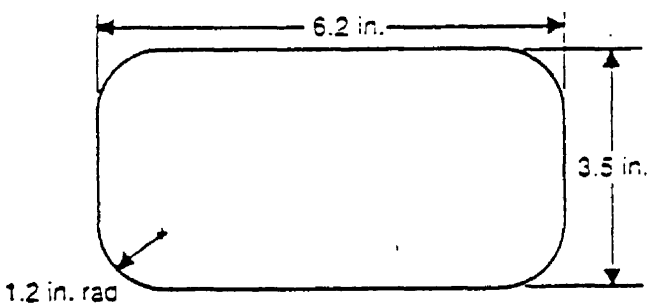


Figure 4-8: Small Torso Template*

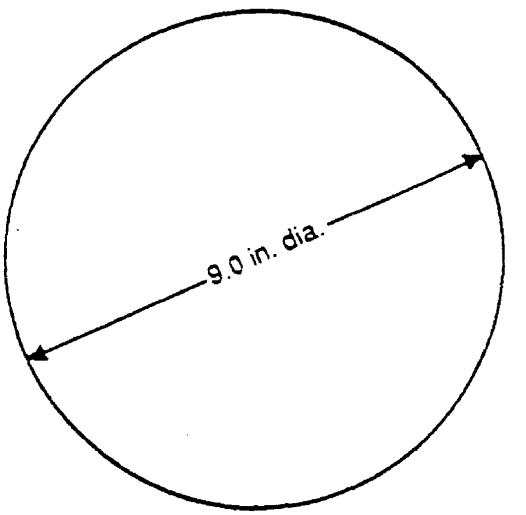


Figure 4-9: Large Head Template*

Performance Criteria*
- When tested in accordance with the following procedure, an opening conforms to the entrapment requirement if:
  (1) the opening does not admit the Small Torso Template, or
  (2) the opening admits the Small Torso Template and also admits the Large Head Template.
- An opening fails to conform to the entrapment requirement if it admits the Small Torso Template but does not admit the Large Head Template.

* This Figure is an adapation of a Figure in the CPSC *Handbook for Public Playground Safety*.

Test Procedure* (see Figure 4-10)

- Attempt to place the Small Torso Template in the opening with the plane of the template parallel to the plane of the opening. While keeping it parallel to the plane of the opening, rotate the template to its most adverse orientation (i.e., so that the major axis of the template is parallel to the major axis of the opening).
- If the Small Torso Template can be freely inserted through the opening, place the Large Head Template in the opening, again with the plane of the template parallel to the plane of the opening, and attempt to freely insert it through the opening.

The dimensions of the Small Torso Template are based on the size of the torso of the smallest child at risk of entrapment. If an opening is too small to admit this template, it is also too small to permit feet-first entry by a child. In addition, because children's heads are larger than their torsos, an opening that does not admit the Small Torso Template will prevent head-first entry by a child.

The dimensions of the Large Head Template are based on the largest dimensions on the head of the largest child at risk of entrapment. If an opening is large enough to permit free passage of this template, it is large enough to permit free passage of the head of the largest child at risk in any orientation. In addition, openings large enough to permit free passage of the Large Head Template will not entrap a child's chest.

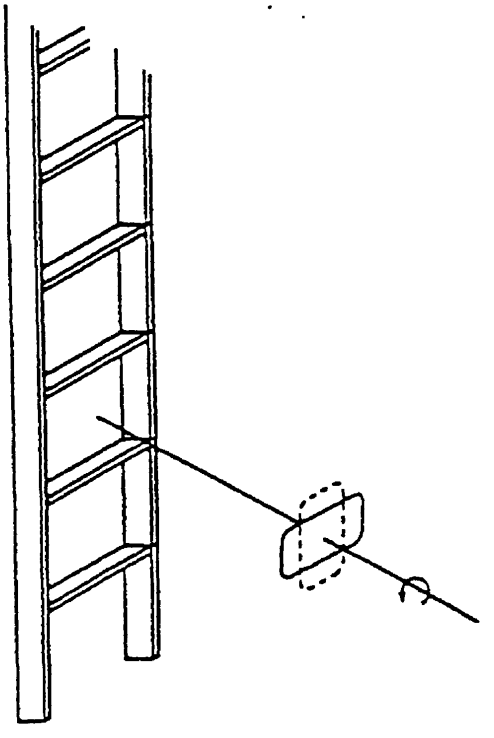


Figure 4-10: Test Procedure for Completely-Bounded Openings*

* This Figure is an adapation of a Figure in the CPSC *Handbook for Public Playground Safety.*

4.7.4.3 Entrapment Requirements for Non-rigid Openings

The most appropriate way to determine whether a non-rigid opening presents an entrapment hazard is to evaluate it using the test fixtures, performance criteria, and test procedure described below.*

Test Fixtures for Non-Rigid Openings*

- The Small Torso Probe is illustrated in Figure 4-11.
- The Large Head Probe is illustrated in Figure 4-12.

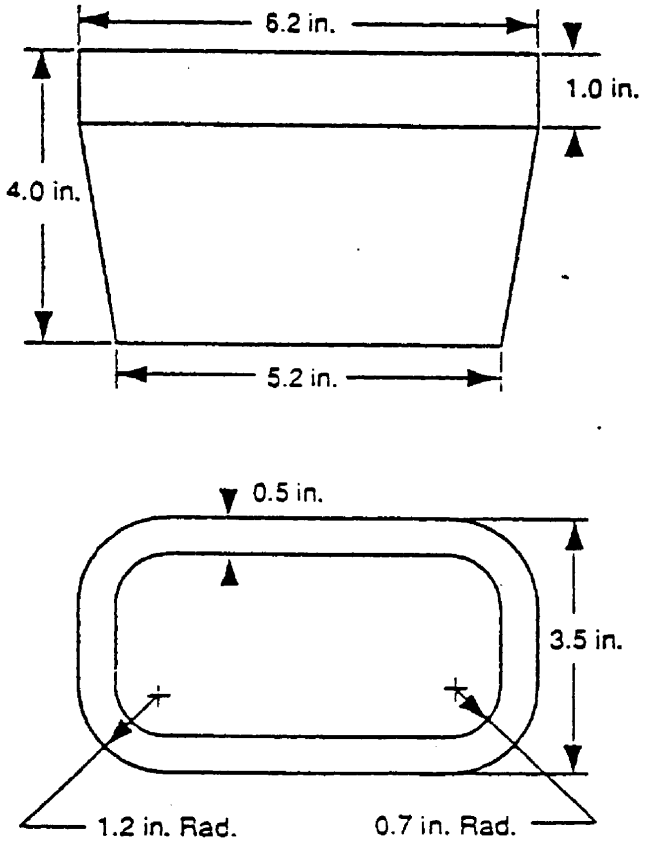


Figure 4-11: Small Torso Probe+

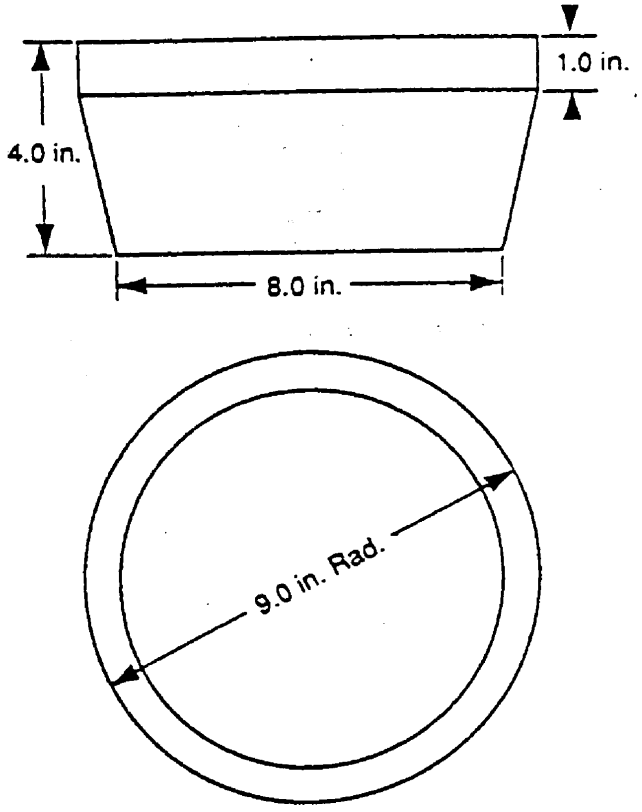


Figure 4-12: Large Head Probe+

Performance Criteria for Non-Rigid Openings*

- When tested in accordance with the following procedure, a non-rigid opening conforms to the entrapment requirement if:
  (1) the opening does not allow complete passage of the Small Torso Probe,
  or
  (2) the opening allows complete passage of the Small Torso Probe as well as of the Large Head Probe.

+ This Figure is an adapation of a Figure in the CPSC *Handbook for Public Playground Safety.*

- A non-rigid opening fails to conform to the entrapment requirement if it allows complete passage of the Small Torso Probe but does not allow complete passage of the Large Head Probe.

Test Procedures for Non-Rigid Openings*

- Place the Small Torso Probe in the opening, tapered end first, with the plane of its base parallel to the plane of the opening. While keeping its base parallel to the plane of the opening, rotate the probe to its most adverse orientation (i.e., so that the probe's major axis is parallel to the opening's major axis). Determine whether the probe can be pushed or pulled through the opening by a force no greater than 50 pounds.
- If the Small Torso Probe passes completely through the opening, place the Large Head Probe in the opening with the plane of its base parallel to the plane of the opening. Attempt to push or pull the probe through the opening with a force no greater than 50 pounds.

Climbing components, such as flexible nets, are a special case for the entrapment tests because the size and shape of openings on such components can be altered when force is applied, either intentionally or simply when a child climbs on or falls through the openings. Children are then at risk of entrapment in these distorted openings.*

4.7.4.4 Entrapment Requirements for Completely-Bounded Openings with Limited Depth

The configuration of some openings may be such that the depth of penetration is a critical issue for determining the entrapment potential (see Figure 4-13).* This case involves openings in two different planes, each of which has the potential to entrap a child and, therefore, shall be tested.

Consider a vertical wall or some other barrier behind a step ladder. The entrapment potential depends not only on the dimensions of the opening between adjacent steps but also on the depth of that opening, which is the horizontal space between the lower boundary of the opening and the barrier. A child may enter the opening between adjacent steps feet first and then attempt to pass through the space between the rear of the lower step and the barrier but become entrapped if the child's head is unable to pass through either of these openings.

Figure 4-14 shows examples of this type of opening for a step ladder with a barrier behind it as well as generically. Plane A is the plane of the completely-bounded opening in question. Plane B is the plane of the opening encompassing the horizontal space between the lower boundary of the opening in Plane A and the barrier. Both of these openings shall be tested according to the following performance criteria and test procedures, which depend on the series of questions described below and illustrated in Figure 4-15.*

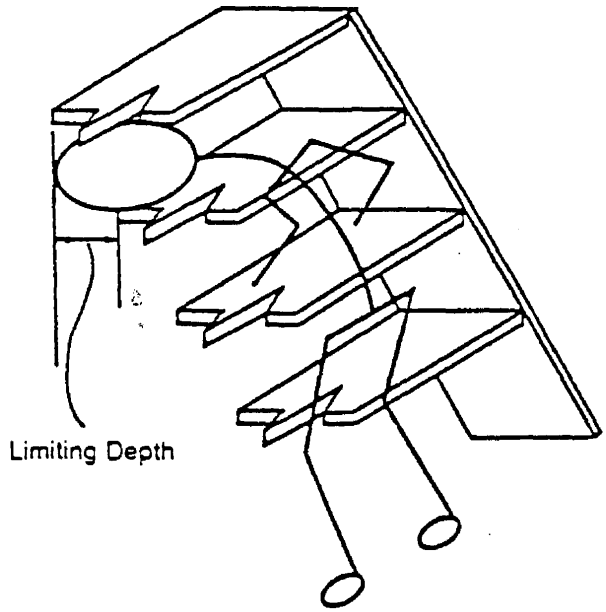


Figure 4-13: Completely-Bounded Openings with Limited Depth*

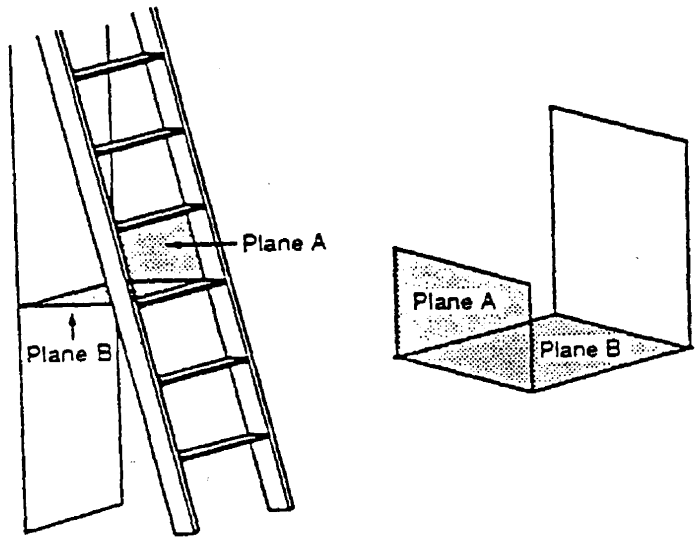


Figure 4-14: Examples of Completely-Bounded Openings of Where Depth of Penetration is a Critical Issue*

* This Figure is an adapation of a Figure in the CPSC *Handbook for Public Playground Safety.*

Performance Criteria and Test Procedures for Completely-Bounded Openings with Limited Depth*

- Determine whether or not the smallest child at risk can enter the opening in Plane A.

  If the opening in Plane A does not admit the Small Torso Template in any orientation, then the opening is small enough to prevent either head-first or feet-first entry by the smallest child at risk and is not an entrapment hazard. The opening conforms to the requirements. Stop.

  If the opening in Plane A admits the Small Torso Template, then the smallest child at risk can enter the opening in Plane A. The entrapment potential depends on whether or not the smallest child at risk can also enter the opening in Plane B. Continue.
- Does the opening in Plane B admit the Small Torso Template?

  If the opening in Plane B does not admit the Small Torso Template, then it is small enough to prevent either head-first or feet-first entry by the smallest child at risk. Therefore, the depth of penetration into the opening in Plane A is insufficient to result in entrapment of the smallest child at risk. The opening conforms to the requirements. Stop.

  If the opening in Plane B admits the Small Torso Template, then the smallest child at risk can enter the opening in Plane B feet first. The entrapment potential depends on whether or not the largest child at risk can exit the opening in Plane A. Continue.
- Does the opening in Plane A admit the Large Head Template?

  If the opening in Plane A does not admit the Large Head Template, then a child whose torso can enter the opening in Plane A as well as the opening in Plane B may become entrapped by the head in the opening in Plane A. The opening fails to conform to the requirements. Stop.

  If the opening in Plane A admits the Large Head Template, then the largest child at risk can exit the opening in Plane A. The entrapment potential depends on whether the largest child at risk can also exit the opening in Plane B. Continue.
- Does the opening in Plane B admit the Large Head Template?

  If the opening in Plane B does not admit the Large Head Template, then the largest child at risk cannot exit the opening in Plane B. This presents an entrapment hazard because a child's torso may enter the openings in Plane A and Plane B and a child's head may pass through the opening in Plane A but then become entrapped in the opening in Plane B. The opening fails to conform to the requirements. Stop.

  If the opening in Plane B admits the Large Head Template, then the largest child at risk can exit the opening in Plane B, so there is no entrapment hazard. The openings in both Plane A and Plane B conform to the requirements.

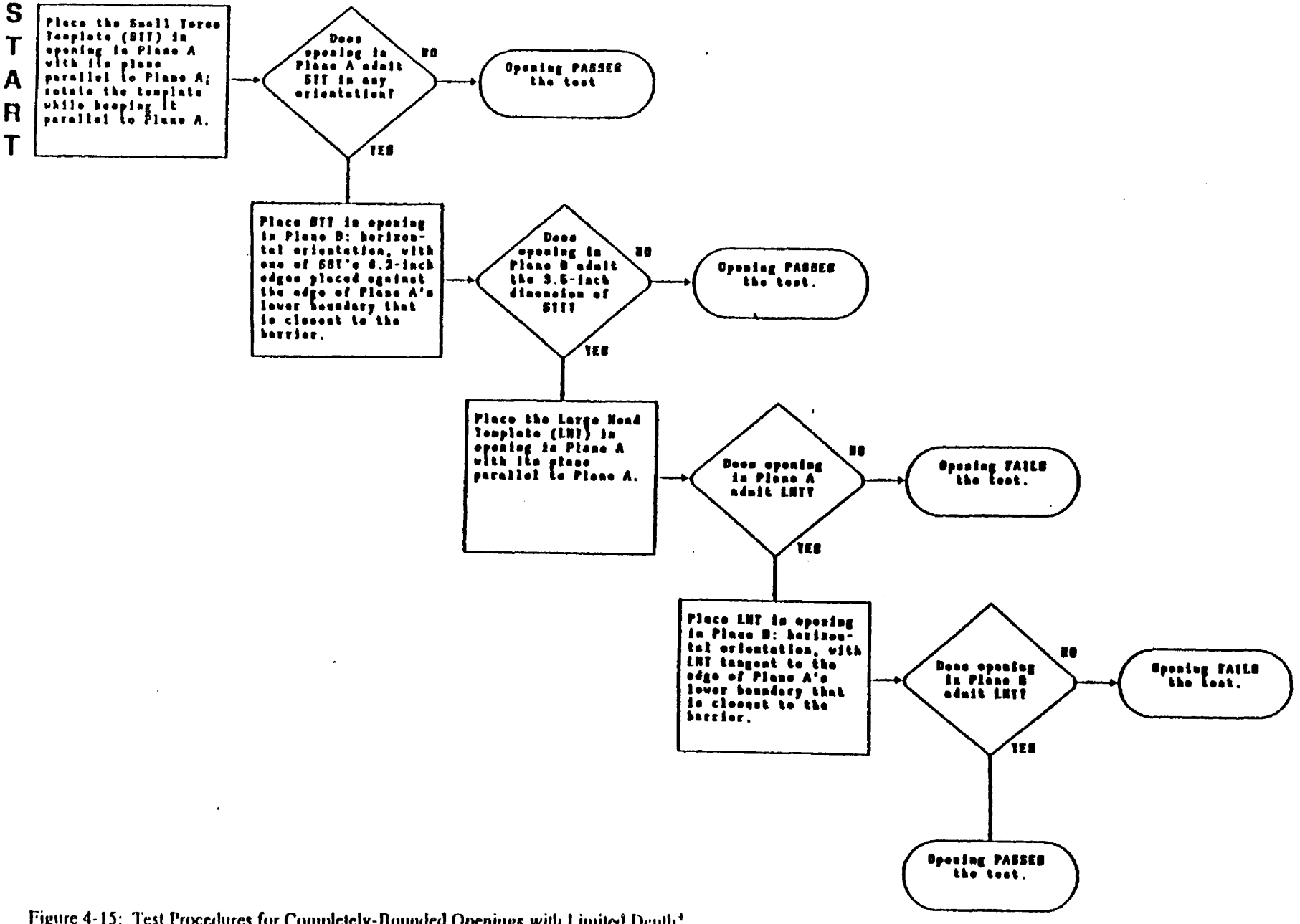
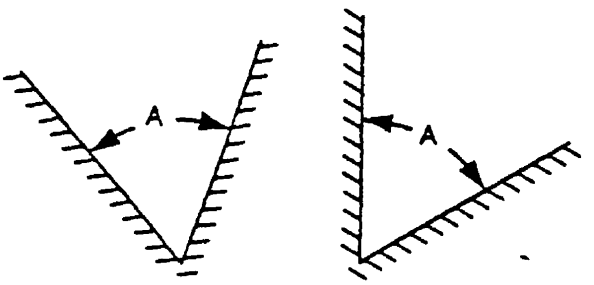


Figure 4-15: Test Procedures for Completely-Bounded Openings with Limited Depth[4]

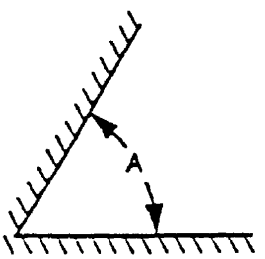
[4] This Figure is an adaptation of a Figure in the Comsis Report (Rattié et al., 1990).

4.7.4.5 Angles

The angle of any vertex formed by adjacent components shall not be less than 55 degrees, unless the lower leg is horizontal or projects downwards (see Figure 4-16). An exception to this requirement can be made if a rigid shield is attached to the vertex between adjacent components and the shield is of sufficient size to prevent a 9-inch circular template (such as the Large Head Template described above and illustrated in Figure 9) from simultaneously touching components on either side of the vertex, as illustrated in Figure 4-17.*



Angle A should exceed 55°



Angle A is exempt if one leg of the vee is horizontal or slopes downward from the apex

Figure 4-16: Requirements for Angles+

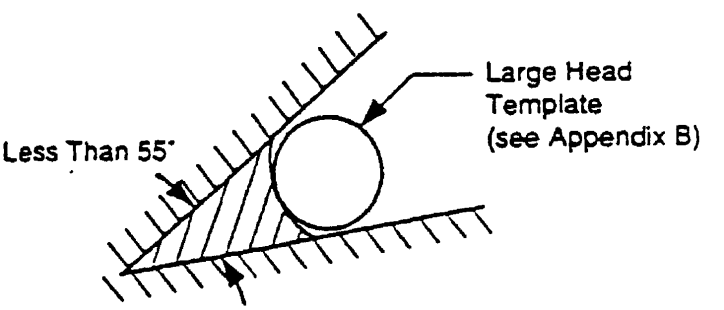


Figure 4-17: Shield for Angles Less than 55 Degrees+

+ This Figure is an adapation of a Figure in the CPSC *Handbook for Public Playground Safety.*

4.7.5 TRIP HAZARDS

4.7.5.1 The play area shall be free of obstacles which may cause children to trip.

4.7.5.2 All environmental obstacles, such as rocks, roots, and any other protrusions from the ground shall be removed from the play area.*

4.7.5.3 All anchoring devices for play equipment shall be installed below the playing surface to eliminate trip hazards.*

In addition to preventing actual tripping, the above requirement will also help prevent children who do fall from sustaining injuries due to impact with structural components.

4.7.5.4 All retainer walls used to contain loose surfacing materials shall be highly visible and any changes of elevation shall be obvious.*

Additional Recommendations:

- It is recommended that retainer walls be highly visible to playing children. Children are more likely to notice retainer walls and, therefore, less likely to trip when they must consciously climb over the wall; elevations from both directions of travel can help accomplish this design goal. The use of bright colors can also increase the visibility of retainer walls and minimize trip hazards.*

4.7.6 SUSPENDED HAZARDS

4.7.6.1 Cable, wires, ropes, and other flexible components suspended between play units or from the ground to a play unit within 45 degrees of horizontal shall not be located in areas of high traffic because they may cause injuries to a running child. This requirement does not apply to suspended members located 7 feet or more above the play surface.*

4.7.6.2 Any suspended members allowed by the above requirement shall be fixed at both ends so that they cannot loop back on themselves, have a minimum diameter of 1 inch at their smallest cross-section, and be highly visible (i.e., be of bright and contrasting colors).

4.7.7 ELECTRICAL HAZARDS

The play area shall be free of electrical hazards. Electrical hazards include but are not limited to accessible electrical switch boxes, utility meters, air conditioners, and any other electrical equipment. Where such equipment is necessary, it shall be secured from children's access by locked enclosures. All electrical wiring shall be located beyond the reach of children climbing on the play equipment or in trees.

Section 5

SAFETY AND DESIGN REQUIREMENTS FOR PLAY AREAS INTENDED FOR USE BY PRESCHOOL-AGE CHILDREN

5.6 **Rotating Equipment**
5.6.1 Swinging Gates
5.6.2 Log Rolls
5.6.3 Merry-Go-Rounds

5.7 **Seesaws**

5.8 **Spring Rocking Equipment**

Note: The numbered sections above contain requirements that could be adopted as law. In some cases, these requirements are followed by italicized text that is the rationale for the requirement. Where appropriate, additional recommendations are included. CFA views these provisions as those that will help achieve an even safer outdoor play environment. Also where appropriate, introductory explanations are given at the beginning of major sections.

An asterisk (*) follows all requirements that are the same as a recommendation contained in the CPSC *Handbook for Public Playground Safety*.

5.1 Climbing Components

Most climbing components serve as a means of access to or egress from another play event or events on a composite structure. Some, however, may also be designed as separate play events.

Climbing components vary greatly in their level of challenge. The least challenging climbing components include: ramps, stairways, step ladders, stepped or layered platforms, stepping timbers, balance beams, tunnels, and solid bridges. Climbing components that present an intermediate challenge include: rung ladders, suspension bridges, chinning bars, parallel bars, and dome climbers. Structures that require more advanced coordination and balance for successful climbing and, therefore, present greater challenges include: arch ladders, tire climbers, net climbers, and sliding poles. In addition, because upper body devices such as overhead horizontal ladders and overhead rings require children to support all of their weight with their hands (as compared to other climbing components which allow foot support as well), they can be especially difficult to maneuver -- children under 4 usually cannot fully negotiate upper body equipment.

5.1.1 GENERAL REQUIREMENTS

5.1.1.1 All play areas shall provide a range of challenge with a variety of climbing components.

When children can make choices and select play events suited to their individual skill levels, they are less likely to get hurt.

5.1.1.2 Composite structures shall be designed so that the mode of use, level of challenge, and play and traffic patterns of adjacent components are compatible.*

5.1.1.3 Climbing equipment shall not have any obstructions, climbing rungs, or structural components on the interior of the structure which could interrupt a fall to the protective surfacing below and cause an impact injury.

5.1.1.4 The fall height of climbing equipment -- which is the height of the highest climbing component -- shall not exceed 6 feet above the protective surfacing.

Limiting potential fall heights is critical, because most climbing equipment-related injuries are caused by falls and because falls cause the most serious injuries.

Additional Recommendations:

- Play equipment should incorporate large platforms that can accommodate several children at a time together with multiple means of access/egress. This design strategy contributes to safer use of both composite structures and separate play events, particularly free-standing slides.
  Offering an easy egress component is especially important for preschool-age children because the ability to descend a specific climbing component typically lags somewhat behind the ability to ascend the same structure.*
- It is recommended that the fall height of climbing equipment not exceed 5 feet above the protective surfacing as an added precaution against serious fall injuries.

5.1.2 RAMPS

5.1.2.1 Access Slope -- The slope of ramps shall not exceed 1 foot to 8 feet (vertical to horizontal).*

This maximum slope for ramps is consistent with BOCA National Building Codes. It is not, however, intended to address ramps designed for disabled access.

5.1.2.2 Width

- Ramps intended for single-file use shall be at least 12 inches wide.*
- Ramps intended for use by more than one child at a time shall be at least 30 inches wide.*

The minimum width for single-file ramps is based on the shoulder breadth of the largest user; the shoulder breadth of a 95th percentile 5-year-old is 11.5 inches. The minimum width for ramps for use by more than one child at a time is based on twice the shoulder breadth of the largest user plus an allowance for space between children.

5.1.3 STAIRWAYS, STEP LADDERS, AND RUNG LADDERS

Stairways have steps intended primarily for foot support. Step ladders also have steps, but due to their steeper slopes, are intended to require foot support as well as a limited degree of hand support -- there is more climbing involved when negotiating a step ladder than a stairway. Rung ladders require even more climbing, and the rungs are intended to be used for both hand and foot support.

5.1.3.1 All steps and rungs shall be securely attached to their side supports and shall not turn or wobble when stepped on or grasped.

5.1.3.2 All steps and rungs shall be horizontal within a tolerance of ± 2 degrees.

5.1.3.3 When risers on stairways or stepladders are closed, their design shall allow for drainage and prevent the accumulation of debris.* Drainage holes shall preclude finger entrapment and pinching.

5.1.3.4 All steps and rungs on stairways and ladders shall be evenly spaced. This requirement also applies to the distance between the top step or rung and the underside of the platform it serves.*

5.1.3.5 Access Slope

- Stairways shall have slopes no greater than 35 degrees.*
- Step ladders shall have slopes between 50 and 75 degrees.*
- Rung ladders shall have slopes between 75 and 90 degrees.*

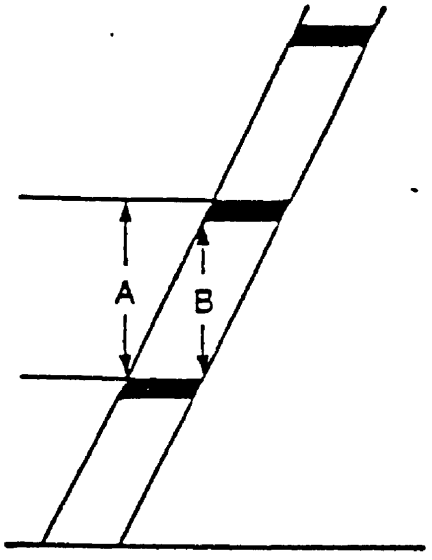
5.1.3.6 Vertical Rise -- Vertical rise is the tread-to-tread distance between two consecutive steps or rungs. The same requirements also apply to the distance between the top step or rung and the underside of the platform it serves.

On stairways and step ladders, vertical rise shall not exceed 9 inches. Unless the distance between interior opposing surfaces of consecutive steps is less than 3.5 inches, all risers shall be closed to conform with the entrapment criteria (see Section 4.7.4).*

On rung ladders, vertical rise shall not be greater than 12 inches. To satisfy the entrapment criteria (see Section 4.7.4) and because the design of rung ladders does not allow closed risers, the distance between interior opposing surfaces of consecutive rungs shall not be between 3.5 and 9 inches.*

The vertical rise of steps shall simultaneously meet two criteria (see Figure 5-1):
(1) The distance between interior opposing surfaces of consecutive steps as well as the distance between the top step and the underside of the platform it serves shall preclude the possibility of entrapment. Entrapment criteria prohibit openings with an interior dimension between 3.5 and 9 inches.
(2) The distance between the top surfaces of consecutive steps shall not exceed the step height of the smallest user. The step height of a 5th percentile 2-year-old is 8.7 inches.

Rung ladders shall also satisfy entrapment criteria; however, the vertical rise may slightly exceed the step height of the smallest user since rung ladders are intended to be climbed using both hand and foot support.



A is the vertical rise between consecutive steps or rungs, which is the vertical distance from tread to tread.

B is the distance between interior opposing surfaces of consecutive steps or rungs, which is subject to entrapment requirements.

Stairways and Stepladders
For preschool-age children, A must not exceed 9 inches, and unless B is smaller than 3.5 inches the openings between steps must be closed to preclude entrapment.

Rung Ladders
For preschool-age children, A must not exceed 12 inches, and B must not be between 3.5 inches and 9 inches to preclude entrapment.

Figure 5-1: Vertical Rise Criteria*

5.1.3.7 Tread or Rung Width

- Stairways intended for single-file use shall be at least 12 inches wide.*
- Stairways intended for use by more than one child at a time shall be at least 30 inches wide.*
- Step ladders shall be between 12 and 21 inches wide.*
- Rung ladders shall be at least 12 inches wide.*

The minimum tread and rung widths are based on the shoulder breadth of the largest user; the shoulder breadth for a 95th percentile 5-year-old is 11.5 inches.

* This Figure is an adaptation of a Figure in the Comsis Report (Ratté et al., 1990).

Because children essentially walk up stairways and do not need hand support on both sides, young children can manage wider stairways. For stairways intended for use by more than one child at a time, the minimum width is based on twice the shoulder breadth of the largest user plus an allowance for space between children.

A maximum width is specified for step ladders because the availability of hand support on both sides is critical for preschool-age children while climbing up steeper inclines (as compared to walking up stairways). If handrails are too far apart, young children may not be able to employ sufficient force in trying to pull themselves up stepladders in a vertical direction. The 21-inch maximum width ensures that the minimum user can make use of the handrails on both sides of a step ladder. This value corresponds the shoulder breadth of a 5th percentile 2-year-old (8.7 inches) plus an allowance on each side for the acromion-radiale length (5.9 inches), which approximates the distance between elbows when the arms are extended out from the shoulder.

No maximum is specified for rung ladders since their intended use involves both hand and foot support which can be provided by the rungs themselves.

5.1.3.8 Tread Depth -- On stairways and step ladders, for both open and closed risers, tread depth shall be at least 7 inches.*

Because preschool-age children have a less-developed sense of balance as well as less upper body strength, the requirements for tread depth are conservative, allowing for almost full support of the largest user's foot. The length of a 95th percentile 5-year-old's foot is 7.2 inches.

5.1.3.9 Rung Diameter -- Rungs shall meet the general requirements for the diameter of hand-gripping components (see Section 5.2.3).*

Additional Recommendations:

- Play equipment designed for preschool-age children should not incorporate rung ladders, because young children may not have the requisite upper body strength, balance, or coordination to safely climb them. Placing a few rungs below a low platform as a means of access to a composite structure is, however, an acceptable design strategy for preschool-age children, provided the rungs meet the criteria specified in Section 5.1.3 and that there is also an alternate means of access/egress.

5.1.4 SPIRAL STAIRWAYS

5.1.4.1 Spiral stairways shall meet the general criteria above for straight stairways as well as those regarding slope, vertical rise, and tread width (see Sections 5.1.3.1 through 5.1.3.7).

5.1.4.2 Tread depth at the outer edge of steps on a spiral stairway shall be at least 7 inches.

When combined with requirements for tread width, the above requirement ensures that children have an adequate contact area for their feet when climbing spiral stairways.

5.1.5 ARCH LADDERS

Arch ladders consist of metal rungs or wood members attached to convex side supports.

5.1.5.1 Free-standing arch ladders shall not be included in play areas designed for preschool-age children.*

Only arch ladders that are designed as an access/egress component may be included in play areas designed for preschool-age children.

5.1.5.2 Arch ladders shall not be the sole means of access to play equipment.*

Arch ladders are considered to be one of the more challenging climbing components. Providing a less challenging mode of access/egress, such as a stairway or step ladder, will ensure that young children use the arch ladder because they want to assume its challenge not because they are forced to use it.

5.1.5.3 The top climbing member of an arch ladder shall be no higher than 4 feet above the protective surfacing.

Given the added challenge of arch ladders, a lower maximum fall height is warranted since falls are common during the transitions from climbing an access/egress component to standing on the platform.

5.1.5.4 The top climbing member of an arch ladder used as an access/egress component shall be at or below the level of the platform it serves.

This requirement is intended to facilitate the transition from climbing to standing. If the top member of an arch ladder used as an access/egress component is located above the platform it serves, children may have difficulty making this transition and will be at increased risk of falls.

5.1.5.5 The openings formed by the climbing members of an arch ladder shall conform to the entrapment criteria (see Section 4.7.4).

5.1.5.6 Rungs used on arch ladders shall conform to the general requirements for the diameter of hand-gripping components (see Section 5.2.3).*

5.1.6 CLIMBING EVENTS WITH FLEXIBLE COMPONENTS

Play events such as net or chain climbers (which consist of a grid of cables or chains) or tire climbers (which may have tires secured tread-to-tread in the form of a sloping grid or suspended individually by chains or some other means) are classified as climbing events with flexible components.

5.1.6.1 Free-standing climbing events with flexible components shall not be included in play areas designed for preschool-age children.

Only climbing events with flexible components that are designed as an access/egress component may be included in play areas designed for preschool-age children.

5.1.6.2 Climbing events with flexible components shall not be the sole means of access to play equipment.*

Climbing events with flexible components are considered to be one of the more challenging climbing components. Providing a less challenging mode of access/egress such as a stairway or step ladder, will ensure that young children use the climbing event with flexible components because they want to assume its challenge not because they are forced to use it.

5.1.6.3 The top climbing member of a climbing event with flexible components shall be no higher than 4 feet above the protective surfacing.

Given the added challenge of a climbing event with flexible components, a lower maximum fall height is warranted since falls are common during the transitions from climbing an access/egress component to standing on the platform.

5.1.6.4 The top climbing member of a climbing event with flexible component used as an access/egress component shall be at or below the level of the platform it serves.

This requirement is intended to facilitate the transition from climbing to standing. If the top member of a climbing event with flexible component used as an access/egress component is located above the platform it serves, children may have difficulty making this transition and will be at increased risk of falls.

5.1.6.5 The slope of a climbing event with flexible components shall not exceed 50 degrees.

Limiting the slope of climbing events with flexible components is important for preschool-age children as a means reducing falls because they are so challenging. This slope is correlated to the maximum allowable slope of stairways.

5.1.6.6 All openings within climbing events with flexible components or formed between their components and other structural components shall conform to the entrapment criteria (see Section 4.7.4).*

5.1.6.7 Climbing events with flexible components shall be securely fixed at both ends,* and anchoring devices shall not present trip hazards.

5.1.7 SLIDING POLES

Sliding poles shall not be included in play areas designed for preschool-age children.*

Vertical sliding poles are designed to be more challenging than other climbing components. In most cases, preschool-age children do not have the requisite upper body strength and coordination to safely use vertical poles. Further, once younger children grasp the pole and start their descent, they are forced to complete the event since there is no alternative. Play equipment designers should minimize potentially frightening situations in which young children may get stuck without an easy way downt.

5.1.8 TURNING OR CHINNING BARS

5.1.8.1 Turning or chinning bars shall have a circular cross-section.

5.1.8.2 The diameter of turning or chinning bars shall conform to the general requirements for the diameter of hand-gripping components (see Section 5.2.3).

5.1.8.3 Turning or chinning bars shall be at least 3 feet but not more than 4 feet above the protective surfacing.

This range of acceptable heights for turning bars is intended to ensure that the largest users will not hit their head when hanging from their knees while also ensuring that the smallest users will not have too much difficulty mounting the equipment. The distance from the largest user's head to knees was estimated by subtracting knee height from stature for a 95th percentile 5-year-old; this value is 31.5 inches.

5.1.9 PARALLEL BARS

Parallel bars designed as an upper body device shall not be included in play areas designed for preschool-age children.

Preschool-age children do not have the requisite strength and coordination to safely negotiate parallel bars designed as an upper body device.

5.1.10 OVERHEAD HORIZONTAL LADDERS

5.1.10.1 All spaces between rungs on overhead horizontal ladders shall conform to the entrapment criteria (see Section 4.7.4).*

5.1.10.2 Rungs on overhead horizontal ladders shall be parallel and evenly spaced.

5.1.10.3 The distance between consecutive rungs on an overhead horizontal ladder shall not exceed 12 inches, center-to-center.

5.1.10.4 The horizontal distance between the first handhold on an overhead horizontal ladder and its access/egress structure, at both ends of the horizontal ladder, shall be between 8 and 10 inches.

This requirement is intended to facilitate mount and dismount of upper body equipment by ensuring that the first handhold at either end is reachable for the smallest user while also minimizing the risk of an impact incident if a child falls from the first handhold.

5.1.10.5 The maximum height of handholds on overhead horizontal ladders shall not exceed 60 inches above the protective surfacing.

A separate maximum height requirement is warranted for upper body equipment due to the high level of challenge. Because children must support all of their body weight with their hands, they are at greater risk of fatigue and, therefore, falls when

using overhead horizontal ladders as compared to other climbing components. The 60-inch requirement corresponds to the vertical grip reach of the largest user plus an allowance for ground clearance. The vertical grip reach of a 95th percentile 5-year-old is 53.9 inches.

5.1.10.6 The maximum height of an access/egress structure serving an overhead horizontal ladder shall not exceed 18 inches above the protective surfacing.

The distance between the top of the access/egress structure and the first handhold must accommodate the vertical grip reach of the smallest user without making the equipment difficult for the largest user to mount/dismount. The vertical grip reach of a 5th percentile 2-year-old is 39.1 inches.

5.1.10.7 Overhead horizontal ladders shall be located so that children traversing the ladder cannot interfere with the play of children on adjacent play events.*

Overhead horizontal ladders shall not be located adjacent to slides.*

Overhead horizontal ladders shall not be used as a support structure for swing seats.

The swinging movements of children generated on overhead horizontal ladders warrant special precautions to reduce the risk of impact with children on adjacent play events.

5.1.10.8 The design of structures and play events adjacent to overhead horizontal ladders shall discourage climbing on its top support bars or handholds.*

5.1.11 OVERHEAD RINGS

Overhead rings shall not be included in play areas designed for preschool-age children.

Young children do not have the advanced perceptual skills necessary to safely negotiate upper body equipment on which the handholds are not stationary or equidistant.

5.1.12 TRACK RIDES

Track rides shall not be included in public play areas, regardless of the age of intended users.

5.1.13 CLIMBING ROPES

Individual climbing ropes shall not be included in public play areas, regardless of the age of intended users.

5.1.14 TUNNELS

Tunnels shall have an interior diameter or cross-sectional dimension of at least 23 inches.

Additional Recommendations:

- It is recommended that tunnels not be longer than 48 inches, unless the play area is totally enclosed to prevent public access during off-hours.

5.1.15 SUSPENSION BRIDGES

Suspension bridges are flexible walkways built of decking material suspended between two platforms.

5.1.15.1 Suspension bridges shall not be any wider than the outer width of its support structure.

5.1.15.2 The two platforms from which a suspension bridge is suspended shall have equal heights so that the bridge has the same elevation on each end.

5.1.15.3 Spaces between planks of a suspension bridge as well as any openings between the first plank on either end and the platform shall not present pinch or crush hazards (see Section 4.7.3).

5.1.15.4 Spaces between planks of a suspension bridge as well as any openings between the first plank on either end and the platform shall conform to all entrapment criteria (see Section 4.7.4).

5.1.15.5 Suspension bridges shall conform to all criteria for elevated surfaces (see Section 5.3), including the requirements for guardrails or protective barriers.

5.1.16 BALANCE BEAMS

Balance beams shall not be higher than 12 inches above the play surface.*

This maximum height corresponds to the approximate crotch height of the smallest user; the gluteal furrow height of a 5th percentile 2-year-old is 11.5 inches. Additional height is not necessary for play value.

5.1.17 CHAIN OR CABLE WALKS

Chain or cable walks shall not be included in public play areas, regardless of the age of intended users.

Chain or cable walks present tripping hazards. Further, if not well maintained they provide children with a chain or cable attached only on one end which presents the risk of strangulation. Other play events can be used more safely to provide children with balancing activities.

5.2 Hand-Gripping Components

Handrails and other handholds are essential in helping steady children as they negotiate climbing components.

5.2.1 HANDRAILS

5.2.1.1 Continuous handrails shall be provided on both sides and along the entire length of all stairways and step ladders.*

Handrails are a critical means of support that help children maintain balance while climbing up or down the access/egress component. The design of handrails shall be continuous so that children do not have to remove their hands while climbing.

5.2.1.2 For spiral stairways, a continuous handrail shall be provided at least along the outer edge.

5.2.1.3 Handrails shall be available for use at the appropriate height beginning with the first step.*

5.2.1.4 Handrail height, which is the vertical distance between the top front edge of a step (tread nosing) and the top surface of the handrail above it, shall be greater than 20 inches but less than 26 inches.

The values required for handrail height are based on the approximate elbow height of the smallest and largest users; the elbow heights for a 5th percentile 2-year-old and a 95th percentile 5-year-old were estimated as the difference between suprasternale height and shoulder-to-elbow length. A range is allowed because children are likely to grasp handrails above elbow height and sometimes at or above shoulder height. Note that the shoulder height (suprasternale height) of the smallest user, a 5th percentile 2-year-old, is 26.1 inches, so that even handrail heights at the upper end of the range should be usable by all children in this age group.

5.2.1.5 Handrails shall extend high enough at the top of the access to provide uninterrupted support while a child fully achieves the desired posture on the platform.

5.2.1.6 Any openings formed by handrails and structural components of the play equipment shall conform to the entrapment criteria (see Section 4.7.4).*

5.2.2 OTHER HANDHOLDS

5.2.2.1 Hand support shall be provided to facilitate a child's transition from climbing to standing for climbing components which serve as access/egress to platforms and other play events.*

5.2.2.2 Any openings formed by handholds and structural components of the play equipment shall conform to the entrapment criteria (see Section 4.7.4).*

Additional Recommendations:

- Options for handholds other than traditional handrails include vertical handrails and loop handgrips, which may extend out over the top of the access.*
- Single, overhead horizontal bars are not recommended as an alternate means of hand support.

5.2.3 DIAMETER OF HAND-GRIPPING COMPONENTS

5.2.3.1 Handrails, handholds, rungs and other components intended to be grasped by the hands shall have a diameter or maximum cross-sectional dimension between 0.95 and 1.67 inches.*

5.2.3.2 When hand-gripping components are intended to be grasped such that users are supporting their entire body weight by their hands, they shall be generally round in cross-section with a diameter between 0.95 and 1.55 inches.*

Additional Recommendations:

- To benefit the weakest children, a diameter of 1.25 inches for hand-gripping components is preferred.* Requirements for the diameter of hand-gripping components are based on anthropometric data related to grip strength and hand size. Grip strength for the minimum user peaks at a diameter of about 1.25 inches, which also allows at least three-quarters of the smallest user's hand to enclose the component.

5.3 Platforms and Other Elevated Play Surfaces

5.3.1 GENERAL REQUIREMENTS

5.3.1.1 Platforms shall be within ± 2 degrees of a horizontal plane.*

5.3.1.2 All transitional play surfaces, such as platforms, landings, walkways, and ramps, shall allow for proper drainage* and prevent the accumulation of debris. Drainage holes shall preclude finger entrapment and pinching.

5.3.1.3 Structures with roofs shall be designed to discourage climbing on top of them.

5.3.2 GUARDRAILS AND PROTECTIVE BARRIERS

Both guardrails and protective barriers are intended to prevent inadvertent falls off elevated play surfaces. Protective barriers, however, are intended to provide a greater degree of protection: in addition to preventing falls over the edge, protective barriers are designed to prevent intentional attempts by children seeking to defeat the barrier by climbing either under or through it.

Guardrails and protective barriers are an essential means of preventing injuries due to falls.

5.3.2.1 General Requirements to Protect Against Falls from Elevated Surfaces

5.3.2.1.1 Guardrails or protective barriers shall be provided on all elevated surfaces, such as platforms, walkways, landings, ramps, and other transitional play surfaces, in accordance with the following requirements. An elevated surface is exempt from these requirements if a guardrail or protective barrier would interfere with the intended use of the equipment; this includes most climbing components and platforms that are layered so that the fall height does not exceed 20 inches.*

- Any elevated surface that is more than 20 inches above the underlying surface shall be protected with either a guardrail or protective barrier.*
- Guardrails are acceptable for elevated surfaces higher than 20 inches but less than or equal to 30 inches high; protective barriers, however, may still be preferable for this age group given their increased risk of falls.*
- Any elevated surface that is more than 30 inches above the underlying surface shall be protected with a full protective barrier.*

The degree of protection required depends on the height of the elevated surface in combination with the age of the intended users. For preschool-age children, a greater degree of protection is warranted at lower elevations due to their less developed sense of balance and coordination, which increases their risk of falls.

5.3.2.1.2 All guardrails and protective barriers shall completely surround the elevated surface, except for the entrance and exits necessary for each play event.

5.3.2.1.3 All guardrails and protective barriers shall provide stationary, non-flexible protection against falls.

5.3.2.1.4 All guardrails and protective barriers shall not impede supervision.*

5.3.2.1.5 All guardrails and protective barriers shall be designed to discourage climbing.*

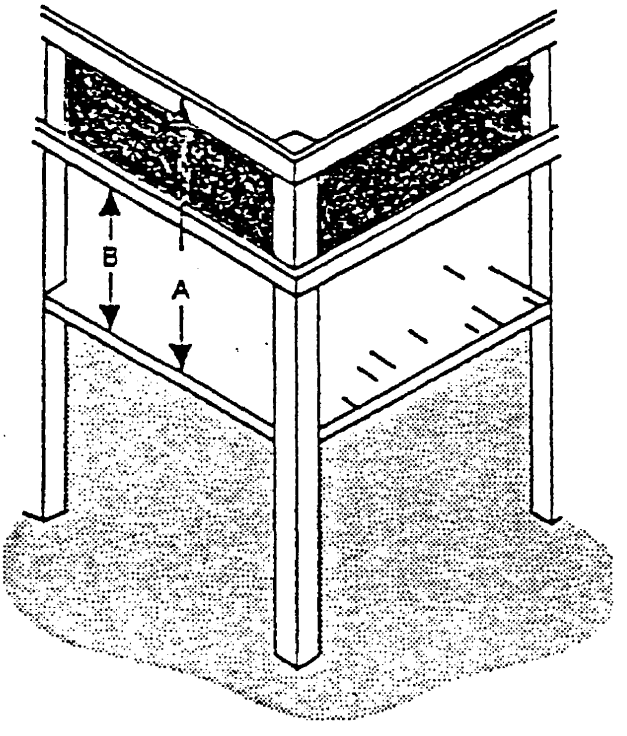
Horizontal cross-pieces shall not be used as infill below the top rail.*

5.3.2.2 Requirements for Guardrails

5.3.2.2.1 The top surface of guardrails shall be at least 29 inches high and the lower edge of the guardrail shall not be more than 23 inches above the elevated surface (see Figure 5-2).*

The minimum height of guardrails ensures that the standing center of gravity of the largest user is below the top edge, and thus provides protection against inadvertent falls over the guardrail. The standing center of gravity for a 95th percentile 5-year-old is 26.9 inches.

The maximum distance between the lower edge of the guardrail and the elevated surface ensures that the smallest user cannot inadvertently walk under the guardrail. This measurement corresponds to the chest height at axilla for a 5th percentile 2-year-old, which is 23.6 inches.



A is the minimum height of the top surface of guardrail.

B is the maximum height of the lower edge of a guardrail.

For preschool-age children, A must be at least 29 inches above the elevated play surface, and B must not exceed 23 inches above the elevated play surface.

Figure 5-2: Height Requirements for Guardrails*

5.3.2.2.2 Guardrails may have openings greater than 9 inches, but shall not have any openings between 3.5 and 9 inches to conform with entrapment criteria (see Section 4.7.4).*

Because guardrails are not intended to prevent intentional attempts to climb under or through them, they may have openings greater than 9 inches which would allow a child to pass through without being at risk of entrapment.

* This Figure is an adaptation of a Figure in the CPSC *Handbook for Public Playground Safety*.

5.3.2.3 Requirements for Protective Barriers

5.3.2.3.1 The top surface of protective barriers shall be at least 29 inches high.*

The minimum height of protective barriers ensures that the standing center of gravity of the largest user is below the top edge, and thus provides protection against inadvertent falls over the guardrail. The standing center of gravity for a 95th percentile 5-year-old is 26.9 inches.

5.3.2.3.2 Protective barriers shall not have any openings greater than or equal to 3.5 inches within the barrier (i.e., between uprights) or between the lower edge of the barrier and the elevated surface to conform with entrapment criteria (see Section 4.7.4).*

Because protective barriers are designed to prevent children from climbing under or through them, all openings must be less than 3.5 inches so that children are not at risk of entrapment.

5.3.3 STEPPED PLATFORMS

On some composite structures, platforms may be layered or tiered so that falls from a higher platform are terminated by a lower platform rather than the ground surface.

5.3.3.1 The difference in height between stepped platforms shall not exceed 12 inches, unless an alternate means of access/egress is provided between the platforms.*

Because children typically climb up stepped platforms rather than step up, the vertical rise between stepped platforms may be somewhat greater than the smallest user's step height. The step height of a 5th percentile 2-year-old is 8.7 inches.

5.3.3.2 All openings between stepped platforms shall conform to the entrapment criteria (see Section 4.7.4).*

5.3.3.3 When the height of the lower of two consecutive stepped platforms is greater than 30 inches above the protective surfacing, protective infill shall be provided in the space between the stepped platforms so that there are no openings greater than 3.5 inches.*

Because elevated surfaces above 30 inches in height require protective barriers, the space between stepped platforms should not allow children to pass through them, preventing falls as well as intentional jumps. To conform to entrapment criteria, this space, therefore, must not present any openings greater than 3.5 inches.

Additional Recommendations:

- Stepped platforms are a good easy access/egress component for preschool-age children.

5.4 Slides

Slides may be straight, wavy, curved, or spiral and may provide either open bedways or tubes for descent.

Slides are now commonly attached to composite structures, although some free-standing slides are still available. Alternatively, slide chutes can be built onto the grade of a natural or man-made slope; these are called embankment or hill slides.

5.4.1 ACCESS TO SLIDES AND SLIDE PLATFORMS

5.4.1.1 Climbing components and platforms which provide access to slides shall follow the general requirements stated in Section 5.1 and Section 5.3.1.*

5.4.1.2 Slide platforms shall be protected by guardrails or protective barriers in accordance with the requirements for elevated surfaces (see Section 5.3.2).*

5.4.1.3 Slide platforms shall be at least 22 inches long.*

Platforms at the top of slides shall be long enough to accommodate children as they make the transition from a standing to a sliding position. The length of slide platforms corresponds to the buttock-to-knee measurement for a 95th percentile 12-year-old. The added protection of using an anthropometric value based on school-age children is warranted given the increased risk of falls for younger children.

5.4.1.4 Slide platforms shall be at least as wide as the slide chute.*

Additional Recommendations:

- Because there is a high risk of falls at the top of slides and their accompanying access structures, designs which incorporate large platforms with multiple means of access/egress and adequate handholds for transitions contribute to the safer use of slides. Providing multiple means of access/egress to and from slides is especially important for preschool-age children since many climb up to the top of a slide and are then hesitant to go down the chute and, therefore, need an alternate, easy way to climb back down.

5.4.2 SLIDE CHUTE ENTRANCE

5.4.2.1 Slide chutes shall be designed and constructed so that there are no gaps or spaces between the platform and the start of the sliding surface.*

5.4.2.2 The design of the slide chute entrance shall channel the user into a seated position for sliding. This may be accomplished with a hood, guardrail, or other device. Such means shall not encourage climbing or other dangerous uses.*

5.4.2.3 Handholds or some other means of hand support shall be provided at the slide chute entrance to facilitate the transition from a standing to a sitting position for sliding.*

This hand support may be an integral part of the design feature which channels the user into a seated position.

5.4.2.4 The fall height of slides – which is the height of the slide chute entrance -- shall not exceed 6 feet above the protective surfacing, with the exception of spiral slides.

The deck height of platforms accessing spiral slides shall not exceed 5 feet above the protective surfacing when designed for preschool-age children.

Limiting the fall height of slides is essential given the great risk of falls and related potential for serious injuries.

*The deck height of platforms accessing spiral slides is further restricted for preschool-age children because spiral slides involve a more complex motion and young children have less ability to maintain balance and postural control.**

Additional Recommendations:

- A single horizontal bar or chain in front of the slide chute entrance is not recommended as a means to channel users into a seated position because children use such components in many hazardous ways.
- Special attention to designs which provide extra protection against falls at the top of slides is warranted.
- It is recommended that the fall height of slides not exceed 5 feet above the protective surfacing as an added precaution against serious fall injuries.

5.4.3 SLIDING SURFACE

5.4.3.1 The average incline of the sliding surface, as measured by a Height/Length ratio, shall not exceed 0.5, and no span of the sliding surface shall have a slope greater than 45 degrees.

The Height of the slide shall be taken as the vertical distance between the protective surfacing and the slide chute entrance. The Length of the slide shall be taken as the horizontal distance between the slide chute entrance and the end of the exit region.

5.4.3.2 Any change in the slope of the sliding surface (e.g., wave slides) shall not allow a child to lose contact with the sliding surface.*

5.4.3.3 The sliding surface shall have an inside width of at least 12 inches.

The slide surface width is intended to accommodate the largest user, either in a seated position or lying down since both are anticipated uses. The hip breadth and shoulder breadth of a 95th percentile 5-year-old are 9.1 inches and 11.5 inches, respectively.

5.4.3.4 For tube slides, the minimum internal diameter of the tube shall be at least 23 inches.*

*This minimum diameter is required to ensure that all intended users can slide through the tube unimpeded.**

5.4.3.5 Slides shall have sides which are an integral part of the chute design at least 4 inches high extending along both sides for the entire length of the sliding surface.*

For slides with a circular or semi-circular cross-section, the height of the sides shall be at least four inches when measured at right angles above a horizontal line which is at least 12 inches wide inside the chute.

Tube slides are exempt from this requirement.

5.4.3.6 Curved and spiral slides shall be designed to minimize the likelihood of lateral discharge of the user.*

5.4.3.7 Metal slides shall face North or be located in shaded areas.*

Metal slides can become hot enough to cause burns if the chute is in direct sun.

5.4.3.8 The sliding section shall not have any seams or joints which could cause entanglement incidents or in which hazardous debris may collect.

Additional Recommendations:

- For tube slides, it is recommended that either barriers be provided or surfaces be treated to prevent children from sliding on top of tube.*
- A high level of supervision is recommended for tube slides since children using such slides are not visible.*
- Roller slides are not recommended for public play areas unless frequent inspections and maintenance can be guaranteed.*

5.4.4 EXIT REGION

5.4.4.1 The design of all slides shall incorporate an exit region* as specified below.

The exit region helps children maintain balance and facilitates a smooth transition from a sitting, sliding position to a standing, exiting position, thereby reducing the likelihood of falls and injuries at the lower end of slides.

5.4.4.2 The exit region shall be essentially horizontal and parallel to the ground.*

5.4.4.3 The exit region shall be at least 11 inches long.*

The length of the exit region is correlated to the thigh length of the largest user. This dimension, which is the distance between tibiale and trochanter, for a 95th percentile 5-year-old is 11 inches.

5.4.4.4 The exit region shall be at least 7 inches but not more than 11 inches above the protective surfacing.

The height of the exit region is correlated to the distance between the back of the knee and heel for the smallest and largest users. The tibiale height, which is used to estimate this distance, is approximately 7 inches for a 5th percentile 2-year-old and 11 inches for a 95th percentile 5-year-old.

5.4.4.6 The radius of curvature of the sliding surface in the exit region shall be at least 30 inches.

5.4.4.7 All slide exit edges shall be rounded or curved in accordance with Section 4.7.1.*

5.4.4.8 All slide exits shall be located in uncongested sections of the play area.*

5.4.5 CLEAR ZONE FOR SLIDES

A clear zone is required for slides in addition to the fall zone and buffer zones described in Sections 4.1.6.5 and 4.2.1.3.

5.4.5.1 A clear zone surrounding the sliding surface shall be free of other play events and obstacles, extending from the chute entrance through the exit region. The clear area shall be at least 46 inches high, when measured vertically from the sliding surface and cover a width of at least 15 inches on each side of the sliding surface when measured horizontally from the inside of the chute sidewalls.

A clear zone is required to protect children from impact with other equipment or children while sliding down the chute. The intent of this requirement is to create an invisible bubble that surrounds the sliding surface and thus protects children from hazardous protrusions and obstructions.

The dimensions of the clear zone are based on the standing height and approximate lateral grip reach from the shoulder of the largest user, which are 45.4 inches and 14.4 inches, respectively for a 95th percentile 5-year-old.

5.4.5.2 Hoods and other designs at the top of slides intended to channel users into a seated position (in accordance with Section 5.4.2.3) are exempt from Section 5.4.5.1 and may be located within the clear zone.

5.4.5.3 Tube slides are exempt from Section 5.4.5.1 and may be located within the clear zone.

Tube slides are not subject to the requirement for a clear zone surrounding the sliding surface, because their design actually encapsules the user and already provides the necessary protection from impact incidents.

5.4.5.4 Spiral slides are exempt from Section 5.4.5.1 but shall maintain the following clear zone. There shall be a clear zone which extends out at least 15 inches horizontally when measured from the inside of the outer sidewall of the chute; this clear area is required along the entire outer perimeter as the slide curves around.

Spiral slides are exempt from the requirement of a 46-inch high clear zone as well as the inner horizontal clear zone specified in Section 5.4.5.1, because their design prevents other equipment from encroaching in these hazardous spaces. The horizontal clear zone is required for protection along the outer edge of spiral slides.

5.5 Swings

5.5.1 GENERAL REQUIREMENTS

The following types of swings shall not be included in public play areas, regardless of the age of intended users.*

- Animal Swings
- Multiple Occupancy Swings (i.e., Gliders), except Tire Swings
- Swinging Exercise Rings and Trapeze Bars
- Rope Swings

Animal swings, gliders, swinging exercise rings, and trapeze bars are constructed of heavy, hard-hitting, rigid materials that may cause serious head impact injuries.

Rope swings present children with a free hanging rope that could cause strangulation hazards.

5.5.2 CONVENTIONAL TO-FRO SWINGS

5.5.2.1 Swing Seats

5.5.2.1.1 All swing seats shall be made of lightweight, impact-absorbing materials, such as rubber, plastic, or canvas.

Swing seats shall not be constructed of wood, metal, or other rigid materials.*

Using lighrweight, impact-absorbing materials for swing seats helps reduce the severity of injuries if impact incidents occur. Rigid swing seats may cause serious impact injuries.

5.5.2.1.2 The edges of all swing seats shall be smoothly finished or have rounded edges and shall conform the requirements for protrusions on suspended members of swing assemblies described in Section 4.7.2.8.*

5.5.2.1.3 All seats for single-axis swings shall be designed to accommodate only one user at a time.*

5.5.2.1.4 The width of the seat surface, which is the distance between the hardware that connects the swing seat to the suspending elements on each end, shall be at least 18 inches.

The width of swing seats should accommodate the hip breadth of all anticipated users, including adults.

5.5.2.1.5 The seat height of an unoccupied conventional swing shall be between 12 and 18 inches above the protective surfacing.

Swings should be suspended at a height which allows the smallest children to seat themselves relatively easily without being so low that the largest children's feet will consistently hit the ground while swinging. This range is intended to accommodate the approximate seated height of a 95th percentile 5-year-old (tibiale height, which

is the distance from the heel to the back of the knee,is 11.4 inches) and the buttock height of a 5th percentile 4-year-old (gluteal furrow height is 14.6 inches) who is assumed to be the smallest likely users of this type of swing. Note that the buttock height of a 50th percentile 3-year-old is 15.1, so that most three-year-olds are also accommodated by this specification.

Additional Recommendations:

- Flexible, strap-type seats constructed either of molded rubber with a steel insert bonded into the rubber or polyethylene are recommended for strength and durability.

5.5.2.2 Infant/Tot Swings

Infant/tot swings are seats designed for use by children under the age of two with adult assistance.

5.5.2.2.1 The seats and suspension systems of infant/tot swings shall conform to all of the requirements specified in Sections 5.5.2, except 5.5.2.1.5 and 5.5.2.1.6, and entrapment criteria (see Section 4.7.4) without presenting any strangulation hazards.*

5.5.2.2.2 Infant/tot seats shall provide equal support on all sides of the child.

Figure 5-3 illustrates well-designed infant/tot seats.

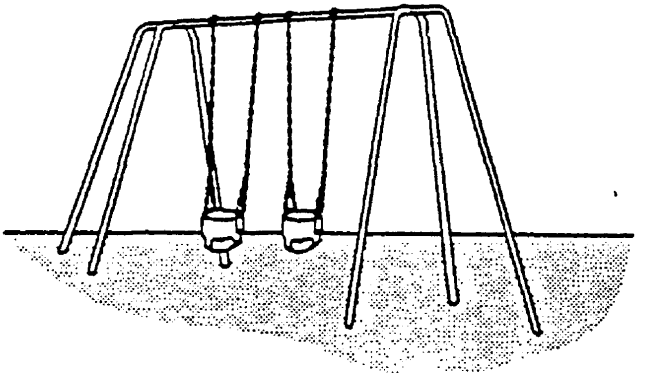


Figure 5-3: Recommended Design for Infant/Tot Seats+

5.5.2.2.3 Infant/tot seats designed to provide proper support in only one orientation shall preclude the possibility of an adult seating the child in other, unintended orientations.

There should not be any openings in infant/tot seats that could be confused as leg cut-outs and, consequently, lead to improper, hazardous orientations.

5.5.2.2.4 Infant/tot seats shall be suspended at least 24 inches above the protective surfacing.

5.5.2.2.5 Infant/tot seats shall not be suspended in the same bay as other swings.*

+ This Figure is an adapation of a Figure in the CPSC *Handbook for Public Playground Safety.*

Additional Recommendations:

- Bucket-style, two-sided infant/tot seats of molded rubber with steel inserts bonded into the rubber for strength, durability, and vandal-resistance are recommended.
- Chair-style contour infant/tot seats are not recommended because they do not provide equal support on all sides of the child and, therefore, are likely to tip. In addition, children often fall out or can climb out of this type of seat. Many of the chair seats also present entrapment hazards.

5.5.2.3 Swing Structures

5.5.2.3.1 Single-axis swings shall not be attached to composite structures.*

5.5.2.3.2 Swing support structures shall be designed to discourage climbing.*

Support structures shall not use horizontal cross-bars, other than the top cross-beam from which the swings are suspended.*

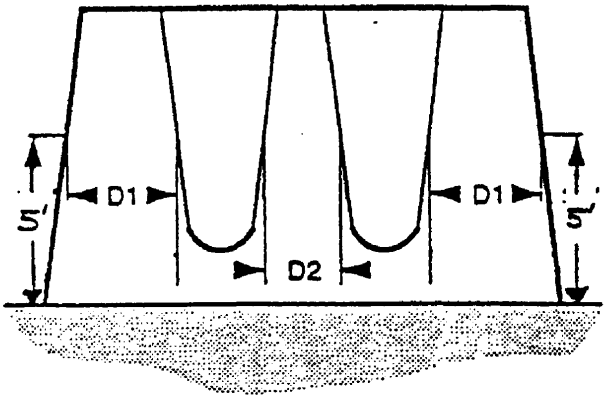
5.5.2.3.3 Swing support structures shall not also be an overhead horizontal ladder.

5.5.2.3.4 Swing hangers shall be hung wider than the width of the swing seat.*

Hanging swings in this manner helps reduce side-to-side movement and, therefore, the potential for impact incidents.

5.5.2.3.5 The following clearances shall be provided for swings and swing structures up to a height of 5 feet above the protective surfacing (see Figure 5-4).

- The horizontal distance between adjacent swings shall be at least 24 inches.*
- The horizontal distance between a seat and an adjacent structural component shall be at least 30 inches.*



D1 = Minimum 30"
D2 = Minimum 24"

Figure 5-4: Minimum Clearances for Swings+

+ This Figure is an adapation of a Figure in the CPSC *Handbook for Public Playground Safety.*

The 24-inch minimum clearance required between adjacent swings accommodates the shoulder breadth of a 95th percentile 12-year-old (16 inches) with some tolerance on each side; at the same time this distance is not so large as to encourage children to run between swings.

The minimum clearance required between a swing and an adjacent structural component is greater to provide extra protection against injuries caused by impact with a rigid structure.

These minimum clearances shall be satisfied up to a height of 60 inches to accommodate the stature of a 95th percentile 12-year-old.

The above dimensions are based on anthropometrics of older children but are appropriate for preschool-age children as well since younger children will benefit from proportionally larger clearances given their less developed cognitive and motor skills and their increased risk of injuries caused by impact with moving swings.

5.5.2.3.6 No more than two swing seats shall be suspended within each bay of a swing support structure.*

This requirement is intended to minimize the likelihood of children getting hit by a moving swing.

5.5.2.3.7 The fall height of swings with conventional seats-- which is the height of the pivot point – shall not exceed 10 feet above the protective surfacing.

5.5.2.3.8 The fall height of swings with infant/tot seats-- which is the height of the pivot point – shall not exceed 8 feet above the protective surfacing.

5.5.2.3.9 Swing structures shall be located away from other equipment and activities.*

Locating conventional swings away from other equipment and activities, preferably in a corner of the play area, is an essential means of preventing impact injuries caused by children inadvertently running into the path of a moving swing.

Additional Recommendations:

- Greater protection against impact injuries can be provided by means of a low barrier at the edge of the buffer zone (see Section 4.2.1.3), such as a fence or hedge, to separate swings from other equipment. Such barriers, however, must not be an obstacle in the fall zone or hamper supervision by blocking visibility.*
- It is recommended that the fall height of swings with conventional to-fro seats not exceed 8 feet above the protective surfacing.

5.5.3 TIRE SWINGS

Tire swings are typically suspended in a horizontal orientation from a multi-axis swivel mechanism using three chains or cables; these swings permit rotation and a swinging motion in any axis.

5.5.3.1 Tire swing support structures shall be designed to discourage climbing.*

Support structures shall not use horizontal cross-bars, other than the top cross-beam from which the swing is suspended.*

5.5.3.2 A multi-axis tire swing shall not be suspended from a structure having any other swings in the same bay.*

5.5.3.3 Only one tire swing shall be suspended within a single bay.

5.5.3.4 The lower edge of the tire shall be at least 12 inches but not more than 18 inches above the protective surfacing.

5.5.3.5 When the tire is held in a position closest to the support structure, the distance between the outer-most edge of the tire and the adjacent upright of the support structure shall be at least 30 inches (see Figure 5-5).*

This clearance is required to provide adequate space for children to reach out with their arms and legs or to lean back while sitting on the tire without impacting support structures.

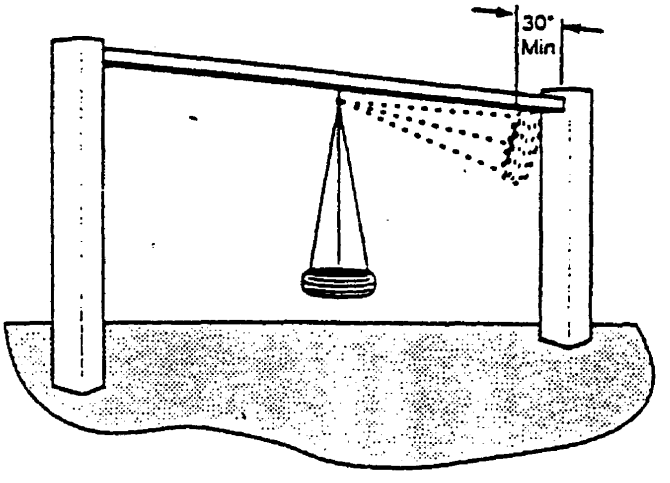


Figure 5-5: Minimum Clearances for Tire Swings+

5.5.3.6 A tire swing structure consisting of only one bay may be attached to the end of a composite structure but not between two play events.

Where a tire swing is attached to a composite unit, there shall not be any access/egress components located within 6 feet of the end of the tire swing structure which connects to the composite structure.

5.5.3.7 The fall height of tire swings -- which is the height of the pivot point -- shall not exceed 8 feet above the protective surfacing.

Additional Recommendations:

- Preferably, no swings -- including tire swings -- will be attached to a composite unit. Younger children, in particular, are at great risk of impact injuries caused by inadvertently running into the path of a moving swing. It is, therefore, recommended that all swings be located away from other play events.

+ This Figure is an adapation of a Figure in the CPSC *Handbook for Public Playground Safety.*

5.6 Rotating Equipment

5.6.1 SWINGING GATES

Swinging, rotating gates shall not be included in public play areas, regardless of the age of intended users.

5.6.2 LOG ROLLS

Log or barrel rolls shall not be included in play areas designed for preschool-age children.

Preschool-age children do not have the requisite body strength or coordination to control this type of equipment.

5.6.3 MERRY-GO-ROUNDS

Merry-go-rounds are the most common type of rotating equipment. Most merry-go-rounds consist of a circular base, close to the ground, which children either sit or stand on and that rotates when pushed. Some merry-go-rounds designed for younger children are a concave, dish-like platform in which children sit.

5.6.3.1 The rotating base of all merry-go-rounds shall be continuous and approximately circular.*

The difference between the minimum and maximum radii of a non-circular base shall not exceed 2 inches (see Figure 5-6).*

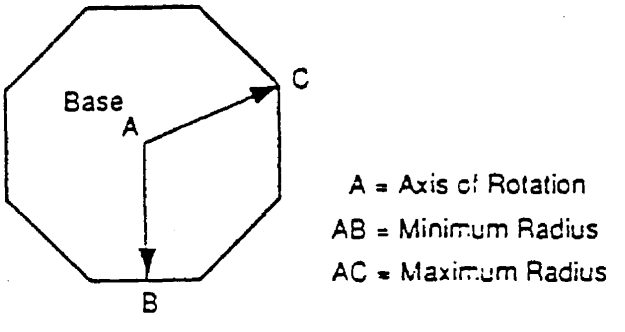


Figure 5-6: Minimum and Maximum Radii of a Non-Circular Merry-Go-Round Platform*

* This Figure is an adapation of a Figure in the CPSC *Handbook for Public Playground Safety.*

5.6.3.2 The rotating base shall be solid and preclude access to the undercarriage and rotating mechanism of the merry-go-round.

Open-base designs with a bench that rotates around the central structure allowing children to sit facing the center or to run inside the bench have been attributed to serious injuries.

The undercarriage and rotating mechanism of merry-go-rounds must be enclosed to eliminate pinch, crush, and shearing hazards.

5.6.3.3 The rotating base shall not have any sharp edges.*

5.6.3.4 Nothing shall protrude beyond the outer edge of the rotating base.*

5.6.3.5 The diameter of the rotating base shall not exceed 4 feet.

One means of reducing the frequency and severity of injuries associated with merry-go-rounds is to limit the size of their rotating base.

5.6.3.6 All merry-go-rounds, with or without seats, shall provide a means of hand support.*

5.6.3.7 Handrails or handgrips provided on merry-go-rounds shall conform to the general requirements for the diameter of hand-gripping components (see Section 5.2.3) as well as to all protrusion requirements (see Section 4.7.2.7).*

5.6.3.8 The standing surface of merry-go-rounds shall not exceed 1 foot above the protective surfacing.

Limiting the height of merry-go-rounds is an important means of reducing fall injuries. This requirement also helps ensure that children can get on and off the merry-go-round easily.

5.6.3.9 Merry-go-rounds shall be located away from other play events, preferably at the edge of the play area.*

Because of the increased risk of injuries associated with moving equipment, it should be separated from other equipment.

5.6.3.10 Merry-go-rounds shall not be equipped with an oscillatory (up and down) motion.*

Additional Recommendations:

- It is strongly recommended that merry-go-rounds be included only in play areas where there is constant adult supervision because young children cannot control merry-go-rounds once they are on the equipment and it is in motion.

5.7 Seesaws

Seesaws consist of a board or pole with a seat at each end, supported at the center by a fulcrum.

Given a lack of control and unpredictability, there are inherent hazards in the design of fulcrum seesaws. Safe use depends on the cooperative and complementary behavior of two children.

5.7.1 Fulcrum seesaws shall not be included in play areas designed for preschool-age children.*

Fulcrum seesaws require body control and coordination that most preschool-age children have not yet developed. Further, young children are at increased risk of falls and impact injuries because most will not be able to relate their actions to those of the other user, which is essential for safe seesaw use.

Additional Recommendations:

- For preschool-age children, it is recommended that spring-loaded seesaws (see Section 5.8) be substituted for fulcrum seesaws.*

5.8 Spring Rocking Equipment

Spring rocking equipment may be in the form of individual seat assemblies mounted on a spring mechanism or consist of several seat assemblies linked by a common spring mechanism (i.e., a spring-loaded seesaw).

Although younger children enjoy and benefit developmentally from individual spring rockers, this equipment typically does not present enough challenge to interest older children. Older children do, however, enjoy spring platforms.

5.8.1 SPRINGS

The spring mechanism of rocking equipment shall minimize the possibility of children pinching either their hands or feet between coils of the spring or between the spring and part of the rocker.*

5.8.2 SEAT ASSEMBLIES

The requirements for seat assemblies apply to individual spring rockers as well as spring-loaded seesaws.

5.8.2.1 Seat design shall minimize the likelihood of the rocker being used by more than the intended number of children at one time.*

5.8.2.2 Seat assemblies of rocking equipment shall be no higher than 24 inches above the protective surfacing.

This maximum height is intended to limit potential fall heights while accommodating the waist height of the largest user, assuming that 5-year-olds are the typically the oldest users of spring rockers. The waist height of a 95th percentile 5-year-old is 26.3. Since children actively climb up onto the equipment, this 24-inch height is also reasonable from the standpoint of smaller, younger users.

5.8.2.3 Handholds shall be provided for each seat position on spring rockers.*

Handholds on spring rockers shall conform to the general requirements for the diameter of hand-gripping components (see Section 5.2.3) as well as to all protrusion requirements (see Section 4.7.2.7).*

5.8.2.4 Footrests shall be provided for each seat position on spring rockers.*

Footrests on spring rockers shall conform to all protrusion requirements (see Section 4.7.2.7).*

5.8.2.5 There shall be a minimum distance of 36 inches between adjacent seat assemblies on spring rocking equipment or between individual spring rockers.

This requirement is intended to prevent potentially hazardous interaction between children on adjacent seat assemblies of spring rocking equipment.

5.8.3 SPRING PLATFORMS

The standing surface of spring platforms shall not be higher than 18 inches above the protective surfacing.

It is important to limit the height of spring platforms given the potential for falls.

Section 6

SAFETY AND DESIGN REQUIREMENTS FOR PLAY AREAS INTENDED FOR USE BY SCHOOL-AGE CHILDREN

6.6 Rotating Equipment
6.6.1 Swinging Gates
6.6.2 Log Rolls
6.6.3 Merry-Go-Rounds

6.7 Seesaws

6.8 Spring Rocking Equipment

Note: The numbered sections above contain requirements that could be adopted as law. In some cases, these requirements are followed by italicized text that is the rationale for the requirement. Where appropriate, additional recommendations are included. CFA views these provisions as those that will help achieve an even safer outdoor play environment. Also where appropriate, introductory explanations are given at the beginning of major sections.

An asterisk (*) follows all requirements that are the same as a recommendation contained in the CPSC *Handbook for Public Playground Safety.*

6.1 Climbing Components

Most climbing components serve as a means of access to or egress from another play event or events on a composite structure. Some, however, may also be designed as separate play events.

Climbing components vary greatly in their level of challenge. The least challenging climbing components include: ramps, stairways, step ladders, stepped or layered platforms, stepping timbers, balance beams, tunnels, and solid bridges. Climbing components that present an intermediate challenge include: rung ladders, suspension bridges, chinning bars, parallel bars, and dome climbers. Structures that require more advanced coordination and balance for successful climbing and, therefore, present greater challenges include: arch ladders, tire climbers, net climbers, and sliding poles. In addition, because upper body devices such as overhead horizontal ladders and overhead rings require children to support all of their weight with their hands (as compared to other climbing components which allow foot support as well), they can be especially difficult to maneuver.

6.1.1 GENERAL REQUIREMENTS

6.1.1.1 All play areas shall provide a range of challenge with a variety of climbing components.

When children can make choices and select play events suited to their individual skill levels, they are less likely to get hurt.

6.1.1.2 Composite structures shall be designed so that the mode of use, level of challenge, and play and traffic patterns of adjacent components are compatible.*

6.1.1.3 Climbing equipment shall not have any obstructions, climbing rungs, or structural components on the interior of the structure which could interrupt a fall to the protective surfacing below and cause an impact injury.

6.1.1.4 The fall height of climbing equipment – which is the height of the highest climbing component -- shall not exceed 7 feet above the protective surfacing.

Limit potential fall heights is critical, because most climbing equipment-related injuries are caused by falls and because falls cause the most serious injuries.

Additional Recommendations:

- Play equipment should incorporate large platforms that can accommodate several children at a time together with multiple means of access/egress. This design strategy contributes to safer use of both composite structures and separate play events, particularly free-standing slides.
- It is recommended that the fall height of climbing equipment not exceed 6 feet above the protective surfacing as an added precaution against serious fall injuries.

6.1.2 RAMPS

6.1.2.1 Access Slope -- The slope of ramps shall not exceed 1 foot to 8 feet (vertical to horizontal).*

This maximum slope for ramps is consistent with BOCA National Building Codes. It is not, however, intended to address ramps designed for disabled access.

6.1.2.2 Width

- Ramps intended for single-file use shall be at least 16 inches wide.*
- Ramps intended for use by more than one child at a time shall be at least 40 inches wide.*

The minimum width for single-file ramps is based on the shoulder breadth of the largest user; the shoulder breadth of a 95th percentile 12-year-old is 15.7 inches. The minimum width for ramps for use by more than one child at a time is based on twice the shoulder breadth of the largest user plus an allowance for space between children.

6.1.3 STAIRWAYS, STEP LADDERS, AND RUNG LADDERS

Stairways have steps intended primarily for foot support. Step ladders also have steps, but due to their steeper slopes, are intended to require foot support as well as a limited degree of hand support -- there is more climbing involved when negotiating a step ladder than a stairway. Rung ladders require even more climbing, and the rungs are intended to be used for both hand and foot support.

6.1.3.1 All steps and rungs shall be securely attached to their side supports and shall not turn or wobble when stepped on or grasped.

6.1.3.2 All steps and rungs shall be horizontal within a tolerance of ± 2 degrees.

6.1.3.3 When risers on stairways or stepladders are closed, their design shall allow for drainage and prevent the accumulation of debris.* Drainage holes shall preclude finger entrapment and pinching.

6.1.3.4 All steps and rungs on stairways and ladders shall be evenly spaced. This requirement also applies to the distance between the top step or rung and the underside of the platform it serves.*

6.1.3.5 Access Slope

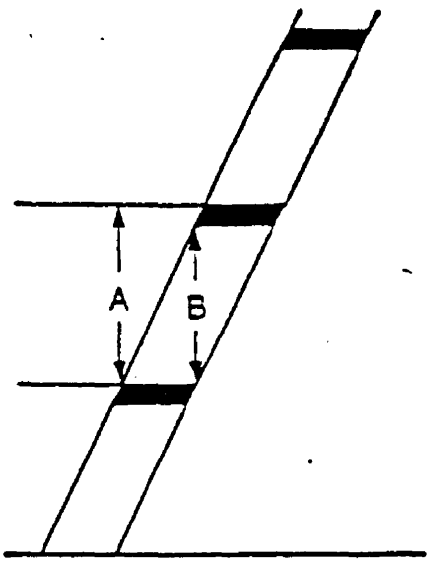
- Stairways shall have slopes no greater than 35 degrees.*
- Step ladders shall have slopes between 50 and 75 degrees.*
- Rung ladders shall have slopes between 75 and 90 degrees.*

6.1.3.6 Vertical Rise -- Vertical rise is the tread-to-tread distance between two consecutive steps or rungs. The same requirements also apply to the distance between the top step or rung and the underside of the platform it serves.

On stairways and step ladders, vertical rise shall not exceed 12 inches. Unless the distance between interior opposing surfaces of consecutive steps is less than 3.5 inches or greater than 9 inches, all risers shall be closed to conform with the entrapment criteria (see Section 4.7.4).*

On rung ladders, vertical rise shall not be greater than 12 inches. To satisfy the entrapment criteria (see Section 4.7.4) and because the design of rung ladders does not allow closed risers, the distance between interior opposing surfaces of consecutive rungs shall not be between 3.5 and 9 inches.*

The vertical rise of steps and rungs shall simultaneously meet two criteria (see Figure 6-1):
(1) The distance between interior opposing surfaces of consecutive steps or rungs as well as the distance between the top step or rung and the underside of the platform it serves shall preclude the possibility of entrapment. Entrapment criteria prohibit openings with an interior dimension between 3.5 and 9 inches.
(2) The distance between the top surfaces of consecutive steps shall not exceed the step height of the smallest user. The step height of a 5th percentile 5-year-old is 12.5 inches.



A is the vertical rise between consecutive steps or rungs, which is the vertical distance from tread to tread.

B is the distance between interior opposing surfaces of consecutive steps or rungs, which is subject to entrapment requirements.

Stairways and Stepladders
For school-age children, **A** must not exceed 12 inches, and unless **B** is smaller than 3.5 inches or greater than 9 inches the openings between steps must be closed to preclude entrapment.

Rung Ladders
For school-age children, **A** must not exceed 12 inches, and **B** must not be between 3.5 inches and 9 inches to preclude entrapment.

Figure 6-1: Vertical Rise Criteria*

6.1.3.7 Tread or Rung Width

- Stairways and step ladders intended for single-file use shall be at least 16 inches wide.*
- Stairways and step ladders intended for use by more than one child at a time shall be at least 40 inches wide.*
- Rung ladders shall be at least 16 inches wide.*

The minimum tread and rung widths are based on the shoulder breadth of the largest user; the shoulder breadth for a 95th percentile 12-year-old is 15.7 inches.

Because older children can manage either stairways or step ladders without the use of handrails on both sides, they can both be wider than single-file. For stairways and step ladders intended for use by more than one child at a time, the minimum

* This Figure is an adaptation of a Figure in the Comsis Report (Ratté et al., 1990).

width is based on twice the shoulder breadth of the largest user plus an allowance for space between children.

No maximum is specified for rung ladders since their intended use involves both hand and foot support which can be provided by the rungs themselves.

6.1.3.8 Tread Depth

- On stairways with either open or closed risers, tread depth shall be at least 8 inches.*
- On step ladders with open risers, tread depth shall be at least 3 inches.*
- On step ladders with closed risers, tread depth shall be at least 6 inches.*

Because stairways rely primarily on foot support, a greater contact area for the feet is required, regardless of whether risers are open or closed. In contrast, step ladders require smaller contact areas for the feet because hand support and upper body strength contribute to climbing. The values specified are based on the length of a 95th percentile 12-year-old's foot, which is 10 inches.

6.1.3.9 Rung Diameter -- Rungs shall meet the general requirements for the diameter of hand-gripping components (see Section 6.2.3).*

6.1.4 SPIRAL STAIRWAYS

6.1.4.1 Spiral stairways shall meet the general criteria above for straight stairways as well as those regarding slope, vertical rise, and tread width (see Sections 6.1.3.1 through 6.1.3.7).

6.1.4.2 Tread depth at the outer edge of steps on a spiral stairway shall be at least 8 inches.

When combined with requirements for tread width, the above requirement ensures that children have an adequate contact area for their feet when climbing spiral stairways.

6.1.5 ARCH LADDERS

Arch ladders consist of metal rungs or wood members attached to convex side supports.

6.1.5.1 Arch ladders shall not be the sole means of access to play equipment.*

Arch ladders are considered to be one of the more challenging climbing components. Providing a less challenging mode of access/egress, such as a stairway or step ladder, will ensure that children use the arch ladder because they want to assume its challenge not because they are forced to use it.

6.1.5.2 The top climbing member of an arch ladder used as an access/egress component shall be no higher than 4 feet above the protective surfacing.

Given the added challenge of arch ladders used as an access/egress component, a lower maximum fall height is warranted since falls are common during the transitions from climbing an access/egress component to standing on the platform.

6.1.5.3 The top climbing member of an arch ladder used as an access/egress component shall be at the same level as the platform it serves.

This requirement is intended to facilitate the transition from climbing to standing. If the top member of an arch ladder used as an access/egress component is located above the platform it serves, children may have difficulty making this transition and will be at increased risk of falls.

6.1.5.4 The openings formed by the climbing members of an arch ladder shall conform to the entrapment criteria (see Section 4.7.4).

6.1.5.5 Rungs used on arch ladders shall conform to the general requirements for the diameter of hand-gripping components (see Section 6.2.3).*

6.1.6 CLIMBING EVENTS WITH FLEXIBLE COMPONENTS

Play events such as net or chain climbers (which consist of a grid of ropes, cables or chains) or tire climbers (which may have tires secured tread-to-tread in the form of a sloping grid or suspended individually by chains or some other means) are classified as climbing events with flexible components.

6.1.6.1 Climbing events with flexible components shall not be the sole means of access to play equipment.

Climbing events with flexible components are considered to be one of the more challenging climbing components. Providing a less challenging mode of access/egress, such as a stairway or step ladder, will ensure that children use the climbing event with flexible components because they want to assume its challenge not because they are forced to use it.

6.1.6.2 The top climbing member of a climbing event with flexible components shall be no higher than 5 feet above the protective surfacing.

Given the added challenge of a climbing event with flexible components, a lower maximum fall height is warranted since falls are common during the transitions from climbing an access/egress component to standing on the platform.

6.1.6.3 The top climbing member of a climbing event with flexible component used as an access/egress component shall be at or below the level of the platform it serves.

This requirement is intended to facilitate the transition from climbing to standing. If the top member of a climbing event with flexible component used as an access/egress component is located above the platform it serves, children may have difficulty making this transition and will be at increased risk of falls.

6.1.6.4 All openings within climbing events with flexible components or formed between their components and other structural components shall conform to the entrapment criteria (see Section 4.7.4).*

6.1.6.5 Climbing events with flexible components shall be securely fixed at both ends,* and anchoring devices shall not present trip hazards.

6.1.7 SLIDING POLES

6.1.7.1 Sliding poles shall not be the sole means of access to or egress from play equipment.

Sliding poles are considered to be one of the more challenging climbing components. Providing a less challenging mode of access/egress such as a stairway or step ladder, will ensure that children use the sliding pole because they want to assume its challenge not because they are forced to use it.

6.1.7.2 Sliding poles shall be continuous with no protruding bolts or seams along the sliding surface.*

6.1.7.3 Sliding poles shall not change directions along the sliding portion.*

6.1.7.4 The horizontal distance between a sliding pole and the edge of the platform or other structure used for access shall be at least 18 inches; this minimum distance shall be satisfied along the entire length of the pole.*

All points on the sliding pole at or above the level of the access structure where a child is likely to reach for the pole shall be no greater than 20 inches away from the vertical plane of the access structure.*

The requirements for minimum and maximum distances between a sliding pole and its access structure ensure that there is sufficient body clearance for the largest user to slide down the pole unimpeded while simultaneously presenting a reasonable challenge for the reaching abilities of the minimum user.

6.1.7.5 The sliding pole shall extend at least 38 inches above the level of the access structure.*

This requirement is intended to help children maintain a balanced position while grasping the pole to begin their descent. This dimension represents a point between the shoulder height and vertical grip reach of the smallest user; the suprasternale height of a 5th percentile 5-year-old is 30.5 inches, and the vertical grip reach of a 5th percentile 5 year-old is 44.8 inches. The 38 inches minimum height extension approximates the smallest user's reach height at an angle which is comfortable to mount a sliding pole. It is assumed that older users will be able to successfully mount the equipment from a crouching position if necessary.

6.1.7.6 The diameter of a sliding pole shall not exceed 1.9 inches.*

This value allows the pole to have structural integrity and stability while also accommodating relatively good grip strength and the hand sizes of anticipated users.

6.1.7.7 The design of the access structure for sliding poles shall minimize the possibility of interference from surrounding play traffic that may be out of the user's sight lines from the top of the pole and during descent.*

6.1.8 TURNING OR CHINNING BARS

6.1.8.1 Turning or chinning bars shall have a circular cross-section.

6.1.8.2 The diameter of turning or chinning bars shall conform to the general requirements for the diameter of hand-gripping components (see Section 6.2.3).

6.1.8.3 Turning or chinning bars shall be at least 4 feet but not more than 6 feet above the protective surfacing.

This range of acceptable heights for turning bars is intended to ensure that the largest users will not hit their head when hanging from their knees while also ensuring that the smallest users will not have too much difficulty mounting the equipment. The distance from the largest user's head to knees was estimated by subtracting knee height from stature for a 95th percentile 12-year-old; this value is 42.6 inches.

6.1.9 PARALLEL BARS

6.1.9.1 Parallel bars shall be at least 1 7/8 inches but not more than 2 1/2 inches in diameter.

This minimum diameter is required to ensure adequate structural integrity of the bars, and the maximum diameter is required to ensure that children can grasp enough of the bar for safe use.

6.1.9.2 Parallel bars shall be between 18 and 24 inches apart, center-to-center.

This range will accommodate the shoulder breadth and arm length of both the smallest and largest intended users.

6.1.9.3 Parallel bars shall not exceed 36 inches in height above the protective surfacing.

Limiting the height of parallel bars is an essential means of reducing fall injuries, given the added challenge of this play event. This maximum height, however, accommodates the chest heights of both the smallest and largest intended users.

6.1.10 OVERHEAD HORIZONTAL LADDERS

6.1.10.1 All spaces between rungs on overhead horizontal ladders shall conform to the entrapment criteria (see Section 4.7.4).*

6.1.10.2 The distance between consecutive handholds on overhead horizontal ladders shall not exceed 15 inches, center-to-center.*

6.1.10.3 The horizontal distance between the first handhold on an overhead horizontal ladder and its access/egress structure, at both ends of the horizontal ladder, shall be between 8 and 10 inches.

This requirement is intended to facilitate mount and dismount of upper body equipment by ensuring that the first handhold at either end is reachable for the smallest user while also minimizing the risk of an impact incident if a child falls from the first handhold.

6.1.10.4 The maximum height of handholds on overhead horizontal ladders shall not exceed 84 inches from the protective surfacing.

A separate maximum height requirement is warranted for upper body equipment due to the high level of challenge. Because children must support all of their body weight with their hands, they are at greater risk of fatigue and, therefore, falls when using overhead horizontal ladders as compared to other climbing components. The 84-inch requirement corresponds to the vertical grip reach of the maximum user plus an allowance for ground clearance. The vertical grip reach of a 95th percentile 12-year-old is 78.2 inches.

6.1.10.5 The maximum height of an access/egress structure serving an overhead horizontal ladder shall not exceed 36 inches above the protective surfacing.

The distance between the top of the access/egress structure and the first handhold must accommodate the vertical grip reach of the smallest user without making the equipment difficult for the largest user to mount/dismount. The vertical grip reach of a 5th percentile 5-year-old is 44.8 inches.

6.1.10.6 Overhead horizontal ladders shall be located so that children traversing the ladder cannot interfere with the play of children on adjacent play events.*

Overhead horizontal ladders shall not be located adjacent to slides.*

Overhead horizontal ladders shall not be used as a support structure for swing seats.

The swinging movements of children generated on overhead horizontal ladders warrant special precautions to reduce the risk of impact with children on adjacent play events.

6.1.10.7 The design of structures and play events adjacent to overhead horizontal ladders shall discourage climbing on its top support bars or handholds.*

6.1.11 OVERHEAD RINGS

6.1.11.1 Overhead rings shall conform to all requirements for overhead horizontal ladders specified in Section 6.1.10, except 6.1.10.1 and 6.1.10.2.

*The requirement regarding the center-to-center distance of rungs on overhead horizontal ladders does not apply to the spacing of overhead rings because, during use, the gripped ring swings through an arc and reduces the distance to the gripping surface of the next ring.**

6.1.11.2 Overhead rings shall conform to all entrapment criteria (see Section 4.7.4).

6.1.12 TRACK RIDES

Track rides shall not be included in public play areas, regardless of the age of intended users.

6.1.13 CLIMBING ROPES

Individual climbing ropes shall not be included in public play areas, regardless of the age of intended users.

6.1.14 TUNNELS

Tunnels shall have an interior diameter or cross-sectional dimension of at least 23 inches.

Additional Recommendations:

- It is recommended that tunnels not be longer than 48 inches, unless the play area is totally enclosed to prevent public access during off-hours.

6.1.15 SUSPENSION BRIDGES

Suspension bridges are flexible walkways built of decking material suspended between two platforms.

6.1.15.1 Suspension bridges shall not be any wider than the outer width of its support structure.

6.1.15.2 The two platforms from which a suspension bridge is suspended shall have equal heights so that the bridge has the same elevation on each end.

6.1.15.3 Spaces between planks of a suspension bridge as well as any openings between the first plank on either end and the platform shall not present pinch or crush hazards (see Section 4.7.3).

6.1.15.4 Spaces between planks of a suspension bridge as well as any openings between the first plank on either end and the platform shall conform to all entrapment criteria (see Section 4.7.4).

6.1.15.5 Suspension bridges shall conform to all criteria for elevated surfaces (see Section 6.3), including the requirements for guardrails or protective barriers.

6.1.16 BALANCE BEAMS

Balance beams shall not be higher than 12 inches above the play surface.*

This maximum height corresponds to the approximate crotch height of the smallest user, in this case taking the younger age group into account for added safety; the gluteal furrow height of a 5th percentile 2-year-old is 11.5 inches. Additional height is not necessary for play value.

6.1.17 CHAIN OR CABLE WALKS

Chain or cable walks shall not be included in public play areas, regardless of the age of intended users.

Chain or cable walks present tripping hazards. Further, if not well maintained they provide children with a chain or cable attached only on one end which presents the risk of strangulation. Other play events can be used more safely to provide children with balancing activities.

6.2 Hand-Gripping Components

Handrails and other handholds are essential in helping steady children as they negotiate climbing components.

6.2.1 HANDRAILS

6.2.1.1 Continuous handrails shall be provided on both sides and along the entire length of all stairways and step ladders.*

Handrails are a critical means of support that help children maintain balance while climbing up or down the access/egress component. The design of handrails shall be continuous so that children do not have to remove their hands while climbing.

6.2.1.2 For spiral stairways, a continuous handrail shall be provided at least along the outer edge.

6.2.1.3 Handrails shall be available for use at the appropriate height beginning with the first step.*

6.2.1.4 Handrail height, which is the vertical distance between the top front edge of a step (tread nosing) and the top surface of the handrail above it, shall be greater than 23 inches but less than 38 inches.

The values required for handrail height are based on the approximate elbow height of the smallest and largest users; the elbow heights for a 5th percentile 5-year-old and a 95th percentile 12-year-old were estimated as the difference between suprasternale height and shoulder-to-elbow length. A range is allowed because children are likely to grasp handrails above elbow height and sometimes even at or above shoulder height. Note, however, that because the shoulder height (suprasternale height) of the smallest user, a 5th percentile 5-year-old is 30.5 inches, handrail heights at the upper end of the range may present some difficulty to the smallest children..

6.2.1.5 Handrails shall extend high enough at the top of the access to provide uninterrupted support while a child fully achieves the desired posture on the platform.

6.2.1.6 Any openings formed by handrails and structural components of the play equipment shall conform to the entrapment criteria (see Section 4.7.4).*

6.2.2 OTHER HANDHOLDS

6.2.2.1 Hand support shall be provided to facilitate a child's transition from climbing to standing for climbing components which serve as access/egress to platforms and other play events.*

6.2.2.2 Any openings formed by handholds and structural components of the play equipment shall conform to the entrapment criteria (see Section 4.7.4).*

Additional Recommendations:

- Options for handholds other than traditional handrails include vertical handrails and loop handgrips, which may extend out over the top of the access.*
- Single, overhead horizontal bars are not recommended as an alternate means of hand support.

6.2.3 DIAMETER OF HAND-GRIPPING COMPONENTS

6.2.3.1 Handrails, handholds, rungs and other components intended to be grasped by the hands shall have a diameter or maximum cross-sectional dimension between 0.95 and 1.67 inches.*

6.2.3.2 When hand-gripping components are intended to be grasped such that users are supporting their entire body weight by their hands, they shall be generally round in cross-section with a diameter between 0.95 and 1.55 inches.*

Additional Recommendations:

- To benefit the weakest children, a diameter of 1.25 inches for hand-gripping components is preferred.* Requirements for the diameter of hand-gripping components are based on anthropometric data related to grip strength and hand size. Grip strength for the minimum user peaks at a diameter of about 1.25 inches, which also allows at least three-quarters of the smallest user's hand to enclose the component.

6.3 Platforms and Other Elevated Play Surfaces

6.3.1 GENERAL REQUIREMENTS

6.3.1.1 Platforms shall be within ± 2 degrees of a horizontal plane.*

6.3.1.2 All transitional play surfaces, such as platforms, landings, walkways, and ramps, shall allow for proper drainage* and prevent the accumulation of debris. Drainage holes shall preclude finger entrapment and pinching.

6.3.1.3 Structures with roofs shall be designed to discourage climbing on top of them.

Additional Recommendations:

- For platforms above 5 feet in height, it is recommended that a landing or intermediate standing surface be provided where children can make a decision not to continue their ascent.*

6.3.2 GUARDRAILS AND PROTECTIVE BARRIERS

Both guardrails and protective barriers are intended to prevent inadvertent falls off elevated play surfaces. Protective barriers, however, are intended to provide a greater degree of protection: in addition to preventing falls over the edge, protective barriers are designed to prevent intentional attempts by children seeking to defeat the barrier by climbing either under or through it.

Guardrails and protective barriers are an essential means of preventing injuries due to falls.

6.3.2.1 General Requirements to Protect Against Falls from Elevated Surfaces

6.3.2.1.1 Guardrails or protective barriers shall be provided on all elevated surfaces, such as platforms, walkways, landings, ramps, and other transitional play surfaces, in accordance with the following requirements. An elevated surface is exempt from these requirements if a guardrail or protective barrier would interfere with the intended use of the equipment; this includes most climbing components and platforms that are layered so that the fall height does not exceed 30 inches.*

- Any elevated surface that is more than 30 inches above the underlying surface shall be protected with either a guardrail or protective barrier.*
- Guardrails are acceptable for elevated surfaces greater than 30 inches but less than or equal to 48 inches high.*
- Any elevated surface that is more than 48 inches above the underlying surface shall be protected with a full protective barrier.*

The degree of protection required depends on the height of the elevated surface in combination with the age of the intended users. The requirement for guardrails or protective barriers starting at a height of 30 inches is consistent with parallel requirements in the One and Two Family Dwelling Code (Section R215). In addition, because older children are at less risk of falls since their cognitive and motor skills are more advanced, protective barriers are not necessary at lower heights.

6.3.2.1.2 All guardrails and protective barriers shall completely surround the elevated surface, except for the entrance and exits necessary for each play event.

6.3.2.1.3 All guardrails and protective barriers shall provide stationary, non-flexible protection against falls.

6.3.2.1.4 All guardrails and protective barriers shall not impede supervision.*

6.3.2.1.5 All guardrails and protective barriers shall be designed to discourage climbing.*

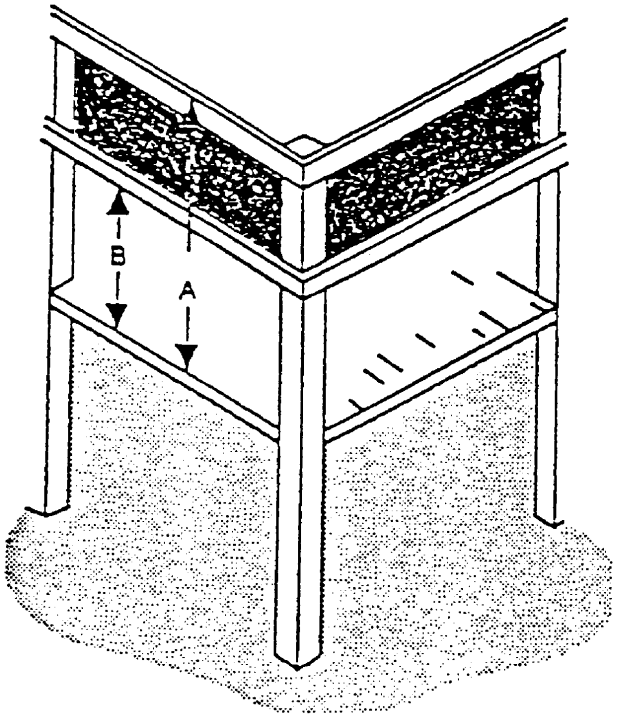
Horizontal cross-pieces shall not be used as infill below the top rail.*

6.3.2.2 Requirements for Guardrails

6.3.2.2.1 The top surface of guardrails shall be at least 38 inches high and the lower edge of the guardrail shall not be more than 28 inches above the elevated surface (see Figure 6-2).

The minimum height of guardrails ensures that the standing center of gravity of the largest user is below the top edge, and thus provides protection against inadvertent falls over the guardrail. The standing center of gravity for a 95th percentile 12-year-old is 35.8 inches.

The maximum distance between the lower edge of the guardrail and the elevated surface ensures that the smallest user cannot inadvertently walk under the guardrail. This measurement corresponds to the chest height at axilla for a 5th percentile 5-year-old, which is 27.8 inches.



A is the minimum height of the top surface of guardrail.

B is the maximum height of the lower edge of a guardrail.

For school-age children, A must be at least 38 inches above the elevated play surface, and B must not exceed 28 inches above the elevated play surface.

Figure 6-2: Height Requirements for Guardrails*

* This Figure is an adapation of a Figure in the CPSC *Handbook for Public Playground Safety.*

6.3.2.2.2 Guardrails may have openings greater than 9 inches, but shall not have any openings between 3.5 and 9 inches to conform with entrapment criteria (see Section 4.7.4).*

Because guardrails are not intended to prevent intentional attempts to climb under or through them, they may have openings greater than 9 inches which would allow a child to pass through without being at risk of entrapment.

6.3.2.3 **Requirements for Protective Barriers**

6.3.2.3.1 The top surface of protective barriers shall be at least 38 inches high.*

The minimum height of protective barriers ensures that the standing center of gravity of the largest user is below the top edge, and thus provides protection against inadvertent falls over the guardrail. The standing center of gravity for a 95th percentile 12-year-old is 35.8 inches.

6.3.2.3.2 Protective barriers shall not have any openings greater than or equal to 3.5 inches within the barrier (i.e., between uprights) or between the lower edge of the barrier and the elevated surface to conform with entrapment criteria (see Section 4.7.4).*

Because protective barriers are designed to prevent children from climbing under or through them, all openings shall be less than 3.5 inches so that children are not at risk of entrapment.

6.3.3 STEPPED PLATFORMS

On some composite structures, platforms may be layered or tiered so that falls from a higher platform are terminated by a lower platform rather than the ground surface.

6.3.3.1 The difference in height between stepped platforms shall not exceed 18 inches, unless an alternate means of access/egress is provided between the platforms.*

Because children typically climb up stepped platforms rather than step up, the vertical rise between stepped platforms may be somewhat greater than the smallest user's step height. The step height of a 5th percentile 5-year-old is 12.6 inches.

6.3.3.2 All openings between stepped platforms shall conform to the entrapment criteria (see Section 4.7.4).*

6.3.3.3 When the height of the lower of two consecutive stepped platforms is greater than 48 inches above the protective surfacing, protective infill shall be provided in the space between the stepped platforms so that there are no openings greater than 3.5 inches.*

Because elevated surfaces above 48 inches in height require protective barriers, the space between stepped platforms should not allow children to pass through them, preventing falls as well as intentional jumps. To conform to entrapment criteria, this space, therefore, must not present any openings greater than 3.5 inches.

Additional Recommendations:

- Stepped platforms are a good easy access/egress component for the younger children of this age group.

6.4 Slides

Slides may be straight, wavy, curved, or spiral and may provide either open bedways or tubes for descent.

Slides are now commonly attached to composite structures, although some free-standing slides are still available. Alternatively, slide chutes can be built onto the grade of a natural or man-made slope; these are called embankment or hill slides.

6.4.1 ACCESS TO SLIDES AND SLIDE PLATFORMS

6.4.1.1 Climbing components and platforms which provide access to slides shall follow the general requirements stated in Section 6.1 and Section 6.3.1.*

6.4.1.2 Slide platforms shall be protected by guardrails or protective barriers in accordance with the requirements for elevated surfaces (see Section 6.3.2).*

6.4.1.3 Slide platforms shall be at least 22 inches long.*

Platforms at the top of slides shall be long enough to accommodate children as they make the transition from a standing to a sliding position. The length of slide platforms corresponds to the buttock-to-knee measurement for the largest user, which is 22 inches for a 95th percentile 12-year-old.

6.4.1.4 Slide platforms shall be at least as wide as the slide chute.*

Additional Recommendations:

- Because there is a high risk of falls at the top of slides and their accompanying access structures, designs which incorporate large platforms with multiple means of access/egress and adequate handholds for transitions, contribute to the safer use of slides.

6.4.2 SLIDE CHUTE ENTRANCE

6.4.2.1 Slide chutes shall be designed and constructed so that there are no gaps or spaces between the platform and the start of the sliding surface.*

6.4.2.2 The design of the slide chute entrance shall channel the user into a seated position for sliding. This may be accomplished with a hood, guardrail, or other device. Such means shall not encourage climbing or other dangerous uses.*

6.4.2.3 Handholds or some other means of hand support shall be provided at the slide chute entrance to facilitate the transition from a standing to a sitting position for sliding.*

This hand support may be an integral part of the design feature which channels the user into a seated position.

6.4.2.4 The fall height of slides -- which is the height of the slide chute entrance -- shall not exceed 7 feet above the protective surfacing.

Limiting the fall height of slides is essential given the great risk of falls and related potential for serious injuries.

Additional Recommendations:

- A single horizontal bar or chain in front of the slide chute entrance is not recommended as a means to channel users into a seated position because children use such components in many hazardous ways.
- Special attention to designs which provide extra protection against falls at the top of slides is warranted.
- It is recommended that the fall height of slides not exceed 6 feet above the protective surfacing as an added precaution against serious fall injuries.

6.4.3 SLIDING SURFACE

6.4.3.1 The average incline of the sliding surface, as measured by a Height/Length ratio, shall not exceed 0.5, and no span of the sliding surface shall have a slope greater than 45 degrees.

The Height of the slide shall be taken as the vertical distance between the protective surfacing and the slide chute entrance. The Length of the slide shall be taken as the horizontal distance between the slide chute entrance and the end of the exit region.

6.4.3.2 Any change in the slope of the sliding surface (e.g., wave slides) shall not allow a child to lose contact with the sliding surface.*

6.4.3.3 The sliding surface shall have an inside width of at least 15 inches.

The slide surface width is intended to accommodate the largest user, either in a seated position or lying down since both are anticipated uses. Because older children are less likely to slide down head first, however, it is acceptable for the slide width to be slightly less than the maximum user's shoulder breadth. The hip breadth and shoulder breadth of a 95th percentile 12-year-old are 13.1 inches and 15.7 inches, respectively.

6.4.3.4 For tube slides, the minimum internal diameter of the tube shall be at least 23 inches.*

*This minimum diameter is required to ensure that all intended users can slide through the tube unimpeded.**

6.4.3.5 Slides shall have sides which are an integral part of the chute design at least 4 inches high extending along both sides for the entire length of the sliding surface.*

For slides with a circular or semi-circular cross-section, the height of the sides shall be at least four inches when measured at right angles above a horizontal line which is at least 15 inches wide inside the chute.

Tube slides are exempt from this requirement.

6.4.3.6 Curved and spiral slides shall be designed to minimize the likelihood of lateral discharge of the user.*

6.4.3.7 Metal slides shall face North or be located in shaded areas.*

Metal slides can become hot enough to cause burns if the chute is in direct sun.

6.4.3.8 The sliding section shall not have any seams or joints which could cause entanglement incidents or in which hazardous debris may collect.

Additional Recommendations:

- For tube slides, it is recommended that either barriers be provided or surfaces be treated to prevent children from sliding on top of tube.*
- A high level of supervision is recommended for tube slides since children using such slides are not visible.*
- Roller slides are not recommended for public play areas unless frequent inspections and maintenance can be guaranteed.*

6.4.4 EXIT REGION

6.4.4.1 The design of all slides shall incorporate an exit region* as specified below.

The exit region helps children maintain balance and facilitates a smooth transition from a sitting, sliding position to a standing, exiting position, thereby reducing the likelihood of falls and injuries at the lower end of slides.

6.4.4.2 The exit region shall be essentially horizontal and parallel to the ground.*

6.4.4.3 The exit region shall be at least 11 inches long.*

The minimum length of the exit region for school-age children is the same as that for preschool-age children. Because older children are better able to maintain balance when exiting a slide, they do not need a longer exit region.

6.4.4.4 The exit region shall be at least 9 inches but not more than 15 inches above the protective surfacing.

The height of the exit region is correlated to the distance between the back of the knee and heel for the smallest and largest users. The tibiale height, which is used to estimate this distance, is approximately 9 inches for a 5th percentile 5-year-old and 15 inches for a 95th percentile 12-year-old.

6.4.4.5 The radius of curvature of the sliding surface in the exit region shall be at least 30 inches.

6.4.4.6 All slide exit edges shall be rounded or curved, in accordance with Section 4.7.1.*

6.4.4.7 All slide exits shall be located in uncongested sections of the play area.*

6.4.5 CLEAR ZONE FOR SLIDES

A clear zone is required for slides in addition to the fall zone and buffer zones described in Sections 4.1.6.5 and 4.2.1.3.

6.4.5.1 A clear zone surrounding the sliding surface shall be free of other play events and obstacles, extending from the chute entrance through the exit region. The clear area shall be at least 60 inches high, when measured vertically from the sliding surface and cover a width of at least 20 inches on each side of the sliding surface when measured horizontally from the inside of the chute sidewalls.

A clear zone is required to protect children from impact with other equipment or children while sliding down the chute. The intent of this requirement is to create an invisible bubble that surrounds the sliding surface and thus protects children from hazardous protrusions and obstructions.

The dimensions of the clear zone are based on the standing height and approximate lateral grip reach from the shoulder of the largest user, which are 63.2 inches and 19.7 inches, respectively for a 95th percentile 12-year-old.

6.4.5.2 Hoods and other designs at the top of slides intended to channel users into a seated position (in accordance with Section 6.4.2.3) are exempt from Section 6.4.5.1 and may be located within the clear zone.

6.4.5.3 Tube slides are exempt from Section 6.4.5.1 and may be located within the clear zone.

Tube slides are not subject to the requirement for a clear zone surrounding the sliding surface, because their design actually encapsules the user and already provides the necessary protection from impact incidents.

6.4.5.4 Spiral slides are exempt from Section 6.4.5.1 but shall maintain the following clear zone. There shall be a clear zone which extends out at least 20 inches horizontally when measured from the inside of the outer sidewall of the chute; this clear area is required along the entire outer perimeter as the slide curves around.

Spiral slides are exempt from the requirement of a 60-inch high clear zone as well as the inner horizontal clear zone specified in Section 6.4.5.1, because their design prevents other equipment from encroaching in these hazardous spaces. The horizontal clear zone is required for protection along the outer edge of spiral slides.

6.5 Swings

6.5.1 GENERAL REQUIREMENTS

Public play areas shall not include the following types of swings.*

- Animal Swings
- Multiple Occupancy Swings (i.e., Gliders), except Tire Swings
- Swinging Exercise Rings and Trapeze Bars
- Rope Swings

Animal swings, gliders, swinging exercise rings, and trapeze bars are constructed of heavy, hard-hitting, rigid materials that may cause serious head impact injuries.

Rope swings present children with a free hanging rope that could cause strangulation hazards.

6.5.2 CONVENTIONAL TO-FRO SWINGS

6.5.2.1 Swings Seats

6.5.2.1.1 All swing seats shall be made of lightweight, impact-absorbing materials, such as rubber, plastic, or canvas.

Swing seats shall not be constructed of wood, metal, or other rigid materials.*

Using lightweight, impact-absorbing materials for swing seats helps reduce the severity of injuries if impact incidents occur. Rigid swing seats may cause serious impact injuries.

6.5.2.1.2 The edges of all swing seats shall be smoothly finished or have rounded edges and shall conform the requirements for protrusions on suspended members of swing assemblies described in Section 4.7.2.8.*

6.5.2.1.3 All seats for single-axis swings shall be designed to accommodate only one user at a time.*

6.5.2.1.4 The width of the seat surface, which is the distance between the hardware that connects the swing seat to the suspending elements on each end, shall be at least 18 inches.

The width of swing seats should accommodate the hip breadth of all anticipated users, including adults.

6.5.2.1.5 The seat height of an unoccupied swing shall be at least 18 inches above the protective surfacing. Note, however, that values greater than this minimum will make it increasingly difficult for younger children in this age group to mount the swing.

Swings should be suspended at a height which allows the smallest children to seat themselves comfortably without being so low that the largest children's feet will

consistently hit the ground while swinging. The height of 16 inches accommodates the buttock height of a 5th percentile 5-year-old (gluteal furrow height is 16.0 inches) as well as the approximate seated height of a 95th percentile 12-year-old (tibiale height, which is the distance from the heel to the back of the knee, is 17.6 inches).

Additional Recommendations:

- Flexible, strap-type seats constructed either of molded rubber with a steel insert bonded into the rubber or polyethylene are recommended for strength and durability.

6.5.2.2 Swing Structures

6.5.2.2.1 Single-axis swings shall not be attached to composite structures.*

6.5.2.2.2 Swing support structures shall be designed to discourage climbing.*

Support structures shall not use horizontal cross-bars, other than the top cross-beam from which the swings are suspended.*

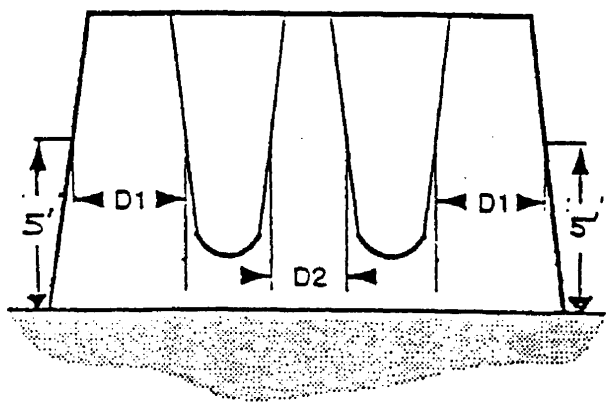
6.5.2.2.3 Swing support structures shall not also be an overhead horizontal ladder.

6.5.2.2.4 Swing hangers shall be hung wider than the width of the swing seat.*

Hanging swings in this manner helps reduce side-to-side movement and, therefore, the potential for impact incidents.

6.5.2.2.5 The following clearances shall be provided for swings and swing structures up to a height of 5 feet above the protective surfacing (see Figure 6-3).

- The horizontal distance between adjacent swings shall be at least 24 inches.*
- The horizontal distance between a seat and an adjacent structural component shall be at least 30 inches.*



D1 = Minimum 30"
D2 = Minimum 24"

Figure 6-3: Minimum Clearances for Swings+

+ This Figure is an adapation of a Figure in the CPSC *Handbook for Public Playground Safety.*

The 24-inch minimum clearance required between adjacent swings accommodates the shoulder breadth of a 95th percentile 12-year-old (16 inches) with some tolerance on each side; at the same time this distance is not so large as to encourage children to run between swings.

The minimum clearance required between a swing and an adjacent structural component is greater to provide extra protection against injuries caused by impact with a rigid structure.

These minimum clearances shall be satisfied up to a height of 60 inches to accommodate the stature of a 95th percentile 12-year-old.

6.5.2.2.6 No more than two swing seats shall be suspended within each bay of a swing support structure.*

This requirement is intended to minimize the likelihood of children getting hit by a moving swing.

6.5.2.2.7 The fall height of swings with conventional seats-- which is the height of the pivot point -- shall not exceed 12 feet above the protective surfacing.

6.5.2.2.8 Swing structures shall be located away from other equipment and activities.*

Locating swings away from other equipment and activities, preferably in a corner of the play area, is an essential means of preventing impact injuries caused by children inadvertently running into the path of a moving swing.

Additional Recommendations:

- Greater protection against impact injuries can be provided by means of a low barrier at the edge of the buffer zone (see Section 4.2.1.3), such as a fence or hedge, to separate swings from other equipment. Such barriers, however, must not be an obstacle in the fall zone or hamper supervision by blocking visibility.*
- It is recommended that the fall height of swings with conventional to-fro seats not exceed 10 feet above the protective surfacing.

6.5.3 TIRE SWINGS

Tire swings are typically suspended in a horizontal orientation from a multi-axis swivel mechanism using three chains or cables; these swings permit rotation and a swinging motion in any axis.

6.5.3.1 Tire swing support structures shall be designed to discourage climbing.*

Support structures shall not use horizontal cross-bars, other than the top cross-beam from which the swing is suspended.*

6.5.3.2 A multi-axis tire swing shall not be suspended from a structure having any other swings in the same bay.*

6.5.3.3 Only one tire swing shall be suspended within a single bay.

6.5.3.4 The lower edge of the tire shall be at least 12 inches but not more than 18 inches above the protective surfacing.

6.5.3.5 When the tire is held in a position closest to the support structure, the distance between the outer-most edge of the tire and the adjacent upright of the support structure shall be at least 30 inches (see Figure 6-4).

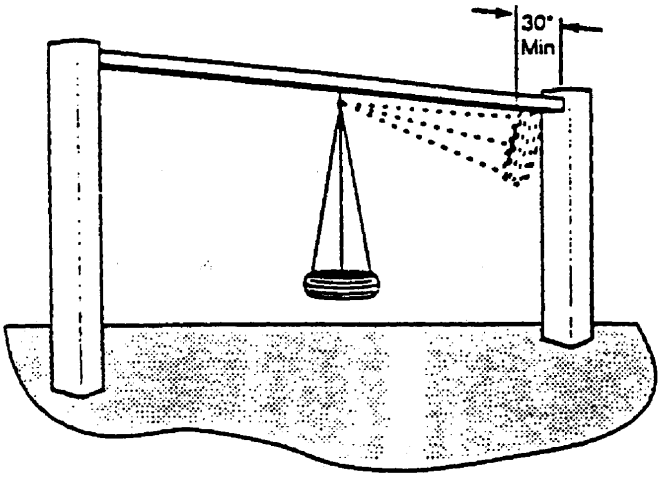


Figure 6-4: Minimum Clearances for Tire Swings*

This clearance is required to provide adequate space for children to reach out with their arms and legs or to lean back while sitting on the tire without impacting support structures.

6.5.3.6 A tire swing structure consisting of only one bay may be attached to the end of a composite structure but not between two play events.

Where a tire swing is attached to a composite unit, there shall not be any access/egress components located within 6 feet of the end of the tire swing structure which connects to the composite structure.

6.5.3.7 The fall height of tire swings – which is the height of the pivot point – shall not exceed 8 feet above the protective surfacing.

Additional Recommendations:

- Preferably, no swings – including tire swings – will be attached to a composite unit. Younger children in particular are at great risk of impact injuries caused by inadvertently running into the path of a moving swing. It is, therefore, recommended that all swings be located away from other play events.

* This Figure is an adaptation of a Figure in the CPSC *Handbook for Public Playground Safety.*

6.6 Rotating Equipment

6.6.1 SWINGING GATES

Swinging, rotating gates shall not be included in public play areas, regardless of the age of intended users.

6.6.2 LOG ROLLS

6.6.2.1 Hand support consisting of a handhold on either side of the log roll shall be provided.

A horizontal bar shall not be used as a means of hand support above a log roll.

6.6.2.2 Log rolls shall be located away from other play events, preferably at the edge of the play area.

Because of the increased risk of injuries associated with moving equipment, it should be separated from other equipment.

6.6.2.3 The fall height of log rolls -- which is the top of the rotating log or barrel -- shall not exceed 2 feet above the protective surfacing.

Additional Recommendations:

- It is strongly recommended that log or barrel rolls be included only in play areas where there is constant adult supervision.

6.6.3 MERRY-GO-ROUNDS

Merry-go-rounds are a common type of rotating equipment. Most merry-go-rounds consist of a circular base, close to the ground, which children either sit or stand on and that rotates when pushed. Some merry-go-rounds designed for younger children are a concave, dish-like platform in which children sit.

6.6.3.1 The rotating base of all merry-go-rounds shall be continuous and approximately circular.*

The difference between the minimum and maximum radii of a non-circular base shall not exceed 2 inches (see Figure 6-5).*

6.6.3.2 The rotating base shall be solid and preclude access to the undercarriage and rotating mechanism of the merry-go-round.

Open-base designs with a bench that rotates around the central structure allowing children to sit facing the center or to run inside the bench have been attributed to serious injuries.

The undercarriage and rotating mechanism of merry-go-rounds must be enclosed to eliminate pinch, crush, and shearing hazards.

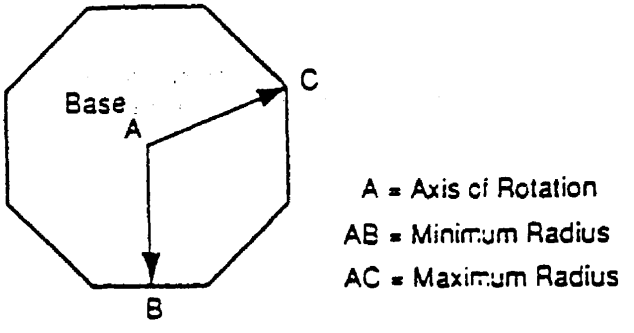


Figure 6-5: Minimum and Maximum Radii of a Non-Circular Merry-Go-Round Platform+

6.6.3.3 The rotating base shall not have any sharp edges.*

6.6.3.4 Nothing shall protrude beyond the outer edge of the rotating base.*

6.6.3.5 The diameter of the rotating base shall not exceed 8 feet.

One means of reducing the frequency and severity of injuries associated with merry-go-rounds is to limit the size of their rotating base.

6.6.3.6 All merry-go-rounds, with or without seats, shall provide a means of hand support.*

6.6.3.7 Any handrails or handgrips provided on merry-go-rounds shall conform to the general requirements for the diameter of hand-gripping components (see Section 6.2.3) as well as to all protrusion requirements (see Section 4.7.2.7).*

6.6.3.8 The standing surface of merry-go-rounds shall not exceed 1 foot above the protective surfacing.

Limiting the height of merry-go-rounds is an important means of reducing fall injuries. This requirement helps ensure that children can get on and off the merry-go-round easily.

6.6.3.9 Merry-go-rounds shall be located away from other play events, preferably at the edge of the play area.*

Because of the increased risk of injuries associated with moving equipment, it should be separated from other equipment.

+ This Figure is an adapation of a Figure in the CPSC *Handbook for Public Playground Safety.*

6.6.3.10 Merry-go-rounds shall not be equipped with an oscillatory (up and down) motion.*

Additional Recommendations:

- It is strongly recommended that merry-go-rounds only be included in play areas where there is constant adult supervision because older children tend to use merry-go-rounds in unintended and dangerous ways when not supervised.

6.7 Seesaws

Seesaws consist of a board or pole with a seat at each end, supported at the center by a fulcrum.

Given a lack of control and unpredictability, there are inherent hazards in the design of fulcrum seesaws. Safe use depends on the cooperative and complementary behavior of two children.

6.7.1 The fulcrum of seesaws shall not present any pinch or crush hazards.*

6.7.2 Tires, or some other shock-absorbing material, shall be embedded in the protective surfacing below the seats, on both ends, of fulcrum seesaws, or be secured on the underside of both seats.*

*This design technique helps cushion the impact when one end of the seesaw hits the ground and also helps protect against limbs being crushed between the seat and the ground.**

6.7.3 Handholds shall be provided for each seat position on fulcrum seesaws.*

Handholds shall not extend beyond the width of the seesaw and are subject to all protrusion requirements (see Section 4.7.2.7).*

Handholds on seesaws shall conform to the general requirements for the diameter of hand-gripping components (see Section 6.2.3).

6.7.4 Footrests shall not be provided on fulcrum seesaws.

6.7.5 Seesaws shall not be longer than 12 feet.

Limiting the length of seesaws is important because it is related to the height above ground which the seats can attain.

6.7.6 The fall height -- which is the highest attainable position of the seats -- shall not exceed 5 feet above the protective surfacing.

Because children may experience an uncontrollable drop to the ground during seesaw use, it is essential to limit the height of these potential drops.

6.7.7 The distance between adjacent seesaws on the same support structure shall be at least 36 inches.

This requirement is intended to prevent potentially hazardous interaction between children on adjacent seesaws.

Additional Recommendations:

- It is recommended that fulcrum seesaws be included only in play areas where there is constant adult supervision.

6.8 Spring Rocking Equipment

Spring rocking equipment may be in the form of individual seat assemblies mounted on a spring mechanism or consist of several seat assemblies linked by a common spring mechanism (i.e., a spring-loaded seesaw).

Although younger children enjoy and benefit developmentally from individual spring rockers, this equipment typically does not present enough challenge to interest older children. Older children do, however, enjoy spring platforms.

6.8.1 SPRINGS

The spring mechanism of rocking equipment shall minimize the possibility of children pinching either their hands or feet between coils of the spring or between the spring and part of the rocker.*

6.8.2 SEAT ASSEMBLIES

The requirements for seat assemblies apply to individual spring rockers as well as spring-loaded seesaws.

6.8.2.1 Seat design shall minimize the likelihood of the rocker being used by more than the intended number of children at one time.*

6.8.2.2 Seat assemblies of rocking equipment shall be no higher than 24 inches above the protective surfacing.

This maximum height is intended to limit potential fall heights while accommodating the waist height of the largest user, assuming that 5-year-olds are the typically the oldest users of spring rockers. The waist height of a 95th percentile 5-year-old is 26.3. Since children actively climb up onto the equipment, this 24-inch height is also reasonable from the standpoint of smaller, younger users.

6.8.2.3 Handholds shall be provided for each seat position on spring rockers.*

Handholds on spring rockers shall conform to the general requirements for the diameter of hand-gripping components (see Section 6.2.3) as well as to all protrusion requirements (see Section 4.7.2.7).*

6.8.2.4 Footrests shall be provided for each seat position on spring rockers.*

Footrests on spring rockers shall conform to all protrusion requirements (see Section 4.7.2.7).*

6.8.2.5 There shall be a minimum distance of 36 inches between adjacent seat assemblies on spring rocking equipment or between individual spring rockers.

This requirement is intended to prevent potentially hazardous interaction between children on adjacent seat assemblies of spring rocking equipment.

6.8.3 SPRING PLATFORMS

The standing surface of spring platforms shall not be higher than 18 inches above the protective surfacing.

It is important to limit the height of spring platforms given the potential for falls.

Section 7

COMPLIANCE WITH THE AMERICANS WITH DISABILITIES ACT

The Americans with Disabilities Act of 1990 (ADA), Public Law 101-336, prohibits discrimination based on disability. ADA mandates that public spaces be accessible to disabled persons. Outdoor public play areas should, therefore, be accessible to all children, regardless of ability.

All children have an equal right to play, and all children should be able to play together. When designing equipment intended for use by disabled children, the design should integrate play components usable by children with varied abilities. Moreover, similar play activities and sensations should be available to all children.

Owners, operators, designers, and manufacturers of play areas and equipment must consider the impact of ADA and address any Federal, State, and Local requirements which are in effect governing their playgrounds. All new playgrounds should be designed in compliance with ADA requirements. Further, consideration should be given to renovating existing playgrounds accordingly.

Both the CPSC *Handbook for Public Playground Safety* and the *ADA Accessibility Guidelines for Building and Facilities* (36 CFR Part 1191) suggest that Federal requirements regarding the accessibility of children's environments, including outdoor recreational facilities, are expected to be published. Also, ASTM is developing a set of detailed specifications for the design of play areas and equipment which are accessible to disabled children. When this information is available, all designers/manufacturers and owners/operators should put the guidelines into practice to create environments -- including integrated play equipment -- in which children with varied abilities can play and learn together.

Section 8

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PARENT CHECKLIST

HOW SAFE IS YOUR LOCAL PLAYGROUND?

Too many children suffer injuries on public playground equipment. It is estimated that nearly 150,000 children are treated in emergency rooms annually because of public playground equipment-related injuries. Injuries sustained while playing on playground equipment are sometimes fatal; at least 17 children die each year as a result of playground-related incidents.

Extensive research has been conducted to identify the hazards which lead to injuries. The following checklist can be used to evaluate the general safety of your local playground. Check the playground where your children play to see how safe it is – including the equipment at your local schools, parks, community centers, churches, and child care centers.

1. Is there a lack of protective surfacing under or around any play equipment?

Protective surfacing is the most critical safety factor on playgrounds because approximately 75% of all injuries are caused by falls.

Hard, paved surfaces such as concrete and asphalt as well as earth surfaces including grass, soil, and hard packed dirt *are not acceptable* for use under and around play equipment. None of these surfaces provides adequate protection against fall injuries. Falls onto concrete or asphalt from as low as 2 inches can cause life-threatening head impact injuries.

Acceptable protective surfacing materials include:

- certain loose-fill surfacing materials – such as hardwood chips, wood mulch, pea gravel, and sand – when maintained at depths of at least 9 to 12 inches and provided that they are not wet or compacted;
- certain unitary synthetic surfaces – including some premolded tiles and pour-in-place systems.

2. Are pieces of play equipment too close together? Is there a lack of protective surfacing where children might fall?

A fall zone is the area under and around a piece of equipment where a child might fall. To reduce injuries, the fall zone should have protective surfacing and be free of other equipment or obstacles onto which a child might fall.

- Stationary climbing equipment should have a fall zone extending a minimum of 8 feet in all directions from the perimeter of the equipment – except on sides where there is no way to get on or off the equipment, then the fall zone should extend a minimum of 6 feet.
- The fall zone for slides should extend a minimum of 8 feet from the perimeter of the structure behind and on each side of the slide. In front of the exit end of the sliding surface, the fall zone should extend a minimum of 8 feet for slides 4 feet high or less and a minimum of 10 feet for slides greater than 4 feet high.
- The fall zone for swings should extend a minimum of 6 feet from the perimeter of the support structure on each side as well as a minimum distance of twice the height of the pivot point in front of and behind the swing seats.

3. Is there any equipment too high above ground?

Platforms for climbing equipment and slides, for example, should not exceed 7 feet for school-age children or 6 feet for preschool-age children.

4. Are swings too close together or too close to support structures?

No more than two swing seats should be suspended in the same section or bay of the support structure. And, the following clearances should be provided for conventional to-fro swings:

- The horizontal distance between adjacent swing seats should be at least 24 inches.
- The horizontal distance between a swing seat and an adjacent structural component should be at least 30 inches.

No more than one tire swing should be suspended in the same section or bay of the support structure. And, when the tire is held in a position closest to the support structure, the distance between the outer-most edge of the tire and the adjacent upright of the support structure should be at least 30 inches.

5. Do elevated surfaces, such as platforms, walkways, and ramps, lack adequate guardrails or protective barriers to prevent falls? Can children fall inadvertently off high elevated surfaces?

6. Does play equipment have any potential head entrapment hazards?
Any opening – except those where the ground serves as its lower boundary – with an interior dimension between 3.5 and 9 inches may cause head entrapment, and such incidents can result in strangulation. Entrapment may occur when a child enters an opening, either head first or feet first, but cannot withdraw his or her head because the opening is too small.

7. Does play equipment have any potential entanglement hazards on which children may catch clothing or anything else around their neck?
Entanglement incidents can cause strangulation.
- Look for open "S"-type hooks, especially on swings.
- Look for protrusions or equipment components which may act as hooks or catch-points, especially at the top of slides.

8. Does any of the hardware present dangerous protrusions or projections? Does any of the hardware appear to be loose or worn?

9. Are there any exposed moving parts which may present pinch or crush points?

10. Are there any exposed footings or environmental obstacles such as rocks or roots which may present tripping hazards and/or cause impact injuries?

11. Does play equipment show any signs of deterioration or corrosion?
- Look for loose splinters, large vertical cracks, and decay on wood components.
- Look for rust and chipped paint on metal components.
- Look for splitting or cracking on plastic components.
- Special attention is warranted for deterioration and corrosion on structural components which contact the ground; look for any emerging anchoring problems that may cause instability.

12. Has the play area been poorly maintained or vandalized?
- Look for scattered debris or litter.
- Look for missing or damaged equipment components, checking items such as handholds, guardrails, swing seats, and benches.

If the answer to any of these questions is yes and you find the hazards described above, contact the owner or operator of the playground – whether it is the school principal, the local Parks and Recreation Department, or the child care provider. Let them know that the equipment is not safe. Share the results of this survey with them and demand that corrective action be taken.

A more detailed evaluation of the playground's safety can be completed using Consumer Federation of America's *Report and Model Law on Public Play Equipment and Areas* (Morrison and Fise, 1992). All public play spaces and equipment should meet these criteria. If you find that a playground where your child plays does not measure up, insist that the equipment be upgraded or removed. Most importantly, ensure that adequate protective surfacing gets installed and maintained under and around all play equipment.

APPENDIX F

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APPENDIX G

Additional Sources of Information on Playground Safety

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