AN ENVIRONMENTAL APPROACH TO THE PREVENTION OF PLAYGROUND EQUIPMENT INJURIES

BY

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A Thesis submitted to the Faculty of Graduate Studies of the University of Manitoba in partial fulfillment of the requirements for the degree of

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To Craig, Laura, Gillian and all children

whose play should be without pain

ABSTRACT

Injuries associated with playground equipment are important due to their frequency, severity and potential for prevention. Between 3-10% of trauma emergency room visits are for playground equipment injuries, and 10-20% of them require admission. Upper limb fractures and head injuries are the most common non-trivial injuries. Falls are implicated in up to 93% of injuries and falls to the ground surface in 60%. Climbers, slides and swings are most commonly involved, and children aged 5-10 are injured most frequently.

The purpose of this study was to assess the level of compliance of existing public playgrounds in Winnipeg to the Canadian Standards Association's Guideline issued in 1990, and to describe the heights of and surfacing beneath equipment. A checklist was developed from the guideline and 49 playgrounds were assessed from May to August 1993. Compliance scores were generated and design and maintenance compliance were contrasted. Comparisons were made between groups of sites on the basis of school or community, different equipment compositions, and different ages. Equipment types were assessed for prevalence, compliance scores, heights and surfacing. Individual criteria pertaining to fall injury prevention and entrapment were described.

Overall compliance was 64.7% (62.8%-66.6%) with maintenance scoring higher than design ($p<0.001$). Sites <10 years old showed better design compliance ($p=0.0006$). Heights of equipment were greater in schools than community ($p=0.006$). Sites with creative playstructures had more equipment than more traditional sites, as did sites <10 years old when compared to older sites. Traditional sites were older than sites with creative playstructures ($p<0.001$). Creative playstructures, swings, climbers, and slides contributed the most noncompliance which approximated their reported injury rates. While type and area of protective surfacing was reasonably adequate, the depth of surfacing, 31.6mm (26.6mm-36.6mm), was inadequate for nearly all equipment on all sites. Recommendations pertaining to fall injury prevention and entrapment were inadequately met.

The greatest potential for injury prevention lies in improving compliance to fall injury prevention standards. Most notably, the depth of protective surfacing requires immediate attention with priority to school sites due to the greater heights of equipment. Consideration should be given to lower equipment heights on new sites planned.

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LIST OF ABBREVIATIONS

ANOVA	Analysis of Variance
CPS	Creative Playstructure: playground equipment characterized by a connected series of platforms with multiple access points and often incorporating other equipment types such as slides, climbers and sliding poles
CPS-Comm	Community playsite with CPS present
CPS-School	School playsite with CPS present
CV	Coefficient of variation
Dist	Distribution of a data set
Equip	Equipment
Max	Maximum
NA	Not Applicable
Norm	Normal Distribution
NS	Not Significant
SF	Single Function playground equipment (ex: freestanding slides, swings)
Sig	Significant
TPH	Total Potential Hazards
VR	Variance Ratios

CHAPTER 1

INTRODUCTION

The importance of injury and injury prevention is captured in the following statement made by the National Academy of Sciences in 1985: "Injury is probably the most under-recognized major public health problem facing the nation today, and the study of injury represents unparalleled opportunities for reducing morbidity and mortality and for realizing significant savings in both financial and human terms" (1). Injury remains the leading cause of death under the age of 45 (2), and is responsible for the most potential years of life lost before the age of 65 (3). The amount of morbidity caused by injury is considerable (4), and the overall cost to society is staggering (2,3). However, in recent decades advances have been made in the study of injuries, and injuries today are viewed as understandable, predictable and preventable (3).

The concept of "accidents" being random, unpredictable events has pervaded society's attitude towards injuries (3,4,5,6), and has been described as "the last folklore subscribed to by rational men" (7). A number of major contributions over the last decades have worked towards changing this viewpoint, and models useful in injury prevention have been advanced

(3). The causation of injury is understood as an interaction between host, agent (in vehicles or vectors) and environment (physical and social) similar to the causation of disease (4). Further, the injury event is divided into phases of pre-event, event, and post-event to facilitate identifying potential intervention points (3). While the scientific study of injury is relatively new, it is believed that if currently known countermeasures were effective applied, the injury burden reduction would be dramatic (3).

The study of playground equipment injuries is an area of pediatric injury research that has received an increasing amount of attention. While playground injuries are rarely fatal (8), there appears to be a significant amount of morbidity associated with playground equipment, including fractures and head injuries (9). Considering that playgrounds are built to enhance child development through physical and social stimulation, the acceptable risk of serious injuries on playgrounds should be small (10). Playground equipment and playspaces constitute the agent (vehicle) and physical environment components in playground injury causation. Due to the perception of excess risk due to unsafe playgrounds, many countries have issued safety standards concerning playspaces and playground equipment (11).

Canada issued voluntary playground standards in 1990 (12). The Guideline applies to playgrounds developed or renovated after 1990, but the level of compliance of all existing playsites to current recommendations is also of relevance. This descriptive study was undertaken to assess the level of compliance to C.S.A. recommendations of existing playgrounds in Winnipeg, and to further describe parameters thought to be important in the environmental approach to playground injury prevention.

CHAPTER 2

BACKGROUND INFORMATION

2.0 REVIEW OF THE INJURY LITERATURE

2.0.0 SCOPE OF THE PROBLEM

Injury (in + jus "not right") is defined as "an act that damages or hurts" (13). In the injury prevention literature, the term injury is defined as "any unintentional or intentional damage to the body resulting from acute exposure to thermal, mechanical, electrical, or chemical energy or from the absence of such essentials as heat or oxygen" (3), and is used interchangeably with the term trauma.

Injury represents a major public health problem, and its scope is largely under-recognized (5). Pediatric injuries have been described as "an endemic of epidemic proportions" (14) and "the silent epidemic" (15). The toll of injuries in terms of premature death, long-term disability, cost and suffering is significant.

Unintentional injuries are the leading cause of death under the age of 45, and the fourth highest cause of all deaths in the United States (2). This accounts for a death rate of 40 per 100,000 (2) equivalent to 400 deaths per day (3). In Canada, intentional and unintentional injuries account for

63% of deaths occurring between the ages of 1 and 24 (16). Between 1978 and 1982, injuries accounted for 44% of deaths in 1-4 year old children and 80% of children aged 15-19 (15). Death rates as a result of injury are higher for Canadian children than children in most other industrialized countries (17); in particular, the mortality rate for Canadians aged 5-14 surpasses Japan, Australia, and most Western European countries (18).

In 1930, deaths from diseases were eight times as common as deaths from injuries in children aged 1-4 . Disease and injury death rates reached equivalence by 1980, as disease death rates had shown dramatic reductions while injury death rates had decreased by only a half (19). Injury currently take more lives during childhood than the next nine leading causes combined (4) including cancer, circulatory diseases, infectious diseases, congenial anomalies and diseases of the nervous and respiratory systems (20). Death rates vary between provinces (21), and injury death rates for natives are higher than non-natives (22). In developed nations, fatal injuries are twice as common in boys than girls aged 0-14 (23).

Because injuries disproportionately strike the young, the impact is better understood by considering the potential years of life lost (PYLL) before the age of 65 due to injury. In 1984, 837 childhood injury deaths in Canada represented 49,000 PYLL (20). American data showed that more PYL are lost from injuries than from cancer and cardiovascular disease combined.

Nearly one-third of the 11.8 million American PYLL in 1985 were due to injuries (3).

In addition to the burden of injury deaths, nonfatal injuries represent a tremendous amount of morbidity. It has been estimated that for every pediatric injury death, approximately 45 injuries require admission to hospital, 1270 are treated in an emergency room and released, and likely twice that amount do not require hospital care (4). One out of three Americans are estimated to sustain an injury serious enough to require medical care or limit normal activity annually (3). Survey data for 1981 reported that 36.2-38.2% of children sustain injuries limiting their activities or requiring care each year (4). Beyond the acute event, injuries contribute greatly to the morbidity of long-term disability and chronic disease. One quarter of permanent disability in the United States results from unintentional injury, and highway trauma alone is considered responsible for 20,000 new cases of epilepsy annually (2).

In addition to the individual suffering injury represents, the cost to society is an important consideration. In comparison to the cost of other health care problems, motor vehicle injuries alone were more costly than heart disease and stroke (exceeded only by cancer) in 1975. Since motor vehicle injuries represent only half of injury deaths, it is estimated that the cost of all injuries would have exceeded that of cancer as well (3). Even injuries at the minor end of the severity spectrum are costly from a health care utilization perspective. Injuries are the leading cause of physician contacts in the United States, surpassing both heart disease and respiratory disease (2). The actual cost of injury is difficult to estimate, in that all factors ranging from the cost of emergency rescue and transportation through to psychiatric rehabilitation and the years of productive work lost should be considered. Nevertheless, the estimated cost of injuries in 1987 in the United States was reported to be $133.2 billion (3).

The impact of injuries clearly reaches beyond injured individuals to families, employers, health care systems and communities (5). However, evidence is mounting that we need not be passive spectators to this human carnage. The view that injuries are understandable and predictable, and thus preventable, has arisen over the past decades. A review of the basic concepts in injury prevention follows.

2.0.1 CONCEPTS IN INJURY PREVENTION

Early injury prevention efforts focused largely on the actions or failings of the victim. A traffic safety effort in the 1920's and a home safety movement in the 1950's directed programs towards the responsibility of individuals (3): in terms of causation, making a more careful "host". While modern injury prevention does not ignore individual responsibility, other aspects have assumed a greater role (24). Modifications of the agent (in vehicles and vectors) and the environment are believed to show more potential for the reduction of injuries. Some notable contributions have influenced the development of this modern approach to injury prevention.

In 1942, Hugh De Haven, a World War I pilot, published the results of his study of 50 to150 feet freefall survivors. He observed that force alone did not determine injury, but important also was the extent to which the environment was able to decelerate and distribute force over the body (3,24). In 1949, John E. Gordon was the first to suggest that injuries paralleled classical infectious diseases and other forms of known pathology and could be studied using the same techniques. He noted that injuries could be characterized by point epidemics, seasonal variation, long-term trends and geographic, socioeconomic and rural-urban distributions. Additionally, he suggested that injuries were the product of at least three sources; the host, agent and environment (3,24). However, Gordon's definition of the agent included such examples as glass-paneled doors, faulty ladders and playful pups; evidently an infinite number of potential agents existed. A further contribution by James J. Gibson, an experimental psychologist, clarified and simplified the definition of the agent.

James Gibson, in 1961, stated that injuries are the result of an energy interchange. He went on to define five kinds of physical energy that collectively constitute the "agent" involved in injuries, namely, mechanical, thermal, radiant, chemical and electrical energy (3,20,24). The same conclusion was independently arrived at by William Haddon, who also added the concept of "negative agents", such as the absence of heat or oxygen

(24). Haddon also expanded the concept of vehicles and vectors used in classical epidemiology for use in the context of injury causation. He recognized that agents of physical energy often reach the body carried by inanimate objects (vehicles) or living organisms (vectors) (24). For example, moving objects such as cars are vehicles of mechanical energy, a heated stove element is a vehicle of thermal energy, and poisonous plants and animals are vectors of chemical energy. Hence, Gordon's long list of agents came to be viewed as the vehicles and vectors of physical energy.

Haddon went on to make several other landmark contributions to the conceptual approach to injury research. He made the distinction between active versus passive prevention strategies, developed the "Haddon matrix", and put forward ten strategies to reduce injuries or limit their severity (3,6,20,24,25,26,27). Each of these contributions will be described.

The distinction between active and passive approaches to injury prevention lies in the level of effort or action required on the part of individuals for the strategy to be effective (3,24,26). Active strategies are those requiring the most effort (such as seat belt use), whereas passive strategies lie at the opposite end of the continuum where little or no action is required (such as automobile airbags). Both the level of activity and the number of individuals whose cooperation must be obtained is relevant. Some strategies must be employed by the general population, while others need only be employed by a few individuals within a relevant power structure, such as government or industry (26). Active strategies require the efforts of more individuals. Historically, passive public health measures, such as immunization programs, iodisation of salt, and fluorination of drinking water, have obtained better results than active ones. Consensus within the injury prevention field is that passive strategies should be employed wherever available, and when active strategies are necessary, they are most effective when mandated (24,26). The need for a flexible combination of strategies has been recognized (3).

The Haddon matrix is based on the concept that injury events can be broken down into pre-event, event and post-event phases. When this phase concept is combined with the host, agent (vehicle and vector), and environment (physical and sociocultural) view of causation, a matrix approach to possible interventions results (3,20,24). This matrix approach has been embraced by injury prevention researchers, and applied in various forms to numerous injury prevention situations (6). Haddon's matrix will be illustrated when applied to playground equipment injury prevention in Chapter 3.

A further contribution developed between 1962 to 1970 was what Haddon termed his ten countermeasure strategies for reducing injuries (3). These are generic measures that can be applied to any type of injury prevention initiative. They are listed in an abbreviated form below (20), but are available in full elsewhere (24,25,27).

1. Prevent the creation of the hazard in the first place.
2. Reduce the amount of hazard brought into being.
3. Prevent the release of an existing hazard.
4. Modify the rate or spacial distribution of release of the hazard from its source.
5. Separate, in time or in space, the hazard and that which is to be protected.
6. Separate the hazard and that which is to be protected by interposition of a material barrier.
7. Modify the basic qualities of the hazard.
8. Make that which is to be protected more resistant to damage from the hazard.
9. Counter damage already done by the environmental hazard.
10. Stabilize, repair, and rehabilitative and cosmetic surgery.

Another model that is often applied to interventions targeted at behavioral changes is the PRECEDE model. PRECEDE stands for predisposing, reinforcing and enabling causes in educational diagnosis and evaluation. The model works through a six phase process by identifying the desired outcome, and designing the program input able to accomplish the outcomes. Some programs have utilized the PRECEDE model in conjunction with Haddon's matrix (3).

The field of injury prevention today is based on the conceptual framework developed by these pioneers, and is still in a developmental phase relative to many other health care disciplines. Parallels have been drawn between the status of injury as a field today, and oncology as a developing multidisciplinary field twenty years ago (4). Many challenges to the study and effective reduction of injuries have been identified, and will be mentioned briefly.

The need for injury surveillance at national and local levels to allow for a data-based approach to the design, implementation, and evaluation of programs has been stressed (3,5). It is imperative that all new programs be evaluated for effectiveness (3,5). Collaboration between the multiple health care disciplines and the many government, industry and community factions involved in the study and prevention of injury is needed. Leadership needs to emerge to coordinate all levels of injury prevention activity. The amount of funding allocated needs to rise to a level commensurate with the size of the problem (3,5) Canada is lagging behind the United States in both funding and organization at a national level (5).

Attitudes toward injury prevention in the general public, medical profession, government and industry remain a significant barrier to progress in the field. While the concept of "accidents" being random, isolated, unpredictable events has been expunged from injury prevention research, it is still commonly encountered throughout the rest of society. The coverage of injuries in the media perpetuates this concept, as injuries are reported as isolated, and random events, unconnected to similar previous occurrences. Risk taking is glamorized in advertising, television and movies. The marketing of prevention strategies lack equivalent attractiveness. Finally, prevention strategies perceived as coercive (such as seatbelt laws) commonly encounter resistance on the basis of denying freedom of choice. (3,5). All of these issues require continuing attention.

Many successes in the field of injury prevention have already been realized. The impact of seat restraints, child-resistant medicine containers, bars on upper-story windows, motorcycle helmets, and nonflammable childrens' sleepwear are some of the interventions shown to be effective (5,20). Yet there is much progress still to be made. Whether adequate resources, leadership and manpower are allotted to the problem will determine "whether preventing injuries remains an expression of hope or becomes a reality". (3)

2.1 PLAYGROUND EQUIPMENT INJURIES

2.1.0 LITERATURE REVIEW

Injuries associated with the use of playground equipment have received increasing attention over the last two decades. Playground injuries do not contribute significantly to mortality rates in children (8), but are of contemporary concern. A growing body of literature suggests that a non-trivial amount of morbidity results from playground equipment injuries. Also, playgrounds are environments solely designed for the use and enjoyment of children, hence society expects the risk of injury to be low. Playground equipment has been referred to as an "unsuspected hazard" (28) which illustrates this perception of danger hiding behind a wholesome facade.

Many difficulties are encountered when reviewing the available literature on playground equipment injuries, and should be noted at the outset. First, it is often unclear whether incidence rates presented are for all injuries occurring on playgrounds, or injuries specifically related to playground equipment. Incidence of playground injuries may represent all injuries (obtained by cohort studies), injuries presenting to emergency rooms, or injuries requiring admission. Often it is not evident whether rates reflect home, public, or all playground equipment injuries. Playground injuries as a subset of school or daycare injuries are also studied. A variety of denominators are used in calculating incidence rates, including total population, specific age categories, children, students, student-years or daycare registrations.

Further difficulty arises due to the span of time over which studies have been conducted. The playgrounds on which injuries occurred twenty years ago differ from the playgrounds of today. Considerable variation also occurs due to location, as playground composition may vary internationally and locally. Lastly, exposure to playground equipment has remained an elusive entity despite its conceptual importance. All of these factors make the precise estimation of playground equipment injury incidence problematic, yet much information is available.

Deaths related to playground equipment appear to be rare. While in one study in England the incidence of death during play was quoted as 1.1/100,000 per year (8), only 2 of the 14 deaths reported were directly related to playground equipment. This lowers the mortality rate to 0.15/100,000 children aged 0 - 15 per year. A study of fatal head injuries reported that 0.8% were due to playground equipment (swings) (29). From this, an incidence rate of 0.04/100,000 children below age 16 per year can be calculated. Absolute numbers of deaths internationally have been reported as 1 per year in Britain (30), 36 deaths in the United States from 1973-1977 (10,31) and 23 during a 15 month period (28,32). Fourteen deaths were reported in Australia in a 4 year period (10). Head injuries, falls and strangulation were the most common causes of death, with collapse of equipment, impact with moving equipment, and running into equipment occurring less frequently (31,33,34).

A published review of the international literature reported the following overall incidence rates for playground equipment injuries. The incidence of emergency room visits ranged from 330 to 1040 per 100,000 children per year, while the rate of admissions ranged from 10 to 150 per 100,000 children per year. An overall admission rate of 70 per 100,000 children per year was calculated, and between 10 to 20% of children seen in the emergency room required admission (35). The wide range of incidence rates reported is not surprising considering the above mentioned difficulties.

Various individual reports of incidence appear in the literature. A New Zealand study based on national discharge data reported a playground equipment injury admission incidence of 137 per 100,000 children aged 0-14 per year (9). (If home injuries and trampoline injuries were excluded, the incidence was 100 admissions per 100,000 children per year). Earlier, the same author reported an incidence of 126 admissions per 100,000 children per year for playground equipment fall injuries, which he subsequently viewed as an overestimate (9,11). Earlier British work from which incidence rates of 250 per 100,000 children had been extrapolated was also considered an overestimate (9,36). A later British study estimated an admission rate of 90 per 100,000 children (10). More recent British estimates based on data from the Leisure Accident Surveillance System (LASS) begun in 1987 are significantly lower. Rates of 435 emergency room visits and 20 admissions per 100,000 children per year were reported, which were based on all playground injuries (30). Playground equipment was implicated in 60% of the injuries, corresponding to calculated incidence rates of 261 and 12 per 100,000 respectively. An Australian survey from 1979 reported that 1% of children aged 4-8 (1000 per 100,000) were treated in hospital annually for playground equipment related injuries (37). Other age-specific rates for playground equipment injuries presenting to emergency departments include 327 per 100,000 children aged 0-4 years, and 302 per 100,000 children aged 5-9 years (38).

A Canadian 1984/85 chart review allowed the calculation of incidence rates from the number of playground injuries reported. The rate of emergency visits as a result of playground equipment was calculated as 92 per 100,000 total population per year (39). An American study reporting incidence in terms of total population similarly reported 83 emergency room visits per 100,000 total population in 1981 (38).

Absolute numbers of playground injuries are reported as 42,000 emergency room visits and 2000 admissions annually in Britain (30). The annual number of playground injuries requiring emergency room care in the United States based on the National Electronic Injury Surveillance System (NEISS) are as follows: 118,000 in 1974, 125,000 in 1975, 150,773 in 1977, 150,500 in 1978, and nearly 200,000 in 1992 (28,31,33,34,39). These figures include both home and public playgrounds, with 40-50% of injuries occurring at home. Canada's Children's Hospital Injury Reporting and Prevention Program (CHIRPP) records data on injured children age 0-19 seen at 10 pediatric and 3 general hospitals. From April 1990 to July 1992, 3517 injuries related to playground equipment were recorded out of 126,000 trauma visits (2.8%) (41). A study in Montreal reported 500 emergency room visits from May 1 to September 1, 1991 for children aged 1-14 injured on playground equipment (41). American figures indicate that the number of preschoolers injured on playground equipment has doubled from 1978 to 1988 (40).

A number of studies report the frequency of playground equipment injuries in terms of the proportion of all emergency room visits, or all trauma emergency room visits, associated with playground equipment. A study done in Hawaii reported that 10% of all pediatric trauma seen in an emergency department occurred on playgrounds. Playground equipment was involved in 3.4% of all trauma (ages 0-20), and 4.8% of trauma (ages 1-10) (42). NEISS reported that 4.5% of injuries in 1-4 year olds seen in emergency departments between 1983 and 1987 were playground equipment related (home and public) (43). Playground equipment was implicated in 1.2% of all consumer product-related injuries presenting to emergency departments (all ages) in Athens County, Ohio from 1980-1985 (44).

The proportion of children visiting emergency departments with playground equipment injuries who required admission is an indication of the severity of the injuries sustained. International estimates for the proportion of emergency department attendances for playground injuries requiring admission are 10-20% (35). National CHIRPP data indicate that 9% of playground equipment injuries presenting to emergency departments require admission. Similarly, the Montreal study reported a corresponding 8% admission rate (41). Since admission rates for trauma emergency visits in general have been estimated at 3.5% (4), it appears that playground equipment injuries are more frequently severe than injuries overall.

Few cohort studies have been done that include the reporting of injuries which received medical care outside emergency departments. However, one ongoing cohort study in New Zealand surveyed over 1000 children for injuries which medical care was obtained. For children in their sixth and seventh years of life, 2.8% of the cohort reported a fall from playground equipment that required medical care over the two year period. This represented 11% of all injuries reported (45). In their tenth and eleventh years of life, 2.7% of the same cohort reported being injured falling from playground equipment. This accounted for 5.3% of all injuries reported (46).

Further information about the incidence of playground equipment injuries can be obtained from studies of school and daycare injuries. One third of all playground equipment injuries obtained from hospital discharge records had occurred at school (9). An incidence rate of 0.89 per100 elementary student years was described, based on school injury reporting in Tuscon, Arizona over a two year period (47). Another study reported 2.37 playground equipment related injuries annually per 100 elementary students in Boulder, Colorado (48). A Canadian study done in Vancouver reported 0.34 playground equipment injuries per 100 elementary students per year (49). An incidence of 0.14 per 100 student years was reported for falls from playground equipment (50), and an older study reported 0.19 fractures per 100 students due to playground equipment (51). Considerable variation exists, likely due to differences in reporting practices.

Playground equipment injuries account for a significant proportion of all injuries occurring at elementary schools. The playground was the location of 50% (52), 32% (53), and 77% (54) of all school injuries, with one study reporting that 38% of all playground injuries were associated with playground equipment (48). Playground or sports equipment were implicated in 14% of school injuries, and were more likely to be severe (55), while 32.6% of all serious injuries occurred on the playground (56). Falls from playground equipment accounted for 20.5% of school injuries (57).

Playground equipment is associated with a significant proportion of daycare injuries as well. Data from NEISS reported that playground equipment was associated in 33.2% of injuries occurring at daycare in 1-4 year olds (43). Elsewhere, the proportion of daycare injuries that are associated with playground equipment have been reported as 33.5% (age 2-5 year olds) (58) and 45% (2-6 year olds) (59). Also, 47% of daycare injuries were found to occur on playgrounds, with 33% of all injuries being due to falls from playground equipment (60). In a review of hospital admissions resulting from playground equipment injuries, 2% of home injuries and 36% of daycare injuries were associated with playground equipment (61).

The types of equipment involved, and the mechanisms of injury have been reported in a number of studies. Earlier studies identified swings as the most common type of equipment involved in injuries (28,31,33,36), but more recent studies have found climbers most commonly involved (9,37,43,48,60,62,63). Trends of decreasing swing injuries and increasing climber injuries have been noted, and explained by the increasing use of impact absorbing swing seats, and the increasing numbers and variety of climbers respectively (62). The proportion of playground equipment injuries attributable to climbing equipment has been reported as 51% (48), 43% (62), 40% (43), 38% (9), 31% (37) and 30% (63). Swings and slides in either order are the next most frequent sources of injury, with all other equipment types accounting for the remaining small proportion of injuries (9,37,62,63). Trampolines also account for a significant proportion of injuries in the countries where they are popular (9,37). It is generally observed that injuries associated with climber and slide equipment types are more severe (36,60).

By far the most common mechanism of injury is a fall from playground equipment. In one review, a range of 43% to 91% of playground equipment injuries were due to such falls (9). The wide range indicates that injuries of varying degrees of severity were included. Individual studies reported that 93% (9), 75% (28,33,34), and 72% (31,38) of playground equipment injuries were due to falls, and 60% (43) were due to falls to the ground surface. Falls are believed to account for the largest proportion of serious injuries (40,9).

The nature of the body part affected and the severity of injuries are described in some studies. It is generally perceived that arm fractures and head injuries are the most common types of non-trivial playground equipment injuries sustained (10). Upper limb fractures have been reported to account for 40% (10) and 33% (41) of playground equipment injuries presenting to emergency departments. Head injury reportedly accounts for 45% (10) and 15% (41). Of injuries requiring hospitalization, 48% were arm fractures and 26% were intracranial injuries (9). For children aged 1-4 years, two thirds of playground equipment injuries involved the head and neck (43), and 50% of fall injuries resulted in head and neck injuries (28). Again, nearly half of playground equipment injuries involved the head and neck (42%), with 28% involving the arm and hand, 15% the leg and foot, and 9% the trunk (31,62). The most common types of injuries were lacerations, contusions and abrasions (65-75%) and, less commonly, fractures (17%) in preschoolers (43,62). In older children, the proportion of fractures, strains and sprains almost equalled lacerations, contusions and abrasions (62). The assumption that most head injuries are serious has been refuted by a recent study which found the proportion of serious limb injuries to be more frequent than serious head injuries. Additionally, it was revealed that most admissions for head injuries were for only one night, indicating a likely precautionary admission for observation (30).

The mean age of children sustaining playground equipment injuries has been reported as 6.3 (36) and 7.2 years (9), with peak age ranges of 4-8 years (37) and 5-10 years (33,39). Conflicting reports occur regarding the sex distribution of playground equipment injuries (9,36,38,50).

In keeping with the Haddon's matrix approach to injury prevention, some researchers have investigated the physical characteristics of playgrounds. In the host, agent, environment view of causation, moving playground equipment represents the agent of mechanical energy transferred to the victim through a vehicle (such as a swing seat). Falls to the ground surface represent a transfer of mechanical energy resulting from the victim impacting the physical environment, which may or may not be impact absorbing. Thus, several studies report the physical characteristics of playground equipment (often relative to existing playground standards) and attributes of ground surfaces relative to the heights of equipment.

Ground surface has been considered to transfer the agent of mechanical energy in 60% of playground injuries (62). Daycare playground equipment was found to be installed over protective surfacing only half of the time (43). 61.4% of New Hampshire daycares failed to have impact absorbing surfaces (64), and 97% of Connecticut daycares had inadequate shock absorbing surfaces (60). A study on US child care safety regulations discovered that none of the 45 States surveyed specified maximum heights of playground equipment, and only 4% mentioned playground surfacing in their regulations (65).

A study of 68 elementary schools found that 90% of playground equipment had a sand surface underlying them (rather than grass, dirt or rock), but only 53% had maintained the sand surface depth at two inches or greater and had no other hazards beneath the equipment (47). A sand depth two inches would be inadequate to absorb the impact from fall heights of most playground equipment, as can be seen by the summary of available impact absorbing information presented in Appendix 1. Fall heights and the type of surfacing under climbing equipment were investigated in both school and community playgrounds in New Zealand. The frequency of types of surfacing in schools were grass/earth 43.8%, asphalt 28.3 %, concrete 14.4%, woodchips 8.2% and gravel 3.7%. Fully 88% of climbing equipment was not mounted over suitable surfacing. Additionally, 23% of climbing equipment exceeded the 2.5 meter maximum height recommended by British Standards (66). On public sites, the frequency of surfacing under climbing equipment was grass/earth 59.3%, asphalt 16.5%, concrete 12.1%, and woodchips 7.7%, corresponding to 92% of climbing equipment mounted over unsuitable surfacing. A similar 28% of climbing equipment exceeded 2.5 meters in height (67).

A recent school study originating from Utah sought to investigate fall injury rates relative to types of surfacing (50). A different distribution of surface types under climbing equipment were noted in comparison to the New Zealand study. Surfaces consisted of gravel (60%), mats (18%), sand (12%), grass (8%) and asphalt (2%). The rates of injury reported in association with the various surface types was greatest for asphalt, even though the equipment heights located on asphalt were considerably lower. No other significant differences in injury rates were found between all other surface types. The authors concluded that impact absorbing surfaces do not provide any improvement in fall injury prevention compared to grass. However, it should be pointed out that no surface depths were measured in the study, and the authors noted that surfaces were rarely maintained at recommended depths. Reviewing again the published G-forces associated with fall heights to various types and depths of protective surfaces in Appendix 1, it can be observed that very little injury prevention would be expected from inadequate depths of recommended protective surfaces.

Some playground equipment studies have reported the frequency of various equipment types on playgrounds. In the absence of a good method to assess exposure, equipment frequency is used to approximate exposure to various equipment types, even though it is well recognized that child preferences may be important and are not known (50). One study reported the frequency of climbing equipment (58%) and not climbing equipment (42%) (47). A child care center study reported equipment frequency as climbers (23.6%), swings (15.6%), slides (13.1%), barrels, seesaws and merry-go-rounds (6%), spring riders (5%), and balance beams and sandboxes (4%) (68). Differences in the frequency of equipment on school and public sites were observed in New Zealand. In school playgrounds, 94% of equipment pieces were climbing apparatus, 3% slides, and 2% swings. In contrast, in public playgrounds, only 33% of equipment pieces were climbing apparatus, 25% swings, 13% see-saws, 9% slides, and 6% merry-go-rounds. All school sites had at least one piece of climbing apparatus, while

21% of public sites had no climbing apparatus (9). A recent Canadian survey of 254 Montreal playgrounds found the following breakdown of equipment types; 27% climbers (all kinds), 23.3% swings, 16.5% spring toys, 8.1% slides, 6.4% see-saws, 6.2% sandboxes, 2.9% merry-go-rounds, 1.8% horizontal bars and 1.5% each balancing games and tunnels (41).

Three studies were identified in which multiple attributes of playground equipment were assessed with the use of a checklist instrument (41,68,69). One utilized a 14 item list adapted from the Statewide Comprehensive Injury Prevention Program of the Massachusetts Department of Public Health, and additionally measured the maximum height of equipment, and minimum depth of surfacing directly below equipment in child care centers (68). The major findings from this study showed that 42.9% of centers with 5 or less hazards identified reported a playground related injury the previous year, while 52.0% of centers with 6-11 hazards, and 60.0% of playgrounds with 12 or more hazards reported an injury. Additionally, climbing equipment six feet and higher generally lacked adequate impact absorbing surfaces, and had twice the fall injury rate of climbers less than 6 feet.

A random sample of playgrounds in Boston were surveyed using the 177-item Boston Playground Safety Checklist which was also adapted from the Massachusetts Department of Public Health's Statewide Comprehensive

Injury Prevention Program Playground Checklist (69). Hazardous conditions identified were weighted on the basis of the severity of injury that could result from the presence of the condition. The hazards attributable to equipment types described 34% of hazards associated with climbers, 30% with slides, 22% with swings, with all other equipment types making up the remaining 14%. Climbers also had the greatest proportion of serious hazards (likely to cause severe trauma). Regarding protective surfacing, in 36.2% of cases it was of unsuitable material, and in the remainder the surfacing was of inadequate depth or maintenance. Therefore, 100% of the playgrounds surveyed had unsafe surfacing.

A survey of 254 playgrounds on the island of Montreal was undertaken using a 100-item checklist based on the CSA recommendations (41). An Index of Non-Conformity to Standard (INCS) was calculated to present the discrepancy between what was observed and what was recommended. The objectives of the study were to identify the most and least observed standards, to describe equipment types using INCS, and to identify differences in INCS with respect to makes of equipment, and the population, density and proportion of low income households in the neighborhoods where playgrounds were located. Additionally, equipment heights and characteristics of surfaces were also observed.

The chief results of this study will be discussed in some detail, due to the similarity of this study to the study undertaken in Winnipeg. In general, design, installation and maintenance items highly conformed to standard. Standards with a high degree of non-conformity were glass fragments in sandboxes, maximum equipment heights and protective surfacing recommendations, nonencroachment zones, the existence of entrapment spaces, and failure to indicate the age of intended users. Specifically, the proportion of equipment that conformed to US maximum height recommendations (2.1 meters for preschoolers, and 3.0 meters for older children) and had an adequate protective surface area (1.8 meters on all sides) of an acceptable type of protective surface (sand, pea gravel, or wood chips) were as follows: 26% of slides, 9-10% of climbers, and 30-37% of modular climbers. The depths of protective surfaces were not measured, so it is unknown whether the proportion of conforming equipment complied or did not comply with depth requirements. In particular, merry-go-rounds and see-saws had inadequate nonencroachment zones, and merry-go-rounds, slides, and see-saws commonly exhibited entrapment spaces. Of note is that while 90% of climbers and slides conformed to the US height recommendations, 50% of school equipment built by municipalities exceeded the recommended heights.

Observations regarding the three most frequent equipment types will be mentioned. 99% of rung climbers were found to lack intermediate landings when over 180cm, 75% of pre-school age and 59% of school age climber rungs were of inappropriate diameter, 75% were not installed on a protective surface, and 33% of protective surfaces were too small. Modular climbers ("new generation" play equipment combining several types of equipment) were installed on protective surfacing 84% of the time, yet 59% of protective surfaces were too small. All contained entrapment spaces, and 90% of platforms over 120cm high had spaces large enough for children to fall through. Swings were made of non-impact absorbing material 67% of the time, and infant seats lacked adequate support 78% of the time. Only 50% of swings were installed over protective surfacing, and 50% of those were too small. 50% of slides in modular climbers lacked side enclosures continuous with the starting platforms, while 50% of freestanding slides were not located on protective surfacing, 90% had strangulation potential, and 50% of starting platforms over 120cm had fall spaces.

Conformity on the basis of makes of equipment was hampered due to inability to identify the makes, but merry-go-rounds, and climbers were found to have better INCS if industry built than municipality built.

Global indexes were created combining the INCS of all equipment types within municipalities to detect differences in conformity on the basis of population, density and poverty rates. Regarding population size, large communities displayed 22% non-conformity, medium 19% and small 21%. In terms of population density, low density areas showed 20% non-conformity, medium density 20%, and high density 22%. When the poverty rate was low, 19% non-conformity was observed, with 20% and 22%

corresponding to medium and high poverty rates. These results were reported as differences, but no p values were supplied. The overall (all playground) global non-conformity was 21%.

Poverty levels were further investigated in neighborhoods where playgrounds were located. Nine out of 19 equipment types were found to have statistically significant lower conformity in poorer neighborhoods. Eight types were significant to $p<0.001$, and one was significant to $p<0.01$. No differences in the height of equipment were found in relation to the population size, density or economic level of the municipalities, but the frequency of inadequate protective surfaces followed the same trend of less conformity in poorer neighborhoods.

Two studies were identified in which manoeuvres were attempted to increase the safety of playground equipment. One study directed workshops on playground safety issues towards 1500 professionals involved with public playgrounds. Additionally, a multimedia campaign was employed to raise public awareness regarding the safety of home playground equipment. The outcomes observed were significant improvements in personnel's pre-test and post-test scores, a 42% reduction in the average number of hazards identified per playground site, and a 22.4% decrease in playground equipment injuries presenting to hospital after the intervention (70).

The second intervention study was not as successful in achieving the desired outcomes. Playground hazards were identified in 58 child care centers. The deficiencies were described to the director of the center, and safety information was provided. Two years later the 58 centers were reassessed along with 71 control centers. The intervention group showed a higher rate of hazards per playground than did the control group.

2.1.1 LOCAL INDICATORS

The previous literature review has presented information from international sources, and its relevance to the playgrounds and playground equipment injuries seen in Winnipeg is unknown. To ascertain the magnitude of the problem on a local level, two sources will be reviewed. A chart review of injuries related to playground equipment seen in the emergency department of the Children's Hospital in Winnipeg was conducted. Additionally, the Children's Hospital participates in the Children's Hospital Injury Research and Prevention Program (CHIRPP), and the playground equipment injuries captured in the local CHIRPP data for four months in 1993 will be reviewed.

A chart review of all emergency room visits for injuries related to playground equipment during 1991 was conducted by a resident and orthopedic surgeon at the Winnipeg Children's Hospital (70). A total of 392 playground equipment injuries were identified out of 34,024 emergency visits (1.2%) and 6,038 trauma visits (6.5%). Falls represented the most common mechanism of injury (92%). The frequency of involvement of specific equipment types were; play structures 31.9%, monkey bars 23.5%, slides 22.5%, swings 16.8%, trampolines 3.3%, see-saws 1.8% and merry-go-rounds 0.3%. Injuries sustained on monkey bars tended to be more severe. The peak age for playground equipment injuries was 5-8 years, with 62% of injuries falling within this age category. Admission was required in 72 cases (18.4%), which is significantly higher than reported elsewhere in Canada (41).

Orthopedic injuries accounted for 168 (43%) of all playground equipment injuries and 52 (41%) required closed reduction (which is the repositioning of the broken bone fragments often with anesthesia, but without a surgical incision). Admissions for orthopedic injuries represented 89% of all playground equipment injuries requiring hospital admission. The upper limb accounted for 85% of fractures, the lower limb was the site of 14% of fractures, and the remaining 1% represented 3 cervical spine (neck) injuries, and 1 lumbar spine (low back) injury.

Non-orthopedic injuries were seen in 224 patients (57.1%), with the following distribution: contusion/sprains 116 (30%), lacerations 49 (13%), head injuries 26 (7%), dental injuries 5 (1%), other injuries 28 (7%), and one death by unintentional hanging. Of the head injuries, 18 were minor, 7 were concussions and 1 was a depressed skull fracture. Thus, relatively more serious head injuries (concussions and depressed skull fracture) represented only 2% of all playground equipment injuries presenting to the emergency room. This is consistent with reports from a previous study proposing that upper limb fractures were more common, and more often severe than head injuries (30).

The location where injuries occurred was reported as school 142 (36%), community 136 (35%), home 76 (19%), daycare 16 (4%), and unknown 22 (6%). Home injuries comprise a smaller proportion of playground equipment injuries than reported elsewhere (28,31,33,34,39). School injuries occurring during school hours accounted for 84% of all school playground equipment injuries. Since the ratio of community to school playgrounds has been estimated as 2.4 to 1 (see section 5.2.2), the relative excess of school injuries is of concern.

Injury data recorded at the Children's Hospital in Winnipeg was obtained from the Children's Hospital Injury Reporting and Prevention Program (CHIRPP). From May to August 1993, 95 emergency room visits for injuries related to playground equipment in children aged 1-14 were recorded (26 in May, 32 in June, 20 in July and 17 in August). A total of 2009 injury visits for 1-14 year olds were recorded during the same period, thus playground equipment injuries comprised 4.7% of all identified trauma visits. Injuries related to playground equipment were most frequent in 5-9 year olds (59%), while 25% were sustained by 1-4 year olds, and 16% by 10 -14 year olds. In contrast, the age distribution was more even for all injuries, with 5-9 year olds sustaining 32%, 1-4 year olds 38% and 10-14 year olds 30%. 61% of children injured on playground equipment were male, and 39% female. This proportion was observed throughout all age categories, and was similar to the gender distribution for all injuries recorded during the same time period (58% male, 42% female).

The distribution of body parts injured were as follows; upper extremity 47%, head 19%, lower extremity 19%, and trunk 6%. The body part injured was not specified in 9% of records. The most frequent nature of injury was fracture (45%), with the following injury types in order of descending frequency; hematoma 19%, laceration 16%, inflammation 6%, abrasion, dental, sprain and no injury 3% each, and multiple trauma 2%. The proportion of fractures seen in playground injuries was double that seen in all injuries (23%).

Injury severity can be inferred from patient disposition. CHIRPP data records whether the patient was admitted, required significant treatment, minor treatment, no treatment, or left before being seen. 26% of playground equipment injuries required admission and 33% required significant treatment, while 17% required minor treatment, 22% required no treatment, and 2% left before being seen. The corresponding dispositions for all injuries were 16% admitted, 35% significant treatment, 26% minor treatment, 21% no treatment, 1% left without being seen, and 1% were observed and released. Thus, playground equipment injuries had a higher rate of admission, and lower rate of minor treatment compared to all injuries.

Of playground equipment injury admissions, 24 out of 25 were for fractures, and the remaining 1 was for inflammation. Injuries requiring significant treatment were fractures and lacerations (18 and 10 out of 31 respectively). The remainder were dental injuries (2) and inflammation (1). A total of 18 head injuries were recorded with the natures of injury distributed as follows; 10 lacerations, 5 hematomas, 2 abrasions, and 1 fracture. Of the 43 fractures recorded, 35 (81%) were located on the upper extremity. The remainder were located on the lower extremity (6), head (1) and trunk (1).

The playground equipment types involved could be extracted from 92 of the 95 records. The frequencies of equipment involved were playstructures 31%, climbers (including monkey bars) 30%, swings 20%, slides 16%, teeter totters 2% and merry-go-rounds 1%. Including all equipment types, falls were the mechanism of injury in 75 (79%) of playground injuries. Whether injuries occurred on school or community playgrounds was not recorded.

CHAPTER 3

METHODS

3.0 RATIONALE FOR THE METHODS

The rationale for this study is based on current concepts in injury research and the available knowledge about playground equipment injuries. Important concepts in injury research include understanding the host, agent, environment theory of causation, Haddon's phase-factor matrix, and the distinction between passive and active approaches to injury prevention. The application of these concepts to playground equipment injuries will be explained.

In playground equipment injuries, the host is the child, and the agent is mechanical energy (with the rare exception of thermal energy involved in burns from hot slides). Items of playground equipment such as moving swings may be the vehicle of mechanical energy, and another moving child may be a vector of mechanical energy. The physical environment is comprised of stationary equipment that a moving child may strike, and the ground which a child strikes in a fall. The sociocultural environment involves a variety of factors such as economics, supervision, and attitudes towards risk taking.

Playground equipment mishaps can be broken down into pre-event, event and post-event phases. "Pre-event" defines factors related to a mishap before the mishap occurs, "event" identified factors at play during a mishap, and "post-event" refers to factors relevant after a mishap occurs that impacts on the injury outcome of a mishap. Haddon's matrix considers the intersection of the phase considerations, and the host, agent, environment categorization, whereby potential interventions can be identified in appropriate cells. The Haddon's matrix approach to playground equipment injury prevention is presented in Appendix 2.

The concept of passive versus active approaches to injury prevention is relevant to the prevention of playground equipment injuries. Active approaches would involve modifying the behaviour of children through safe play education, or strict supervision. Passive approaches would target making playsites and playground equipment safer. The field of injury prevention favours passive over active strategies wherever feasible, due to the superior effectiveness of passive strategies (24,26). With this in mind, the cells in the Haddon's matrix in Appendix 1 that offer the most potential to reduce playground equipment injures would be those where pre-event and event intersect vehicles and physical environment. The potential strategies can be summarized as designing safer, well spaced playground equipment installed on an adequate impact absorbing surface, and subsequently maintaining the playground. This approach was the impetus behind the development of national standards for playground equipment. Hence, in considering the prevention of playground equipment injuries, it seemed relevant to explore playsites and playground equipment to assess how closely they complied with recommendations designed to make playgrounds a less hazardous place for children.

The literature on playground injuries emphasizes the importance of falls as a mechanism of injury. The height of equipment and the characteristics of the surface beneath were identified as important variables in determining if an injury will result when a fall does occur. This was the rationale for adding a special focus on equipment heights and protective surfacing.

Conversely, the literature is lacking in studies that compare the level of compliance to guidelines, or the heights of equipment and adequacy of protective surfacing on the basis of site characteristics such as school or community, type of equipment, age of equipment or amount of equipment. Additionally, no studies were found in which design and maintenance features of playgrounds were separately considered. This study was designed to contribute such information.

3.1 THE INSTRUMENT

3.1.0 OBJECTIVES AND OVERVIEW

The primary objective of this study was to ascertain the compliance of existing public playgrounds in Winnipeg to current recommendations of the Canadian Standards Association (12). An additional objective was to describe various parameters deemed particularly relevant to the prevention of playground injuries. Specifically, the maximum heights of equipment, the mean depth of protective surfacing, the size of sites (equipment volume), and playsite age were of interest. Further objectives were to contrast the level of compliance and the descriptive parameters on the basis of various site characteristics and equipment types, as well as to describe selected individual recommendations.

In order to do this, it was necessary to reorganize the recommendations contained in the CSA document "A Guideline on Children's Playspaces and Equipment" into a checklist format, also capable of recording equipment heights and protective surface depths. Both design and maintenance recommendations were to be included, and assessed separately to permit comparisons in the analysis. Section 3.1.1 provides background information on the Guideline, section 3.1.2 describes the process of developing the checklist instrument from the Guideline, while section 3.1.3 critiques the checklist developed.

3.1.1 BACKGROUND OF THE CSA GUIDELINE

The document, "A Guideline on Children's Playspaces and Equipment" (CAN/CSA-Z614-M190) (12) was released in June 1990, and revised in

June 1991. It is the first Canadian Guideline to address the safety of public playsites, and has been approved as a National Standard of Canada by the Standards Council of Canada. It is a voluntary standard which applies to public playsites developed or renovated after June 1990. No certification or testing program is associated with the Guideline. Its 88 pages of recommendations were developed by a Technical Committee with representation from a wide variety of disciplines including the playground equipment industry, the Canadian Institute of Child Health, Health and Welfare Canada, Parks and Recreation, Canadian Council of Professional Engineers, Consumer and Corporate Affairs Canada, Canada Safety Council, the Canadian Pediatric Society, and others.

In recent years, there has been a rising international awareness of the burden of playground equipment injuries. By 1988, a number of countries had issued voluntary standards for playground equipment, including Britain, the United States, Australia, and New Zealand (11). In Canada, the Canadian Institute of Child Health began looking into playground injuries in 1979. They perceived a need for playground equipment standards, and established the Task Force for the Development of Guidelines for Children's Playspaces. A document entitled "Guideline Recommendations for Safe Children's Play Spaces and Equipment" was produced by the Task Force, and submitted to the Canadian Standards Association in 1985. A technical committee was established by the CSA, which went on to produce the

Guideline on which this study is based.

3.1.2 DEVELOPMENT OF THE CHECKLIST INSTRUMENT

The objective of the checklist development was to transform all injury prevention recommendations contained in the Guideline into a checklist format appropriate for use during playsite inspections. Specific exclusion criteria were established to identify any recommendations not directly related to the prevention of injuries, or not feasible to assess on an existing site. The distinction between design recommendations (those presented in most of the document) and maintenance recommendations (those presented in section 14 on Inspection and Maintenance) were retained. The recommendations then had to be reorganized into an equipment-specific format whereby both general recommendations and recommendations specific to certain equipment types could be readily applied to playground equipment as it is encountered on playgrounds. In order to assess a rate of noncompliance, it was necessary to build in both a numerator (number of recommendations not met) and a denominator (number of recommendations assessed) into the checklist. The design of the checklist needed to be flexible enough to accommodate the uniqueness of playsites, yet apply recommendations in a standardized way. Each aspect of the checklist development will be further addressed.

The specific exclusion criteria employed are listed as follows;

1. Recommendations that were not possible or feasible to assess on an existing playsite.

2. Recommendations that involved extensive subjective judgement for their evaluation.

3. Recommendations on equipment types not commonly found in local playsites, specifically, skateboarding hills, pulley or cable rides and track rides.

4. Recommendations concerning plant materials in children's playspaces.

5. Recommendations on miscellaneous playspace elements (section 12 of the Guideline).

6. Recommendations not deemed directly related to the prevention of playground injuries.

7. Recommendations pertaining to supervised play opportunities.

8. Recommendations pertaining to play opportunities for children with disabilities.

The first exclusion criterion arises because the Guideline is oriented towards providing information on designing and installing new playground equipment. As such, many of the recommendations are not possible or feasible to assess after the equipment is installed. Whether a site was built over septic beds, whether chains are appropriately sized for sufficient strength, whether wood was pressure treated or plastics chosen that are able to withstand weathering are all examples of recommendations to be considered during manufacturing or installation, but cannot be assessed by inspection. In addition, section 13 provides guidelines on installation techniques that cannot be assessed on existing playgrounds.

Some recommendations involved subjective judgements that were deemed possible to assess with acceptable reliability. These were included in the checklist. An example is "no sharp edges, points, or projections that can cut or puncture human tissue". Other recommendations involved a greater degree of subjectivity and were not included. "Play equipment should be located so that children are able to approach, use and exit from the equipment without colliding with other children" and "The sand area should be large enough to encompass activities by several groups of children without interference" are examples of statements judged to be too subjective for inclusion.

After consultation with a senior official in the City of Winnipeg Parks and Recreation Department, it was established that certain equipment types have been discouraged (and some systematically removed) due to public complaints regarding injuries. Since skateboard hills, pulley or cable rides and track rides are extremely infrequent in local playgrounds, they were not included in the checklist.

Section 11 addressed plant materials in children's playspaces and was not included due to the researcher's lack of ability to recognize the 51 poisonous plants listed, and the infrequency of plants near playground equipment. Additionally, the focus of the study was on playground equipment and, while poisonous plants on site are hazardous, the topic is outside the scope of this study. Similarly, section 12 dealt with miscellaneous playspace elements, such as whether an emergency phone was available, and the characteristics of drop-off zones (where children can be safely dropped off and picked up by vehicles). While important, these recommendations were not considered directly relevant to the study objectives.

Some recommendations addressed quality of play issues, such as the statement that children show preferences to play in corners and edges of sandboxes, so designs should maximize these features. Such statements that are not relevant to the prevention of injuries were thus excluded.

Lastly, Appendix A and B offered information on supervised play opportunities and play opportunities for children with disabilities respectively. These were not mandatory parts of the guideline, and were not directly related to the objectives of the study, and thus excluded.

While section 14 directly addressed inspection and maintenance issues (and a suggested maintenance checklist was provided), all other recommendations were defined as design issues by exclusion. Thus the first 26 pages of the checklist instrument were based on the majority of recommendations presented in the Guideline. The maintenance part of the instrument was an adapted version of the suggested checklist on page 79 (Appendix C) of the Guideline. The reason for separately assessing design and maintenance recommendations was that the City of Winnipeg uses an inspection checklist similar to the one supplied in the Guideline. Since a concerted effort is made to address maintenance issues, but very little attention is given to design features on existing sites, it was hypothesized that the level of compliance to these aspects of playground safety might differ.

Once the recommendations to be included and the distinction between design and maintenance items was established, the next task was to put the recommendations in a format usable for inspections of existing playgrounds. It was noted that the suggested maintenance checklist was organized by equipment types. It made sense to similarly organize the design recommendations by equipment types. However, the maintenance checklist identified an equipment type called creative playstructures that was not directly discussed in section 10 (Recommendations on Specific Play Equipment) in the Guideline. It was noted that a wealth of recommendations regarding access to raised portions of playstructures, intermediate landings, platforms, handrails and guardrails appeared section 9 (Recommendations for General Aspects of Play Equipment). These, along with embedded specific play equipment such as slides and sliding poles, are what constitutes a creative playstructure according to popular terminology. (The term creative playstructure was not defined in the Guideline). Hence, for the purpose of the instrument, creative playstructure was defined as a connected series of platforms with a variety of access types at multiple points, with or without other embedded equipment. I used the general guidelines for access, platforms and guardrails as recommendations applying to the component parts of creative playstructure equipment types.

The outline for all possible equipment types likely to be encountered during playground inspections is shown in the Playground Checklist Outline in Appendix 3. Note that provision was made for all possible types of access to slides and sliding poles. When the access to these equipment types was by a creative playstructure, no data were entered for access to avoid duplicating the data entered for creative playstructures. Creative playstructures were divided into access, platforms and intermediate landings, and guardrails and handrails. Where other specific equipment types were embedded in creative playstructures (slides, sliding poles and climbers), they were assessed in their respective parts of the checklist.

The CSA definition for climbers was adopted (any structure designed to be climbed on without the exclusive use of inclined ramps or stairs). Monkey bars (any play equipment whose primary play element consists of horizontal or sloping bars used for swinging or gymnastic manoeuvers) were considered a subtypes of climbers, but no attempt was made to distinguish between types of climbers. Climbers have been subtyped differently elsewhere, and the term "modular climber" has been used in place of "creative playstructure" (41). The lack of uniformly accepted equipment nomenclature is problematic.

In the Guideline, both general recommendations and recommendations for specific play equipment were made. For each equipment type in the checklist, applicable general and specific recommendations were incorporated. Therefore, a number of general recommendations were repeated throughout the checklist wherever they applied to equipment types.

Within each equipment type, recommendations were organized into: 1) general features; 2) measurements; 3) protective surface area; 4) nonencroachment zone; and 5) protective surface adequacy. Regarding protective surface area and nonencroachment, measurements were done and compliance was qualitatively recorded. However, the actual measurements for maximum heights and surface depths were recorded to assess protective surface adequacy. This was done because protective surface adequacy was not directly addressed in the Guideline. Rather, mention was made that the depth of the surface material depends on the potential fall height and the resiliency of the material (page 27) and that the manufacturer/designer should inform the owner of specific requirements for protective surfacing and for depth of sand or thickness of manufactured surfacing (page 71). Accordingly, the measurements needed to be recorded and assessed for adequacy on the basis of an outside source (see Appendix 1 in this paper). Also, due to falls to the surface being implicated in a high proportion of playground injuries, quantitative data regarding potential fall heights and protective surface depth are desirable.

The first column in the checklist contained a list of specific recommendations or criteria to assess. The second column bore the heading "# hazards", but is more appropriately thought of as number of unmet criteria or units of noncompliance. The third column is headed "# potential" referring to the number of potential hazards (or total number of criteria assessed). The term hazard was originally used, but was abandoned in favour of the term noncompliance to avoid the false impression that compliance to recommendations was equivalent to safety, and noncompliance equivalent to hazards. Unfortunately, the checklist was already in use when the terminology was changed, so remnants of the old terminology remain.

The number of hazards column was used to record the number of times a specific criterion applied to equipment being assessed, and was not met. The number of hazards column could accommodate the assessment of any number of equipment units. For example, if a site had 3 rungladders, the criterion "angle of inclination between 50-90 degrees" would be applied to 3 units of rung ladders. If 2 rungladders complied, and one did not, the "number of hazards" entered would be 1.

The "number of potential hazards" column was used to record the number of times the specific criterion applied to equipment being assessed. Without this information, no rate of compliance could be ascertained. How often a criterion applied was established differently under three sets of circumstances. The most common situation was to consider each criterion to be applicable once per equipment structure unit. For instance, "open ends of all tubing should be finished with smooth caps or plugs" was considered to apply once for one unit of swings, or twice if there were two swing sets on the site. A less frequent situation arose when the item being assessed was a component of an equipment structure. For example, "seats made of impact absorbing material" applied to each of the seats in a swing set, where some might meet the criteria and some might not. In this situation, the number of times a recommendation applied was established by the number units of equipment components present. This only applied to swings and the component parts of creative playstructures.

The third situation arose in the general recommendations section when the number of times a recommendation could potentially apply could not be defined. In these situations, the potential was always defined as 1. This only occurred in the section for "General Considerations" in the design section and for certain items in the maintenance section. The general considerations section was used to assess any aspect of a site that had not been assessed in the previous sections. For example, the recommendation "no accessible sharp edges, points or projections" might apply to a table which had not specifically been assessed, but how many times that recommendation was potentially applicable to general aspects of a site could not be defined.

A further complication arose when, in some instances, none of the above three situations applied. For example, the criterion "All platforms with fall heights over 1200mm need panel-style or vertical fence-style guardrails" may only have applied to a subset of all platforms being assessed (those over 1200mm). If there were 6 platforms, 3 were above 1200mm, and 2 of those failed to have the appropriate style of guardrail, the data recorded would be 2 hazards out of 3 potential hazards. Therefore, while the checklist was organized on the basis of potential = unit of structure, potential = unit of component, and potential = one (see Appendix 4), each criterion assessed had to be considered individually. This method allowed the maximum flexibility in assessing unique playsite compositions, while maintaining a standardized approach.

Each time a criterion was applicable to a situation and was not met, it represented a unit of noncompliance out of one possible unit of noncompliance (or unit of hazard). This is the basic measurement unit on which the analysis of compliance to the CSA Guideline is based. However, it should be emphasized that from a safety perspective, not all units of noncompliance are equivalent. Contrast "gripping surfaces should be splinter free" with "all platforms with fall heights over 1200mm require panel-style or vertical fence-style guardrails". Clearly, a fall from a significant height represents the risk of a more serious injury than the risk of a splinter. Recall that another study weighed criteria on the basis of the severity of potential injuries associated with noncompliance (69). However, overall, a higher level of compliance would represent a greater degree of safety.

It was mentioned at the outset that other parameters of interest were to be recorded, namely equipment heights, surface depths, site size and site age. The recording of heights and surface depths has been described. The parameter "site size" was not described by a unique set of measurements, but was derived from the "total potential hazards" column. The potential hazards (number of criteria assessed) for an entire site were summed to give "total potential hazards" for a playsite. Sites with more playground equipment had a larger number of criteria apply and be assessed than a site with less equipment. Thus, the total number of times CSA recommendations applied to equipment on a site was the indicator used for playsite size and was referred to as "total potential hazards". Age was estimated at the time playground inspections, but age data were obtained after all inspections were completed from school and city officials. The estimates made on site were only used in the analysis when no age data were available.

A cover sheet was provided for recording basic descriptive information about the site, including site name, number, location, date and time of inspection and other general information. Diagrams from the Guideline were reduced and included with the checklist for reference. The checklist was created using WordPerfect for Windows 5.1 (71). It was printed double sided and laminated to conserve on paper usage. Two copies were made to permit a maximum of two inspections per day. The checklist instrument is submitted in full as Appendix 4.

3.1.3 CRITICISM OF THE CHECKLIST INSTRUMENT

Criticisms of the checklist fall into three groups. One type is the omission or improper application of recommendations in the guideline detected in hindsight. The second relates to the way denominators (potential hazards) were established and the resulting impact on the analysis. The third relates to inherent weakness in the checklist due to ambiguousness in the Guideline that made interpretation difficult.

Two errors were detected after the completion of the study with regards to including and interpreting all relevant recommendations in the Guideline. The specifications for neck entrapment openings (item 9.6.2) was difficult to interpret, and misunderstood at the time of the checklist development. It was initially read as duplicating item 9.6.1 on head and neck entrapment, and as such, neck entrapment spaces were not specifically assessed.

Secondly, the specifications regarding heights of handrails and guardrails were confusing and likely applied incorrectly. Guardrail heights specified in item 9.13.2 states that the minimum height for top guardrails should be 610mm and should be increased for older children based on anthropometric data specific to the average age of the users. No height of the second (lower) guardrail is supplied. In the study, all panel and vertical style guardrails, and the top guardrail at points of access were assessed using the criteria of 610mm. However, the two vertical beam style guardrails were erroneously assessed using the recommended heights for handrails (required for stairs, steps and ramps). The actual recommended heights of horizontal guardrails acceptable for platforms 450-1200mm requires clarification.

The approach of defining potential hazards three different ways had weaknesses detected retrospectively. For swing equipment types, the effect of assessing many criteria per individual swing resulted in a larger total potential hazard sum for swings than seemed appropriate. This was particularly striking in the maintenance part of the checklist, as individual components of creative playstructures were not assessed separately, and swings were. Swings impacted maintenance scores considerably more than creative playstructures did, which is counter-intuitive. Despite creative playstructures being less prevalent than swings, when present they contained a large volume of equipment, so their contribution to the scores should have been greater than what it was. In developing a better instrument from the Guideline, consideration should be given to a more fair contribution by various equipment types to both the design and maintenance scores.

The most significant weakness in the Guideline that weakened the checklist, was not having clear guidelines on acceptable surface depths relative to the various heights of equipment. A second weakness was that the unit of equipment defined in this study as creative playstructures, and defined elsewhere as modular climbers, was not treated as a specific equipment type. Assessing this type of equipment with equal reliability as a more standard type of equipment was impossible. More attention needs to be focussed on clearer specifications for this newer style of playground equipment in future editions of the Guideline.

3.2 THE POPULATION AND THE SAMPLE

3.2.0 DEFINING THE POPULATION

The population defined for the purpose of this study was all public school and community playgrounds with playground equipment located in the city of Winnipeg. The city of Winnipeg boundaries were defined as the Perimeter Highway or city limits, as some schools in Winnipeg school divisions actually lie outside the Perimeter Highway. Private schools, daycare playsites or other privately owned sites were not included even if used by the general public. Home playgrounds were not included.

The sampling frame was obtained by contacting each of the five Parks and Recreation districts, and requesting lists of all parks with playground equipment. Complete district lists were supplied with characteristics such as the presence of playground equipment described for each site. Similarly, each school division was contacted to ascertain which schools in each district were elementary schools. Elementary schools were all assumed to have playground equipment. To verify that assumption, the lists were mailed to each school division to confirm the accuracy and the presence of equipment. Eight out of the ten districts responded and verified the lists as correct.

A complete list of all the Parks and Recreation and school sites were entered alphabetically by district or division in a spreadsheet using Microsoft Excel software (72). A total of 484 community sites and 172 school sites were identified. Thus the total sampling frame consisted of 656 playgrounds in Winnipeg with playground equipment.

3.2.1 OBTAINING THE SAMPLE

A sample size of 50 playsites was desired. Since no similar study had been done, it was not possible to properly estimate the sample size that would detect the differences considered relevant. In addition, the length of the checklist prohibited a large enough pilot study to be done to generate estimated standard deviations. Statistical advice was sought and the recommendation was to apply a statistical generalization used in uncertain situations of sampling approximately 10% of the population. In addition, the number of inspections one researcher could carry out in a season had to be considered, and was a limiting factor. A sample size of 50 (7.6%) was considered both feasible and close enough to 10% to be statistically adequate to detect relevant differences.

Since comparisons between community and school compliance and parameters were planned for the analysis, the most appropriate method of sampling was with stratification. If a random sample had been drawn from all sites together, the number of school sites in the sample may have been too small to permit estimation or comparisons. The ratio of community to school sites in the sampling frame was 2.8:1. To permit estimation and comparisons, schools were oversampled relative to their prevalence in the sampling frame. Community and schools were sampled in a ratio of 2:1.

Two random samples were drawn; one from the community list of 484 sites and one from the school list of 172 sites. The sampling function in Microsoft Excel (72) was used to obtain the samples. The program carried out sampling with replacement such that duplicates were possible. Therefore, oversampling was done to ensure a large enough sample size to accommodate any potential duplication, or rejection of sites during fieldwork. A total of 33 community sites (6.8%) and 17 school sites (9.9%) was considered a minimum. Random samples of 55 community sites and 30 school sites were obtained to allow for more than the minimum number of inspections if time permitted, as well as allowing for duplicates and rejections. The first 33 unique community sites and the first 17 unique school sites were accepted as the study sample. (Duplication had occurred twice in the community draw, and once in the school draw).

During the study, 6 sites from the community sample were rejected. Three were school sites that had been drawn from the community sampling frame. They had appeared in both sampling frames, and were rejected on the basis of misclassification. Three additional community sites were rejected because no playground equipment was present, despite records to the contrary. In each case when a rejection occurred, the next community site on the list was inspected. No rejections occurred in the school sample.

One unusual school site was encountered. It was a large playground shared by two schools, both of which had entered the sample. It was decided during data collection to divide the playground in half, and assign one half to each school. However, statistical advice indicated that it was more appropriate to consider the playground as a single site. Thus, the data for the two schools were later consolidated, and the original sample size of 17 decreased to 16 (9.3% of schools). The total number of sites inspected was 49 (7.5%).

To avoid bias in the order of site inspections, the sites were listed in order of the random sample. Since it was not always feasible to follow the order exactly, blocks of 5 sites were assigned per week, with flexibility of order within the block. For example, if it was about to rain, the closest site in the block was selected. Two community sites were seen for every one school to maintain a balance between the two groups. The only departure from this occurred at the beginning of the study when school was still in session, as it was inappropriate to conduct school site inspections during the week.

After the 49 site inspections had been completed, the sampling function on Microsoft Excel (72) was used to randomly select two sites from the sample to check again. No stratification was necessary. The design portion of the checklist was applied to the two sites a second time, and the results compared to the original results. This was to assess the reliability of the data collected.

3.3 DATA COLLECTION

3.3.0 APPLYING THE CHECKLIST

In addition to the checklist, a number of tools were required for playsite assessments. They are listed below followed by descriptions of their functions.

1) Measuring tape
2) Metal 30cm ruler
3) Metal 100cm ruler (adapted)
4) Plumb line
5) Measurement calipers
6) Level/protractor (adapted)
7) 76mm diameter ball
8) 254mm diameter ball
9) Calculator
10) Tool belt

The measuring tape was used to measure equipment heights and other large measurements. The 30cm ruler was used to measure surface depths and make other small measurements. The 100cm ruler was used for measurements, but also acted to define the radius of a circle described by a plumb line to assess the deceleration curvature of slides. The ruler was modified by mounting small screws at 70 and 100cm. A plumb line of corresponding lengths could then be attached and the radius of curvature for slides assessed. Calipers were required to measure bar and handle bar diameters and to measure the spaces between planks in platforms. A small level was mounted on a protractor to measure the angle of inclination of slides, and all types of access (relative to level). The two balls substituted for the recommended headforms. A calculator was used to sum a set of surface depth measurements and calculate the means.

A site was approached by first recording general descriptive information. The assessment then proceeded in the order of the equipment types appearing in the checklist. Recommendations within equipment types were assessed in order which they appeared on the checklist. The routine was altered only if children were occupying equipment, as children's play was not disturbed for the assessment. Care was taken to assess all equipment present, and to assess each piece of equipment only once to avoid redundancy.

The method of measuring surface depths requires an explanation. Measurements directly below equipment units were obtained by taking 5-10 measurements in the appropriate area, and entering the mean. Similarly, measurements throughout the protective surface area were obtained by taking 5 -10 measurements at random locations throughout the protective surface area, and entering the means. For each type of equipment, a standardized approach was developed, and measurements taken the same way each time.

For each of the criteria, an effort was made to develop and maintain a standardized application. For example, regarding the criterion concerning wood splintering, one visible splinter rendered it unmet. For spaces in platform decking, two or more spaces exceeding recommendations rendered the criteria unmet. Throughout all criteria assessed, the maximum strictness was applied as a precaution against inconsistency, Therefore, a bias towards the strictest possible assessment of equipment is recognized.

Prior to data collection, two randomly chosen sites were pre-tested to identify and solve difficulties in the application. The main difficulty encountered initially was how to be organized and efficient in the data collection. It is not felt that the individual criteria were applied differently from the first pre-test to the last site. However, the speed and efficiency of inspections improved continually throughout the study.

The mean time taken for each site assessment was 1.5 hours. The range was from 30 minutes to 5 hours. In total, 74 hours were spent in site assessments, not including travel time. The majority of site assessments were executed in the mornings between 10:00 and 12:00.

3.3.1 DIFFICULTIES IN APPLYING THE CHECKLIST

Single function equipment was relatively easy to assess in a uniform, routine manner. Creative playstructure equipment was more difficult to assess due to the unique composition of each unit. No two creative playstructures seen were identical. Some components of creative playstructures were not provided for in the checklist, and had to be assessed under the heading of climbers (if their function was for climbing), or general considerations.

Difficulty was experienced when large numbers of the same equipment types needed assessment. For example, it was difficult to find room to record criteria data for 10 or more platforms, in addition to 10 height and surface depth recordings.

Weather proved challenging on many site assessments. Measurements could be made in the rain, but recording of data was difficult. On some occasions, the checklist was left in a dry location, and the assessment carried out a little at a time between runs to record data. On windy days, a wide elastic was used to keep the checklist open to the appropriate page. A mosquito net hat and jacket were worn when required. Morning and evening assessments were avoided on particularly bad mosquito days.

Crowded sites were difficult to assess, as the order of inspection had to be changed to accommodate equipment usage. Sites with daycare attending were particulary problematic. Scheduling morning inspections aided in avoided crowds.

3.3.2 DATA ENTRY AND STORAGE

Data were recorded each day after the inspection using spreadsheets created on Microsoft Excel (72). Four templates were created to accommodate the various information collected. The first template (see Appendix 5) was designed for recording basic descriptive information about the site and inspection, and any additional comments. The second template, a companion to the checklist itself, listed each criterion and the number of hazards and total hazards recorded for each. In addition, the template contained operations to automatically create sums and compliance scores (see Appendix 6). A third template was created to record equipment heights and surface depths and to calculate means (see Appendix 7). Lastly, a template was designed as a summary sheet for each site to record the total hazards, total potential hazards and compliance scores for each equipment type, and to provide design scores, maintenance scores and total scores for the site (see Appendix 8).

At the time of data entry, each template was opened, and named according to the site being recorded. The templates then became worksheets, and all four were saved bound together as a workbook for each site. To retrieve data for a particular site, a single workbook was accessed, and all four worksheets opened simultaneously.

The advantage of creating identical worksheets from templates was that it allowed for sums of individual criteria to be made in the analysis. Also, all of the operations desired could be built in to the template and did not need to be repeated for each worksheet.

A hard copy of the data for each site was printed and the data backed up each day.

CHAPTER 4

ANALYSIS

4.0 OVERVIEW OF THE ANALYSIS

The objective of the analysis was to assess the level of compliance of existing playground equipment to current C.S.A. recommendations, and to describe other parameters of interest that are particularly relevant to playground injury prevention. Levels of compliance and other parameters of interest were first analyzed using playground sites as the units for consideration, and numerous contrasts were made on the basis of site characteristics. Secondly, specific types of playground equipment were viewed as the identified units, and levels of compliance and other parameters described and contrasted on the basis of equipment type. Lastly, specific checklist criteria were seen as the units of interest, and various criteria of particular interest were selected for description. At the outset, testing to assess the reliability of the data, and to check for a potential order bias in the data collection was performed.

To measure the level of compliance to the guidelines (as itemized in checklist form in the instrument), the data for each site was manipulated into "compliance scores". The numerator was obtained by subtracting "total hazards" from "total potential hazards", and the denominator was "total potential hazards". The score was multiplied by 100 to put it in percentage form. Thus, a compliance score represents the percent of applicable C.S.A. criteria met for a given site, type of equipment, or particular criteria.

The sums of total hazards and total potential hazards from the design section of the checksheet were used to calculate "design scores", while the sums of all total hazards and total potential hazards from the maintenance section were used to calculate "maintenance scores". Similarly, grand totals of total hazards and total potential hazards for a given site, equipment type or particular criteria were used to calculate "total scores". Design scores, maintenance scores and total scores are three types of compliance scores described, and used for comparisons throughout the analysis.

The other parameters of interest described and compared are maximum site or equipment heights, mean depth of protective surfacing, site size estimated by a site's total potential hazards, and site age. These parameters are described by means calculated directly from measurements made during data collection, with the exception of site age which was obtained from playground owners after data collection was completed.

All mean compliance scores and parameters reported are accompanied by 95% confidence intervals, and a calculation of the coefficient of variation (standard deviation divided by the mean and expressed in percent). All comparisons of mean compliance scores and parameters were done by t-testing (if comparing 2 groups) and analysis of variance (if comparing more than 2 groups). Where testing involved multiple comparisons, the appropriate Bonferoni correction was made by calculating a stricter p value to compensate for the increased alpha error inherent in multiple comparisons. The corrected value was calculated as follows: p' = standard p value of 0.05 divided by number of comparisons made.

To assess whether the assumptions inherent in these tests were met (data sets conforming to a normal distribution and comparison groups having similar variances), histograms were made for all groups involved in comparisons, and variance ratios were calculated. Any data sets with variance ratios greater than 2 were examined to see if one or two unusual sites were responsible for the variance difference. This was done by removing an unusual site from the data set and recalculating the variance. If the variance ratio using the recalculated variance was 2 or less, it was assumed that the groups compared had similar enough variances overall to permit t-testing or ANOVA. When no unusual site could explain the difference in the variances, and one group's values occupied a wider range around it's mean (indicating that a true difference in variances did exist), F-testing of the variances was carried out to ascertain if the difference was significant at $p<0.05$. When significance was found, thus violating the assumptions of t-testing and ANOVA, nonparametric testing was done. The Mann-Whitney U test was done in place of t-testing, and the Kruskal-Wallis test done in place of ANOVA. These results are supplied along with the results of all comparisons made.

The statistical analysis and charting were carried out using the analysis functions and charting tools on Microsoft Excel (72), except the calculation of confidence intervals, coefficients of variations, preliminary variance ratio calculations, and nonparametric testing which were calculated by the author.

4.1 PRELIMINARY CONSIDERATIONS

4.1.0 RELIABILITY OF THE DATA

Analysis of the reliability of the data was carried out by assessing the differences in data entered for two sites that were re-checked after completion of the study. Only design criteria were re-checked and compared, as it was assumed that maintenance criteria may have legitimately changed between inspection dates. The data for each criteria recorded during the study and at re-check were compared, and the number of times that the data were discordant was counted. Any discrepancies due to legitimate physical changes in the playgrounds were discarded. Discordance rates (number of discordant criteria divided by the number of all criteria assessed expressed in percent) were reported for each of the two sites re-checked, and also described for specific equipment types. Discordance rates were contrasted between single function and creative playstructure equipment types. The discordant items were classified into subjective judgement errors, and measurement errors.

The impact of the errors on scores was examined. Re-check data were defined as correct, and whether errors made during the original evaluation had the effect of increasing or decreasing the scores was evaluated. It was hypothesized that errors would effect scores equally in both directions. This was tested by a McNemar's paired chi squared test.

4.1.1 ORDER BIAS ANALYSIS

The possibility of bias due to the order in which sites were seen was considered. A potential learning effect may have altered the way the instrument was applied over time. This could have effected all types of compliance scores. Additionally, the actual condition of sites may have changed over the study due to the progression of seasonal maintenance and upgrading. This factor would have likely impacted maintenance scores only. If neither such bias had occurred, it was assumed that compliance scores of sites seen during the first half of the study should not differ from sites seen in the last half of the study.

To test for this, the design scores, maintenance scores and total scores were compared between the first 24 sites seen and the last 25 sites seen. The groups contained similar proportions of community and school sites. The means of the scores were t-tested. A Bonferoni correction was made by dividing the standard p value of 0.05 by the number of comparisons ($p'=0.017$).

4.1.2 DESIGN SCORES AND MAINTENANCE SCORES

The relationship between design and maintenance compliance scores was of interest. Since the two scores originated from observations made at the same sites, a paired analysis was appropriate. It was hypothesized that maintenance scores would be higher than design scores because after original installation, design is not commonly re-evaluated, while maintenance issues are continually addressed. Thus, a one-way paired t-test was done to compare design scores and maintenance scores of all sites.

The possibility of a linear relationship between design and maintenance scores was considered. It seemed possible that a site with higher design compliance would also have higher maintenance compliance. A scattergram was made to visually observe the nature of the relationship. The correlation coefficient was calculated and tested to explore this possibility. Additionally, regression was carried out using design scores as the independent variable, and maintenance scores as the dependent variable.

4.2 SITES AS THE UNITS OF CONSIDERATION

4.2.0 ALL SITES

The mean compliance scores (design, maintenance and total), mean maximum height, mean surface depth, mean size and mean age were calculated for all sites (n=49). Confidence intervals and coefficients of variation were calculated for each mean. Histograms were done to visualize the distribution of the data sets.

4.2.1 INNER CITY VS NOT INNER CITY SITES

It was speculated that compliance scores may differ between inner city sites and all other sites. Inner city sites were defined as those lying within the old City of Winnipeg boundaries, and not inner city sites were all other sites outside the boundaries. The mean compliance scores (design, maintenance and total) were calculated for inner city and not inner city sites. Confidence intervals and coefficients of variation were calculated, and histograms done for each of the groups. Inner city and not inner city scores were then t-tested. A Bonferoni correction was made to account for the three comparisons, and $p'=0.017$ used as the criteria for significance. Variance ratios were calculated for each comparison made.

4.2.2 COMMUNITY VS SCHOOL SITES

The relative proportions of community and school sites in the sample and the population (sampling frame) were examined for similarity. During the study, some community sites were rejected from the sample either because no equipment was actually present, or the site was a school site and appeared in both the community and school sampling frame. The rejection rate calculated from the sample was applied to the community sampling frame to estimate the true number of community sites that had equipment and were not duplicates of school sites. No school sites were rejected during the study, and the school sampling frame was not adjusted. The relative proportions of community and school sites were compared for the original sampling frame, the adjusted sampling frame, and the sample.

The means for compliance scores, maximum heights, surface depths, size and age for community and school sites were calculated and accompanied by 95% confidence intervals and coefficients of variation. Histograms were done and variance ratios calculated for each group being compared. T-testing was employed to compare all of the above means. A Bonferoni correction was made to adjust for the seven comparisons, and p' =0.007 was used as the criteria for significance. Variance ratios over 2 were handled as outlined in 4.0.

4.2.3 SINGLE FUNCTION VS CREATIVE PLAYSTRUCTURE SITES

School and community sites were further subdivided into single function site types (SF) and creative playstructure site types (CPS). SF sites contained equipment intended for a single function such as swing sets, freestanding slides, freestanding climbers, teeter totters, rocking equipment, merry-go-rounds and sandboxes. CPS sites contained a composite unit of equipment comprised of joined platforms with multiple access points and a variety of built-in equipment such as slides, sliding poles, and climbers. Most CPS sites also had SF equipment on site. Community sites had both SF and CPS site types, but school sites were all CPS site types. Therefore, three categories emerged for comparison regarding site type; SF, CPS community (CPS-Comm) and CPS schools (CPS-School). The relative proportions of the three site types in the sample was described.

The means for compliance scores, maximum heights, surface depths, size and age for SF, CPS-Comm and CPS-School sites were calculated and accompanied by 95% confidence intervals and coefficients of variation. Since more than two means were being compared, ANOVA was used to test for differences between the three groups. If significance was found, Tukey's multiple comparisons testing was done. Given that the group sizes were not identical, the group size harmonic means were used in calculating the relevant Tukey's value for each of the two groups compared.

Histograms were done and variance ratios calculated for each group being compared. Variance ratios over 2 were handled as outlined in 4.0. A Bonferoni correction was made to adjust for the seven comparisons, and $p' = 0.007$ was used as the criteria for significance.

4.2.4 NEWEST VS OLDER VS OLDEST SITES

Site ages were obtained as accurately as possible from school and community officials with access to site records. Individual sites were assigned a reference age which was either the actual date of installation, or the most accurate estimate of the age of the majority of equipment present. In addition, sites were categorized into newest (0 - 9 years), older (10-19 years) and oldest (>19 years).

The available age information was somewhat lacking, so an assessment of the quality of the data was undertaken. Data quality was categorized into good data (when an accurate age was supplied), poor data (when an age range was supplied, or the equipment on a single site originated from a number instalment dates) or no data. The proportion of school and community sites within each category was described.

An assessment of the accuracy of age estimation was done, as estimated ages were used when ages were not available. All sites had been classified into age categories on the basis of site observations prior to obtaining site age information from the owners. All age estimates which were confirmed by owner information were assessed for accuracy. This level of accuracy was assumed to be similar to the accuracy for the estimated ages used in the analysis.

To further clarify the issue of equipment of various ages on a single site, the proportion of school and community sites with a history of a significant renovation was described.

The proportion of school and community sites within the three age categories was described. The proportion of the three site types within the age categories was also described.

The means for compliance scores, maximum heights, surface depths, size and age for newest (0-9 years), older (10-19 years), and oldest (>19 years) sites were calculated and accompanied by 95% confidence intervals and coefficients of variation. Again, since more than two means were being compared, ANOVA was used to test for differences between the three groups. If significance was found, Tukey's multiple comparisons testing was done. Given that the group sizes were not identical, the group size harmonic means were used in calculating the relevant Tukey's value for each of the two groups compared.

Histograms were done and variance ratios calculated for each group being compared. Variance ratios over 2 were handled as outlined in 4.0. A Bonferoni correction was made to adjust for the six comparisons, and $p' = 0.008$ was used as the criteria for significance.

4.3 EQUIPMENT TYPES AS THE UNITS OF CONSIDERATION

4.3.0 PREVALENCE OF EQUIPMENT TYPES

The prevalence of specific types of equipment was described. Equipment was classified according to the equipment types identified in the checklist which were either discrete single function equipment types, or components of a creative playstructure.

Prevalence data were reported in a number of ways. The number of sites with equipment types present, percentage of sites with equipment types present, the total number of units of equipment types encountered, and the mean number of equipment type units per site were all reported. Each type of prevalence was reported for community, school and all sites. Bar graphs were used to display prevalence in terms of percent of all sites with equipment types present. The frequency of CPS components in sites with CPS (rather than all sites) was portrayed to allow the visual comparison of CPS components in community and school sites.

4.3.1 EQUIPMENT-SPECIFIC COMPLIANCE SCORES

The design and maintenance compliance scores for specific equipment types were described. The classification of equipment was slightly different in the design and maintenance parts of the checklist, so no equipment - specific total score could be generated. (Design items were evaluated for component parts of CPSs and for types of access to freestanding slides, whereas these aspects were consolidated in the maintenance part of the checksheet).

Equipment-specific design and maintenance scores were obtained by combining equipment data from all sites Confidence intervals and coefficients of variation were presented with the scores. Bar graphs were used to display both design and maintenance scores for community sites, school sites and all sites.

4.3.2 MAGNITUDE OF NONCOMPLIANCE OF EQUIPMENT TYPES

The description of equipment-specific prevalence and compliance scores offers a great deal of information, but does not convey where the greatest burden or magnitude of noncompliance lies in terms of equipment types. The magnitude of noncompliance is a function of both the equipment-specific prevalence and level of noncompliance. For the purpose of this analysis, compliance is more appropriately presented in terms of noncompliance. This is calculated by the number of total hazards divided by total potential hazards and expressed in percent for each equipment type. Thus a noncompliance score reflects the proportion of all relevant items assessed that were not compliant with C.S.A. guidelines. It is equivalent to 100 minus the compliance score.

The equipment-specific magnitude of noncompliance was described visually in a graph. The x-axis represented scaled units of total potential hazards to reflect the study wide prevalence of specific types of equipment. The whole x-axis equalled the total potential hazards found in the entire study, and the base of each column reflected the proportion of total potential hazards contributed by each equipment type. The y-axis is the percent of noncompliance. Therefore, the area of each equipment-specific column describes the magnitude of noncompliance for that type of equipment. The areas were measured and ranked, and equipment types were displayed in order from the largest magnitude of noncompliance to the smallest.

4.3.3 EQUIPMENT-SPECIFIC MAXIMUM HEIGHTS AND SURFACE DEPTHS

Due to the high proportion of playground injuries that are due to falls from heights, the equipment-specific maximum heights and surface depths were described. Two types of surface depths were recorded and described; depths of the surfacing directly below equipment, and depths of the surfacing throughout the protective surface area. The means are presented in a table where equipment is listed in order from the highest maximum mean height to the lowest. All means are accompanied by confidence intervals and coefficients of variation.

4.4 INDIVIDUAL CRITERIA AS THE UNITS OF CONSIDERATION

To describe information regarding each individual item or criterion in the checklist, the consolidation feature in Microsoft Excel (72) was used to sum the contents of individual cells through multiple worksheets. Because data from all 49 sites were recorded on worksheets made from a single template, results for each criterion were located in identical cells on all worksheets. This made summing through identically located cells to obtain individual criterion totals possible. For example, the number of hazards and number of potential hazards pertaining to the first criterion on the checksheet (no accessible sharp edges or points on toddler swings) were located in cells B5 and C5 respectively. Summing through those cells for all sites would give study totals for total hazards and total potential hazards for that particular criterion. Compliance scores for each criterion were calculated in the usual way (total potential hazards minus total hazards divided by total potential hazards and expressed in percent).

Since equipment-specific scores for community and school sites appeared very similar, there was no rationale for conducting separate consolidations for community and school sites. Also, any comparison between individual checklist criteria would have been made very difficult to interpret due to the widely varying number of observations each criterion score was based on. For example, if a criterion was 60% met in community sites (based on 50 observations), and 90% met in school sites (based on 5 observations), would that represent a true difference, or only an apparent difference due to the small number of school observations? Thus, all data was consolidated for the criteria-specific analysis.

The consolidation function in Microsoft Excel (72) was not able to generate any descriptive statistics. Considering the enormous task of generating descriptive statistics on nearly 1000 criteria summed through 49 worksheets, it was not feasible to calculate confidence intervals and coefficients of variation for each of the criteria compliance scores. However, the total hazards and total potential hazards used to calculate the scores appear on the consolidation data sheets, so the number of observations on which the score is based is available. The criteria consolidation results are reproduced in full in Appendix 9.

Due to the high proportion of playground equipment injuries related to falls from heights, specific criteria that related to the prevention of injuries due to falls were selected. All protective surface and guardrail (or handrail) criteria were examined for each equipment type. Compliance scores for each of the criteria selected were presented along with the number of observations on which the score was based.

Protective surface criteria included the adequacy of protective surfacing type, the protective surfacing area on all sides of equipment, the adequacy of protective surfacing depth directly below equipment and throughout the protective surface area, and whether there were hard, sharp objects in the zone of use that a child could hit in a free fall (rather than the protective surface). The rates of compliance to these criteria were presented.

Guardrail and handrail criteria included the heights of upper and lower railings for preschool aged children (18 months - 4 years) and older children (5-14 years), and the minimum height of top guardrails at access points (or of panel or vertical style guardrails). Additionally, whether railings were contiguous with walking surfaces, all equipment over 450mm had appropriate guardrails, platforms over 1200mm had panel or vertical rail styles of guardrails and whether openings in guardrails for access were less than 380mm wide or had a top guardrail were selected. All compliance scores for the above guardrail criteria were presented, and the number of observations used to generate the scores were stated.

The compliance scores were similarly presented for criteria that addressed head or body part entrapment. Scores for the following criteria were reported; no opening > 76mm and < 254mm, stairs enclosed if the rise is between 76 and 254mm, and the perpendicular distance between rails or rails and the stepping surface must be <76 mm or > 254mm. Compliance scores for the above criteria were presented for each equipment type, and the number of observations represented by the score supplied.

Three sites in the sample reported installation or major renovation dates after 1990. The C.S.A. recommendations were published in 1990, so it can be expected that sites installed from 1991 on should respect the recommendations. Three sites were installed or renovated in 1990, but they were not included as the design plans would likely have been completed before the Guideline was available.

No meaningful comparisons with sites of older ages could be made on the basis of only three sites. However, the description of specific criteria that remain unmet on these very new sites may provide useful feedback to researchers and playground developers. The consolidation data is reproduce in full in Appendix 10 as a reference.

CHAPTER 5

RESULTS

5.0 OVERVIEW OF THE RESULTS

The presentation of the results follows the same order as the analysis outlined in Chapter 4. Results are summarized in tables where appropriate, with further explanation in the text. As charts are central to the description of the results, they are included in the body of the paper.

5.1 PRELIMINARY CONSIDERATIONS

5.1.0 RELIABILITY RESULTS

The results of the reliability analysis are presented in Table 1. The first re-check site displayed 85% agreement overall, while the second re-check site displayed 95% agreement. The agreement rate for specific equipment types ranged from 65% (site 1 re-check guardrails) to 97% (site 2 re-check child swings). Both guardrails and platforms had lower agreement rates than all other equipment types. In total, 328 criteria were re-checked which represents 2% of all design criteria assessed throughout the study.

Table 1.-- Results of Two Sites Re-checked for Reliability

	Site 1 Re-check			Site 2 Re-check		
Equipment	# Errors	# Items checked	% Agreement	# Errors	# Items checked	% Agreement
Toddler Swings	2	26	92%	2	26	92%
Child Swings	3	25	88%	1	24	97%
Slides	4	29	86%			
Climbers	1	20	95%			
Sandboxes	2	19	89%			
Merry-go-rounds				1	27	96%
Rung Ladders	3	19	84%	1	19	95%
Stepladders	2	23	91%			
Cargo nets	2	12	83%			
Platforms	5	19	74%			
Guardrails	8	23	65%			
General	2	21	90%			
TOTALS	34	232	85%	5	96	95%

Table 2 shows that single function equipment had a higher agreement rate than did creative playstructure equipment. This accounts for the difference in agreement rates between the two sites re-checked, as the first had both CPS and SF equipment, and the second had only SF equipment.

Table 2.-- Results of the Reliability of CPS and SF Equipment Types

	# Errors	# Checked	% Agreement
All CPS equipment	22	116	81%
All SF equipment	17	212	92%

Table 3 classifies the errors made into subjective judgement errors (such as do surfaces contain rough textures or joints capable of cutting or abrading), and measurement errors. More subjective errors were made overall.

Table 3.-- Description of the Types of Errors Made

	Subjective Judgement	Measurement
Re-check 1 Errors (n=34)	59% (20)	41% (14)
Re-check 2 Errors (n=5)	80% (4)	20% (1)
Overall (n=39)	62% (24)	38% !15)

Table 4 reports the impact the errors had on the scores. Errors impacted the scores of the two sites in opposite directions. The overall effect of the errors was to decrease design scores. However, when the difference was tested with McNemar's paired chi squared test, the difference was not significant (chi squared=1.64, 1 df, NS). This indicates that similar errors made throughout the study would be expected to have no overall effect on the scores.

Table 4.--Impact of the Errors on Design Scores

	Proportion of errors that increased design scores	Proportion of errors that decreased design scores
Re-check 1 Errors (n=34)	32% (n=11)	68% (n=23)
Re-check 2 Errors (n=5)	80% (n=4)	20%(n=1)
Overall (n=39)	38% (n=15)	62% (n=24)

5.1.1 ORDER BIAS RESULTS

Table 5 summarizes the results of the t-tests comparing compliance scores of the first 24 sites with the second 25 sites. No significant differences were found in design scores, maintenance scores or total scores using a corrected p value of 0.017 as the criteria for significance. No evidence of an order bias was found.

Variances were similar, and the data were normally distributed.

Table 5.-- Compliance Scores Compared Between the First 24 and Second 25 Sites

Groups Compared	Results of T-tests	VR
Design Scores: First 24 vs Second 25 Sites	t=1.33, df=47, NS	1.1
Maintenance Scores: First 24 vs Second 25 Sites	t=0.38, df=47, NS	1.6
Total Scores: First 24 vs Second 25 Sites	t=1.03, df=47, NS	1.0

5.1.2 DESIGN AND MAINTENANCE SCORES RELATIONSHIP RESULTS

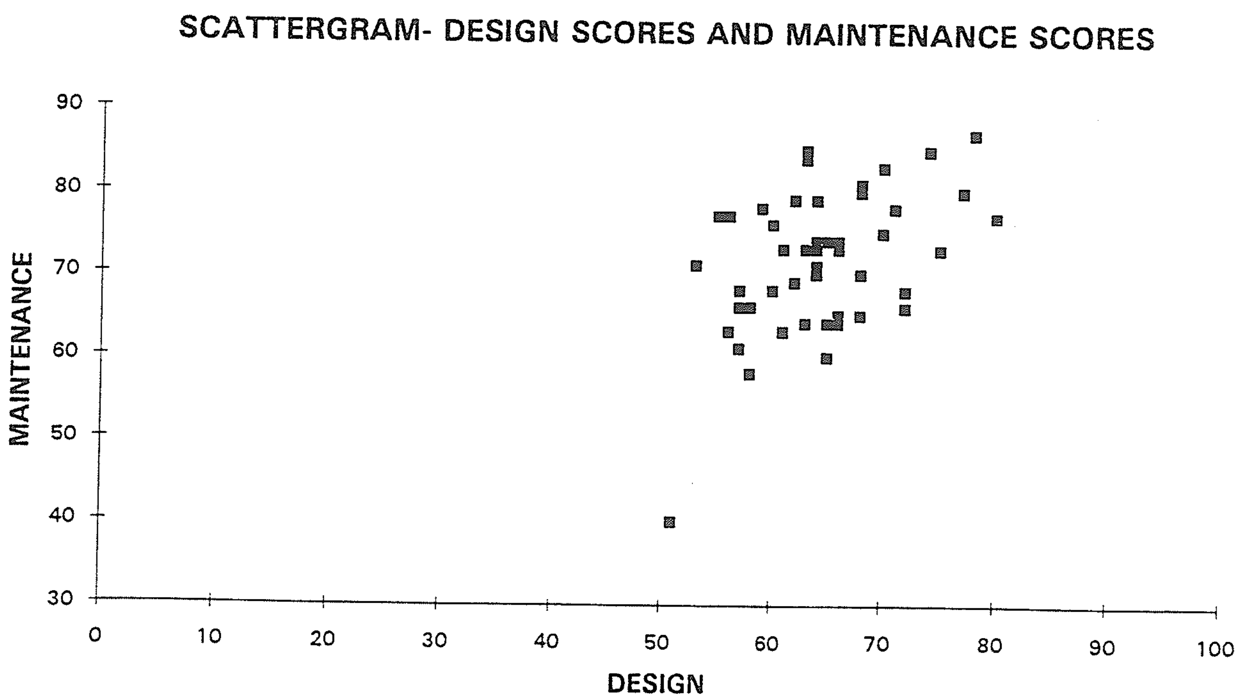
Table 6 shows the results of the tests done to analyze the relationship between design and maintenance scores. Maintenance scores were found to be significantly higher than design scores. Variances were similar, and the data normally distributed.

Additionally, design and maintenance scores were positively correlated, and a significant linear relationship was found. Chart 1 displays a scattergram showing the relationship between design and maintenance compliance scores.

Table 6.--The Relationship Between Design and Maintenance Scores

Testing Done	Results of Testing	VR
Paired T-test (one tailed): All Sites Maintenance Scores vs All Sites Design Scores	t=6.61, df=48, (p<0.001)	1.7
Correlation: All Sites Design Scores and All Sites Maintenance Scores	r=0.513, df=47, (p<0.001)	NA
Regression: All Sites Design Scores and All Sites Maintenance Scores	y=(28.54)+ (0.674)x F=16.8, df=1,47 (p<0.001) Variance explained by regression=26.32%	NA

Chart 1



5.2 SITES AS THE UNITS OF CONSIDERATION

5.2.0 ALL SITES

Table 7 summarizes the means, confidence intervals and coefficients of variation for the compliance scores and parameters of all sites. The coefficients of variation for all compliance scores and maximum heights are acceptable, but they are high for surface depths, size and age. This indicates that there is more variation around the means relative to the size of the means. Thus, the estimations of the true population means for these parameters are less precise.

Table.7.-- Compliance Scores and Parameters of All Sites

Compliance Scores and Parameters	Means and Confidence Intervals (95%)	CVs	Dist
All Sites Design Scores	64.7% (62.8%-66.6%)	10.4%	Norm
All Sites Maintenance Scores	72.2% (69.6%-74.8%)	12.2%	Norm
All Sites Total Scores	67.4% (65.5%-69.3%)	9.6%	Norm
All Sites Max Height	3157mm (2994mm-3320mm)	17.9%	2 Norm dist ?
All Sites Mean Surface Depth	31.6mm (26.6mm-36.6mm)	55.0%	Norm
All Sites Size (Total Potential Hazards)	582.8 (493.0-672.6)	53.4%	2 Norm dist ?
All Sites Mean Age	13.4 years (10.7 years-16.1 years)	68.7%	2 Norm dist ?

The data for compliance scores and surface depths displayed normal distributions, but maximum heights, size and age had a more complicated distribution. It appeared that the data were distributed around two peaks, possibly reflecting subgroups within the data set.

5.2.1 INNER CITY VS NOT INNER CITY SITES

Table 8 summarizes the means, confidence intervals, coefficients of variation, and patterns of distribution for the compliance scores of inner city and not inner city sites All coefficients of variation are acceptable, and the data are normally distributed.

Table.-- 8 Compliance Scores for Inner City and Not Inner City Sites

Compliance Scores	Means and Confidence Intervals (95%)	CVs	Dist
Inner City Design Scores	67.1% (63.5%-70.7%)	9.2%	Norm
Not Inner City Design Scores	63.8% (61.5%-66.1%)	10.6%	Norm
Inner City Maintenance Scores	73.8% (69.8%-77.8%)	9.3%	Norm
Not Inner City Maintenance Scores	71.5% (68.2%-74.8%)	13.3%	Norm
Inner City Total Scores	69.1% (65.8%-72.4%)	8.7%	Norm
Not Inner City Total Scores	66.7% (64.3%-69.1%)	10.0%	Norm

Table 9 presents the results of t-testing the compliance scores of inner city vs not inner city sites. No significant differences were found using a corrected p value of 0.017 to allow for the 3 comparisons made. Variance ratios were all less than 2.

Table 9.-- Compliance Scores Compared Between Inner City and Not Inner City Sites

Groups Compared	Results of T-tests	VR
Design Scores: Inner City Sites vs Not Inner City Sites	t=1.58, df=47, NS	1.2
Maintenance Scores: Inner City Sites vs Not Inner City Sites	t=0.81, df=47, NS	1.9
Total Scores: Inner City Sites vs Not Inner City Sites	t=1.15, df=47, NS	1.2

5.2.2 COMMUNITY VS SCHOOL SITES

The proportions of community and school playgrounds in the study sample were compared with the proportions of community and school sites in the population. However, the sampling frame for community sites appeared to overestimate the population, and an adjustment was necessary.

In the sample, 6 sites obtained from the community sampling frame were rejected from the study. Three sites were rejected because they had no playground equipment on site, and three were rejected because they were actually school sites and appeared in both the community and school sampling frames. This confusion occurred because in some areas of the city, Parks and Recreation is responsible for some or all of school playground maintenance.

To obtain a more accurate estimate of the true community population, the rejection rate from the sample was calculated and applied to the sampling frame. The rejection rate was 6 out of 39 sites which is 0.154. Using this rate, the true community population was estimated as follows: 484 - (0.154)(484) = 409. No school sites were rejected in the study so the school sampling frame was not corrected.

Table 10 presents the ratio of community to school sites in the unedited sampling frame, the corrected sampling frame, and in the sample. Actual numbers are included in parenthesis. The unedited ratio of community to school sites is 2.8:1, which is likely overestimated. The corrected population ratio of 2.4 community sites to 1 school site is reasonably similar to the sample ratio of 2.1 to 1. For the remainder of the analysis, the sample is assumed to reasonably reflect the population community to school ratio.

Table 10.-- Ratio of Community and School Playgrounds in the Population and the Sample

	Community Sites	School sites
Sampling Frame (unedited)	2.8 (n=484)	1(n=172)
Sampling Frame (corrected)	2.4 (n=409)	1(n=172)
Sample	2.1 (n=33)	1(n=16)

Table 11 summarizes the means, confidence limits, coefficients of variation and distributions for community and school site data.

Table 11.--Compliance Scores and Parameters of Community and School Sites

Compliance Scores and Parameters	Means and Confidence Intervals (95%)	CVs	Dist
Community Design Scores	64.4% (62.2%-66.6%)	9.6%	Norm
School Design Scores	65.4% (61.2%-69.6%)	12.0%	Norm
Community Maintenance Scores	73.9% (71.4%-76.4%)	9.5%	Norm
School Maintenance Scores	68.5% (62.6%-74.4%)	16.2%	Norm
Community Total Scores	67.9% (66.0%-69.8%)	8.0%	Norm
School Total Scores	66.4% (61.9%-70.9%)	12.7%	Norm
Community Max Height	3007mm (2815mm-3199mm)	17.9%	Norm
School Max Height	3466mm (3203mm-3729mm)	14.3%	Norm
Community Mean Surface Depth	30.8mm (24.2mm-37.4mm)	59.8%	Norm
School Mean Surface Depth	33.1mm (24.9mm-41.3mm)	46.5%	Norm
Community Size (Total Potential Hazards)	509.6 (416.3-602.9)	51.5%	2 Norm dist
School Size (Total Potential Hazards)	733.8 (544.5-923.1)	48.4%	Norm
Community Mean Age	16.0 years (12.5 years-19.5 years)	61.2%	2 Norm dist
School Mean Age	8.1 years (5.5 years-10.7 years)	57.0%	Norm

Coefficients of variation are high for community and school surface depths, site size and age as was found previously for all sites. Again, the population estimates for these parameters are less precise. Normal distributions were found in all but two histograms. Community size and community age data appeared distributed around two peaks, indicating that subgroups within these groups may vary around different means.

Table 12 presents the results of testing the compliance scores and parameters of community and school sites.

Table 12.-- Compliance Scores and Parameters Compared Between Community and School Sites

Groups Compared	Results of Testing	VR 1	VR 2
Design Scores: Community vs School Sites	t=0.48, df=47, NS	1.6	NA
Maintenance Scores: Community vs School Sites	t=2.09, df=47, NS	2.5	1.4
Total Scores: Community vs School Sites	t=0.76, df=47, NS	2.4	1.7
Max Site Heights: Community vs School Sites	t=2.87, df =47, p=0.006	1.2	NA
Surface Depths: Community vs School Sites	t=0.42, df=47, NS	1.4	NA
Size (Total Potential Hazards): Community vs School Sites	t=2.49, df=47, NS	1.8	NA
Age: Community vs School Sites	t=3.08, df=47, p=0.003	4.6 df= 15,32 p<0.05	NA
Age: Community vs School Sites (Mann-Whitney U Test)	U=126,n=33, m=17, NS	NA	NA

Note: VR 1 and VR 2 are the variance ratios calculated with all the data, and with atypical site(s) removed respectively.

Variance ratios for three comparisons were greater than 2. Variance ratios for both maintenance and total score comparisons were explained by a single atypical site with a maintenance score of 40. Referring back to Chart 1, the atypical site is seen well below the cluster of scores with a low design score, and extremely low maintenance score. When this site was removed from the data sets, and variances recalculated, the variance ratios for maintenance and total scores fell below 2. It can therefore be assumed that maintenance and total score data sets have similar enough variances to permit t-testing.

The variance ratio for the age comparison was also high which was explained by less variability in school ages than community ages. F-testing of the variance ratio found it to be significant, thus violating the assumptions of t-testing. The nonparametric Mann-Whitney U test was done to replace t-testing for this comparison.

School maximum site heights were found to be significantly higher than community sites (p'=0.007), and the rest of the comparisons detected no significant differences. Of note is that the age comparison which yielded significant results with t-testing, did not with nonparametric testing.

5.2.3 SINGLE FUNCTION VS CREATIVE PLAYSTRUCTURE SITES

Table 13 describes the prevalence of community and school sites further categorized into single function and creative playstructure site types. Of note, is that all 16 school sites in the study were creative playstructure site types. Therefore, only three distinct site types emerged for description and comparison; single function community sites, creative playstructure community sites and creative playstructure school sites. Community sites were nearly evenly divided between SF and CPS types, and the three site types represented similar proportions of the sample.

Table 13.-- Prevalence of Site Types

	Single Function(SF)	With Creative Playstructure (CPS)	All Site types
Community	37% (18)	31% (15)	67% (33)
School	0% (0)	32% (16)	33% (16)
All Sites	37% (18)	63% (31)	100% (49)

It should be noted that while SF site types do not contain CPS equipment, most CPS sites additionally contain some SF equipment. Insufficient numbers of CPS only sites existed to warrant a separate category. Only 5 (16%) CPS sites had exclusively CPS equipment (4 schools and 1 community site). Thus the majority of CPS sites (84%) actually contained combinations of CPS and SF equipment. However, SF equipment contributes a relatively small proportion of a CPS site's total potential hazards, so even the combination sites are predominantly representing CPS equipment.

Chart 2 illustrates the relative proportions of SF, CPS-Comm, and CPS-School sites in the sample. Since it was previously established that the ratio of community to school sites in the sample reflects the population ratio, the proportions of site types shown can be expected to reflect the proportion in the population.

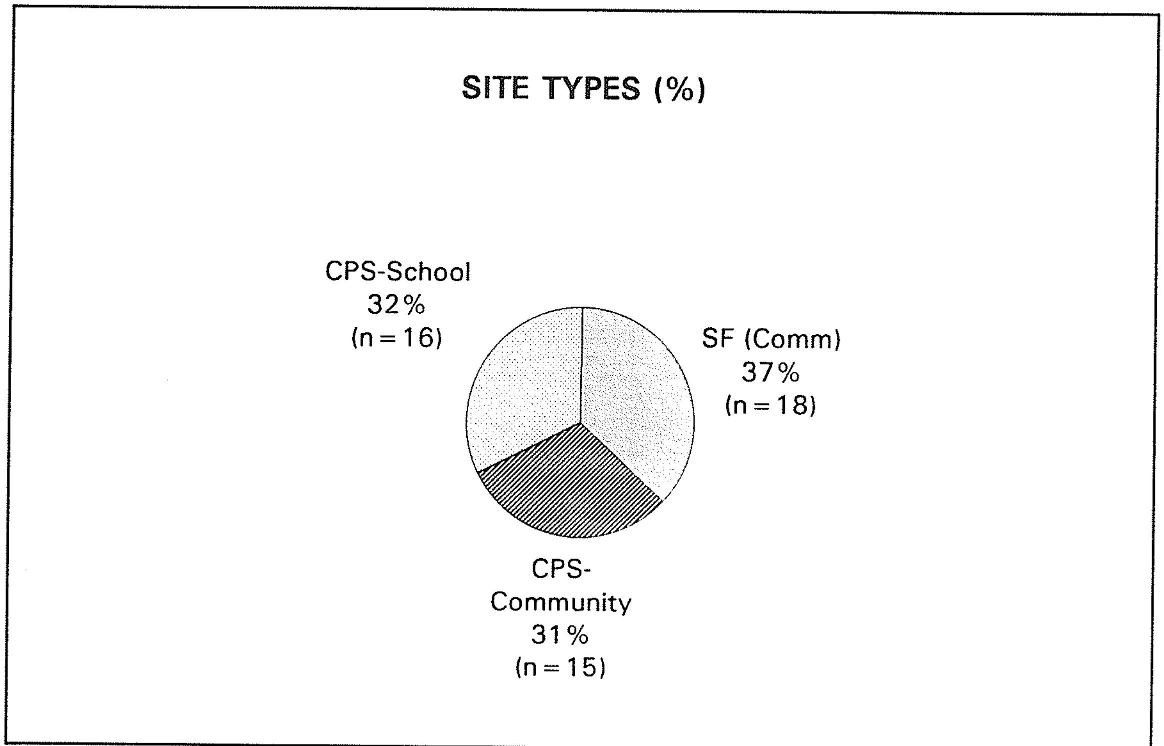


Chart 2

Table 14 summarizes the means, confidence limits, coefficients of variation and distributions for site type compliance scores and parameters. All groups displayed a normal distribution except CPS-Comm age data where no pattern was discernable.

Table 14.--Compliance Scores and Parameters of Single Function and Creative Playstructure Site Types

Compliance Scores and Parameters	Means and Confidence Intervals (95%)	CVs	Dist
SF Design Scores	61.7% (59.2%-64.2%	8.2%	Norm
CPS-Comm Design Scores	67.7% (64.4%-71.0%	8.9%	Norm
CPS-School Design Scores	65.4% (61.2%-69.6%)	12.0%	Norm
SF Maintenance Scores	72.0% (69.0%-75.0%)	8.5%	Norm
CPS-Comm Maintenance Scores	76.3% (72.1%-80.5%)	9.9%	Norm
CPS-School Maintenance Scores	68.5% (62.6%-74.4%)	16.2%	Norm
SF Total Scores	65.8% (64.0%-67.6%)	5.6%	Norm
CPS-Comm Total Scores	70.4% (67.0%-73.8%)	8.8%	Norm
CPS-School Total Scores	66.4% (61.9%-70.9%)	12.7%	Norm
SF Max Site Heights	2814mm (2572mm-3056mm)	17.3%	Norm
CPS-Comm Max Site Heights	3238mm (2948mm-3528mm)	16.1%	Norm
CPS-School Max Site Heights	3466mm (3203mm-3729mm)	14.3%	Norm
SF Mean Surface Depths	28.6mm (18.1mm-39.1mm)	73.8%	Norm
CPS-Comm Mean Surface Depths	33.5mm (25.2mm-41.8mm)	44.4%	Norm
CPS-School Mean Surface Depths	33.1mm (24.9mm-41.3mm)	46.5%	Norm
SF Size (Total Potential Hazards)	330.7 (287.7-373.7)	26.1%	Norm
CPS-Comm Size (Total Potential Hazards)	724.2 (590.8-857.6)	33.3%	Norm

Table 14 -Continued

Compliance Scores and Parameters	Means and Confidence Intervals (95%)	CVs	Dist
CPS-School Size (Total Potential Hazards)	733.8 (544.5-923.1)	48.4%	Norm
SF Mean Age	21.2 years (17.2 years-25.2 years)	37.6%	Norm
CPS-Comm Mean Age	9.8 years (5.3 years-14.3 years)	83.1%	?
CPS-School Mean Age	8.1 years (5.6 years-10.6 years)	57.0%	Norm

Coefficients of variation are again acceptable for compliance scores and maximum site heights, but high for surface depths, size and age. Community size, however, showed a decrease from the previous coefficient of variation when subdivided into site types. Mean size for these subgroups can be estimated more precisely than can size for all community sites. The coefficient of variation for CPS-Comm mean age was excessively high. The data showed marked variability which agrees with the lack of a recognizable distribution previously noted.

Table 15 presents the results of ANOVA testing of the above compliance scores and parameters of the three site types. Variance ratios in five comparisons were greater than 2. Two of these (design scores and maintenance scores) reduced their variance ratios below 2 when the same atypical site was removed as in 5.2.2. However, the variance ratios for total scores and ages reflected true differences in their variances and attained significance on F-testing. (Age also lacked a normal distribution.)

Table 15.--Compliance Scores and Parameters Compared Between Single Function and Creative Playstructure Site Types

Groups Compared	Results of ANOVA	VR 1	VR 2
Design Scores: SF vs CPS-Comm vs CPS-School	F=3.77, df=2,46 NS	2.5	1.9
Maintenance Scores: SF vs CPS-Comm vs CPS-School	F=3.29, df=2,46 NS	3.3	1.9
Total Scores: SF vs CPS-Comm vs CPS-School	F=2.50, df=2,46 NS	5.2 df= 15,17 $p<0.05$	NA
Max Site Heights: SF vs CPS-Comm vs CPS-School	F=7.47, df =2,46 p=0.0016	1.2	NA
Surface Depths: SF vs CPS-Comm vs CPS-School	F=0.41, df=2,46 NS	2.0 (NS)	NA
Size (Total Potential Hazards): SF vs CPS-Comm vs CPS-School	F=14.68, df=2.46 $p<0.001$	17.0	7.8 df= 17,14 $p<0.05$
Age: SF vs CPS-Comm vs CPS-School	F=17.29, df=2.46 $p<0.001$	3.1 df= 13,14 p=0.02	NA

The variance ratio for size was excessively high due to one atypical site. One school site was a shared site between two schools, and was twice the size of most other school sites. When this site was removed from the data set, and variance ratios recalculated, a high variance ratio still remained, as single function sites are much less variable in size than CPS sites. On F-testing, significance was attained and nonparametric testing required.

In summary, total scores, size and age required nonparametric testing. The results of Kruskal-Wallis testing (the nonparametric equivalent of ANOVA) are reported in table 16. No difference was found in the comparison of total scores, but significant differences were detected in the size and age comparisons. Of note, is that the test results derived from the nonparametric testing are the same as the test results from the parametric testing.

Table 16.-- Results of Kruskal-Wallis Testing

Comparison	Results of Kruskal-Wallis testing
Total Scores: SF vs CPS-Comm vs CPS-School	$H=3.82$, $df=2$, NS
Size (Total Potential Hazards): SF vs CPS-Comm vs CPS-School	$H=25.71$, $df=2$, $p<0.001$
Age: SF vs CPS-Comm vs CPS-School	$H=21.69$, $df=2$, $p<0.001$

Of the significant results obtained, further testing was required to locate specific differences. Table 17 presents the results of Tukey's Multiple Comparison testing done in follow up of all significant results obtained during ANOVA. Two of the results presented involve means which required nonparametric testing, but due to the unavailability of nonparametric multiple comparison tests, Tukey's testing was done for further insight into the differences.

Table 17.--Results of Tukey's Multiple Comparison Testing for all Significant Site Type Comparisons

Comparisons Attaining Significance	Results of Tukey's Testing (p<0.05)
Max Site Heights: SF vs CPS-Comm vs CPS-School	SF CPS-Comm CPS-School 2814 3238 3466
Size (Total Potential Hazards): SF vs CPS-Comm vs CPS-School	SF CPS-Comm CPS-School 330.8 724.2 733.8
Age: SF vs CPS-Comm vs CPS-School	CPS-School CPS-Comm SF 7.9 9.8 21.2

Since the groups varied slightly in number, Tukey's testing was carried out using the harmonic means of the two group sizes for each of the multiple comparisons done. This resulted in a slightly different Tukey's value for each of the comparisons. For maximum site heights, CPS-School sites were significantly higher than SF sites, and no different was found between CPS-Comm and CPS-School sites. The difference between SF and CPS-Comm sites was close to attaining significance, as the calculated Tukey's value was 425 and the actual difference between the means was 424.

As mentioned, the results of Tukey's testing for size and age cannot be taken as conclusive, because parametric testing was found to be invalid for these data sets. However, clear differences between the means are apparent, and likely interpretations regarding the differences may be made intuitively. Both types of CPS sites were larger than SF sites, but not different in size from each other. Similarly, both types of CPS sites were newer than SF sites, but not different in age from each other.

5.2.4 NEWEST VS OLDER VS OLDEST SITES

While all other data were obtained by observations made on playground sites, age data were obtained from the parties responsible for the playgrounds seen. Obtaining accurate age information was difficult, and a preliminary report of the accuracy of age data is required.

Age data quality were categorized as good (when a specific year was known, usually from written records), poor (age was given as a range, usually from memory rather than written records or site equipment was of widely varying ages) and no data (when no written or recalled information was available). Community sites had more difficulty supplying written records, as there have been a series of district reorganizations, and installation records have not commonly been transferred. Table 18 shows the quality of community and school age data.

Table 18.-- Quality of Age Data for Community and School Sites

	Good Data	Poor Data	No Data
Community (n=33)	46% (15)	33% (11)	21% (7)
School (n=16)	81% (13)	19% (3)	0% (0)
All Sites(n=49)	57% (28)	29% (14)	14%(7)

For the 7 sites with no available age data, estimated ages were used in the analysis. To assess how accurate the estimations are likely to be, a comparison was made between the age estimate made during the data collection and the age data supplied for the 42 sites for which data was available. For community sites, 18 out of 26 sites were categorized correctly, and for school sites, 12 out of 16 were categorized correctly. Overall, 30 of the 42 sites with known ages had been estimated correctly during data collection (75%). This is the level of accuracy predicted for the 7 estimated ages used.

A further confounder with site age data, is that very commonly, sites are renovated and new equipment added. The equipment on many sites does not have a uniform age. To assess the magnitude of this problem, the proportion of sites renovated was examined. The proportions are presented in table 19.

Table 19.-- Proportions of Sites Renovated

	Proportion of Sites Renovated
Community (n=33)	42.4% (n=14)
School (n=16)	50.0% (n=8)
All Sites(n=49)	44.9% (n=22)

Overall, nearly half of all sites in the sample had reported a renovation. Effort was made to maximize the age accuracy by using whichever date (installation or renovation) reflected the age of the majority of equipment.

When the amounts of newer and older equipment were equivalent, the mean of the two ages was used as the reference age.

The proportion of school and community sites within each age category is illustrated in chart 3.

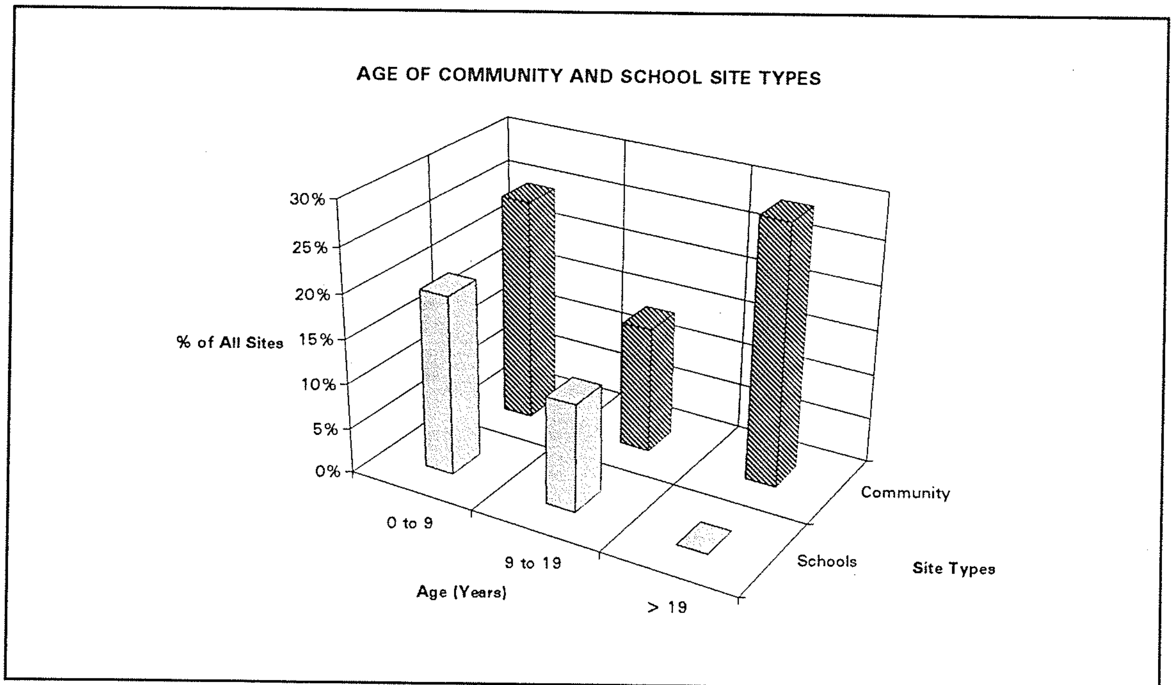


Chart 3

Chart 4 presents the proportion of school and community sites within each age category further divided into site types. Both charts present proportions in % of all sites, so that the column heights are comparable throughout. Note that while one SF site appeared in the 0-9 age category, it was an atypical site. At the time of data collection, only a freestanding slide was present, as all other older equipment had been removed. Subsequent to the study, further creative playstructure equipment was installed.

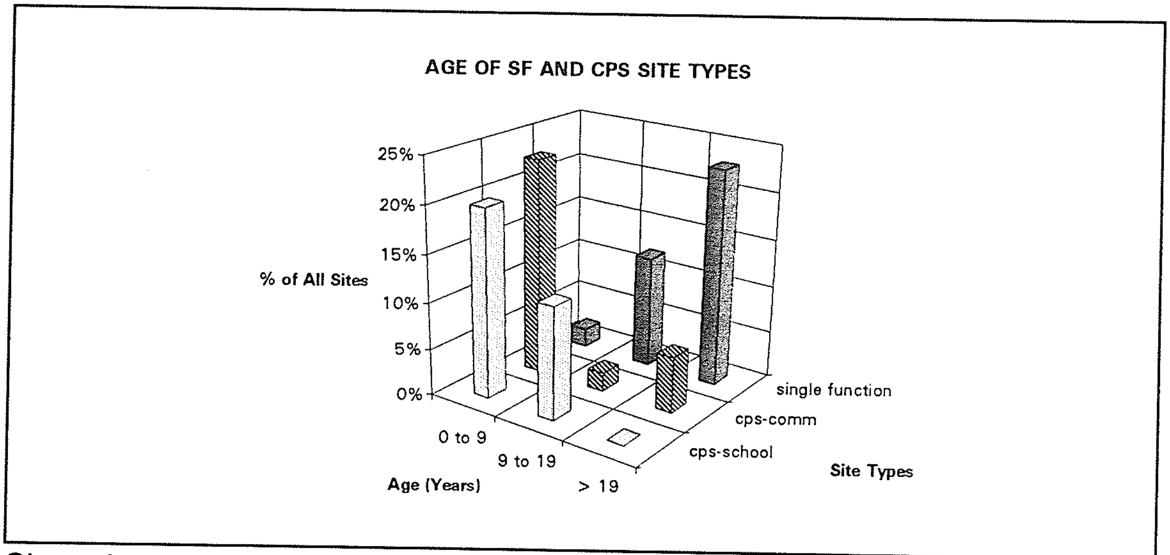


Chart 4

One time trend is particularly striking. There is a clear trend away from traditional single function equipment sites, and towards creative playstructure equipment sites.

Table 20 summarizes the means, confidence limits, coefficients of variation and distributions of all compliance scores and parameters for the three age categories. Coefficients of variation are again high for the parameters of surface depth and size. All others acceptable. All data sets appeared normally distributed except oldest design scores, and midage maximum site heights. Given that nearly all comparison groups have been normally distributed, this is not sufficient reason to abandon ANOVA.

Table 20.--Compliance Scores and Parameters According to Age

Scores and Parameters	Means (95% Conf. Int.)	CVs	Dist
Newest Design Scores (0-9)	68.6% (65.7%-71.5%)	9.6%	Norm
Midage Design Scores (10-19)	61.5% (58.5%-64.5%)	8.1%	Norm
Oldest Design Scores (>19)	61.6% (58.6%-64.6%)	8.5%	?
Newest Maintenance Scores(0-9)	74.7% 71.4%-78.0%	10.0%	Norm
Midage Maintenance Scores(10-19)	69.0% (61.7%-76.3%)	17.5%	Norm
Oldest Maintenance Scores(>19)	71.2% (67.4%-75.0%)	9.1%	Norm
Newest Total Scores (0-9)	70.5% (67.5%-73.5%)	9.5%	Norm
Midage Total Scores (10-19)	64.4% (60.4%-68.4%)	10.2%	Norm
Oldest Total Scores (>19)	65.3% (63.2%-67.4%)	5.7%	Norm
Newest Max Site Heights (0-9)	3265.5mm (2961.1mm-3773.5mm)	14.2%	Norm
Midage Max Site Heights (10-19)	3367.3mm (2961.1mm-3773.5mm)	20.0%	?
Oldest Max Site Heights (>19)	2790mm (2531.7mm-3048.3mm)	16.0%	Norm
Newest Mean Surface Depths(0-9)	34.1mm (27.4mm-40.8mm)	43.9%	Norm
Midage Mean Surface Depths (10-19)	30.6mm (19.3mm-41.9mm)	61.1%	Norm
Oldest Mean Surface Depths(>19)	28.4mm (16.8mm-40.0mm)	70.8%	Norm
Newest Size (Total Potential Hazards) (0-9)	748.4 (587.1-903.7)	45.5%	Norm
Midage Size (Total Potential Hazards) (10-19)	491.2 (385.3-597.1)	35.7%	Norm
Oldest Size (TotalPotential Hazards) (>19)	1407.6 (299.3-515.9)	46.0%	Norm

Table 21 presents the results of ANOVA testing of the compliance scores and parameters listed in table 19. Variance ratios were over 2 in the maintenance scores, total scores, site heights and size comparisons. The first two are due to the same aberrant site encountered previously, and variance ratios fell below 2 when the site was removed. The variance ratio for site heights was not significant on F-testing. The variance ratio for size was explained by two atypical sites also previously mentioned. One was a very large school site shared between two schools, and the other consisted of a single slide due to awaiting completion of a renovation. With those sites removed, the variance ratio decreased to 2.1 which was not significant. A corrected p value of p' = 0.008 was employed.

Table 21.--Compliance Scores and Parameters Compared Between Age Categories

Groups Compared	Results of ANOVA	VR 1	VR 2
Design Scores: (0-9) vs (10-19) vs (>19) Years	F=8.82, df=2,46 p=0.0006	1.8	NA
Maintenance Scores: (0-9) vs (10-19) vs (>19) Years	F=1.92 df=2,46 NS	3.4	1.8
Total Scores: (0-9) vs (10-19) vs (>19) Years	F=5.52 df=2,46 p=0.007	3.2	1.5
Max Site Heights: (0-9) vs (10-19) vs (>19) Years	F=4.99 df=2,46 NS	2.3 df 12,13 NS	NA
Surface Depths:(0-9) vs (10-19) vs (>19) Years	F=0.48 df=2,46 NS	1.8	NA
Size (Total Potential Hazards): (0-9) vs (10-19) vs (>19) Years	F=7.50 df=2,46 to p=0.0015	4.2	2.1 df 19,12 NS

The comparisons between design scores, total scores and size detected significant differences. Tukey's Multiple Comparison testing was required to further elucidate the differences. Again, the harmonic means of each two groups compared was used for the groups sizes in the calculations. Since assumptions inherent in ANOVA were met, the results of Tukey's testing can be accepted. Table 22 reports the results of Tukey's testing.

Table 22.-- Results of Tukey's Multiple Comparison Testing of All Significant Results in Table 21

Comparisons Attaining Significance	Results of Tukey's Testing ($p<0.05$)		
Design Scores: (0-9) vs (10-19) vs (>19) Years	(10-19) 61.46	(>19) 61.64	(0-9) 68.59
Total Scores: (0-9) vs (10-19) vs (>19) Years	(10-19) 64.39	(>19) 65.29	(0-9) 70.50
Size (Total Potential Hazards): (0-9) vs (10-19) vs (>19) Years	(10-19) 407.64	(>19) 491.23	(0-9) 748.41

All three significant results reflected a difference between the newest sites (0-9) and all other sites. To summarize, newer sites have higher design scores and total scores, and are larger than all older sites. Of note is that the difference in total scores was due to the design component of the score, as maintenance scores were not significantly different. The difference seen in total scores simply repeats the findings of the design score comparison. Thus, the two relevant statements resulting from this analysis are that newer sites are more compliant to C.S.A recommendations in design, and they are larger.

5.2.5 SUMMARY OF THE RESULTS WHEN SITES ARE THE UNITS OF CONSIDERATION

Table 23 reiterates the results of all the comparisons made on the basis of site characteristics.

Table 23--Summary of the Results of Comparisons Made on the Basis of Site Characteristics

Parameters	School vs Community	Site Types	Age
Compliance scores	no diff	no diff	0-9 yr sites better design scores than all others
Max site heights	school higher than community	CPS-Schools higher than SF	No diff
Surface depths	no diff	no diff	no diff
Size	no diff	all CPS larger than SF	0-9 yr larger than all others
Age	no diff	SF older than all CPS	NA

5.3 EQUIPMENT TYPES AS THE UNITS OF CONSIDERATION

5.3.0 PREVALENCE OF EQUIPMENT TYPES

Table 24 reports four types of information regarding the prevalence of specific types of equipment. The number of sites and the percentage of sites with given equipment types present are described. The total number of equipment units per site calculated (using the number of sites with the equipment type present as the denominator).

Table 24.-- Prevalence of Specific Equipment Types

Equipment Type	Number of Sites with Equipment Type Present			% of Sites with Equipment Type Present			Total Number of Equipment Units			Mean Number of Equipment Units per Site		
	C	S	T	C	S	T	C	S	T	C	S	T
Toddler Swings	24	1	25	73	6	50	25	1	26	0.76	0.06	1.04
Child Swings	29	5	34	88	29	68	35	5	40	1.06	0.29	1.18
Multi-axis Swings	3	1	4	9	6	8	3	3	6	0.09	0.18	1.5
Other Swings	1	7	8	3	41	16	1	9	10	0.03	0.53	1.25
FS Slides	19	3	22	58	18	44	21	4	25	0.64	0.24	1.14
Slides in CPS	15	17	32	45	100	64	26	31	57	0.79	1.82	1.78
Sliding Poles	11	13	24	33	76	48	13	19	32	0.39	1.12	1.33
SA-Str. Stairs	1	0	1	3	0	2	2	0	2	0.06	0	2.0
SA- Spr. Stairs	0	0	0	0	0	0	0	0	0	0	0	0
SA-Ramps	0	0	0	0	0	0	0	0	0	0	0	0
SA- Rung Ladders	0	0	0	0	0	0	0	0	0	0	0	0
SA- Stepladders	17	2	19	52	12	38	18	3	21	0.55	0.18	1.11
SA-Cargo Nets	0	0	0	0	0	0	0	0	0	0	0	0
SA- Climbers	1	1	2	3	6	4	1	1	2	0.03	0.06	1
Rocking Equipment	11	1	12	33	6	24	25	1	26	0.76	0.06	2.17
Teeter Totters	5	1	6	15	6	12	6	1	7	0.18	0.06	1.17
Climbers	27	17	44	82	100	88	67	78	145	2.03	4.59	3.3
Merry-go-rounds	1	0	1	3	0	2	1	0	1	0.03	0	1.00
Sandboxes	26	6	32	79	35	64	26	6	32	0.79	0.35	1.00
CPS	15	17	32	45	100	64	19	24	43	0.58	1.14	1.34
CPS- Str. Stairs	4	5	9	12	29	18	6	8	14	0.18	0.47	1.56
CPS- Spr. Stairs	0	0	0	0	0	0	0	0	0	0	0	0
CPS-Ramps	10	10	20	30	59	40	13	20	33	0.39	1.18	1.65
CPS- Rung Ladders	12	12	24	36	71	48	25	28	53	0.76	1.65	2.21
CPS-Stepladders	6	5	11	18	29	22	14	12	26	0.42	0.71	2.36
CPS-Cargo Nets	9	15	24	27	88	48	12	37	49	0.36	2.18	2.04
Platforms	18	17	35	55	100	70	80	124	203	2.39	7.29	5.8
Guardrails	20	17	37	61	100	74	69	108	177	2.09	6.35	4.7

A series of bar charts were generated to illustrate the relative prevalence of various equipment types. Chart 5 shows the prevalence of equipment types for community, school and all sites. Equipment is ranked in order of most common to least common for all sites. All types of slides, all swings, and all CPS components were consolidated for this illustration. Subtypes of these equipment types will be described in further detail.

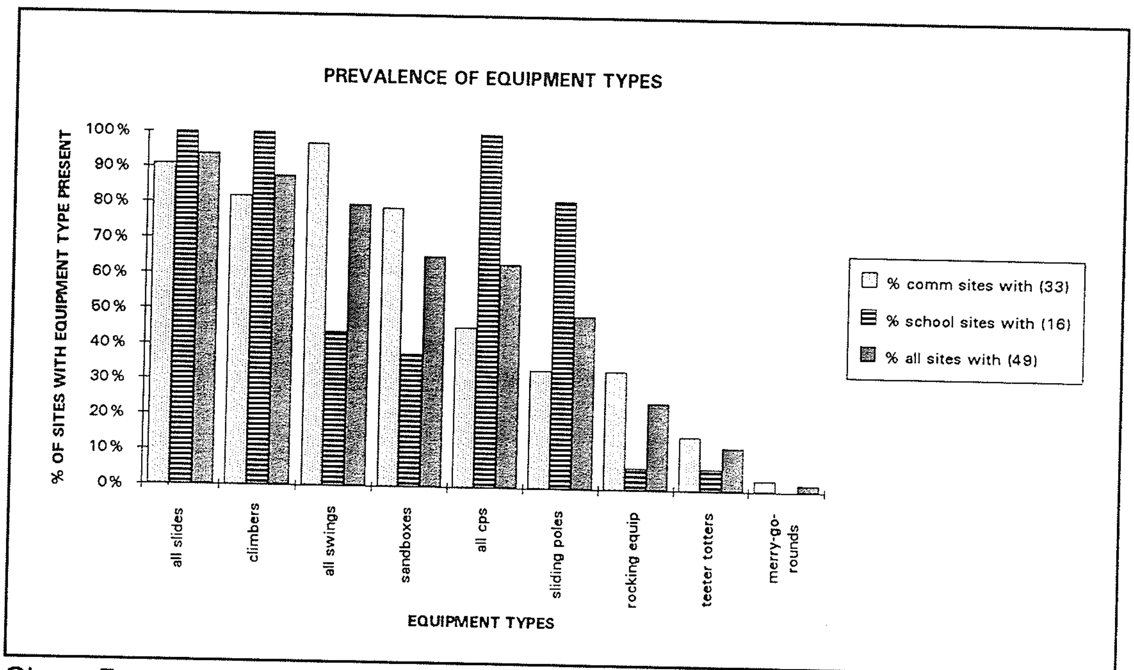


Chart 5

Some similarities and differences between community and school equipment prevalence can be observed. Slides and climbers are very common in both community and school sites. Swings and sandboxes are more common in community sites, while creative playstructures are considerably more common in school sites. Sliding poles are also more common in school sites, as they occur in creative playstructures. Rocking equipment, teeter totters and merry-go-rounds are more common in community than school sites, but are quite uncommon overall compared to other equipment types.

Chart 6 shows the prevalence of slide subtypes. While most community sites have slides (see Chart 5), slide type is divided nearly evenly between freestanding slides, and slides in playstructures, the latter being slightly more common. In contrast, school sites had a very small proportion of freestanding slides compared to slides in playstructures, as 100% of school sites had playstructures, and all playstructures had slides.

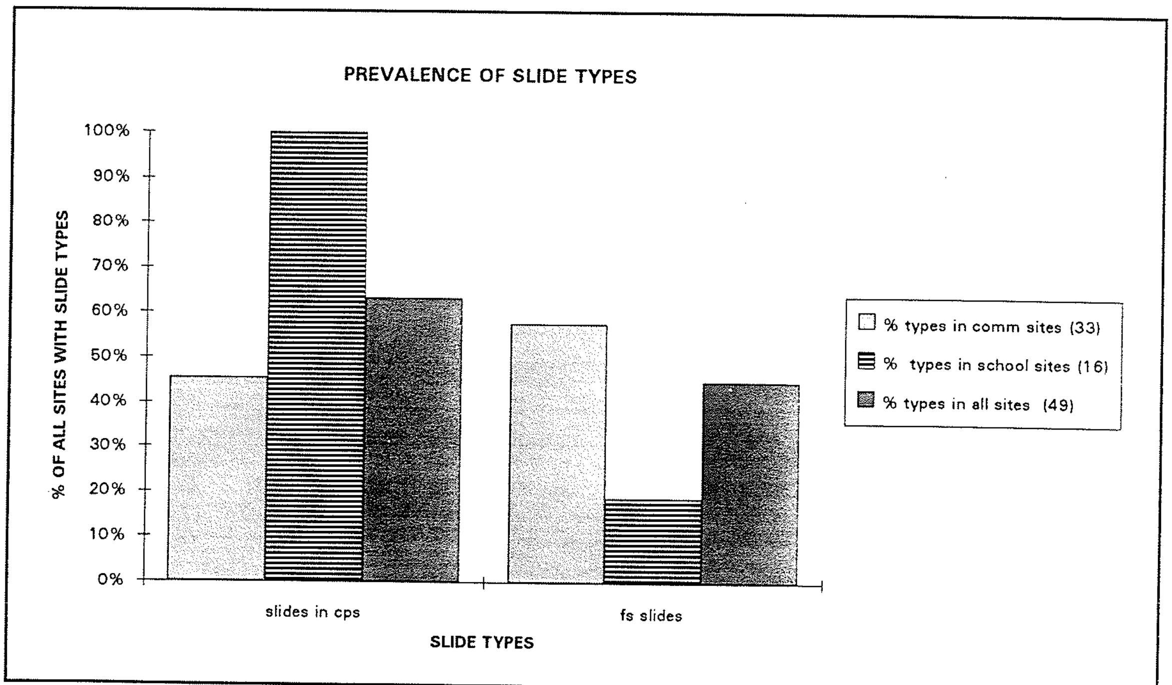


Chart 6

Chart 7 displays the prevalence of types of access to freestanding slides. Nearly all access to freestanding slides was by stepladder equipment. Rarely, straight stairs or climbers provided access.

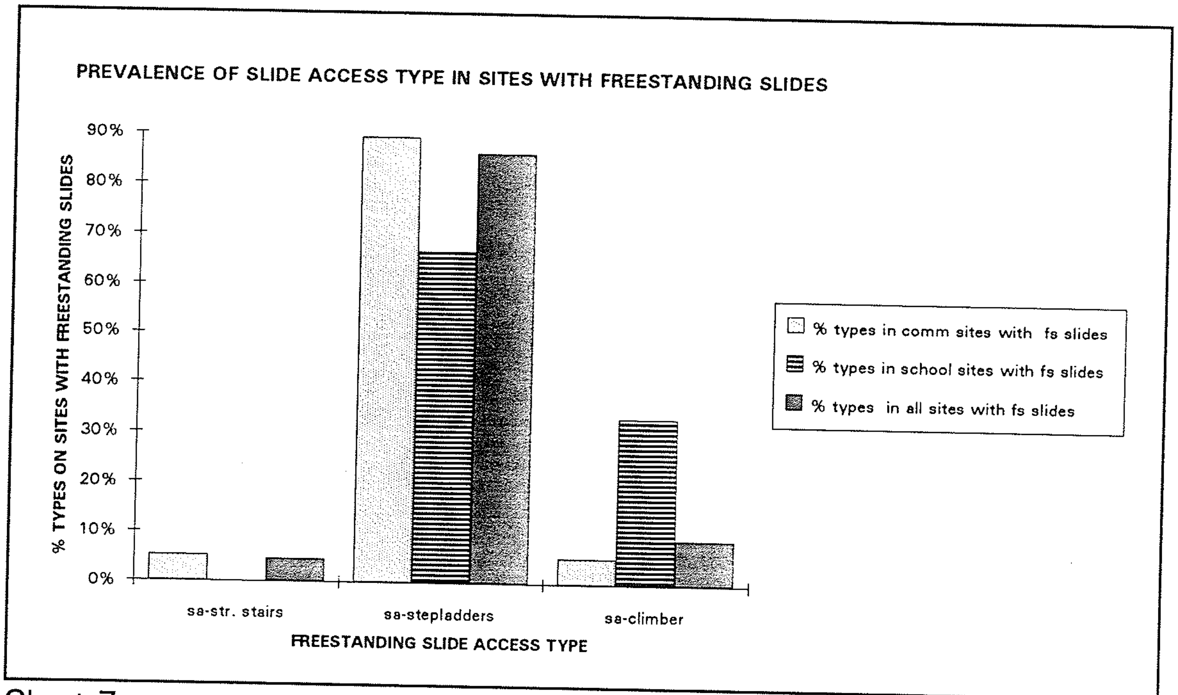


Chart 7

Chart 8 shows the prevalence of the four different types of swinging equipment on community, school and all sites, from the most common to least common on all sites. Child and toddler swings are more common on community sites than school sites. Other swings, although less common overall, were more common on school than community sites. "Other swings" did not describe a uniform type of equipment, but included any type of swinging equipment not described by the other three types. Most commonly, other swinging equipment referred to a series of rings on chains in creative playstructures that allowed a progressive swinging activity. Multiple axis swings were uncommon on all site types.

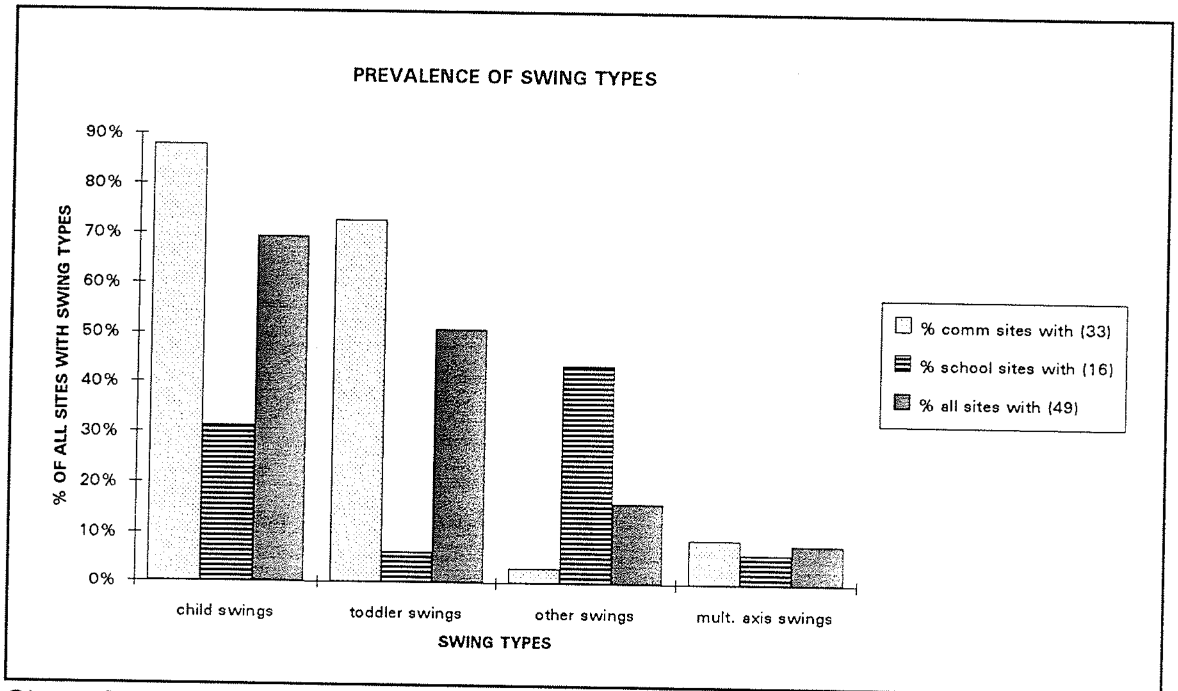


Chart 8

Chart 9 shows the prevalence of components of creative playstructure equipment in all sites with creative playstructures. Components are ordered from the most common to the least common in all sites. It can be seen that platforms and guardrails exist in all creative playstructures. The most common types of access are rung ladders, cargo nets and other, and ramps.

"Cargo nets and other" included cargo net access and any other kind of access not described by the other categories. Most commonly, it described a linked tire type of access. Less commonly, stepladders and straight stairs provided access. Other than a slightly higher prevalence of cargo net and other access types in school sites, the prevalence of CPS components were similar in community and school sites. This indicates that wherever creative playstructures exist, the composition is relatively uniform.

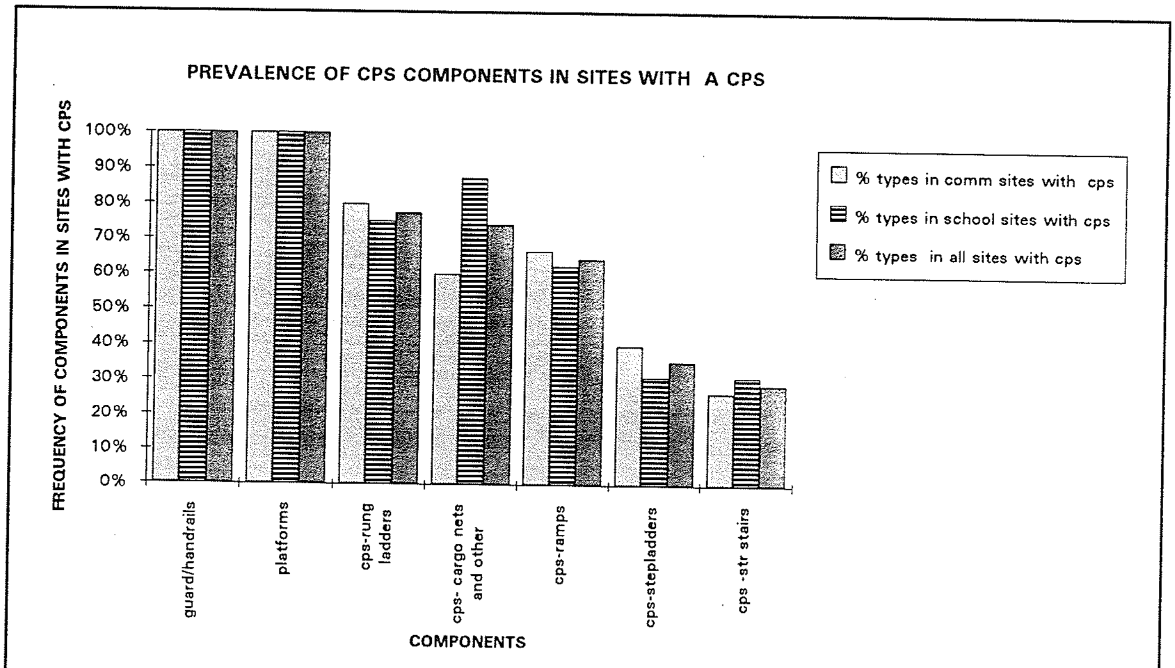


Chart 9

5.3.1 EQUIPMENT-SPECIFIC COMPLIANCE SCORES

Table 25 summarizes mean design compliance scores, confidence intervals and coefficients of variation for specific equipment types.

Table 25.-- Equipment-Specific Design Scores All Sites

Equipment Type	Means	Confidence Intervals	CV
Toddler Swings	65.8 (+/- 4.4)	61.4 - 70.2	18.2%
Child Swings	75.4 (+/- 2.6)	73.2 - 78.1	10.0%
Multi axis swings	68.3 (+/- 13.8)	54.5 - 82.1	12.7%
Other Swings	63.6 (+/- 16.5)	47.1 - 80.1	31.0%
Slides	65.1 (+/- 4.0)	61.1 - 69.1	20.8%
Sliding Poles	60.5 (+/- 4.0)	56.5 - 64.5	15.6%
SA- Stairs	68	NA	NA
SA- Stepladders	55.6 (+/- 5.6)	50.0 - 61.2	21.0%
Rocking Equipment	65.3 (+/- 3.9)	61.4 - 69.2	20.6%
Teeter Totters	78.7 (+/- 4.3)	74.4 - 83.0	5.2%
Climbers	61.4 (+/- 4.8)	56.6 - 66.2	25.1%
Merry-go-rounds	59	NA	NA
Sandboxes	73.3 (+/- 4.4)	68.9 - 77.7	16.6%
CPS- Stairs	63.4 (+/- 11.6)	51.8 - 75.0	23.8%
CPS-Ramps	63.8 (+/- 4.0)	59.8 - 67.8	13.4%
CPS- Rung Ladders	69.1 (+/- 4.0)	65.1 - 73.1	13.8%
CPS-Stepladders	57.5 (+/- 4.2)	53.3 - 61.7	10.8%
CPS-Cargo Nets	63.3 (+/- 3.8)	59.5 - 67.1	13.7%
Platforms	60.7 (+/- 3.6)	57.1 - 64.3	16.7%
Guardrails/Handrails	56.8 (+/- 6.3)	50.5 - 63.1	32.5%

Chart 10 illustrates the design scores of specific equipment types on community, school and all sites. Scores are ranked from highest to lowest on the basis of the all sites scores. Equipment-specific scores described for community and school sites are very similar. Rocking equipment scores appear to differ, but the high score was derived from only one site. Hence, it was considered valid to consolidate community and school equipment-specific design scores for the estimation presented in table 25.

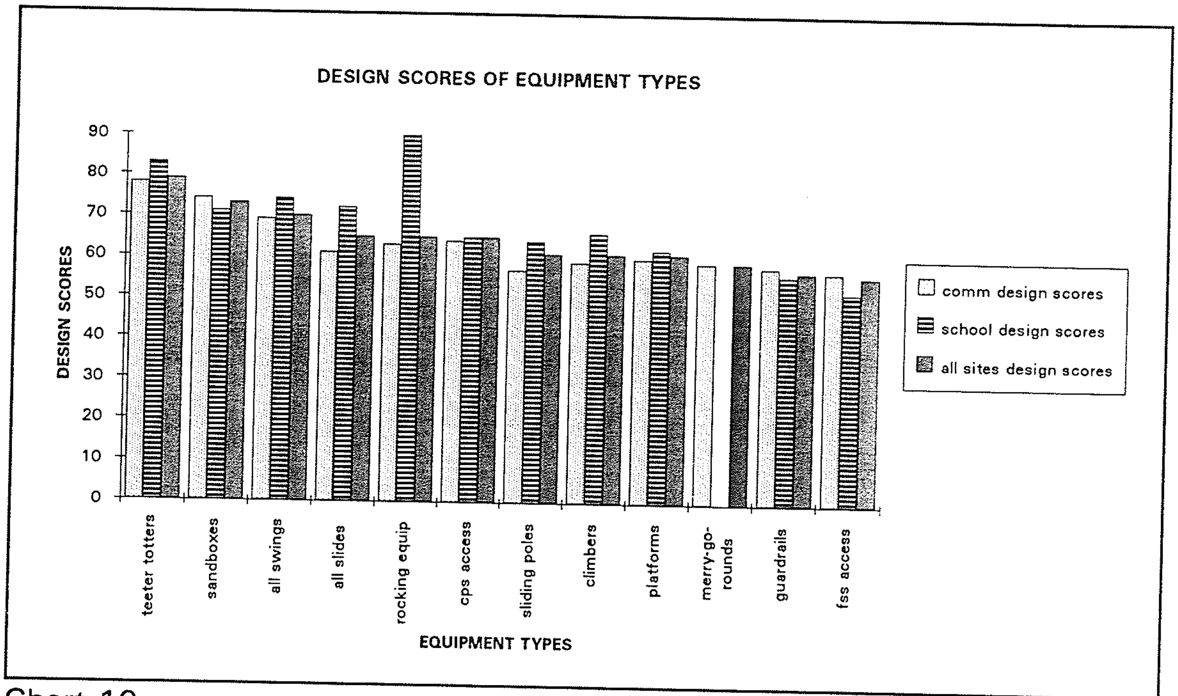


Chart 10

The highest scores were obtained by teeter totters, followed by sandboxes and swings. Slides, rocking equipment and CPS access were roughly equivalent, followed by sliding poles, climbers and platforms, also very similar. The merry-go-round score was based on only one unit of equipment. Guardrails and freestanding slide access exhibited the poorest design compliance.

Chart 11 offers more detail on the design compliance scores of swing subtypes. Child swings achieved the highest level of compliance while all others appeared equivalent. However, multiple axis swings and other swings displayed wide confidence intervals due to the small number of equipment units encountered, so accuracy cannot be assumed.

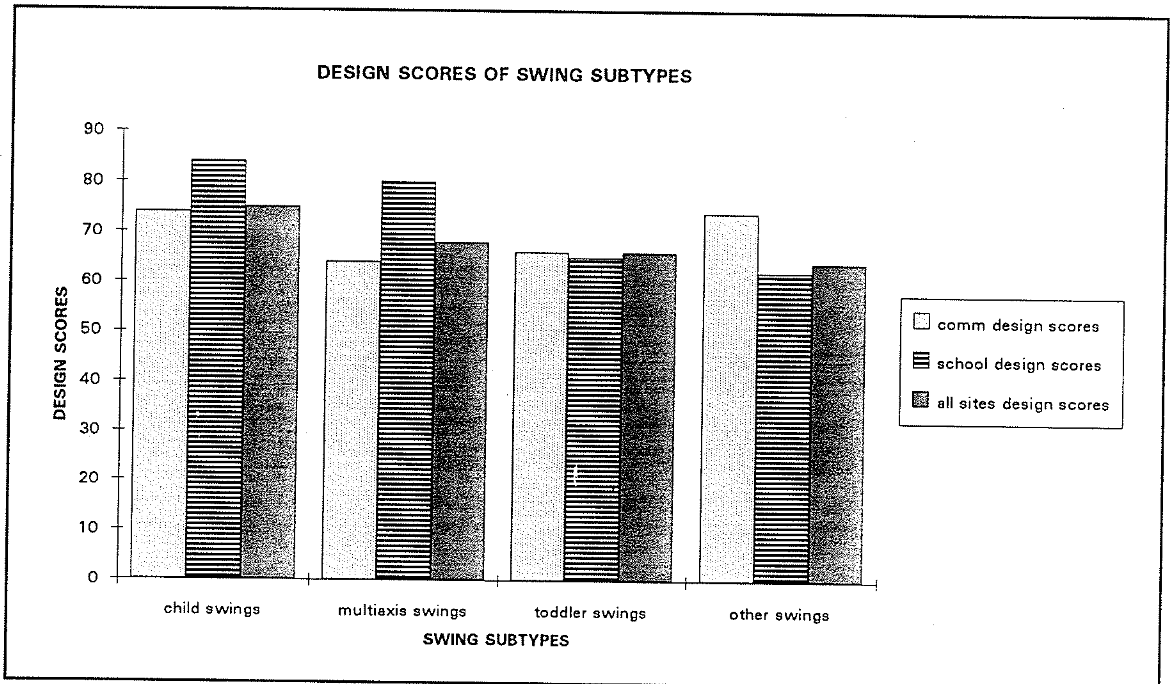


Chart 11

Design scores for creative playstructure components are shown in chart 12. Rung ladders obtained the highest score, followed by ramps, stairs, cargo nets and others, and platforms in very close order. Stepladders and guardrails obtained the lowest scores. Community and school component scores were very similar.

Design scores were not assessed separately for freestanding slides and slides in creative playstructures, so slide type scores cannot be reported.

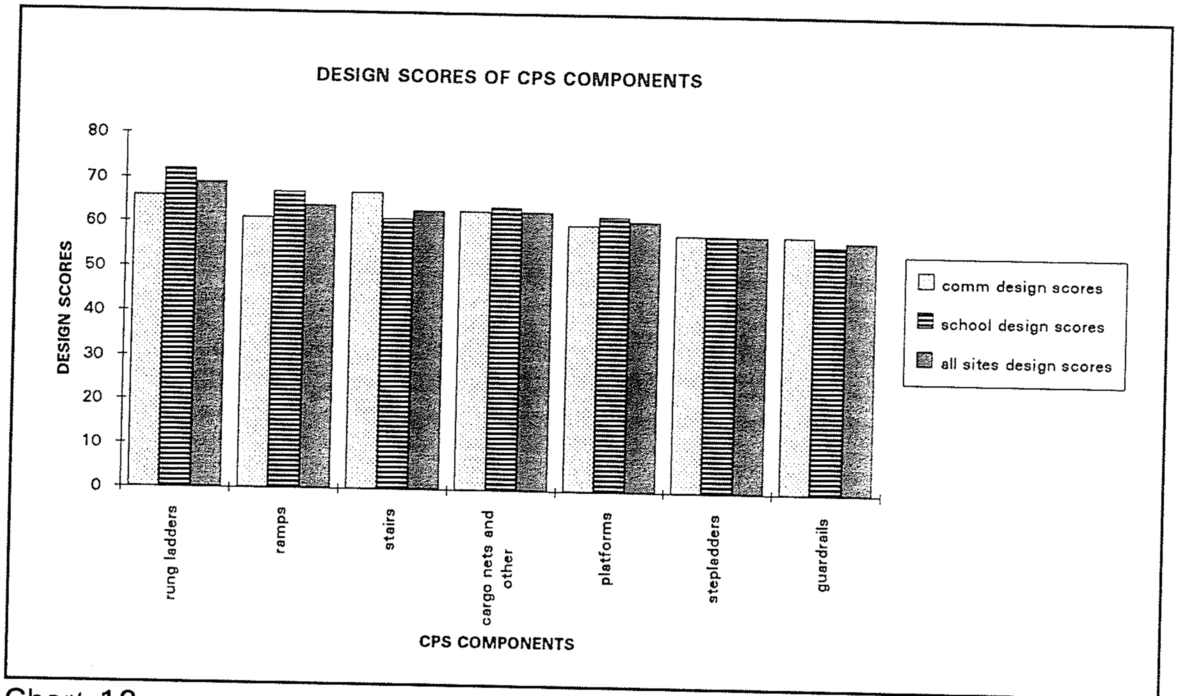


Chart 12

Table 26 summarizes mean maintenance compliance scores, confidence intervals and coefficients of variation for specific equipment types. Note that equipment types are categorized differently in maintenance and design scores, so it was not possible to generate equipment-specific total scores. As with design scores, all data from community and school sites were consolidated to generate equipment-specific mean maintenance scores, as there was no evidence that equipment-specific scores differed between community and school sites. Chart 13 shows equipment-specific maintenance scores for community, school and all sites, and no differences are apparent.

Table 26.--Equipment-Specific Maintenance Scores All Sites

Equipment Type	Means	Confidence Intervals	CV
Toddler Swings	71.8 (+/- 3.9)	67.9 - 75.7	14.6%
Child Swings	80.3 (+/- 3.2)	77.1 - 83.5	12.9%
Multi Axis Swings	71.5 (+/- 21.1)	50.4 - 92.6	18.5%
Other Swings	76.6 (+/- 9.7)	66.9 - 86.3	15.1%
Slides	66.4 (+/- 3.3)	63.0 - 69.6	16.6%
Sliding Poles	77.4 (+/- 4.1)	73.3 - 81.5	12.4%
Rocking Equipment	76.9 (+/- 8.4)	68.5 - 85.3	17.1%
Teeter Totters	84.8 (+/- 6.3)	78.5 - 95.3	7.1%
Climbers	68.3 (+/- 3.8)	64.5 - 72.1	17.7%
Merry-go-rounds	63	NA	NA
CPS	57.4 (+/- 5.1)	52.3 - 62.5	24.1%
Sandboxes	84.3 (+/- 4.7)	79.6 - 89.0	15.2%

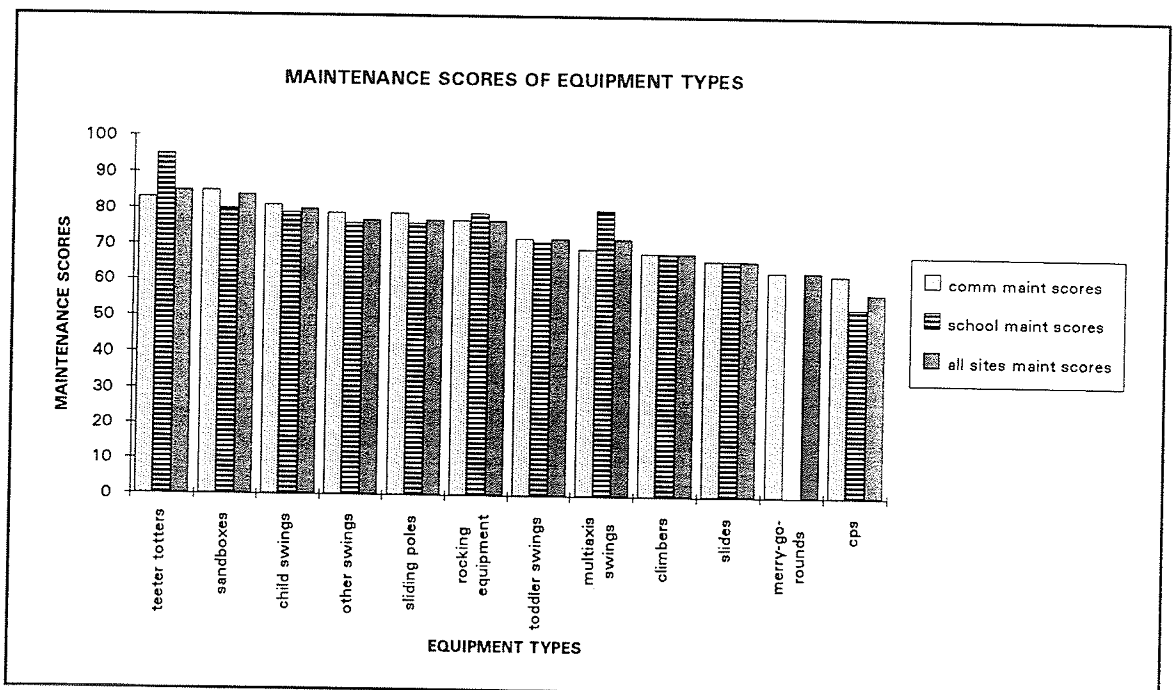


Chart 13

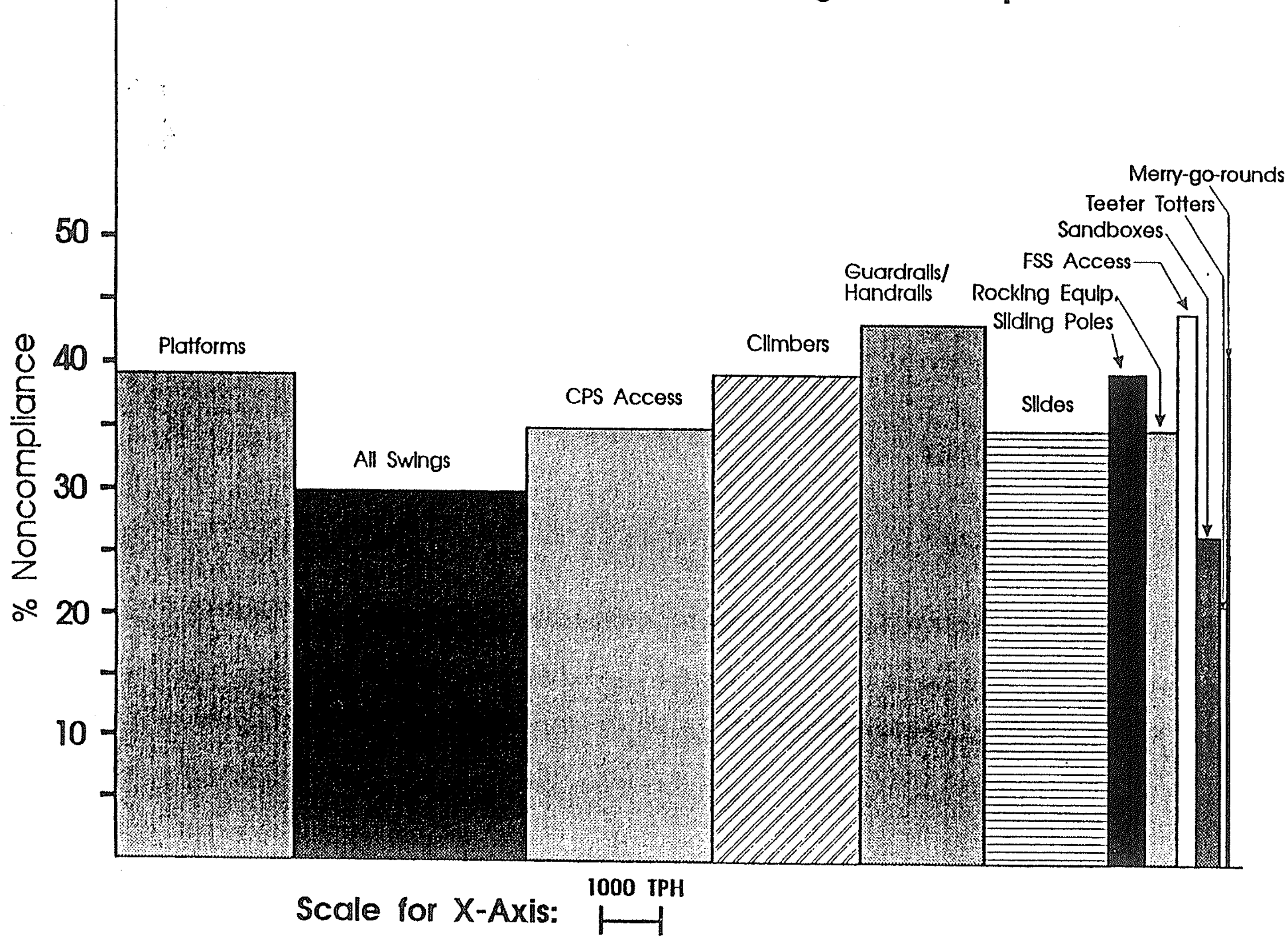
Although equipment was categorized differently for design and maintenance scores, overall trends for high and low scoring equipment are apparent. Teeter totters and sandboxes obtained the highest scores for maintenance as well as design. Swings, sliding poles and rocking equipment again occupied the midrange. Slides ranked lower for maintenance than design, possibly because freestanding slide access was included in the slide maintenance score, but assessed separately in the design score. The fact that slides, climbers and creative playstructures rank low in maintenance deserves attention due to the high prevalence of these equipment types (see chart 5). Climbers and slides are the most prevalent equipment types overall, and creative playstructures are particularly prevalent in schools.

5.3.2. MAGNITUDE OF NONCOMPLIANCE OF EQUIPMENT TYPES

Chart 14 visually conveys the magnitude of design noncompliance of specific equipment types. The area of the bars corresponding to specific equipment types reflects both the prevalence (x-axis) and level of compliance (y-axis) of the equipment. Equipment is ordered from the highest to lowest magnitude of noncompliance (bar area). This is presented to demonstrate the overall burden of noncompliance posed by specific equipment types. It is evident that components of creative playstructures contribute significantly to the overall magnitude of noncompliance, as platforms, CPS access and guardrails are all within the five highest equipment types.

Chart 14

Equipment-Specific Magnitude of Design Noncompliance



5.3.3 EQUIPMENT-SPECIFIC MAXIMUM HEIGHTS AND SURFACE DEPTHS

Table 27 presents the maximum heights and mean surface depths for specific equipment types. Both surface depth directly below equipment, and surface depth throughout the protective surface area are reported. Equipment types are listed in descending order from the highest to lowest maximum heights.

Heights and surface depths are presented together because the required depth of protective surfacing is dependent on the maximum height of equipment from which a child could fall. Generalizing from current recommendations of the Consumer Product Safety Commission (see Appendix 1), any equipment height over 4 or 5 feet (1219.2 - 1524.0 mm) requires a minimum of 6 inches (152.4mm) sand or gravel. This would apply to all equipment types encountered in this study with the exception of merry-go-rounds, rocking equipment and teeter-totters. (No recommendations are currently available for heights less than 4 feet). Nine inches (228.6 mm) of sand or gravel is required for fall heights between 5 to 7 feet (1524 - 2133.6 mm), and a minimum of 12 inches (304.8 mm) of sand or gravel could be protective in fall heights up to 9 or 10 feet (2743.2 - 3048.0 mm). In short, the range of adequate sand or gravel depth for the equipment types presented in table 26 is 152.4 - 304.8 mm. While swings had slightly deeper surface depths than other equipment, uniformly all equipment types are below minimum recommendations.

Table 27.-- Surface Depths and Heights for Specific Equipment Types

Equipment Type	Mean Surface Depth DBE (mm)	Mean Surface Depth T/O PSA (mm)	Mean Max Height (mm)
Sliding Poles n= 32	34.0 (25.7-42.3) CV = 68%	36.1 (29.8-42.4) CV = 49%	3078 (2873-3283) CV = 18%
Child Swings n= 40	41.8 (29.1-54.5) CV = 95%	33.4 (25.2-41.6) CV = 77%	2723 (2596-2850) CV = 15%
Slides n=82	33.9 (28.6-39.2) CV = 71%	26.9 (22.6-31.2) CV = 73%	2527 (2423-2631) CV = 19%
Rungladders in CPS n= 53	32.8 (27.9-37.7) CV = 54%	36.8 (31.6-42.0) CV = 51%	2388 (2258-2518) CV = 20%
Cargo nets and Other in CPS n= 49	32.0 (27.1-36.9) CV = 53%	34.7 (29.4-40.0) CV = 53%	2380 (2263-2497) CV = 17%
Platforms and Landings n= 202	34.7 (32.3-37.1) CV = 49%	35.8 (33.4-38.2) CV = 50%	2355 (2255-2455) CV=31%
Other Swings n=10	27.1 (15.8-38.4) CV = 54%	44.4 (31.0-57.8) CV = 39%	2315 (2052-2578) CV = 16%
Toddler Swings n= 26	43.3 (30.9-55.7) CV = 71%	31.2 (22.2-40.2) CV = 72%	2195 (2081-2309) CV = 13%
Stairs in CPS n= 14	28.3 (16.4-40.2) CV = 73%	29.9 (15.6-44.2) 83%	2042 (1794-2066) CV = 21%
Ramps in CPS n= 33	38.3 (32.0-44.6) CV = 46%	39.4 (32.6-46.2) CV = 48%	2041 (1852-2230) CV = 26%
Climbers n= 145	34.9 (31.2-38.6) CV = 65%	35.4 (31.9-38.9) CV = 61%	2020 (1932-2108) CV = 27%
Multiaxis Swings n=6	41.3 (21.6-61.0) CV = 45%	29.8 (21.6-58.0) CV = 44%	1978 (1414-2542) CV = 27%
Stepladders in CPS n=26	21.5 (14.2-28.8) CV = 84%	28.0 (19.1-36.9) CV = 80%	1678 (1491-1865) CV = 28%
Merry-go-rounds n= 1	10.0	0	1000
Rocking Equipment n= 26	39.6 (29.9-49.3) CV = 61%	31.2 (20.2-42.2) CV = 88%	771 (709-833) CV = 20%
Teeter Totters n= 7	36.1 (21.4-50.8) CV = 44%	32.3 (16.3-48.3) CV = 64%	614 (589-649) CV = 6%

5.4 INDIVIDUAL CRITERIA AS THE UNITS OF CONSIDERATION

Results from the criteria-specific analysis are lengthy and detailed, and are intended primarily as reference material for playground designers and researchers in the field. Oversimplifying and generalizing the results would destroy the intended utility of the information assembled. As such, relevant consolidated checklist data will be reproduced in full Appendix 9. Appendix 9 contains the consolidated criteria data for the entire study, showing total number of hazards, total potential hazards, and compliance scores for each criterion. Criteria are ranked by compliance scores from the highest to lowest for each equipment type. Appendix 10 presents the consolidated criteria for three sites installed or renovated since 1991. The remainder of this section will focus on specific criteria selected for their importance in the prevention of injuries from falls, and entrapment.

Table 28 presents the results of criteria-specific compliance scores for criteria pertaining to protective surface adequacy. Some generalizations about the criteria can be made. Overall, the adequacy of protective surface type was well met for all equipment types. The area of protective surface was better met by creative playstructure equipment than single function equipment. A particular lack of protective surface area was detected in the rear of slides.

Table 28.-- Criteria Pertaining to the Adequacy of Protective Surfacing

Equipment Types	PS Type %	PS Area %				Depth DBE %	Depth throughout PSA %	No Falls to Hard/sharp Equipment %
		F	R	S	A			
Toddler Swings	96 (26)	49 (26)	15 (26)	38 (26)	-	0 (26)	0 (26)	92 (26)
Child Swings	97 (40)	46 (40)	38 (40)	54 (40)	-	0 (40)	0 (40)	92 (40)
Multiple Axis Swings	100 (6)	83 (6)	83 (6)	65 (6)	-	0 (6)	0 (6)	83 (6)
Other Swings	100 (9)	100 (8)	100 (7)	95 (8)	-	11 (9)	11 (9)	78 (9)
Slides	96 (82)	87 (82)	22 (27)	72 (80)	-	1 (82)	0 (82)	72 (82)
Sliding Poles	100 (32)	NA	NA	NA	NA	0 (32)	0 (32)	81 (32)
Rocking Equipment	92 (26)	54 (26)	35 (26)	49 (26)	-	46 (26)	46 (26)	85 (26)
Teeter Totters	100 (7)	NA	NA	NA	NA	57 (7)	57 (7)	100 (7)
Climbers	93 (146)	71 (118)	65 (112)	65 (131)	-	5 (144)	5 (144)	72 (146)
Merry-go-rounds	100 (1)	0 (1)	0 (1)	0 (1)	0 (1)	0 (1)	0 (1)	0 (1)
CPS-Stairs	86 (14)	-	-	-	85 (39)	0 (14)	0 (14)	76 (17)
CPS-Ramps	100 (33)	-	-	-	94 (67)	0 (33)	0 (33)	71 (35)
CPS-Rung Ladders	98 (63)	-	-	-	95 (120)	0	0	68 (35)
CPS-Stepladders	85 (26)	-	-	-	93 (67)	0 (26)	0 (26)	62 (26)
CPS-Cargo Nets/ Others	100 (49)	-	-	-	94 (124)	0 (49)	0 (49)	41 (49)
CPS-Platforms	100 (202)	-	-	-	92 (288)	0 (202)	0 (202)	51 (213)

NOTE: F=front, R=rear, S=sides, A=all directions

The adequacy of protective surface depth directly below equipment, and throughout the protective surface area was uniformly unmet, with a few exceptions. One "other swing" and two climbers were noted to have a synthetic surface installed. Since it is impossible to assess the adequacy of a synthetic surface by visual inspection, the three equipment units were given the benefit of the doubt and were judged adequate. Rocking equipment and teeter totters were usually below the minimum height for which surface depth recommendations were available. The adequacy of surfaces for these equipment was a product of subjective judgement. Swings (toddler and child), and teeter totters were most successful at meeting the no falls to hard/sharp equipment criteria, while cargo nets and platforms scored poorly.

Table 29 summarizes the compliance scores for criteria pertaining to guardrail and handrail criteria.

Table 29.--Criteria Pertaining to the Adequacy of Guardrails and Handrails

	Ht Upper Rail		Ht Lower Rail		Min Ht Top Rail 610mm	Contiguous with stepping surface	Rails required on all hts over 450mm	Platforms > 1200mm need panel or vertical rail style	Opening for access not > 380mm, or top guardrail
	T	C	T	C					
SA-Stepladders (n=21)	38% (21)	19% (21)	NA	NA	NA	NA	NA	NA	NA
SA-Stairs (n=2)	0% (2)	0% (2)	0% (2)	0% (2)	NA	100%(2)	NA	NA	NA
CPS-Stairs (n=14%	50% (12)	18% (11)	27% (11)	10% (10)	NA	86%(14)	79%(14)	NA	NA
CPS-Ramps (n-33)	30% (30)	19% (31)	31% (26)	23% (26)	NA	97%(33)	81%(31)	NA	NA
CPS-Stepladders (n=26)	0% (5)	0% (5)	NA	NA	NA	NA	12%(26)	NA	NA
CPS-Platforms (n=204)	46% (108)	12% (90)	30% (46)	15% (48)	88%(64)	85%(142)	69%(191)	36%(107)	26% (122)

NOTE: T=Toddler (18 months to 4 years old), C=Child (5-14 years old)

Criteria pertaining to horizontal rail heights are poorly met. Having two sets of criteria apply on sites not segregating age groups inherently makes these specifications difficult to meet. Rails existed on most equipment with heights over 450mm (with the exception of stepladders), and were commonly contiguous with the stepping surface. The requirements for platforms over 1200mm to have panel or vertical rail style guardrails, and openings for access of appropriate size were poorly met.

Table 29 summarizes the results for criteria pertaining to entrapment.

Table 30.-- Criteria Pertaining to Entrapment

Equipment Type	No openings>76mm and <254mm	Stairs enclosed if rise is 76-254mm	Rails:rails, rails:surface not 76-254mm
Toddler Swings	4% (27.5)	NA	NA
Child Swings	87% (39.5)	NA	NA
Multi-axis Swings	83% (6)	NA	NA
Other Swings	56% (9)	NA	NA
Slides	43% (82)	NA	NA
Sliding Poles	78% (32)	NA	NA
SA- Stairs	100% (2)	100% (2)	0% (2)
SA- Stepladders	38% (13)	NA	10% (20)
Rocking Equipment	31% (26)	NA	NA
Teeter Totters	29% (7)	NA	NA
Climbers	63% (144)	NA	NA
Merry-go-rounds	100% (1)	NA	NA
CPS-Stairs	55% (11)	73% (11)	33% (12)
CPS-Ramps	67% (33)	NA	83% (24)
CPS-Rung Ladders	40% (53)	NA	NA
CPS-Stepladders	30% (23)	NA	50% (4)
CPS- Cargo Nets	20% (40)	NA	NA
CPS-Platforms	74% (203)	NA	NA
CPS-Guardrails	68% (147)	NA	78% (41)

Toddler swings were noted to have very low compliance to entrapment criteria. This was because the openings for legs are virtually always between 76mm - 254mm. However, it is somewhat unclear whether the specifications only apply to rigid materials, in which case the toddler swing entrapment score would approximate the child swing score. Other swings also had a somewhat low score because many other swings are rings on chains for progressive swinging. The rings for this purpose are nearly always between 76mm - 254mm. Slides and stepladder slide access displayed low compliance to entrapment criteria, as did rocking equipment and teeter totters. However, the slide score is of more concern considering the higher prevalence of slides.

Rung ladders, stepladders, cargo nets and stair railings exhibited the lowest entrapment compliance of creative playstructure components. Other than scores determined by only a few equipment units, child and multiple axis swings showed the best compliance. The compliance of most equipment types fell within the range of 55-78%. This represents a concerning level of entrapment noncompliance considering the serious nature of potential entrapment injuries.

CHAPTER 6

DISCUSSION

An overview of the playground equipment injury literature can be summarized as follows. Fatalities related to playground equipment occur rarely, but a significant amount of morbidity results from playground equipment injuries. By far, the most common mechanism of injury is falling, in particular, falls from a height to the ground surface. Many of the injuries are contusions, abrasions and lacerations, but fractures are common, and may increase in frequency with age. Head injuries are not as common as previously thought, but can be severe. The most common non-trivial and serious injuries are upper limb fractures. The severity of injuries and rates of admission for playground equipment injuries are higher than for injuries overall.

Locally, the proportion of playground equipment injuries requiring admission in Winnipeg is higher than reported elsewhere on the basis of both the chart review findings (70) and CHIRPP. The CHIRPP admission rate (26%) was higher than that found in the chart review (18.4%). Whether this reflects an actual difference is not known. A potential bias in CHIRPP is that there may be a greater motivation to record serious injuries than apparently trivial ones. This could be clarified by doing a retrospective chart review and comparing the data to CHIRPP data for the same time period.

The proportion of fractures reported as the nature of injury was also higher in Winnipeg than other reports. Both the higher admission rate and fracture rate seen locally could be due either to a true local difference in injury severity, or to local patterns of obtaining medical care. A possible preference to obtain care for more serious injuries at the Children's Hospital, but elsewhere for less severe injuries may be operating. This appears to be supported by the overall injury admission rate of 16% in Winnipeg compared with estimates of 3.5% elsewhere (4). If only a subset of the more severe playground injuries are attending Children's Hospital, then the occurrence of playground injuries is markedly underestimated by the local sources currently utilized. Local differences in criteria for admission must also be considered.

The proportion of playground injuries due to falls in Winnipeg is among the highest reported. The peak age for playground equipment injuries in Winnipeg is 5-8 years old, consistent with other reports. School and community playgrounds were represented equally as the location of injury, but since community sites significantly outnumber school sites, this represents a relative over-representation of school as the location of injury. However, as previously mentioned, exposure is not known. In Winnipeg, the most common equipment types involved in injuries are playstructures, monkey bars (climbers), slides and swings in descending order.

Despite the theoretical importance of surfacing due to the high toll of falls, relatively few studies have addressed this issue. In this study, the single most important finding was the grossly inadequate depth of protective surfacing discovered in all sites without exception. Accordingly, this will be discussed first.

From the literature, it is evident that falls to the ground surface are by far the most frequent mechanism of playground equipment injury. It would follow that protective surfacing should receive much attention in national standards, studies and prevention initiatives. On the contrary, the C.S.A. Guideline is vague regarding the depth of protective surfacing. The relative merits of various types of protective surface materials, and the area of protective surfacing required are presented, but protective surface depths relevant to fall heights are not directly addressed. Results from this study showed that the type of protective surface was nearly always appropriate, and the area was usually appropriate around creative playstructures, indicating an increased attention to these issues in newer sites. However, the depth of protective surfacing was so inadequate, that it rendered the presence and area of protective surfacing of no practical value.

The best available references on surface depth adequacy relative to fall heights appear in Appendix 1. Even these are difficult to use, as the heights for which surface depth adequacy are presented are extremely limited. What would be useful in the field is a table presenting surface depths required for a full range of heights.

Additionally, the above references are derived from studies of G-forces measured on headforms observed under experimental conditions. No field studies have been done to test the effectiveness of the recommended surfacing in the prevention of all fall injuries. Studies comparing the injury rates on playgrounds before and after ideal surfacing, or comparing injury rates on upgraded surface sites vs control sites would be valuable. However, the absence of such studies should not encourage complacency regarding the preventative role of surfacing.

Only one study was found that assessed the type, area and depth of protective surfacing (69). It reported that none of the 47 sites surveyed in Boston had adequate protective surfacing. A different study of injury rates relative to types of surfacing concluded that no injury reduction was afforded by any of the protective surface types in comparison to grass, despite noting that protective surfacing was not maintained at recommended depths (50). This is analogous to concluding that an experimental medication is not effective in treating a disease, despite noting that it was tested using sub-therapeutic doses. However, this raises the valid point that there is no justification for the cost of protective surface installation, if there is no intention of maintaining it at a depth that could offer a protective advantage over grass.

The barriers to maintaining appropriate depths of protective surfacing are difficult to comprehend in light of the potential for injury prevention. The cost for upgrading the surface of an average sized playsite in the United States was estimated at $500.00 in 1993 (69). If this estimate is close to Canadian costs, an estimate for upgrading the surface of all Winnipeg playgrounds in one year would be approximately $290,000. A large school playground built in 1992 was reported to have cost $73,000 (73), which means all playgrounds could be resurfaced for the price of four similar new playgrounds. If this strategy had a significant impact in injury reduction, the medical care savings might outweigh the initial maintenance expenditure, particularly if averaged over a two or three year cycle. This would need to be explored by obtaining current Canadian cost estimates for the required upgrading, and a cost analysis of the current injury burden (hospital and outpatient care). From these figures, a target in injury reduction could be calculated at which point the cost of upgrading would be recovered. Priorizing expenditure has been discussed in the literature in terms of safe surfacing taking precedence over new equipment purchases (40).

A further surfacing issue in Winnipeg is that playgrounds are typically covered in snow from November to March, or 5 out of the 10 school term months. Since students play outdoors for 30 minutes each school day except in extreme temperatures, the playground surfaces they are exposed to 50% of the time are ice and snow. No standards have addressed design issues for playground equipment in locations that are not able to provide recommended protective surface types for nearly half of the year. In fact, the standard method for testing surfaces for adequate impact attenuation tests various protective surfaces at three temperatures, the coldest being -1 degree C (74). No testing was encountered that measured the G-forces of falls to packed snow and ice. One paper was encountered in the literature that addressed the winter use of playgrounds (75). Most notably, this paper remarked that "virtually no research has been conducted on the winter use of playgrounds".

Other fall prevention items were complied with to a higher degree, but warrant discussion. While an impact absorbing surface acts in the event phase to limit injury once a mishap is in progress, interventions to prevent the mishap from occurring are clearly preferable. Guardrails, handrails and opening in guardrails were the specific fall prevention features examined. Guardrails were generally contiguous with the stepping surface, and most standing surfaces over 450mm had guardrails (except stepladders). However, only about one third of platforms over 1200mm had the appropriate type of guardrails (vertical fence or panel style) that avoid spaces permitting a child to fall through. In Montreal, 90% of guardrails had spaces large enough for a child to fall through (41). The openings in guardrails failed to be less than 380mm or have a top guardrail over a third of the time in Winnipeg, and this was also found to be poorly met in Montreal. These features are important as they represent potential falls from heights over 1200mm, and many considerably higher. This needs to be made a priority in renovating old sites as well as when designing new ones.

Other relevant findings included better design scores in sites aged 0-9, but no other differences in design, maintenance and total scores. School sites were higher than community sites, and creative playstructure sites were larger than traditional single function types. Newer playgrounds (0-9 years) were also larger than all older sites. Single function site types were older than creative playstructure site types.

A trend of increasing prevalence of creative playstructure equipment was noted. Virtually all older sites were single function sites, and no new single function sites were discovered. All school sites, and all newer community sites contained creative playstructures as the majority of the equipment. This has relevance for future editions of the C.S.A. Guideline, as creative playstructures were not directly addressed as a discrete equipment type, but are in fact the main type of equipment likely to have been installed in Winnipeg from 1990 on. Additionally, this trend raises concerns arising from the above findings. The question raised is whether the transition from single function equipment to the new generation creative playstructure equipment has increased or decreased the safety of playgrounds.

One positive finding in this regard is that design scores for newer sites are in fact higher than for older sites. However, other impacts need to be considered. Creative playstructures are higher than single function equipment, so in the transition we have put children higher off the ground with no accompanying increase in protective surface depth. Creative playstructure sites are larger than single function sites due to the volume of creative playstructure equipment, so even if creative playstructures are slightly more compliant to recommendations, we may be increasing children's exposure to noncompliance (hazards) in an absolute sense. For example, a smaller playground 65% compliant to recommendations had 153 unmet safety criteria, while a larger playground with 80% compliance had 356 unmet criteria. Therefore, a site with better overall compliance may actually expose children to more absolute hazards.

Also, other aspects of playstructure design are problematic. Due to the joined multi-platform design of these structures, there were more potential falls to hard sharp objects other than the protective surface for this equipment type than for single function types. Clearly, if protective surface is required for all equipment over 450mm, a fall of over 450mm from one level of a creative playstructure to another is of concern. This problem unfortunately seems inherent in the design of a multi-level, multi-component piece of equipment. Other problems in the design of creative playstructures were frequent entrapment spaces, and poor compliance to the required type of guardrails for platforms over 1200mm as previously mentioned. The latter two problems were also observed in the playground study conducted in Montreal (41).

The relationship of maintenance and design scores warrants some explanation. Maintenance scores were higher than design scores, and a significant linear regression relationship was observed. The interpretation could be that maintenance is superior to design in keeping with the objectives of the maintenance crews. However, a flaw in the checksheet design was detected that could account for, or contribute to, this difference. Swings were over-represented, and creative playstructures under-represented in the maintenance part of the checklist relative to the design section. Since swings generally scored higher than components of creative playstructures, this would have the effect of artificially raising maintenance scores. My qualitative impression from the general state of good repair observed, is that both factors contributed to higher maintenance scores. However, no conclusions can be drawn without further study.

One interesting observation is that the order of equipment types presented in consideration of the magnitude of noncompliance is similar to the order of equipment implicated most frequently in playground injuries in Winnipeg. The equipment types with the highest magnitude of noncompliance in descending order were creative playstructures, swings, climbers and slides. Recall that the order of equipment implicated in injuries was playstructures, climbers, slides and swings, with only swings being out of sequence. This would suggest that the magnitude of noncompliance roughly estimates exposure to hazards. Another concerning observation is that the lowest maintenance scores were obtained by equipment types with high prevalence (slides, climbers and creative playstructures). There are a number of possible interpretations of this finding. It may be that the most prevalent items receive more traffic, and thus wear out sooner. Alternatively, popular equipment types preferred by children would be used more and wear out sooner than unpopular equipment regardless of their prevalence. Certain types of equipment might wear prematurely, and require more maintenance. Historical biases might exist regarding the maintenance routines for certain equipment types. However, regardless of why maintenance scores were lower in more prevalent equipment, it is clear that more attention should be focused on the maintenance of slides, climbers and creative playstructures.

While the number of sites built since 1990 were too few to separately analyze, the 3 new sites, while considerably more compliant, still fell short of near 100% compliance. In particular, the adherence to recommendations regarding protective surfacing and entrapment spaces were disappointing in these few new sites. A close monitoring of adherence to safety recommendations of new sites with feedback to playground owners may be necessary to see the guidelines maximally implemented.

Some notable similarities and differences were observed between this study and the Montreal study (41). Both studies revealed that playground equipment in school sites are higher than community sites. This is of concern in Winnipeg, due to the relative excess of playground equipment injuries sustained at school. However, other possible explanations exist for this observation. Exposure to school playground equipment could be higher especially during the winter months in Winnipeg when community sites may receive less use than schools. Alternatively, school injuries might be more likely to receive medical care than community injuries. Other factors could relate to differences in equipment types, or the relative congestion on equipment. Further studies would be necessary to reach conclusions in this matter.

The Montreal study noted fairly similar equipment distributions, and made similar observations about protective surface type and area. Protective surface types were generally well observed in both studies for all equipment types, and better protective surface areas were noted for creative playstructures (modular climbers) than for other equipment types. No protective surface depths were recorded in the Montreal study.

Compliance scores (converted to noncompliance scores) for this study can be compared to the Global Index reported in the Montreal study. Overall noncompliance from this study was 33%, while the average Global Index for the Montreal study was 21%. Both of these figures express the level of noncompliance, or nonconformity to standard observed overall. The difference could be explained on the basis of the bias towards the strictest possible application of the checklist in this study, or an artifact due to this study including more items in its checklist than the Montreal study. However, it is possible that playground equipment in Winnipeg is less compliant to recommendations than equipment in Montreal. In any case, between 21-33% of noncompliance to current recommendations emphasizes that much work is still required to raise playground safety to a level consistent with our theoretical knowledge. As with all injury prevention strategies, the impact of the intervention on outcomes should be assessed. If playgrounds were to increase in compliance to C.S.A. recommendations, it would be crucial to evaluate the impact on the incidence of playground equipment injuries.

Another notable difference was the observation that some aspects of conformity were lower in poorer municipalities and neighbourhoods in Montreal. This was not detected in Winnipeg. However, the area defined as inner city in this study actually encompassed a variety of socioeconomically different neighbourhoods, so differences on a neighborhood basis would have been missed. However, qualitative observations made during playground inspections would support the observation that no differences occur on the basis of the level of poverty. On sites located in core inner city areas, an excess of vandalism was observed, as well as appropriate repairs. In discussion with a caretaker at a core area school, he stated that he visually inspected the playground every morning, and that a carpenter crew checked the playground for damage every two weeks during the school year.

This would be in excess of routine maintenance elsewhere in the city. Hence, it was my impression that core area sites achieved equivalent compliance with non-core area sites only with greater effort and resources.

Another difference noted between the two studies was the observation that Montreal still had most child swing seats made of non-impact absorbing material (66.5%), while in Winnipeg 98% of child swing seats were classified as impact absorbing. Unless the criteria for impact absorbing was defined differently between the two studies (the Guideline did not provide specific materials deemed impact absorbing), it appears that Winnipeg playgrounds have successfully abolished the hazard of being struck with a hard swing seat on public sites. This one factor could explain why swings were under-represented in injuries relative to the corresponding magnitude of noncompliance. Both studies noted that two thirds or more baby seats don't hold their shape, and have mobile parts that would permit a child to fall off the seat.

In assessing compliance to the voluntary guidelines currently in place, immediate objectives for improving the safety of playgrounds are apparent. A feedback loop can be envisioned starting with efforts to implement current recommendations, evaluation of the extent to which implementation has been successful, further evaluation of the impact changes have made on the burden of playground injuries, modifying the guidelines on the basis of new knowledge and then starting the loop again. To facilitate this process, a surveillance system would be extremely useful.

Many challenges arise in conceptualizing a surveillance system appropriate for playground equipment injuries. Many injuries don't receive medical care and these injuries would be missed in a surveillance system. While these would be minor injuries, any injury requiring medical care or causing a temporary loss of usual function are commonly considered worth reporting in injury research. The latter group of injuries would not be detected.

Injured children requiring medical care might be taken to any hospital with an emergency department, a private doctors office or clinic, or a walk-in clinic. One conceivable way to access surveillance data from a variety of sources would be to make playground injuries a reportable condition. However, if clinicians are not convinced of the importance of playground injuries, the rate of reporting would be low. Nevertheless, advantages to a surveillance system are many. A more accurate understanding of all aspects of playground injuries across the severity spectrum would be obtained. Injuries could be more directly linked to the environment in which they occurred. Once a baseline of injury incidence was established, many interventions could be evaluated on the basis of the surveillance data. This would not only improve the safety of local playgrounds, but contribute significantly to the international literature.

The above mentioned approaches would hopefully result in progressively safer play environments over time. However, when looking to the future regarding playground safety, it seems appropriate to broaden the focus momentarily and explore some of the attitudes and assumptions that also act to shape the future of play.

One attitude detected within the playground literature, is that children are often to blame for their injury due to the inappropriate misuse of equipment or dangerous horseplay (28,30,34,36). It is indisputable that children use equipment in ways that adults did not intend it to be used, and that they engage in activities that adults perceive as risky. However, the ascription of blame is a troublesome concept and warrants exploration.

Blaming the victim is contradictory to current concepts in injury prevention, and is generally considered counter productive. Why remnants of this older attitude remain in the pediatric injury prevention field may be due to the extent adults are accustomed to being involved in controlling children's behaviour in many aspects of daily life. An adult injured in a fire caused by smoking in bed, and a child injured falling from the support beam of a tire swing have both experienced consequences of their own actions. However, adult injury prevention has recognized that a self-extinguishing cigarette is a more effective preventive strategy than focussing on the victim's negligent behaviour. The approach to children should be no different.

A second disturbing issue arises from the expectation that children should use equipment in the way adults intended it to be used. Consider the implications of that expectation. Children should not use their imaginations or creatively explore their environments, but simply follow adult instruction and repeat a given task over and over again. This clearly describes the only "safe" use of a freestanding slide or single axis swing, but many would balk at this attitude being applied to children at play. Creative playstructures are the product of the perceived need for more creativity in children's formal play environments, but are often little more than the traditional slides and climbers linked by a series of platforms. This calls into question the appropriateness of playground equipment as we know it, and may demand a fresh look at children's needs.

Additionally, holding a child responsible for risk taking behaviour involves an assumption that may be completely invalid. For a child to be responsible for a risk taking action, he or she must be able to perceive the risk. However, it is believed that children generally do not understand risks they are taking, and in fact perceive themselves at low risk for injuries (20). Anecdotally, when children were seen engaging in dangerous activity during the data collection for this study, and were cautioned, the response invariably was "I won't fall". This further raises doubts regarding the appropriateness of current styles of playground equipment. Opportunity for risk taking activities are being presented to unsupervised children who have not yet acquired the ability to assess risk.

One last consideration is the role of supervision in the prevention of playground injuries. A viewpoint that children should be careful, and adults should be watchful is sometimes raised. While appropriate supervision should always be encouraged, improved supervision alone would likely have little effect on the playground injury burden due to a number of considerations. Issues to consider would be what level of adult participation constitutes supervision, the actual ability of a supervising adult to prevent mishaps, and the how frequently adults will actually accompany children even if it is recommended.

Simply having an adult in attendance while children are playing does not seem effective in preventing injuries. A study involving day-care injuries noted that 82.7% of all injuries occurred in supervised situation (58). A school injury study reported that in most cases injuries occurred in supervised settings (56). In Winnipeg, 84% of school playground equipment injuries occurred during school hours, which would imply some supervision. While some literature presents the belief that risk is better managed by public awareness and behavioral changes than technology (30), there is no evidence to support this belief.

What the literature fails to describe is what level of participation the adults in attendance were engaged in. In Winnipeg, observation and inquiry suggests that a ratio of 1 adult to 75 -100 elementary students is status quo for supervision during recess. The amount of preventive intervention an adult can provide under those circumstances is likely minimal. Another way of looking at this is that each elementary student spends the equivalent time in recess during one school year as they would in two weeks of full-time summer day camp. Few parents would send a 6-12 year old child to camp with a 1 to 100 ratio as, intuitively, the level of active supervision would be inadequate.

Whether active supervision is able to prevent mishaps is also questionable. High risk behaviour can be curbed, but considering that mishaps occur in a matter of seconds, it is impossible for an adult to react quickly enough consistently intervene. Teachers, daycare workers and parents are rarely able to supply one on one supervision. Additionally, adults shadowing their children on playground equipment may pose hazards to other children.

Even if supervision of children was proven effective in reducing injuries, the fact remains that many children would continue to play unsupervised. One busy core area playground inspected during this study averaged 20 - 25 children aged 4-10 on two separate days. During the 3 hours of assessment, no supervising adults were seen.

Reviewing Haddon's matrix as it applies to the prevention of playground injuries in Appendix 2, increased supervision, and both parent and child safety appears in the intersection of pre-event, and sociocultural environment. However, as these issues are active prevention strategies, they offer less promise in effective injury reduction than passive strategies such as modifying the vehicles and environments. Recognizing the limitations of supervision, the focus of the CSA Guideline was the "provision of appropriate design to protect the child, regardless of the degree of supervision" (12).

In consideration of the above issues, the challenge to provide safety may need to go a step beyond ensuring the implementation of today's playspace Guideline. Certainly, that is the logical place to start, but it may not be the place to stop. The playground industry and injury researchers should be challenged to define the objectives of playgrounds, define the objectives of safety, and take a fresh look at creative ways to achieve both.

CHAPTER 7

CONCLUSION

The major findings that resulted from this study will be reviewed in a brief summary. The overall compliance of playground equipment to C.S.A. recommendations was 67.4%. Compliance to maintenance recommendations (72.2%) was higher than compliance to design recommendations (64.7%). Playgrounds less than 10 years old had better design scores than older sites. The mean of the highest equipment on each site was 3157mm, and the mean depth of protective surfacing was 31.6mm. The maximum height of equipment was found to be higher on school sites than community sites. Sites with creative playstructures and sites less than ten years old were larger than sites without creative playstructures and sites 10 years or older. A trend towards the increased prevalence of creative playstructure equipment in newer sites was observed.

The most common equipment types found were slides, climbers, swings, sandboxes, and creative playstructures in that order. Schools virtually all had creative playstructures, while only half of community sites had them. The order of equipment types based on decreasing "magnitudes of noncompliance" (a function of their prevalence and rate of noncompliance) was creative playstructures, swings, climbers and slides. This approximated their reported injury rates with the exception of swings.

Recommendations regarding the type of protective surfaces were generally well met by all equipment types. Those concerning the area of protective surfaces were better met by creative playstructures than older style single function equipment. The depths of protective surfacing relative to equipment heights were grossly inadequate for nearly all equipment types. Recommendations on the style of guardrails for platforms over 1200mm were frequently unmet, as were recommendations regarding the size of openings in guardrails for access.

The above findings lead to a number of recommendations concerning the safety of playgrounds. The most urgent issue is the inadequacy of protective surface depths relative to equipment heights. Utmost priority should be assigned to upgrading the depth of sand or pea gravel in all playgrounds in the City of Winnipeg. A freeze on new playground development until this can be accomplished would be appropriate so that funds can be diverted to re-surfacing. Until further studies suggest otherwise, between 23-30 cm (9-12 inches) of sand, pea gravel or bark mulch should be provided in a 1.8 meter radius around all equipment.

Similarly, guardrails and handrails should be upgraded in all existing sites throughout the city. Not all of the C.S.A. recommendations are amenable to retrofitting on existing playgrounds, but surfacing and guardrails are easily modified and may be effective in reducing the number of injuries due to falls. The appropriate type of guardrails should be provided (panel or vertical rail style for equipment over 1.2 meters) and openings for access in guardrails should measure no more than 38cm or have a top rail.

Equipment with serious hazards such as prominent entrapment areas should be identified. If not correctable, the equipment should be removed whether or not funding is available for replacement.

New playgrounds should be more compliant with C.S.A. recommendations than the three new ones in this study. Methods to improve compliance with this voluntary standard should be explored. Playground equipment manufacturers could be given an incentive to demonstrate their abilities to design compliant playgrounds by way of a highly publicized contest. Companies could submit plans that are judged by officials knowledgable with C.S.A guidelines. The most compliant plans would win a sponsored contract to develop a site that could be used as a model for "safer playgrounds". This high profile approach would serve to educate the public regarding what safety standards to expect, in addition to providing playground developers with an incentive to market safety. Another possibility includes funding for new development by the city or school divisions being contingent upon the approval of a qualified public health official. While it is not yet possible to legally enforce compliance to guidelines, methods to encourage compliance should be explored.

An important consideration for new site development should be the maximum heights attained. The development of equipment that can be challenging without excessive heights could significantly decrease the burden of fall injuries. Schools in particular should decrease site heights. The Canadian Standards Association did not publish maximum equipment heights, but the British recommendation of 2500mm (66) or the American recommendations for maximum climber heights of 6 feet (1800mm) for preschoolers and 7 feet (2100mm) for school aged children could be observed. In any case, the guiding principle should be the lower the better, particularly until the implication of falls to snow and ice is better understood.

Safety education of the appropriate city and school officials and maintenance workers should be undertaken. Current maintenance inspections focus on identifying worn or broken equipment and making repairs. It appears that these objectives are being relatively well met since maintenance compliance scored higher than design compliance. City and school maintenance departments should be assisted in broadening their inspection mandate to include some design features that can readily be modified. For instance, swings could be appropriately spaced by removing a swing and repositioning hangers. Baby swings with movable parts could gradually be replaced by bucket style seats. A bench or garbage container could be removed from the protective surface area beneath equipment. Surface depths should be frequently measured as well as being raked.

Additionally, a checksheet for important design items that cannot be remedied easily, such as inadequately spaced equipment or excessive height of equipment, should completed for each site every year. A maintenance technician should be trained to priorize the projects in terms of the maximum reduction of injury risk.

The development of a surveillance system for playground equipment injuries would be of great value in better understanding the scope of these injuries and in evaluating the effectiveness of interventions. The cost and effort of the above mentioned initiatives could not be justified if they were not effective in reducing playground injuries. However, to demonstrate the effectiveness of any prevention initiative, a method to evaluate outcome is imperative. At present, CHIRPP is the only ongoing source of outcome data for playground injuries. While CHIRPP has great importance as a pediatric injury surveillance program, its utility in playground equipment injuries has limitations. Many playground injuries may be cared for outside the Children's Hospital and would remain undetected by CHIRPP. This illustrates the need for a surveillance system, particulary if costly interventions are planned that require evaluation. Links between a surveillance system and designated school and city maintenance officials would facilitate prompt corrective measures when hazards are identified.

In addition to simply monitoring playground injuries, other specific research initiatives would be valuable. The effectiveness of recommended surface type, area and depth in the prevention of injuries needs rigorous evaluation. On such study could compare injury rates before and after the provision of recommended surfaces in a large number of playgrounds. Alternatively, a group of resurfaced playgrounds could be compared to a control group ensuring that the sites were similar in other regards. Injury rates over a one year period could be compared. Once a large enough group of C.S.A. compliant playgrounds have been developed, the injury rates of these sites could be compared to the overall injury rate. All of the above studies would require the existence of a playground injury surveillance system.

The poorly studied issue of winter playground use should be investigated. Seasonal patterns of use of both school and community playgrounds in prairie climates should be studied. The seasonal injury rate should also be investigated. Laboratory studies measuring G-forces on headforms should be conducted on a variety of ice and snow surfaces at a range of winter temperatures. Also relevant would be the study of whether winter clothing has a protective effect on the G-forces measured.

Relevant behavioural studies would involve how children actually use playground equipment. Better understanding of child preferences, actual use of equipment and patterns of risk-taking behaviour could be used to develop completely new styles of safer playground equipment. The role of supervision could also be studied to ascertain whether trained supervisors are effective in preventing mishaps, and if specific adult to child ratios are required. This could have implications in school and childcare settings.

A cost-benefit study similar to that described on page 132 would help priorize research and program initiatives. Estimates of health care savings associated with various levels of injury reduction could be compared to the costs of a variety of research and program options. However, society may support the reduction of playground injuries even if it not shown to be cost-effective.

A significant amount of potential injury reduction is possible with the application of current knowledge about the source of playground equipment injuries and playground safety design. The barriers to achieving reductions in injuries lie in deeply rooted attitudes towards both injuries and playgrounds. Additionally, the cost of upgrading existing playgrounds is a realistic barrier in today's era of budget restraints and cutbacks.

It is not possible, or necessarily desirable, to prevent all minor injuries related to the use of playground equipment. However, greater effort should be applied to eliminate serious and lifethreatening playground equipment injuries. We have a starting base of knowledge - now it needs to be applied and evaluated.

APPENDIX 1

SUMMARY OF REFERENCES ON FALL HEIGHTS AND SURFACE DEPTHS

(Source references given in parenthesis)

(76)

TABLE 2
Critical Heights (in feet) of Tested Materials

Material	Uncompressed depth 6 inch	Uncompressed depth 9 inch	Uncompressed depth 12 inch	Compressed depth 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

(69)

TABLE 1—Drop Height at Which a Fatal Injury Can Occur from a Fall, by Surface and Depth of Surface

Surface	Depth of Surface[a]	Drop Height	G-Force[b]
Concrete	5 in	1 in	210
Asphalt	4 in	2 in	210
Foam matting	1.25 in	4 ft	200
Rubber matting	1.75 in	5 ft	225
Gravel (medium)	9 in	12 ft	190
Sand (coarse)	9 in	6 ft	235
Sand (fine)	9 in	8 ft	215
Wood chips	9 in	11 ft	220
Wood mulch	9 in	12 ft	135

Source: Ramsey and Preston.[11]
[a]At ambient temperature, not compressed.
[b]The threshold for serious injury is a force of 50g; the threshold for fatal injury is 200g.

(33) TABLE. Relationship of Surfaces, Drop Heights, and Gravity Forces*

Surface Material	Drop Height in Feet							
	0.25	0.5	1	2	3.5	4	8	10.5
Concrete	150–200	250–300	475–525					
Thin mat†	60–80	125–150	275–300					
Asphalt	40–45	60–65	140–160					
Packed earth						175–225		
Gym mat 1				8–12		55–70		
Gym mat 2			1–2	4–5		170–190		
Rubber mat (1⅛ in thick)			3–5	6–15		40–55		
Double rubber mat			1	2–15	24–28		50–58	70–80
Sand (10 in deep)‡							10–13	15–20
Pea gravel 1 (8 in deep)§				10–15	10–20		15–40	20–50
Pea gravel 5 (8 in deep)§				10–15	10–20		15–30	25–40
Wood chips (12 in deep)					15–20		30–35	42–48

* Figures given indicate range of gravity force in repeated drop tests. Serious injury is likely to occur in impacts in excess of 50 g. Source of data is Franklin Institute Research Laboratories, Philadelphia.
† Corrugated rubber mat, ⅛ in thick, with ¹⁄₁₆ in vinyl cover.
‡ Wet, firmly packed sand.
§ Rounded, river washed, up to ¾ in diameter.

APPENDIX 2

HADDON'S MATRIX AS APPLIED TO PLAYGROUND EQUIPMENT INJURIES

	Host Factors	Agent (In Vehicles and Vectors)	Environment (Physical)	Environment (Sociocultural)
Pre-Event Phase	-increase fitness & coordination of children -no scarves or drawstrings -proper footwear	-design and install safe moving equipment -keep moving equipment well maintained -adequately space equipment -separate older and younger children	-design and install safe stationary equipment -keep stationary equipment well maintained	-devalue risk-taking -increase awareness of need for supervision (parents/ teachers/ childcare workers) -teach children to play safely
Event Phase	-winter clothing may absorb impact	-design "collision friendly" moving equipment (eg. soft swing seats)	-build lower equipment -provide adequate impact absorbing surfaces -no broken glass or falls to hard, sharp objects -design "collision friendly" stationary equipment (eg. rounded plastic edges)	N/A
Post-Event Phase	-overall good health	N/A	-install telephone on site to obtain emergency vehicle -first aid kit available	-train caregivers, supervisors, and children in first aid

APPENDIX 3

CHECKLIST OUTLINE

1. SWINGS
    - toddler single axis
    - child single axis
    - multiple axis
    - other swinging equipment

2. SLIDING APPARATUS
    - slides
    - sliding poles
    - access to sliding apparatus
        - stairs (straight)
        - stairs (spiral)
        - ramps
        - rung ladders
        - stepladders
        - cargo nets etc.

3. ROCKING EQUIPMENT

4. TEETER TOTTERS

5. CLIMBERS

6. MERRY-GO-ROUNDS / WHIRLERS

7. SANDBOXES

8. CREATIVE PLAYSTRUCTURES
    - access to creative playstructures
        - stairs (straight)
        - stairs (spiral)
        - ramps
        - rung ladders
        - stepladders
        - cargo nets etc.
    - platforms and intermediate landings
    - guardrails and handrails

9. GENERAL CONSIDERATIONS

10. OTHER

11. MAINTENANCE

APPENDIX 4

THE CHECKLIST INSTRUMENT

1.SWINGS

SWINGS- TODDLER SINGLE AXIS

NUMBER OF TODDLER SWING SETS (UNITS OF STRUCTURE)		
NUMBER OF TODDLER SWINGS (UNITS OF COMPONENTS)		
GENERAL FEATURES	# HAZARDS	# POTENTIAL
POTENTIAL = UNITS OF STRUCTURE		
no accessible sharp edges, points or projections		
woodwork should be chamfered or rounded		
open ends of all tubing should be finished with smooth caps or plugs		
all bolts & screws should be countersunk or dome headed		
no accessible pinch, crush or shear points by two moving components		
no opening or distance between two parts > 76mm but < 254 mm (allows probe A, but not probe B)		
gripping surfaces should be splinter free		
no surfaces should contain rough textures or joints capable of cutting or abrading human skin		
located in a nontraffic area		
POTENTIAL = UNITS OF COMPONENT		
seat made of impact absorbing material		
support on all sides and between legs		
no moveable/adjustable elements that would permit child to fall off seat		
swing holds shape so adult can remove child w/o holding swing open		
common coil or machine chain link (not double loop) or chain enclosed in protective cover		
bearing hangers should be hung wider than overall loaded length of seat		
designed for only one user at a time		
MEASUREMENTS		
POTENTIAL = UNITS OF STRUCTURE		
side clearance from chain to side frame at height of swing height + 860mm (min = 600mm)		
POTENTIAL = UNITS OF COMPONENT		
seat height when occupied (min = 350mm, max = 450 mm) except if adult assistance needed		
distance between swings & between swing & frame at seat level (min = 750mm)		
PROTECTIVE SURFACE (AREA)		
POTENTIAL = UNITS OF STRUCTURE		
no hard, sharp equipment parts in zone of use that a child can hit in a free fall		
length in front of swing when arc of 60 degrees, or max distance usual arc (min = 1800mm)		
length in rear of swing when arc of 60 degrees, or max distance usual arc (min = 1800mm)		
length to right side of last swing (not frame) (min = 1800 mm)		
length to left side of last swing (not frame) (min = 1800)		
NONENCROACHMENT ZONE		
POTENTIAL = UNITS OF STRUCTURE		

front (min = 1800mm beyond protective surface) or 3600mm beyond swing when arced		
back (min = 1800mm beyond protective surface) or 3600mm beyond swing when arced		
PROTECTIVE SURFACE (ADEQUACY)	MEASUREMENTS (HAZARDS ASSESSED IN ANALYSIS)	
POTENTIAL = UNIT OF STRUCTURE		
type (O.K. = sand, pea gravel, metering stone, wood/bark chips, some manufactured surfaces)		
surface depth directly below swing (mean of depth below all swings)		
mean depth of 10 random measurements in protective surface area		
max. height of potential fall (height of pivot point)		

SWINGS - CHILD SINGLE AXIS

NUMBER OF CHILD SWING SETS (UNITS OF STRUCTURE)		
NUMBER OF CHILD SWINGS (UNITS OF COMPONENTS)		
GENERAL FEATURES	# HAZARDS	# POTENTIAL
POTENTIAL = UNITS OF STRUCTURE		
no accessible sharp edges, points or projections		
woodwork should be chamfered or rounded		
open ends of all tubing should be finished with smooth caps or plugs		
all bolts & screws should be countersunk or dome headed		
no accessible pinch, crush or shear points by two moving components		
no opening or distance between two parts > 76mm but < 254 mm (allows probe A, but not probe B)		
gripping surfaces should be splinter free		
no surfaces should contain rough textures or joints capable of cutting or abrading human skin		
located in a nontraffic area		
POTENTIAL = UNITS OF COMPONENT		
swing seat made of impact absorbing material		
common coil or machine chain link (not double loop) or chain enclosed in protective cover		
bearing hangers should be hung wider than overall loaded length of seat		
designed for only one user at a time		
MEASUREMENTS		
POTENTIAL = UNITS OF STRUCTURE		
side clearance from chain to side frame at height of swing height + 860mm (min = 600mm)		
POTENTIAL = UNITS OF COMPONENT		
seat height when occupied (min = 350mm, max = 450 mm)		
seat surface width (min 300 mm)		
seat surface depth (min 100 mm)		
distance between swings & between swing & frame at seat level (min=750mm)		
PROTECTIVE SURFACE (AREA)		

POTENTIAL = UNITS OF STRUCTURE		
no hard, sharp equipment parts in zone of use that a child can hit in a free fall		
length in front of swing when arc of 60 degrees, or max distance usual arc (min = 1800mm)		
length in rear of swing when arc of 60 degrees, or max distance usual arc (min = 1800mm)		
length to right of last swing (not frame) (min = 1800 mm)		
length to left of last swing (not frame) (min = 1800mm)		
NONENCROACHMENT ZONE		
POTENTIAL = UNITS OF STRUCTURE		
front (min = 1800mm beyond protective surface) or 3600mm beyond swing when arced		
back (min = 1800mm beyond protective surface) or 3600mm beyond swing when arced		

PROTECTIVE SURFACE (ADEQUACY)	MEASUREMENTS (HAZARDS ASSESSED IN ANALYSIS)
POTENTIAL = UNIT OF STRUCTURE	
type (O.K. = sand, pea gravel, metering stone, wood/bark chips, some manufactured surfaces)	
surface depth directly below swing (mean of depth below all swings)	
mean depth of 10 random measurements in protective surface area	
max. height of potential fall (height of pivot point)	

SWINGS - MULTIPLE AXIS

NUMBER OF MULTIPLE AXIS SWING SETS (UNIT OF STRUCTURE)		
NUMBER OF MULTIPLE AXIS SWINGS (UNIT OF COMPONENT)		
GENERAL FEATURES	# HAZARDS	# POTENTIAL
POTENTIAL = UNITS OF STRUCTURE		
no accessible sharp edges, points or projections		
woodwork should be chamfered or rounded		
open ends of all tubing should be finished with smooth caps or plugs		
all bolts & screws should be countersunk or dome headed		
no accessible pinch, crush or shear points by two moving components		
no opening or distance between two parts > 76mm but < 254 mm (allows probe A, but not probe B)		
gripping surfaces should be splinter free		
no surfaces should contain rough textures or joints capable of cutting or abrading human skin		
located in a nontraffic area		
not combined with other swings or no danger of collision with other swings		
POTENTIAL = UNIT OF COMPONENT		
common coil or machine chain link (not double loop) or chain enclosed in protective cover		
no protrusions or sharp edges if steel-belted tires are used		
no possible entrapment of fingers or head		
MEASUREMENTS		

POTENTIAL = UNIT OF COMPONENT		
distance between frame and swing (min 160 mm between frame and outermost part of swing at 60 degrees from vertical)		
distance between underside of swing support and protective surface (min 2440mm, 1800mm for preschoolers)		
distance between undersurface of swing and protective surface (min 350mm)		
PROTECTIVE SURFACE (AREA)		
POTENTIAL = UNITS OF STRUCTURE		
no hard, sharp equipment parts in zone of use that a child can hit in a free fall		
distance between right side of frame and edge of protective surface (min 1800mm)		
distance between left side of frame and edge of protective surface (min 1800mm)		
in front of swing (min = distance from swing to frame + 1800mm)		
in back of swing (min = distance from swing to frame + 1800mm)		
NONENCROACHMENT ZONE		
POTENTIAL = UNITS OF STRUCTURE		
right side (min = 1800mm beyond protective surface) or 3600mm beyond frame		
left side (min = 1800mm beyond protective surface) or 3600mm beyond frame		
front (min = distance from swing to frame + 3600mm)		
back (min = distance from swing to frame + 3600mm)		

PROTECTIVE SURFACE (ADEQUACY)	MEASUREMENTS (HAZARDS ASSESSED IN ANALYSIS)
POTENTIAL = UNIT OF STRUCTURE	
type (O.K. = sand, pea gravel, metering stone, wood/bark chips, some manufactured surfaces)	
surface depth directly below swing (mean of depth below all swings)	
mean depth of 10 random measurements in protective surface area	
max. height of potential fall (height of pivot point)	

OTHER SWINGING EQUIPMENT (SUSPENDED ELEMENTS)

(EX: TRAPEZE BARS, RINGS, TIGHTROPES, CABLES- any elements designed for grasping and swinging by the hands)

NUMBER OF OTHER SWINGING EQUIPMENT STRUCTURES (UNIT OF STRUCTURE)		
NUMBER OF OTHER SWINGING EQUIPMENT COMPONENTS (UNIT OF COMPONENT)		
GENERAL FEATURES	# HAZARDS	# POTENTIAL
POTENTIAL = UNIT OF STRUCTURE		
no accessible sharp edges, points or projections		
woodwork should be chamfered or rounded		
open ends of all tubing should be finished with smooth caps or plugs		
all bolts & screws should be countersunk or dome headed		
no accessible pinch, crush or shear points by two moving components		
no opening or distance between two parts > 76mm but < 254 mm (allows probe A, but not probe B)		
gripping surfaces should be splinter free		

no surfaces should contain rough textures or joints capable of cutting or abrading human skin		
located in a nontraffic area		
POTENTIAL = UNIT OF COMPONENT		
no possible entrapment of fingers or head		
any single rope should be attached at both ends		
MEASUREMENTS		
POTENTIAL = UNIT OF COMPONENT		
distance between grip of suspended element and protective surface for preschoolers (min 1220mm)		
distance between grip of suspended element and protective surface for 5-14yrs (min 1650)		
PROTECTIVE SURFACE (AREA) (assuming same as for multiple axis swings)		
POTENTIAL = UNITS OF STRUCTURE		
no hard, sharp equipment parts in zone of use that a child can hit in a free fall		
distance between right side of frame and edge of protective surface (min 1800mm)		
distance between left side of frame and edge of protective surface (min 1800mm)		
in front of swing (min = distance from swing to frame + 1800mm)		
in back of swing (min = distance from swing to frame + 1800mm)		
NONENCROACHMENT ZONE		
POTENTIAL = UNITS OF STRUCTURE		
right side (min = 1800mm beyond protective surface) or 3600mm beyond frame		
left side (min = 1800mm beyond protective surface) or 3600mm beyond frame		
front (min = distance from swing to frame + 3600mm)		
back (min = distance from swing to frame + 3600mm)		

PROTECTIVE SURFACE (ADEQUACY)	MEASUREMENTS (HAZARDS ASSESSED IN ANALYSIS)
POTENTIAL = UNIT OF STRUCTURE	
type (O.K. = sand, pea gravel, metering stone, wood/bark chips, some manufactured surfaces)	
surface depth directly below swinging equipment (mean of depth below all swings)	
mean depth of 10 random measurements in protective surface area	
max. height of potential fall (height of pivot point)	

2. SLIDING APPARATUS

SLIDES

NUMBER OF SLIDES (UNITS OF STRUCTURE)	
FREESTANDING___ OR PART OF CREATIVE PLAYSTRUCTURE___	
TYPE OF SLIDE (STRAIGHT___ TUBE___ CURVY___ SPIRAL___)	
TYPE OF ACCESS (stairs___ ramp___rungs___ stepladder___ net___ other___)	

GENERAL FEATURES	# HAZARDS	# POTENTIAL
POTENTIAL = UNITS OF STRUCTURE		
no accessible sharp edges, points or projections		
woodwork should be chamfered or rounded		
sheet materials should be finished on exposed edge with roll or rounded capping		
open ends of all tubing should be finished with smooth caps or plugs		
all bolts & screws should be countersunk or dome headed		
no opening or distance between two parts > 76mm but < 254 mm (allows probe A, but not probe B)		
gripping surfaces should be splinter free		
no surfaces should contain rough textures or joints capable of cutting or abrading human skin		
metal slides located in shade or facing north		
no zero gravity		
sidewall edges are rounded		
side enclosures blend from guardrail to sidewall (if has sitting section)		
MEASUREMENTS		
POTENTIAL = UNIT OF STRUCTURE		
length of starting platform (min = 450mm)		
width of starting platform (min = width of slide)		
length of sitting section if present (max = 300mm)		
slope of sitting section (max = 5 degrees)		
height of sidewalls (min = 100 mm) may be 0 at exit		
radius of curvature if declination </= 30 degrees (min = 760mm)		
radius of curvature if declination > 30 degrees (min = 1000mm)		
exit declination between 1 - 5 degrees		
length of exit section (min = 300 mm)		
end of slide rounded		
height of exit above the finished grade (100mm-254mm for age 18m to 4yrs)		
height of exit above the finished grade (254mm-450mm for age 5-14 yrs)		
PROTECTIVE SURFACE (AREA)		
POTENTIAL = UNITS OF STRUCTURE		
no hard, sharp equipment parts in zone of use that a child can hit in a free fall		
length in front of slide exit (min = 1800 mm)		
length in rear of slide access (min = 1800 mm)		
length to right side of slide (min = 1800 mm)		
length to left side of slide (min = 1800 mm)		
NONENCROACHMENT ZONE		
POTENTIAL = UNITS OF STRUCTURE		

front (min = 1800mm beyond protective surface or 3600 mm beyond front of slide exit)		

PROTECTIVE SURFACE (ADEQUACY)	MEASUREMENTS (HAZARDS ASSESSED IN ANALYSIS)
POTENTIAL = UNIT OF STRUCTURE	
type (O.K. = sand, pea gravel, motoring stone, wood/bark chips, some manufactured surfaces)	
surface depth directly beneath slide exit	
mean depth of 10 random measurements in protective surface area	
max. height of potential fall (max. height of top guardrail)	

SLIDING POLES

NUMBER OF SLIDING POLES (UNIT OF STRUCTURE)		
GENERAL FEATURES	# HAZARDS	# POTENTIAL
POTENTIAL = UNITS OF STRUCTURE		
no accessible sharp edges, points or projections		
woodwork should be chamfered or rounded		
open ends of all tubing should be finished with smooth caps or plugs		
all bolts & screws should be countersunk or dome headed		
no opening or distance between two parts > 76mm but < 254 mm (allows probe A, but not probe B)		
gripping surfaces should be splinter free		
no surfaces should contain rough textures or joints capable of cutting or abrading human skin		
access to sliding pole from one point only		
designed to avoid interference from surrounding traffic (ex. guardrail under platform)		
sliding section of poles should be continuous with no welds or joints		
sliding poles not located in a preschool play area (not recommended for preschoolers)		
set on a protective surface		
no hard, sharp equipment parts in zone of use that a child can hit in a free fall		
MEASUREMENTS		
POTENTIAL = UNITS OF STRUCTURE		
distance from pole to platform or structure (min = 450mm, max = 500mm)		
distance between lower surface of the horizontal section of the pole to platform surface (min = 1500mm)		
diameter of the pole (min = 25mm, max = 45mm)		
access to sliding pole through opening in the guardrail (not > 380mm)		
footing at bottom, if provided, should be 300mm below finished grade		
AREA OF PROTECTIVE SURFACE		
***NOT SPECIFIED IN CSA STANDARDS		
NONENCROACHMENT ZONE		
***NOT SPECIFIED IN CSA STANDARDS		

PROTECTIVE SURFACE (ADEQUACY)	MEASUREMENTS (HAZARDS ASSESSED IN ANALYSIS)

POTENTIAL = UNIT OF STRUCTURE	
type (O.K. = sand, pea gravel, metering stone, wood/bark chips, some manufactured surfaces)	
surface depth at pole landing area	
mean depth of 10 random measurements in protective surface area	
max. height of potential fall (max. height of top guardrail)	

ACCESS TO SLIDES AND SLIDING POLES

(nonencroachment zone, area and adequacy of protective surface, and maintenance assessed under slide and pole sections)

stairs, ramps, rung ladders, stepladders, (nets)

STAIRS (STRAIGHT)

NUMBER OF SETS OF STAIRS (UNITS OF STRUCTURE)		
TYPE OF STAIRS (CLOSED___ OR OPEN___)		
GENERAL FEATURES	# HAZARDS	# POTENTIAL
POTENTIAL = UNIT OF STRUCTURE		
no accessible sharp edges, points or projections		
woodwork should be chamfered or rounded		
sheet materials should be finished on exposed edge with roll or rounded capping		
open ends of all tubing should be finished with smooth caps or plugs		
all bolts & screws should be countersunk or dome headed		
no opening or distance between two parts > 76mm but < 254 mm (allows probe A, but not probe B)		
gripping surfaces should be splinter free		
no surfaces should contain rough textures or joints capable of cutting or abrading human skin		
steps should be evenly spaced		
handrails should be immediately contiguous with the stepping surface		
MEASUREMENTS		
POTENTIAL = UNIT OF STRUCTURE		
inclination between 30 - 50 degrees		
rise from one step to next (range = 76 - 254 mm)		
depth of step (min = 120mm)		
stairs should be enclosed if rise is between 76 and 254 mm		
stairs with no intermediate landing should not have > 1800mm vertical rise (except free-standing slides)		
if stairs rise more than 450mm, should have two continuous handrails on both sides		
lower rail should be 300mm above the step tread for preschoolers (18m - 4yrs)		
lower rail should be 500mm above the step tread for 5 - 14 yr olds		
upper rail should be 700mm above the step tread for preschoolers (18m - 4yrs)		
upper rail should be 1000mm above the step tread for 5 - 14 yr olds		
perpendicular distance between rails, or rail and stair should be < 76mm or > 254mm		
step nosing (max = 25 mm)		

STAIRS (SPIRAL)

	# HAZARDS	# POTENTIAL
NUMBER OF SETS OF SPIRAL STAIRWAYS (UNITS OF STRUCTURE)		
TYPE OF STAIRS (CLOSED __OR OPEN__)		
GENERAL FEATURES	# HAZARDS	# POTENTIAL
POTENTIAL = UNIT OF STRUCTURE		
no accessible sharp edges, points or projections		
woodwork should be chamfered or rounded		
sheet materials should be finished on exposed edge with roll or rounded capping		
open ends of all tubing should be finished with smooth caps or plugs		
all bolts & screws should be countersunk or dome headed		
no opening or distance between two parts > 76mm but < 254 mm (allows probe A, but not probe B)		
gripping surfaces should be splinter free		
no surfaces should contain rough textures or joints capable of cutting or abrading human skin		
steps should be evenly spaced		
handrails should be immediately contiguous with the stepping surface		
MEASUREMENTS		
POTENTIAL = UNIT OF STRUCTURE		
rise from one step to next (range = 76 - 254 mm)		
depth of step at inner edge (min = 120mm)		
stairs should be enclosed if rise is between 76 and 254 mm		
stairs with no intermediate landing should not have > 1800mm vertical rise (except free-standing slides)		
if stairs rise more than 450mm, should have two continuous handrails on both sides		
lower rail should be 300mm above the step tread for preschoolers (18m - 4yrs)		
lower rail should be 500mm above the step tread for 5 - 14 yr olds		
upper rail should be 700mm above the step tread for preschoolers (18m - 4yrs)		
upper rail should be 1000mm above the step tread for 5 - 14 yr olds		
perpendicular distance between rails, or rail and stair should be < 76mm or > 254mm		
step nosing (max = 25 mm)		
outside radius (min = 500mm)		
inclination between 15 and 65 degrees (see refs. chart for where to measure)		

REFERENCE CHART *OUTSIDE RADIUS OF SPIRAL SLIDE*	*WHERE TO MEASURE ANGLE OF INCLINATION*
between 500mm - 900mm	70% of width of step measured from inside edge
between 900mm - 1800mm	60% of width of step measured from inside edge
1800mm or greater	50% of width of step measured from inside edge

RAMPS

NUMBER OF SETS OF RAMPS (UNITS OF STRUCTURE)		
GENERAL FEATURES	# HAZARDS	# POTENTIAL
POTENTIAL = UNIT OF STRUCTURE		
no accessible sharp edges, points or projections		
woodwork should be chamfered or rounded		
sheet materials should be finished on exposed edge with roll or rounded capping		
open ends of all tubing should be finished with smooth caps or plugs		
all bolts & screws should be countersunk or dome headed		
no opening or distance between two parts > 76mm but < 254 mm (allows probe A, but not probe B)		
gripping surfaces should be splinter free		
no surfaces should contain rough textures or joints capable of cutting or abrading human skin		
handrails should be immediately contiguous with the walking surface		
MEASUREMENTS		
POTENTIAL = UNIT OF STRUCTURE		
inclination max = 30 degrees		
ramps with no intermediate landing should not have > 1800mm vertical rise (except free-standing slides)		
if ramp rises more than 450mm, should have two continuous handrails on both sides		
lower rail should be 300mm above the ramp for preschoolers (18m - 4yrs)		
lower rail should be 500mm above the ramp for 5 - 14 yr olds		
upper rail should be 700mm above the ramp for preschoolers (18m - 4yrs)		
upper rail should be 1000mm above the ramp for 5 - 14 yr olds		
perpendicular distance between rails, or rail and ramp should be < 76mm or > 254mm		

RUNG LADDERS

NUMBER OF RUNG LADDERS (UNITS OF STRUCTURE)		
GENERAL FEATURES	# HAZARDS	# POTENTIAL
POTENTIAL = UNIT OF STRUCTURE		
no accessible sharp edges, points or projections		
woodwork should be chamfered or rounded		
open ends of all tubing should be finished with smooth caps or plugs		
all bolts & screws should be countersunk or dome headed		
no opening or distance between two parts > 76mm but < 254 mm (allows probe A, but not probe B)		
gripping surfaces should be splinter free		
no surfaces should contain rough textures or joints capable of cutting or abrading human skin		
rungs should be evenly spaced		
rungs should not turn when grasped		
rung ladders should not be closed		

MEASUREMENTS		
POTENTIAL = UNIT OF STRUCTURE		
angle of inclination between 50 - 90 degrees		
rung ladders with no intermediate landing not have > 1800mm vertical rise (except free-standing slides)		
spacing of rungs < 76mm or > 254mm		
rung diameter between 25-35mm for preschoolers (18m - 4yrs)		
rung diameter 25 - 45mm for 5 - 14 yr olds		
width of ladder (min = 300mm)		
distance between finished grade and top of first rung (max = 450mm)		

STEPLADDERS

NUMBER OF STEPLADDERS (UNITS OF STRUCTURE)		
GENERAL FEATURES	# HAZARDS	# POTENTIAL
POTENTIAL = UNIT OF STRUCTURE		
no accessible sharp edges, points or projections		
woodwork should be chamfered or rounded		
open ends of all tubing should be finished with smooth caps or plugs		
all bolts & screws should be countersunk or dome headed		
no opening or distance between two parts > 76mm but < 254 mm (allows probe A, but not probe B)		
gripping surfaces should be splinter free		
no surfaces should contain rough textures or joints capable of cutting or abrading human skin		
steps should be evenly spaced		
MEASUREMENTS		
POTENTIAL = UNIT OF STRUCTURE		
inclination between 50 and 90 degrees		
step ladders with no intermediate landing not have > 1800mm vertical rise (except free-standing slides)		
rise from step to step (when closed) between 76 - 254 mm		
rise from step to step (when open) < 76 or > 254 mm		
step depth (when closed) min = 120mm		
step depth (when open) min = 76mm		
step width (min = 300mm)		
if stepladder rises more than 450mm, should have one continuous handrail on both sides		
rail should be max. of 700mm above the step tread for preschoolers (18m - 4yrs)(as angle >, ht.<)		
rail should be max. of 1000mm above the step tread for 5 - 14 yr olds (as angle >, ht.<)		
perpendicular dimension between rail and step tread nosing never < 254mm (takes precedence over above 2)		
step nosing (max = 25 mm)		

CARGO NETS, MOVING LADDERS AND SIMILAR DEVICES

NUMBER OF CARGO NETS (UNITS OF STRUCTURE)		
GENERAL FEATURES	# HAZARDS	# POTENTIAL
POTENTIAL = UNIT OF STRUCTURE		
no accessible sharp edges, points or projections		
woodwork should be chamfered or rounded		
open ends of all tubing should be finished with smooth caps or plugs		
all bolts & screws should be countersunk or dome headed		
no opening or distance between two parts > 76mm but < 254 mm (allows probe A, but not probe B)		
gripping surfaces should be splinter free		
no surfaces should contain rough textures or joints capable of cutting or abrading human skin		
should be securely fastened		
no potential head or neck entrapment		
any single rope should be attached at both ends		

3. ROCKING EQUIPMENT

NUMBER OF ROCKING EQUIPMENT PIECES (UNIT OF STRUCTURE)		
GENERAL FEATURES	# HAZARDS	# POTENTIAL
POTENTIAL = UNIT OF STRUCTURE		
no accessible sharp edges, points or projections		
woodwork should be chamfered or rounded		
open ends of all tubing should be finished with smooth caps or plugs		
all bolts & screws should be countersunk or dome headed		
no accessible pinch, crush or shear points by two moving components		
no opening or distance between two parts > 76mm but < 254 mm (allows probe A, but not probe B)		
gripping surfaces should be splinter free		
no surfaces should contain rough textures or joints capable of cutting or abrading human skin		
hand grips and foot rests should be fixed		
hand grips and foot rests should not turn when grasped		
MEASUREMENTS		
POTENTIAL = UNIT OF STRUCTURE		
diameter of hand grips and foot rests (preschoolers 18m - 4yrs) range: 25-35 mm		
diameter of hand grips and foot rests (age 5 - 14 yrs) range: 25 - 45 mm		
hand grips and foot rests should not project beyond max of 125 mm		
any projection should have a min. diameter of 18mm		
distance from ground to seat for preschoolers should be 350 - 600 mm		
AREA OF PROTECTIVE SURFACE		

POTENTIAL = UNIT OF STRUCTURE		
no hard, sharp equipment parts in zone of use that a child can hit in a free fall		
front (min 1800 mm)		
back (min 1800 mm)		
right side (min 1800 mm)		
left side (min 1800 mm)		
NONENCROACHMENT ZONE		
none required unless adjacent to moving equipment		

PROTECTIVE SURFACE (ADEQUACY)	MEASUREMENTS (HAZARDS ASSESSED IN ANALYSIS)
POTENTIAL = UNIT OF STRUCTURE	
type (O.K. = sand, pea gravel, metering stone, wood/bark chips, some manufactured surfaces.)	
surface depth directly beneath spring toy	
mean depth of 10 random measurements in protective surface area	
max. height of potential fall (max height of any part)	

4. TEETER TOTTERS

NUMBER OF TEETER TOTTERS (UNIT OF STRUCTURE)		
GENERAL FEATURES	# HAZARDS	# POTENTIAL
POTENTIAL = UNIT OF STRUCTURE		
no accessible sharp edges, points or projections		
woodwork should be chamfered or rounded		
open ends of all tubing should be finished with smooth caps or plugs		
all bolts & screws should be countersunk or dome headed		
no accessible pinch, crush or shear points by two moving components		
no opening or distance between two parts > 76mm but < 254 mm (allows probe A, but not probe B)		
gripping surfaces should be splinter free		
no surfaces should contain rough textures or joints capable of cutting or abrading human skin		
handles designed to prevent entrapment (loops, slings or rings are not acceptable)		
hand grips or foot rests should not turn when grasped		
hand grips should be fixed		
protruding hand grips should not permit the knee to become entrapped between grip and ground		
if beam allowed to hit ground, an impact cushion should be provided (eg. tires)		
no hard, sharp equipment parts in zone of use that a child can hit in a free fall		
should be set on a protective surface		
MEASUREMENTS		
POTENTIAL = UNIT OF STRUCTURE		
pivot height (max = 760mm above finished grade)		

diameter of hand grips (min = 18mm)		
AREA OF PROTECTIVE SURFACE		
***NOT SPECIFIED IN CSA STANDARDS		
NONENCROACHMENT ZONE		
***NOT SPECIFIED IN CSA STANDARDS		

PROTECTIVE SURFACE (ADEQUACY)	MEASUREMENTS (HAZARDS ASSESSED IN ANALYSIS)
POTENTIAL = UNIT OF STRUCTURE	
type (O.K. = sand, pea gravel, metering stone, wood/bark chips, some manufactured surfaces)	
surface depth directly beneath teeter totter (mean of depths directly under two seats)	
mean depth of 10 random measurements in surrounding area	
max. height of potential fall (max ht. attainable by any part of teeter totter)	

5. CLIMBERS

NUMBER OF CLIMBERS (UNIT OF STRUCTURE)		
GENERAL FEATURES	# HAZARDS	# POTENTIAL
POTENTIAL = UNIT OF STRUCTURE		
no accessible sharp edges, points or projections		
woodwork should be chamfered or rounded		
sheet materials should be finished on exposed edge with roll or rounded capping		
open ends of all tubing should be finished with smooth caps or plugs		
all bolts & screws should be countersunk or dome headed		
no opening or distance between two parts > 76mm but < 254 mm (allows probe A, but not probe B)		
gripping surfaces should be splinter free		
no surfaces should contain rough textures or joints capable of cutting or abrading human skin		
overhead ladders should allow children to grasp first rung from either end from a standing position		
all rungs should permit fall to protective surface without striking any obstruction (bars, platform)		
rungs and bars should not turn when grasped		
MEASUREMENTS		
POTENTIAL = UNIT OF STRUCTURE		
rung diameter (preschoolers 18m - 4yrs) range: 25 - 35mm		
rung diameter (age 5 - 14yrs) not > 45mm		
clear distance between successive rungs (range: 300 - 400mm)		
AREA OF PROTECTIVE SURFACE		
POTENTIAL = UNIT OF STRUCTURE		
no hard, sharp equipment parts in zone of use that a child can hit in a free fall		

front (min 1800 mm)		
back (min 1800 mm)		
right side (min 1800 mm)		
left side (min 1800 mm)		
NONENCROACHMENT ZONE		
POTENTIAL = UNIT OF STRUCTURE		
1800mm if adjacent to moving equipment		
PROTECTIVE SURFACE (ADEQUACY)	MEASUREMENTS (HAZARDS ASSESSED IN ANALYSIS)	
POTENTIAL = UNIT OF STRUCTURE		
type (O.K. = sand, pea gravel, metering stone, wood/bark chips, some manufactured surfaces)		
mean depth of 10 measurements directly beneath climber		
mean depth of 10 random measurements in protective surface area		
max. height of potential fall (max height of climber)		

6. MERRY-GO-ROUNDS/WHIRLERS

****NOTE: "Rotating apparatus presents physical and psychological hazards because once in motion children have no control over its movement. Therefore such equipment is not desirable for use in any playground unless the design overcomes these operational problems. It is further recommended that rotation equipment only be used in supervised areas." pg 57.*

NUMBER OF MERRY-GO-ROUND/WHIRLERS (UNIT OF STRUCTURE)		
GENERAL FEATURES	# HAZARDS	# POTENTIAL
POTENTIAL = UNIT OF STRUCTURE		
no accessible sharp edges, points or projections		
woodwork should be chamfered or rounded		
sheet materials should be finished on exposed edge with roll or rounded capping		
open ends of all tubing should be finished with smooth caps or plugs		
all bolts & screws should be countersunk or dome headed		
no accessible pinch, crush or shear points by two moving components		
no opening or distance between two parts > 76mm but < 254 mm (allows probe A, but not probe B)		
gripping surfaces should be splinter free		
no surfaces should contain rough textures or joints capable of cutting or abrading human skin		
apparatus located in a supervised area		
apparatus located in a nontraffic area		
secure means of holding on provided		
handgrips should not turn when grasped		
no projections beyond the outside diameter of the platform		
MEASUREMENTS		
POTENTIAL = UNIT OF STRUCTURE		

hand grip diameter (preschoolers 18m - 4yrs) range: 25 - 35mm		
hand grip diameter (age 5 - 14yrs) range: 25 - 45mm		
no accessible space > 5mm should be exposed between moving parts within the rotation device		
space between underside of platform and protective surface <76mm or > 254mm		
AREA OF PROTECTIVE SURFACE		
POTENTIAL = UNITS OF STRUCTURE		
no hard, sharp equipment parts in zone of use that a child can hit in a free fall		
front min = 1800mm		
rear min = 1800mm		
right side min = 1800mm		
left side min = 1800mm		
NONENCROACHMENT ZONE		
POTENTIAL = UNITS OF STRUCTURE		
front min = 1800mm beyond protective surface (3600mm from rotating equipment)		
rear min = 1800mm beyond protective surface (3600mm from rotating equipment)		
right side min = 1800mm beyond protective surface (3600mm from rotating equipment)		
left side min = 1800mm beyond protective surface (3600mm from rotating equipment)		

PROTECTIVE SURFACE (ADEQUACY)	MEASUREMENTS (HAZARDS ASSESSED IN ANALYSIS)
POTENTIAL = UNIT OF STRUCTURE	
type (O.K. = sand, pea gravel, metering stone, wood/bark chips, some manufactured surfaces)	
mean depth of 10 measurements directly surrounding rotating apparatus	
mean depth of 10 random measurements in protective surface area	
max. ht. of potential fall (ht. of any part at the perimeter on which a child may sit or stand)	

7. SANDBOXES

NUMBER OF SANDBOXES (UNIT OF STRUCTURE)		
GENERAL FEATURES	# HAZARDS	# POTENTIAL
POTENTIAL = UNIT OF STRUCTURE		
no accessible sharp edges, points or projections		
woodwork should be chamfered or rounded		
sheet materials should be finished on exposed edge with roll or rounded capping		
open ends of all tubing should be finished with smooth caps or plugs		
all bolts & screws should be countersunk or dome headed		
no accessible pinch, crush or shear points by two moving components		
no opening or distance between two parts > 76mm but < 254 mm (allows probe A, but not probe B)		
no surfaces should contain rough textures or joints capable of cutting or abrading human skin		
sand should pack together for moulding (no blow sand)		

sand should appear clean		
sand should be free of contaminants (take sand sample for animal fecal contaminants)		
some shade and shelter provided		
seating for adults near the sandbox (supervision)		
not located in a physical play zone		
sandbox covers, if used, designed to be safely secured in both open and closed positions		
sand play area exposed to some sun and rain		
MEASUREMENTS		
POTENTIAL = UNIT OF STRUCTURE		
total sand play area (min = 6-7 sq. m.)		
height of sandbox ledge above the finished grade(max = 280mm) (outside the box)		
width of sandbox ledge (min = 85mm)		
AREA OF PROTECTIVE SURFACE		
***NOT SPECIFIED IN CSA STANDARDS (N/A)		
NONENCROACHMENT ZONE		
***NOT SPECIFIED IN CSA STANDARDS (N/A)		
PROTECTIVE SURFACE (ADEQUACY)		
***NOT SPECIFIED IN CSA STANDARDS (IF HT >450MM ABOVE FINISHED GRADE, ASSESS ALSO AS CREATIVE PLAYSTRUCTURE)		

8. CREATIVE PLAYSTRUCTURES

INCLUDES ACCESS : STAIRS (STRAIGHT AND SPIRAL), RAMPS, RUNG LADDERS, STEPLADDERS & CARGO NETS, PLATFORMS & INTERMEDIATE LANDINGS, HANDRAILS & GUARDRAILS
(INDIVIDUAL COMPONENTS SUCH AS SLIDES, SLIDING POLES & CLIMBING APPARATUS ARE TO BE ASSESSED IN THEIR RESPECTIVE SECTIONS)

NOTE: AREA OF PROTECTIVE SURFACE AND NONENCROACHMENT ZONE FOR CREATIVE PLAYSTRUCTURES ARE NOT SPECIFICALLY ADDRESSED IN THE GUIDELINES, BUT ARE ASSUMED TO BE THAT OF STATIONARY EQUIPMENT AS GIVEN ON PAGE 31 ie. 1800MM PROTECTIVE SURFACE ON ALL SIDES AND 1800MM FOR NONENCROACHMENT ZONE WHEN ADJACENT TO MOVING EQUIPMENT (OTHERWISE NONE REQUIRED). ADEQUACY OF PROTECTIVE SURFACE WILL BE ASSESSED ON THE BASIS OF MAXIMUM HEIGHT OF POTENTIAL FALL.

ACCESS- STAIRS (STRAIGHT)

NUMBER OF CREATIVE PLAYSTRUCTURES (UNITS OF STRUCTURE)		
NUMBER OF SETS OF STAIRS (UNITS OF COMPONENT PARTS)		
TYPE OF STAIRS (CLOSED___ OR OPEN___)		
GENERAL FEATURES	# HAZARDS	# POTENTIAL
POTENTIAL = UNIT OF COMPONENT		
no accessible sharp edges, points or projections		
woodwork should be chamfered or rounded		
sheet materials should be finished on exposed edge with roll or rounded capping		
open ends of all tubing should be finished with smooth caps or plugs		

all bolts & screws should be countersunk or dome headed		
no opening or distance between two parts > 76mm but < 254 mm (allows probe A, but not probe B)		
gripping surfaces should be splinter free		
no surfaces should contain rough textures or joints capable of cutting or abrading human skin		
steps should be evenly spaced		
handrails should be immediately contiguous with the stepping surface		
MEASUREMENTS		
POTENTIAL = UNIT OF COMPONENT		
inclination between 30 - 50 degrees		
rise from one step to next (range = 76 - 254 mm)		
depth of step (min = 120mm)		
stairs should be enclosed if rise is between 76 and 254 mm		
stairs with no intermediate landing should not have > 1800mm vertical rise (except free-standing slides)		
if stairs rise more than 450mm, should have two continuous handrails on both sides		
lower rail should be 300mm above the step tread for preschoolers (18m - 4yrs)		
lower rail should be 500mm above the step tread for 5 - 14 yr olds		
upper rail should be 700mm above the step tread for preschoolers (18m - 4yrs)		
upper rail should be 1000mm above the step tread for 5 - 14 yr olds		
perpendicular distance between the two rails, or rail and step should be < 76mm or > 254mm		
step nosing (max = 25 mm)		
PROTECTIVE SURFACE (AREA)		
POTENTIAL = # OF RELEVANT DIRECTIONS		
no hard, sharp equipment parts in zone of use that a child can hit in a free fall		
1800mm in all directions		
NONENCROACHMENT ZONE		
POTENTIAL = # OF RELEVANT DIRECTIONS		
1800mm in all directions when adjacent to moving equipment (5400mm total)		

PROTECTIVE SURFACE (ADEQUACY)	MEASUREMENTS (HAZARDS ASSESSED IN ANALYSIS)
POTENTIAL = UNIT OF COMPONENT	
type (O.K. = sand, pea gravel, metering stone, wood/bark chips, some manufactured surfaces)	
mean depth of 10 measurements directly beneath stairs	
mean depth of 10 random measurements in protective surface area	
max. height of potential fall (max. height top guardrail)	

ACCESS- STAIRS (SPIRAL)

NUMBER OF CREATIVE PLAYSTRUCTURES (UNITS OF STRUCTURE)	
NUMBER OF SETS OF SPIRAL STAIRS (UNITS OF COMPONENTS)	

TYPE OF STAIRS (CLOSED___ OR OPEN___)		
GENERAL FEATURES	# HAZARDS	# POTENTIAL
POTENTIAL = UNIT OF COMPONENT		
no accessible sharp edges, points or projections		
woodwork should be chamfered or rounded		
sheet materials should be finished on exposed edge with roll or rounded capping		
open ends of all tubing should be finished with smooth caps or plugs		
all bolts & screws should be countersunk or dome headed		
no opening or distance between two parts > 76mm but < 254 mm (allows probe A, but not probe B)		
gripping surfaces should be splinter free		
no surfaces should contain rough textures or joints capable of cutting or abrading human skin		
steps should be evenly spaced		
handrails should be immediately contiguous with the stepping surface		
MEASUREMENTS		
POTENTIAL = UNIT OF COMPONENT		
rise from one step to next (range = 76 - 254 mm)		
depth of step at inner edge (min = 120mm)		
stairs should be enclosed if rise is between 76 and 254 mm		
stairs with no intermediate landing should not have > 1800mm vertical rise (except free-standing slides)		
if stairs rise more than 450mm, should have two continuous handrails on both sides		
lower rail should be 300mm above the step tread for preschoolers (18m - 4yrs)		
lower rail should be 500mm above the step tread for 5 - 14 yr olds		
upper rail should be 700mm above the step tread for preschoolers (18m - 4yrs)		
upper rail should be 1000mm above the step tread for 5 - 14 yr olds		
perpendicular distance between rails, or rail and stair should be < 76mm or > 254mm		
step nosing (max = 25 mm)		
outside radius (min = 500mm)		
inclination between 15 and 65 degrees (see ref. chart for where to measure)		

REFERENCE CHART *OUTSIDE RADIUS OF SPIRAL SLIDE*	*WHERE TO MEASURE ANGLE OF INCLINATION*
between 500mm - 900mm	70% of width of step measured from inside edge
between 900mm - 1800mm	60% of width of step measured from inside edge
1800mm or greater	50% of width of step measured from inside edge

PROTECTIVE SURFACE (AREA)		
POTENTIAL = # OF RELEVANT DIRECTIONS		
no hard, sharp equipment parts in zone of use that a child can hit in a free fall		
1800mm in all directions		

NONENCROACHMENT ZONE		
POTENTIAL = # OF RELEVANT DIRECTIONS		
1800mm in all directions when adjacent to moving equipment		

PROTECTIVE SURFACE (ADEQUACY)	MEASUREMENTS (HAZARDS ASSESSED IN ANALYSIS)
POTENTIAL = UNIT OF COMPONENT	
type (O.K. = sand, pea gravel, metering stone, wood/bark chips, some manufactured surfaces)	
mean depth of 10 measurements directly beneath stairs	
mean depth of 10 random measurements in protective surface area	
max. height of potential fall (max. height top guardrail)	

ACCESS- RAMPS

NUMBER OF CREATIVE PLAYSTRUCTURES (UNITS OF STRUCTURE)		
NUMBER OF RAMPS (UNITS OF COMPONENTS)		
GENERAL FEATURES	# HAZARDS	# POTENTIAL
POTENTIAL = UNIT OF COMPONENT		
no accessible sharp edges, points or projections		
woodwork should be chamfered or rounded		
sheet materials should be finished on exposed edge with roll or rounded capping		
open ends of all tubing should be finished with smooth caps or plugs		
all bolts & screws should be countersunk or dome headed		
no opening or distance between two parts > 76mm but < 254 mm (allows probe A, but not probe B)		
gripping surfaces should be splinter free		
no surfaces should contain rough textures or joints capable of cutting or abrading human skin		
handrails should be immediately contiguous with the walking surface		
MEASUREMENTS		
POTENTIAL = UNIT OF COMPONENT		
inclination max = 30 degrees		
ramps with no intermediate landing should not have > 1800mm vertical rise (except free-standing slides)		
if ramp rises more than 450mm, should have two continuous handrails on both sides		
lower rail should be 300mm above the ramp for preschoolers (18m - 4yrs)		
lower rail should be 500mm above the ramp for 5 - 14 yr olds		
upper rail should be 700mm above the ramp for preschoolers (18m - 4yrs)		
upper rail should be 1000mm above the ramp for 5 - 14 yr olds		
perpendicular distance between rails, or rails and ramp should be < 76mm or > 254mm		
PROTECTIVE SURFACE (AREA)		
POTENTIAL = # OF RELEVANT DIRECTIONS		
no hard, sharp equipment parts in zone of use that a child can hit in a free fall		

1800mm in all directions		
NONENCROACHMENT ZONE		
POTENTIAL = # OF RELEVANT DIRECTIONS		
1800mm in all directions when adjacent to moving equipment		

PROTECTIVE SURFACE (ADEQUACY)	MEASUREMENTS (HAZARDS ASSESSED IN ANALYSIS)
POTENTIAL = UNIT OF COMPONENT	
type (O.K. = sand, pea gravel, metering stone, wood/bark chips, some manufactured surfaces)	
mean depth of 10 measurements directly beneath ramp	
mean depth of 10 random measurements in protective surface area	
max. height of potential fall (max. height top guardrail)	

ACCESS - RUNG LADDERS

NUMBER OF CREATIVE PLAYSTRUCTURES (UNITS OF STRUCTURE)		
NUMBER OF RUNG LADDERS (UNITS OF COMPONENTS)		
GENERAL FEATURES	# HAZARDS	# POTENTIAL
POTENTIAL = UNIT OF COMPONENT		
no accessible sharp edges, points or projections		
woodwork should be chamfered or rounded		
open ends of all tubing should be finished with smooth caps or plugs		
all bolts & screws should be countersunk or dome headed		
no opening or distance between two parts > 76mm but < 254 mm (allows probe A, but not probe B)		
gripping surfaces should be splinter free		
no surfaces should contain rough textures or joints capable of cutting or abrading human skin		
rungs should be evenly spaced		
rungs should not turn when grasped		
rung ladders should not be closed		
MEASUREMENTS		
POTENTIAL - UNIT OF COMPONENT		
angle of inclination between 50 - 90 degrees		
rung ladders with no intermediate landing not have > 1800mm vertical rise (except free-standing slides)		
rung diameter between 25-35mm for preschoolers (18m - 4yrs)		
rung diameter between 25 - 45mm for 5 - 14 yr olds		
width of ladder (min = 300mm)		
distance between finished grade and top of first rung (max = 450mm)		
PROTECTIVE SURFACE (AREA)		
POTENTIAL = # OF RELEVANT DIRECTIONS		
no hard, sharp equipment parts in zone of use that a child can hit in a free fall		

1800mm in all directions		
NONENCROACHMENT ZONE		
POTENTIAL = # OF RELEVANT DIRECTIONS		
1800mm in all directions when adjacent to moving equipment		

PROTECTIVE SURFACE (ADEQUACY)	MEASUREMENTS (HAZARDS ASSESSED IN ANALYSIS)
POTENTIAL = UNIT OF COMPONENT	
type (O.K. = sand, pea gravel, metering stone, wood/bark chips, some manufactured surfaces)	
mean depth of 10 measurements directly beneath rung ladder	
mean depth of 10 random measurements in protective surface area	
max. height of potential fall (max. height top guardrail)	

ACCESS- STEPLADDERS

NUMBER OF CREATIVE PLAYSTRUCTURES (UNITS OF STRUCTURE)		
NUMBER OF STEPLADDERS (UNITS OF COMPONENTS)		
GENERAL FEATURES	# HAZARDS	# POTENTIAL
POTENTIAL = UNIT OF COMPONENT		
no accessible sharp edges, points or projections		
woodwork should be chamfered or rounded		
open ends of all tubing should be finished with smooth caps or plugs		
all bolts & screws should be countersunk or dome headed		
no opening or distance between two parts > 76mm but < 254 mm (allows probe A, but not probe B)		
gripping surfaces should be splinter free		
no surfaces should contain rough textures or joints capable of cutting or abrading human skin		
steps should be evenly spaced		
MEASUREMENTS		
POTENTIAL = UNIT OF COMPONENT		
inclination between 50 and 90 degrees		
stepladders with no intermediate landing not have > 1800mm vertical rise (except free-standing slides)		
rise from step to step (when closed) between 76 - 254 mm		
rise from step to step (when open) < 76 or > 254 mm		
step depth (when closed) min = 120mm		
step depth (when open) min = 76mm		
step width (min = 300mm)		
if stepladder rises more than 450mm, should have one continuous handrail on both sides		
rail should be max. of 700mm above the step tread for preschoolers (18m - 4yrs) (as angle >, ht. <)		
rail should be max. of 1000mm above the step tread for 5 - 14 yr olds (as angle >, ht. <)		
perpendicular dimension between rail and step tread nosing never < 254mm (takes precedence over above 2)		

step nosing (max = 25 mm)		
PROTECTIVE SURFACE (AREA)		
POTENTIAL = # OF RELEVANT DIRECTIONS		
no hard, sharp equipment parts in zone of use that a child can hit in a free fall		
1800mm in all directions		
NONENCROACHMENT ZONE		
POTENTIAL = # OF RELEVANT DIRECTIONS		
1800mm in all directions when adjacent to moving equipment		

PROTECTIVE SURFACE (ADEQUACY)	MEASUREMENTS (HAZARDS ASSESSED IN ANALYSIS)
POTENTIAL = UNIT OF COMPONENT	
type (O.K. = sand, pea gravel, metering stone, wood/bark chips, some manufactured surfaces))	
mean depth of 10 measurements directly beneath stepladder	
mean depth of 10 random measurements in protective surface area	
max. height of potential fall ((max. height top guardrail)	

ACCESS- CARGO NETS, MOVING LADDERS AND SIMILAR DEVICES

NUMBER OF CREATIVE PLAYSTRUCTURES (UNITS OF STRUCTURE)		
NUMBER OF NETS OR SIMILAR DEVICES (UNITS OF COMPONENTS)		
GENERAL FEATURES	# HAZARDS	# POTENTIAL
POTENTIAL = UNIT OF COMPONENT		
no accessible sharp edges, points or projections		
woodwork should be chamfered or rounded		
open ends of all tubing should be finished with smooth caps or plugs		
all bolts & screws should be countersunk or dome headed		
no opening or distance between two parts > 76mm but < 254 mm (allows probe A, but not probe B)		
gripping surfaces should be splinter free		
no surfaces should contain rough textures or joints capable of cutting or abrading human skin		
should be securely fastened		
any single rope should be attached at both ends		
PROTECTIVE SURFACE (AREA)		
POTENTIAL = # OF RELEVANT DIRECTIONS		
no hard, sharp equipment parts in zone of use that a child can hit in a free fall		
1800mm in all directions		
NONENCROACHMENT ZONE		
POTENTIAL = # OF RELEVANT DIRECTIONS		
1800mm in all directions when adjacent to moving equipment		

PROTECTIVE SURFACE (ADEQUACY)	MEASUREMENTS (HAZARDS ASSESSED IN ANALYSIS)

POTENTIAL = UNIT OF COMPONENT	
type (O.K. = sand, pea gravel, metering stone, wood/bark chips, some manufactured surfaces)	
mean depth of 10 measurements directly beneath cargo net (or facsimile)	
mean depth of 10 random measurements in protective surface area	
max. height of potential fall (max. height top guardrail)	

PLATFORMS & INTERMEDIATE LANDINGS

NUMBER OF CREATIVE PLAYSTRUCTURES (UNITS OF STRUCTURE)		
NUMBER OF PLATFORMS AND INTERMEDIATE LANDINGS (UNITS OF COMPONENTS)		
GENERAL FEATURES	# HAZARDS	# POTENTIAL
POTENTIAL = UNIT OF COMPONENT		
no accessible sharp edges, points or projections		
woodwork should be chamfered or rounded		
sheet materials should be finished on exposed edge with roll or rounded capping		
open ends of all tubing should be finished with smooth caps or plugs		
all bolts & screws should be countersunk or dome headed		
no accessible pinch, crush or shear points by two moving components		
no opening or distance between two parts > 76mm but < 254 mm (allows probe A, but not probe B)		
gripping surfaces should be splinter free		
no surfaces should contain rough textures or joints capable of cutting or abrading human skin		
MEASUREMENTS		
POTENTIAL = UNIT OF COMPONENT		
if platform decking is > 40mm thick, openings in platform deck should not exceed 13mm		
if platform decking is </= 40mm thick, openings in platform deck should not exceed 6mm		
difference between two platforms of different heights should not exceed 300mm (18m - 4 yr olds)		
difference between two platforms of different heights should not exceed 610mm (5 - 14 yr olds)		
entry and exit from intermediate landings should be offset by 90-180 degrees		
dimensions of intermediate landings (min = 900mm by 900mm)		
PROTECTIVE SURFACE (AREA)		
POTENTIAL = # OF RELEVANT DIRECTIONS		
no hard, sharp equipment parts in zone of use that a child can hit in a free fall		
1800mm in all directions		
NONENCROACHMENT ZONE		
POTENTIAL = # OF RELEVANT DIRECTIONS		
1800mm in all directions when adjacent to moving equipment		
PROTECTIVE SURFACE (ADEQUACY)	MEASUREMENTS (HAZARDS ASSESSED IN ANALYSIS)	

POTENTIAL = UNIT OF COMPONENT	
type (O.K. = sand, pea gravel, metering stone, wood/bark chips, some manufactured surfaces)	
mean depth of 10 measurements directly beneath platform	
mean depth of 10 random measurements in protective surface area	
max. height of potential fall (max. height of top guardrail)	

GUARDRAILS AND HANDRAILS (for any not already assessed with access to slides, poles and creative playstructures)

PROTECTIVE SURFACE AND NONENCROACHMENT ZONE TO BE ASSESSED WITH THE EQUIPMENT ON WHICH RAILS ARE ATTACHED

NUMBER OF CREATIVE PLAYSTRUCTURES (UNITS OF STRUCTURE)		
NUMBER OF SETS OF CONTINUOUS HANDRAILINGS/GUARDRAILS NOT YET ASSESSED (UNITS OF COMPONENTS)		
GENERAL FEATURES	# HAZARDS	# POTENTIAL
POTENTIAL = UNIT OF COMPONENT		
no accessible sharp edges, points or projections		
woodwork should be chamfered or rounded		
sheet materials should be finished on exposed edge with roll or rounded capping		
open ends of all tubing should be finished with smooth caps or plugs		
all bolts & screws should be countersunk or dome headed		
no opening or distance between two parts > 76mm but < 254 mm (allows probe A, but not probe B)		
gripping surfaces should be splinter free		
no surfaces should contain rough textures or joints capable of cutting or abrading human skin		
all stairs, steps & ramps rising > 450mm should have two continuous handrails both sides		
stepladders require only a single handrail both sides		
handrails should be immediately contiguous with the stepping surface		
MEASUREMENTS		
POTENTIAL = UNIT OF COMPONENT		
all platforms with fall height of > 450mm should have perimeter guardrails (except at access points)		
all platforms with fall height of > 1200mm need panel-style or vertical fence-style guardrails		
horizontal openings in guardrails for access should be <380mm or have a top guardrail		
height of top guardrail (min = 610mm)		
max. clearance below panel or vertical guardrails = 300mm		
lower rail should be 300mm above the step tread for preschoolers (18m - 4yrs)		
lower rail should be 500mm above the step tread for 5 - 14 yr olds		
upper (or single) rail should be 700mm above the step tread for preschoolers (18m - 4 yrs)		
upper (or single) rail should be 1000mm above the step tread for 5 - 14 yr olds		
perpendicular distance between rails, or rail and stepping surface should be < 76mm or > 254mm		
clearance between platform and bottom of guardrail (max = 300mm) (not >76 &< 254)		
space between vertical railings in fence-style guardrail should be < 76mm		

(TO BE APPLIED TO ALL RELEVANT AREAS OF THE SITE NOT ALREADY ASSESSED)
CAUTION: DO NOT ASSESS ANY SINGLE FEATURE MORE THAN ONCE

GENERAL FEATURES	# HAZARDS	# POTENTIAL
POTENTIAL = ONE		
no accessible sharp edges, points or projections		
woodwork should be chamfered or rounded		
sheet materials should be finished on exposed edge with roll or rounded capping		
open ends of all tubing should be finished with smooth caps or plugs		
all bolts & screws should be countersunk or dome headed		
no accessible pinch, crush or shear points by two moving components		
no suspended lateral elements < 25mm diameter stretched horizontally in area of activity		
if suspended lateral elements > 26mm diameter are unavoidable, should be brightly coloured		
balance cables if protected from lateral access are O.K. , diameter 9mm min		
no opening or distance between two parts > 76mm but < 254 mm (allows probe A, not probe B)		
no surfaces should contain rough textures or joints capable of cutting or abrading human skin		
gripping surfaces should be splinter free		
no hard, sharp equipment parts in zone of use that a child can hit in a free fall		
site not located near high voltage power lines or transformer stations		
play area has visually defined boundaries		
MEASUREMENTS		
POTENTIAL = ONE		
any enclosed space > 1800mm deep from entrance should have min. of 2 independent openings		
crawl space should be min. of 610mm high & 610mm wide		
crawl space with any interior diameter < 760mm should be max. length of 1800mm		
all standing surfaces 450mm above finished grade should have guardrails		
for elevations > 1800mm, more than one method of exit provided (except single function equipment eg. slide)		
angles formed by adjacent surfaces should be >/= 55 degrees (unless lower leg >10 degrees below horizontal, or angle filled such that surfaces of angle are > 254mm apart)		

10. OTHER

MAINTENANCE CHECKLIST

EQUIPMENT FEATURE		SWINGS-TODDLER	SWINGS-CHILD	SWINGS-MULTIAXIS	OTHER SWINGING EQUIPMENT	SLIDES	SLIDING POLES	ROCKING EQUIPMENT	TEETER TOTTERS	CLIMBERS	MERRY-GO-ROUNDS/ WHIRLERS	CREATIVE PLAY-STRUCTURES	SANDBOXES	GENERAL SITE CONDITIONS
POTENTIAL = UNIT OF STRUCTURE	# UNITS OF STRUCTURE													
	STABILITY IN GROUND													
	TILTING													
	HAND RAILINGS													
	SUPPORT BARS/LEGS													
	STAIRS OF SLIDE													
	TUBE SLIDES													
	SPRING & BAR													
	HANDLES													
	PIVOT POINT FOR WEAR													
	GROUND CLEARANCE													
	SURFACE BELOW EQUIPMENT													
	DEBRIS/BROKEN GLASS													
POTENTIAL = UNIT OF COMPONENT	# UNITS OF COMPONENT													
	CHAINS													
	S-HOOKS													
	SEATS													
	HANGER BEARINGS													
	GREASE FITTINGS													
	CHAIN PIPE COVERS													
	FASTENING POINTS													
	ENTRAPMENT POINT AREAS													
POTENTIAL = 1	ALWAYS 1													
	EXPOSED CONCRETE													
	END/CENTRE FITTINGS													
	SIDEWALLS & BEDWAYS													
	SHARP EDGES/POINTS													
	CRACKING/DAMAGE													
	NUTS & BOLTS													
	LOCKING DEVICES INT/EXT													
	WOOD CHECKING													
	PROTRUSIONS													
	PROTECTIVE CAPS/PLUGS													
	WOODEN BORDERS													
	BENCHES													
	ASPHALT PATHS ETC													
	LIGHTING													
	SIGNS													
	FENCING													

APPENDIX 5 DESCRIPTIVE TEMPLATE

SITE NAME	
LOCATION	
SCHOOL OR COMMUNITY	
DATE AND TIME OF DATA COLLECTION	
INSPECTION #	
CONDITION AND DESCRIPTION	
APPROX. # OF CHILDREN ON SITE	
PART OF DAYCARE?	
PART OF CC?	
AGE OF SITE	
PHOTO TAKEN	
COMMENTS	

APPENDIX 6 CHECKLIST DATA TEMPLATE

SWINGS	# HAZARDS	# POTENTIAL
TODDLER -SINGLE AXIS		
NUMBER OF TODDLER SWING SETS (STRUCTURES)		
NUMBER OF TODDLER SWINGS (COMPONENTS)		
no accessible sharp edges, points or projections		0
woodwork should be chamfered or rounded		0
open ends of all tubing should be finished with smooth caps or plugs		0
all bolts & screws should be countersunk or dome headed		0
no accessible pinch, crush or shear points by two moving components		0
no opening or distance between two parts > 76mm but < 254mm		0
gripping surfaces should be splinter free		0
no surfaces should contain rough textures or joints capable of cutting or abrading		0
located in nontraffic area		0
seat made of impact absorbing material		0
support on all sides and between legs		0
no moveable/adjustable elements that would permit child to fall off seat		0
swing holds shape so adult can remove child w/o holding swing open		0
common coil or machine chain link or chain enclosed in protective cover		0
bearing hangers should be hung wider than overall loaded length of seat		0
designed for only one user at a time		0
side clearance from chain to side frame at height of swing height + 860mm (min 600mm)		0
seat height when occupied		0
distance between swings & between swing & frame at seat level		0
no hard, sharp equipment parts in zone of use that a child can hit in a free fall		0
PS length in front of swing when arc of 60 degrees or max distance usual arc		0
PS length in rear of swing when arc of 60 degrees or max distance usual arc		0
PS length to right side of last swing		0
PS length to left side of last swing		0
NE zone front		0
NE zone back		0
adequacy of PS type		0
adequacy of depth directly below swings		0
adequacy of depth throughout PS area		0
TOTAL (TODDLER SINGLE AXIS)	0	0
CHILD -SINGLE AXIS		
NUMBER OF CHILD SWING SETS (STRUCTURES)		
NUMBER OF CHILD SWINGS (COMPONENTS)		
no accessible sharp edges, points or projections		0
woodwork should be chamfered or rounded		0
open ends of all tubing should be finished with smooth caps or plugs		0
all bolts & screws should be countersunk or dome headed		0
no accessible pinch, crush or shear points by two moving components		0
no opening or distance between two parts > 76mm but < 254mm		0
gripping surfaces should be splinter free		0
no surfaces should contain rough textures or joints capable of cutting or abrading		0
located in nontraffic area		0
seat made of impact absorbing material		0
common coil or machine chain link (not double loop) or chain enclosed in protective cover		0
bearing hangers should be hung wider than overall loaded length of seat		0
designed for only one user at a time		0
side clearance from chain to side frame at height of swing height + 860mm (min 600mm)		0
seat height when occupied		0
seat surface width		0
seat surface depth		0
distance between swings & between swing & frame at seat level		0
no hard, sharp equipment parts in zone of use that a child can hit in a free fall		0
PS length in front of swing when arc of 60 degrees or max distance usual arc		0
PS length in rear of swing when arc of 60 degrees or max distance usual arc		0
PS length to right side of last swing		0
PS length to left side of last swing		0
NE zone front		0
NE zone back		0

adequacy of PS type		0
adequacy of depth directly below swings		0
adequacy of depth throughout PS area		0
TOTAL (CHILD SINGLE AXIS)	0	0
MULTIPLE AXIS		
NUMBER OF MULTIPLE AXIS SWING SETS (STRUCTURES)		
NUMBER OF MULTIPLE AXIS SWINGS (COMPONENT)		
no accessible sharp edges, points or projections		0
woodwork should be chamfered or rounded		0
open ends of all tubing should be finished with smooth caps or plugs		0
all bolts & screws should be countersunk or dome headed		0
no accessible pinch, crush or shear points by two moving components		0
no opening or distance between two parts > 76mm but < 254mm		0
gripping surfaces should be splinter free		0
no surfaces should contain rough textures or joints capable of cutting or abrading		0
located in a nontraffic area		0
not combined with other swings or no danger of collision with other swings		0
common coil or machine chain link (not double loop) or chain enclosed in protective cover		0
no protrusions or sharp edges if steel-belted tires are used		0
no possible entrapment of fingers or head		0
distance between frame and swing		0
distance between underside of swing support and protective surface		0
distance between undersurface of swing and protective surface		0
no hard, sharp equipment parts in zone of use that a child can hit in a free fall		0
PS area: distance between right side of frame and edge of protective surface		0
PS area: distance between left side of frame and edge of protective surface		0
PS area in front of swing		0
PS area in back of swing		0
NE zone right side		0
NE zone left side		0
NE zone front		0
NE zone back		0
adequacy of PS type		0
adequacy of depth directly below swing(s)		0
adequacy of depth throughout PS area		0
TOTAL (MULTIPLE AXIS)	0	0
OTHER SWINGING EQUIPMENT		
NUMBER OF OTHER SWINGING EQUIPMENT STRUCTURES		
NUMBER OF OTHER SWINGING EQUIPMENT SWINGS (COMPONENTS)		
no accessible sharp edges, points or projections		0
woodwork should be chamfered or rounded		0
open ends of all tubing should be finished with smooth caps or plugs		0
all bolts & screws should be countersunk or dome headed		0
no accessible pinch, crush or shear points by two moving components		0
no opening or distance between two parts > 76mm but < 254mm		0
gripping surfaces should be splinter free		0
no surfaces should contain rough textures or joints capable of cutting or abrading		0
located in a nontraffic area		0
no possible entrapment of fingers or head		0
any single rope should be attached at both ends		0
distance between suspended element and protective surface (preschoolers)		0
distance between suspended element and protective surface (5-14 yr.)		0
no hard, sharp equipment parts in zone of use that a child can hit in a free fall		0
PS area: distance between right side of frame and edge of protective surface		0
PS area: distance between left side of frame and edge of protective surface		0
PS area in front of swing		0
PS area in back of swing		0
NE zone right		0
NE zone left		0
NE zone front		0
NE zone back		0

adequacy of PS type		0
adequacy of depth directly below swing(s)		0
adequacy of depth throughout PS area		0
TOTAL (OTHER SWINGING EQUIPMENT)	0	0
SLIDES		
NUMBER OF FREESTANDING SLIDES		
NUMBER OF SLIDES AS PART OF CREATIVE PLAYSTRUCTURE		
# STRAIGHT		
#TUBE		
#CURVY		
#SPIRAL		
no accessible sharp edges, points or projections		0
woodwork should be chamfered or rounded		0
sheet materials should be finished on exposed edge with roll or rounded capping		0
open ends of all tubing should be finished with smooth caps or plugs		0
all bolts & screws should be countersunk or dome headed		0
no opening or distance between two parts > 76mm but < 254mm		0
gripping surfaces should be splinter free		0
no surfaces should contain rough textures or joints capable of cutting or abrading		0
metal slides located in shade or facing north		0
no zero gravity		0
sidewall edges are rounded		0
side enclosures blend from guardrail to sidewall (if has sitting section)		0
length of starting platform		0
width of starting platform		0
length of sitting section		0
slope of sitting section		0
height of sidewalls		0
radius of curvature adequate		0
exit declination between 1-5 degrees		0
length of exit section		0
end of slide rounded		0
height of exit above the finished grade (preschoolers)		0
height of exit above the finished grade (5-14 yrs)		0
no hard, sharp equipment parts in zone of use that a child can hit in a free fall		0
PS area: in front of slide exit		0
PS area: length in rear of slide access		0
PS area: length to right of slide		0
PS area: length to left of slide		0
NE zone in front of slide		0
adequacy of PS type		0
adequacy of depth directly below slide exit		0
adequacy of depth throughout PS area		0
TOTAL ALL SLIDES	0	0
SLIDING POLES		
NUMBER OF SLIDING POLES (STRUCTURE)		
no accessible sharp edges, points or projections		0
woodwork should be chamfered or rounded		0
open ends of all tubing should be finished with smooth caps or plugs		0
all bolts & screws should be countersunk or dome headed		0
no opening or distance between two parts > 76mm but < 254mm		0
gripping surfaces should be splinter free		0
no surfaces should contain rough textures or joints capable of cutting or abrading		0
access to sliding pole from one point only		0
designed to avoid interference from surrounding traffic		0
sliding section of poles should be continuous with no welds or joints		0
sliding poles not located in a preschool play area		0
set on a protective surface		0
no hard, sharp equipment parts in zone of use that a child can hit in a free fall		0
distance from pole to platform or structure		0
distance beween lower surface of the horizontal section of the pole to platform surface		0

diameter of the pole		0
access to sliding pole through opening in the gaurdrail (not >380mm)		0
footing at bottom (if provided) at least 300mm below finished grade		0
adequacy of PS type		0
adequacy of depth at pole landing area		0
adequacy of depth throughout PS area		0
TOTAL ALL SLIDING POLES	0	0
ACCESS TO SLIDES AND SLIDING POLES		
STAIRS (Straight)		
NUMBER OF STRAIGHT STAIRS (STRUCTURE)		
# CLOSED		
# OPEN		
no accessible sharp edges, points or projections		0
woodwork should be chamfered or rounded		0
sheet materials should be finished on exposed edge with roll or rounded capping		0
open ends of all tubing should be finished with smooth caps or plugs		0
all bolts & screws should be countersunk or dome headed		0
no opening or distance between two parts > 76mm but < 254mm		0
gripping surfaces should be splinter free		0
no surfaces should contain rough textures or joints capable of cutting or abrading		0
steps should be evenly spaced		0
handrails should be immediately contiguous with the stepping surface		0
inclination between 30-50 degrees		0
rise from one step to next		0
depth of step		0
stairs should be enclosed if rise is between 76 and 254mm		0
stairs with no intermediate landing should not have > 1800mm vertical rise		0
if stairs rise more than 450 mm should have 2 continuous handrails both sides		0
lower rail should be 300mm above step tread for preshchoolers		0
lower rail should be 500mm above step tread for 5-14 yr olds		0
upper rail should be 700mm avove the step tread for preschoolers		0
upper rail should be 1000mm above the step tread for 5-14 yr olds		0
perp. distance between upper and lower rail or rail and stair should be <76 or> 254mm		0
step nosing (max = 25mm)		0
TOTAL (STRAIGHT STAIRS)	0	0
STAIRS (Spiral)		
NUMBER OF SPIRAL STAIRS (STRUCTURE)		
# CLOSED		
#OPEN		
no accessible sharp edges, points or projections		0
woodwork should be chamfered or rounded		0
sheet materials should be finished on exposed edge with roll or rounded capping		0
open ends of all tubing should be finished with smooth caps or plugs		0
all bolts & screws should be countersunk or dome headed		0
no opening or distance between two parts > 76mm but < 254mm		0
gripping surfaces should be splinter free		0
no surfaces should contain rough textures or joints capable of cutting or abrading		0
steps should be evenly spaced		0
handrails should be immediately contiguous with the stepping surface		0
rise from one step to next		0
depth of step at inner edge		0
stairs should be enclosed if rise is between 76-254mm		0
stairs with no intermediate landing should not have > 1800mm vertical rise		0
if stairs rise more than 450mm, should have two continuous handrails on both sides		0
lower rail should be 300mm above step tread for preshchoolers		0
lower rail should be 500mm above step tread for 5-14 yr olds		0
upper rail should be 700mm avove the step tread for preschoolers		0
upper rail should be 1000mm above the step tread for 5-14 yr olds		0
perp. distance between upper and lower rail or rail and stair should be <76 or> 254mm		0
step nosing (max = 25mm)		0
outside radius (min = 500mm)		0

inclination between 15 and 65 degrees		0
TOTAL (STAIRS SPIRAL)	0	0
RAMPS		
NUMBER OF RAMPS (STRUCTURE)		
no accessible sharp edges, points or projections		0
woodwork should be chamfered or rounded		0
sheet materials should be finished on exposed edge with roll or rounded capping		0
open ends of all tubing should be finished with smooth caps or plugs		0
all bolts & screws should be countersunk or dome headed		0
no opening or distance between two parts > 76mm but < 254mm		0
gripping surfaces should be splinter free		0
no surfaces should contain rough textures or joints capable of cutting or abrading		0
handrails should be immediately contiguous with the stepping surface		0
inclination max = 30 degrees		0
ramps with no intermediate landing should not have > 1800mm vertical rise		0
if ramp rises more than 450mm, should have two continuous handrails on both sides		0
lower rail should be 300mm above the ramp for preschoolers		0
lower rail should be 500 mm above the ramp for 5-14 yr olds		0
upper rail should be 700mm above the ramp for preshoolers		0
upper rail should be 1000mm above the ramp for 5-14 yr olds		0
perpendicular distance between rails or rail and ramp should be <76mm or > 254mm		0
TOTAL (RAMPS)	0	0
RUNG LADDERS		
NUMBER OF RUNG LADDERS (STRUCTURE)		
no accessible sharp edges, points or projections		0
woodwork should be chamfered or rounded		0
open ends of all tubing should be finished with smooth caps or plugs		0
all bolts & screws should be countersunk or dome headed		0
no opening or distance between two parts > 76mm but < 254mm		0
gripping surfaces should be splinter free		0
no surfaces should contain rough textures or joints capable of cutting or abrading		0
rungs should be evenly spaced		0
rungs should not turn when grasped		0
rung ladders should not be closed		0
angle of inclination between 50-90 degrees		0
rung ladders with no intermediate landing not have >1800mm vertical rise		0
spacing of rungs <76mm or >254mm		0
rung diameter between 25-35 mm for preschoolers		0
rung diameter 25-45mm for 5-14 year olds		0
width of ladder (min = 300mm)		0
distance between finished grade and top of first rung (max = 450mm)		0
TOTAL (RUNG LADDERS)	0	0
STEPLADDERS		
NUMBER OF STEPLADDERS (STRUCTURE)		
no accessible sharp edges, points or projections		0
woodwork should be chamfered or rounded		0
open ends of all tubing should be finished with smooth caps or plugs		0
all bolts & screws should be countersunk or dome headed		0
no opening or distance between two parts > 76mm but < 254mm		0
gripping surfaces should be splinter free		0
no surfaces should contain rough textures or joints capable of cutting or abrading		0
steps should be evenly spaced		0
inclination between 50-90 degrees		0
step ladders with no intermediate landings not have > 1800mm vertical rise		0
rise from step to step when closed between 76-254mm		0
rise from step to step when open <76 or > 254mm		0
step depth when closed min = 120mm		0
step depth when open min = 76mm		0
step width (min = 300mm)		0
if stepladder rises more than 450mm, should have one continuous handrail both sides		0

rails should be max of 700mm above the step tread for preschoolers		0
rail should be max of 1000mm above the step tread for 5-14yr olds		0
perp dimension between rail and step tread nosing never < 254mm		0
step nosing (max = 25mm)		0
TOTAL (STEPLADDERS)	0	0
CARGO NETS, MOVING LADDERS AND SIMILAR DEVICES		
NUMBER OF CARGO NETS (STRUCTURE)		
no accessible sharp edges, points or projections		0
woodwork should be chamfered or rounded		0
open ends of all tubing should be finished with smooth caps or plugs		0
all bolts & screws should be countersunk or dome headed		0
no opening or distance between two parts > 76mm but < 254mm		0
gripping surfaces should be splinter free		0
no surfaces should contain rough textures or joints capable of cutting or abrading		0
should be securely fastened		0
any single rope should be attached at both ends		0
TOTAL (CARGO NETS)	0	0
ROCKING EQUIPMENT		
NUMBER OF ROCKING EQUIPMENT PIECES (STRUCTURE)		
no accessible sharp edges, points or projections		0
woodwork should be chamfered or rounded		0
open ends of all tubing should be finished with smooth caps or plugs		0
all bolts & screws should be countersunk or dome headed		0
no accessible pinch, crush or shear points by two moving components		0
no opening or distance between two parts > 76mm but < 254mm		0
gripping surfaces should be splinter free		0
no surfaces should contain rough textures or joints capable of cutting or abrading		0
hand grips and footrests should be fixed		0
hand grips and foot rests should not turn when grasped		0
diameter of hand grips and foot rests preschoolers (25-35mm)		0
diameter of hand grips and foot rests 5-14 yr olds (25-45)		0
hand grips and foot rests should not project beyond max of 125 mm		0
any projections should have a min. diameter of 18mm		0
distance from ground to seat for preschoolers should be 350-600mm		0
no hard, sharp equipment parts in zone of use that a child can hit in a free fall		0
PS in front of rocker (1800mm)		0
PS in rear of rocker (1800mm)		0
PS to right side of rocker (1800mm)		0
PS to left side of rocker (1800mm)		0
NE zone if adjacent to moving equipment		0
adequacy of PS type		0
adequacy of PS depth directly below rocker		0
adequacy of PS depth throughout PS area		0
TOTAL ROCKING EQUIPMENT	0	0
TEETER TOTTERS		
NUMBER OF TEETER TOTTERS (STRUCTURE)		
no accessible sharp edges, points or projections		0
woodwork should be chamfered or rounded		0
open ends of all tubing should be finished with smooth caps or plugs		0
all bolts & screws should be countersunk or dome headed		0
no accessible pinch, crush or shear points by two moving components		0
no opening or distance between two parts > 76mm but < 254mm		0
gripping surfaces should be splinter free		0
no surfaces should contain rough textures or joints capable of cutting or abrading		0
handles designed to prevent entrapment		0
hand grips or foot rests should not turn when grasped		0
hand grips should be fixed		0
protruding hand grips not permit knee entrapment between grip and ground		0
if beam allowed to hit ground, an impact cushion should be provided		0
no hard, sharp equipment parts in zone of use that a child can hit in a free fall		0

should be set on a protective surface		0
pivot height (max = 760mm)		0
diameter of hand grips (min = 18mm)		0
adequacy of PS type		0
adequacy of PS depth directly beneath teeter totter		0
adequacy of PS depth throughout the PS area		0
TOTAL TEETER TOTTERS	0	0
CLIMBERS		
NUMBER OF CLIMBERS (UNIT OF STRUCTURE)		
no accessible sharp edges, points or projections		0
woodwork should be chamfered or rounded		0
sheet materials should be finished on exposed edge with roll or rounded capping		0
open ends of all tubing should be finished with smooth caps or plugs		0
all bolts & screws should be countersunk or dome headed		0
no opening or distance between two parts > 76mm but < 254mm		0
gripping surfaces should be splinter free		0
no surfaces should contain rough textures or joints capable of cutting or abrading		0
over head ladders allow children to grasp first rung from standing position		0
all rungs should permit fall fo protective surface without striking any obstruction		0
rungs and bars should not turn when grasped		0
rung diameter (preschoolers 25-35mm)		0
rung diameter (5-14 yr olds not > 45mm)		0
clear distance between successive rungs (300-400mm)		0
no hard, sharp equipment parts in xone of use that a child can hit in a free fall		0
PS area in front of climber		0
PS area in back of climber		0
PS area on right side of climber		0
PS area on left side of climber		0
NE zone (1800 mm if adjacent to moving equipment)		0
adequacy of PS type		0
adequacy of PS depth directly beneath climber		0
adequacy of PS depth throughout the PS area		0
TOTAL CLIMBERS	0	0
MERRY-GO -ROUND /WHIRLERS		
NUMBER OF MERRY-GO-ROUND/WHIRLERS (STRUCTURE)		
no accessible sharp edges, points or projections		0
woodwork should be chamfered or rounded		0
sheet materials should be finished on exposed edge with roll or rounded capping		0
open ends of all tubing should be finished with smooth caps or plugs		0
all bolts & screws should be countersunk or dome headed		0
no accessible pinch, crush or shear points by two moving components		0
no opening or distance between two parts > 76mm but < 254mm		0
gripping surfaces should be splinter free		0
no surfaces should contain rough textures or joints capable of cutting or abrading		0
apparatus located in a supervised area		0
apparatus located in a nontraffic area		0
secure means of holding on provided		0
hand grips should not turn when grasped		0
no projections beyond the outside diameter of the platform		0
hand grip diameter (preschoolers) 25-35mm		0
hand grip diameter (5-14) 25-45		0
no accessible space >5mm between moving parts within rotation device		0
space between underside of platform and ps <76mm or >254mm		0
no hard, sharp equipment parts in zone of use that a child can hit in a free fall		0
PS front		0
PS rear		0
PS right side		0
PS left side		0
NE zone front		0
NE zone rear		0
NE zone right side		0

NEzone left side		0
adequacy of PS type		0
adequacy of depth directly surrounding rotating apparatus		0
adequacy of depth throughout PS area		0
TOTAL MERRY -GO-ROUND/WHIRLERS	0	0
SANDBOXES		
NUMBER OF SANDBOXES (STRUCTURES)		
no accessible sharp edges, points or projections		0
woodwork should be chamfered or rounded		0
sheet materials should be finished on exposed edge with roll or rounded capping		0
open ends of all tubing should be finished with smooth caps or plugs		0
all bolts & screws should be countersunk or dome headed		0
no accessible pinch, crush or shear points by two moving components		0
no opening or distance between two parts >76mm but <254mm		0
no surfaces should contain rough textures or joints capable of cutting or abrading		0
sand should pack together for moulding		0
sand should appear clean		0
sand should be free of contaminants		0
some shade and shelter provided		0
seating for adults near the sandbox		0
not located in a physical play zone		0
sandbox covers, if used, designed to be safely secured open and closed		0
sand play area exposed to some sun and rain		0
total sand play area 6-7 sq. m.		0
height of sandbox ledge above the finished grade (max 280mm)		0
width of sandbox ledge (min 85mm)		0
TOTAL SANDBOXES	0	0
CREATIVE PLAYSTRUCTURES		
NUMBER OF CREATIVE PLAYSTRUCTURES (STRUCTURE)		
ACCESS - STRAIGHT STAIRS		
NUMBER OF STRAIGHT STAIRS (COMPONENT)		
#CLOSED		
#OPEN		
no accessible sharp edges, points or projections		0
woodwork should be chamfered or rounded		0
sheet materials should be finished on exposed edge with roll or rounded capping		0
open ends of all tubing should be finished with smooth caps or plugs		0
all bolts & screws should be countersunk or dome headed		0
no opening or distance between two parts > 76mm but < 254mm		0
gripping surfaces should be splinter free		0
no surfaces should contain rough textures or joints capable of cutting or abrading		0
steps should be evenly spaced		0
handrails should be immediately contiguous with the stepping surface		0
inclination between 30-50 degrees		0
rise from one step to next		0
depth of step		0
stairs should be enclosed if rise is between 76 and 254mm		0
stairs with no intermediate landing should not have > 1800mm vertical rise		0
if stairs rise more than 450 mm should have 2 continuous handrails both sides		0
lower rail should be 300mm above step tread for preshchoolers		0
lower rail should be 500mm above step tread for 5-14 yr olds		0
upper rail should be 700mm avove the step tread for preschoolers		0
upper rail should be 1000mm above the step tread for 5-14 yr olds		0
perp. distance between upper and lower rail or rail and stair should be <76 or> 254mm		0
step nosing (max = 25mm)		0
no hard, sharp equipment parts in zone fo use that a child can hit in a free fall		0
PS 1800mm in all relevant directions		
NE zone in all relevant directions		
adequacy of PS type		0
adequacy of PSdepth directly beneath stairs		0
adequacy of depth throughout PS area		0

TOTAL (STRAIGHT STAIRS)	0	0
STAIRS (Spiral)		
NUMBER OF SPIRAL STAIRS (COMPONENT)		
#CLOSED		
#OPEN		
no accessible sharp edges, points or projections		0
woodwork should be chamfered or rounded		0
sheet materials should be finished on exposed edge with roll or rounded capping		0
open ends of all tubing should be finished with smooth caps or plugs		0
all bolts & screws should be countersunk or dome headed		0
no opening or distance between two parts > 76mm but < 254mm		0
gripping surfaces should be splinter free		0
no surfaces should contain rough textures or joints capable of cutting or abrading		0
steps should be evenly spaced		0
handrails should be immediately contiguous with the stepping surface		0
rise from one step to next		0
depth of step at inner edge		0
stairs should be enclosed if rise is between 76-254mm		0
stairs with no intermediate landing should not have > 1800mm vertical rise		0
if stairs rise more than 450mm, should have two continuous handrails on both sides		0
lower rail should be 300mm above step tread for preshchoolers		0
lower rail should be 500mm above step tread for 5-14 yr olds		0
upper rail should be 700mm avove the step tread for preschoolers		0
upper rail should be 1000mm above the step tread for 5-14 yr olds		0
perp. distance between upper and lower rail or rail and stair should be <76 or> 254mm		0
step nosing (max = 25mm)		0
outside radius (min = 500mm)		0
inclination between 15 and 65 degrees		0
no hard, sharp equipment parts in zone fo use that a child can hit in a free fall		0
PS 1800mm in all relevant directions		
NE zone in all relevant directions when adjacent to moving equipment		
adequacy of PS type		0
adequacy of PSdepth directly beneath stairs		0
adquacy of depth throughout PS area		0
TOTAL (STAIRS - SPIRAL)	0	0
RAMPS		
NUMBER OF RAMPS (COMPONENT)		
no accessible sharp edges, points or projections		0
woodwork should be chamfered or rounded		0
sheet materials should be finished on exposed edge with roll or rounded capping		0
open ends of all tubing should be finished with smooth caps or plugs		0
all bolts & screws should be countersunk or dome headed		0
no opening or distance between two parts > 76mm but < 254mm		0
gripping surfaces should be splinter free		0
no surfaces should contain rough textures or joints capable of cutting or abrading		0
handrails should be immediately contiguous with the stepping surface		0
inclination max = 30 degrees		0
ramps with no intermediate landing should not have > 1800mm vertical rise		0
if ramp rises more than 450mm, should have two continuous handrails on both sides		0
lower rail should be 300mm above the ramp for preschoolers		0
lower rail should be 500 mm above the ramp for 5-14 yr olds		0
upper rail should be 700mm above the ramp for preshoolers		0
upper rail should be 1000mm above the ramp for 5-14 yr olds		0
perpendicular distance between rails or rail and ramp should be <76mm or > 254mm		0
no hard, sharp equipment parts in zone fo uswe that a child can hit in a free fall		0
PS 1800mm in all relevant directions		
NE zone in all relevant directions when adjacent to moving equipment		
adequacy of PS type		0
adequacy of PSdepth directly beneath ramp		0
adquacy of depth throughout PS area		0
TOTAL (RAMPS)	0	0

APPENDIX 6 CHECKLIST DATA TEMPLATE

RUNG LADDERS		
NUMBER OF RUNG LADDERS (COMPONENT)		
no accessible sharp edges, points or projections		0
woodwork should be chamfered or rounded		0
open ends of all tubing should be finished with smooth caps or plugs		0
all bolts & screws should be countersunk or dome headed		0
no opening or distance between two parts > 76mm but < 254mm(esp. rung spacing)		0
gripping surfaces should be splinter free		0
no surfaces should contain rough textures or joints capable of cutting or abrading		0
rungs should be evenly spaced		0
rungs should not turn when grasped		0
rung ladders should not be closed		0
angle of inclination between 50-90 degrees		0
rung ladders with no intermediate landing not have >1800mm vertical rise		0
rung diameter between 25-35 mm for preschoolers		0
rung diameter 25- 45mm for 5-14 year olds		0
width of ladder(min = 300mm)		0
distance between finished grade and top of first rung (max = 450mm)		0
no hard, sharp equipment parts in zone fo uswe that a child can hit in a free fall		0
PS 1800mm in all relevant directions		
NE zone in all relevant directions when adjacent to moving equipment		
adequacy of PS type		0
adequacy of PSdepth directly beneath rung ladder		0
adquacy of depth throughout PS area		0
TOTAL (RUNG LADDERS)	0	0
STEPLADDERS		
NUMBER OF STEPLADDERS (COMPONENT)		
no accessible sharp edges, points or projections		0
woodwork should be chamfered or rounded		0
open ends of all tubing should be finished with smooth caps or plugs		0
all bolts & screws should be countersunk or dome headed		0
no opening or distance between two parts > 76mm but < 254mm		0
gripping surfaces should be splinter free		0
no surfaces should contain rough textures or joints capable of cutting or abrading		0
steps should be evenly spaced		0
inclination between 50-90 degrees		0
step ladders with no intermediate landings not have > 1800mm vertical rise		0
rise from step to step when closed between 76-254mm		0
rise from step to step when open <76 or > 254mm		0
step depth when closed min = 120mm		0
step depth when open min = 76mm		0
step width (min = 300mm)		0
if stepladder rises more than 450mm, should have one continuous handrail both sides		0
rails should be max of 700mm above the step tread for preschoolers		0
rail should be max of 1000mm above the step tread for 5-14yr olds		0
perp dimension between rail and step tread nosing never < 254mm		0
step nosing (max = 25mm)		0
no hard, sharp equipment parts in zone of use that a child can hit in a free fall		0
PS 1800mm in all relevant directions		
NE zone in all relevant directions when adjacent to moving equipment		
adequacy of PS type		0
adequacy of PS depth directly beneath stepladder		0
adquacy of depth throughout PS area		0
TOTAL (STEPLADDERS)	0	0
CARGO NETS, MOVING LADDERS AND SIMILAR DEVICES		
NUMBER OF CARG0 NETS (COMPONENTS)		
no accessible sharp edges, points or projections		0
woodwork should be chamfered or rounded		0
open ends of all tubing should be finished with smooth caps or plugs		0
all bolts & screws should be countersunk or dome headed		0

no opening or distance between two parts > 76mm but < 254mm		0
gripping surfaces should be splinter free		0
no surfaces should contain rough textures or joints capable of cutting or abrading		0
should be securely fastened		0
any single rope should be attached at both ends		0
no hard, sharp equipment parts in zone fo uswe that a child can hit in a free fall		0
PS 1800mm in all relevant directions		
NE zone in all relevant directions when adjacent to moving equipment		
adequacy of PS type		0
adequacy of PS depth directly beneath cargo net		0
adquacy of depth throughout PS area		0
TOTAL (CARGO NET)	0	0
PLATFORMS AND INTERMEDIATE LANDINGS		
NUMBER OF PLATFORMS AND INTERMEDIATE LANDINGS (COMPONENT)		
no accessible sharp edges, points or projections		0
woodwork should be chamfered or rounded		0
sheet materials should be finished on exposed edge with roll or rounded capping		0
open ends of all tubing should be finished with smooth caps or plugs		0
all bolts & screws should be countersunk or dome headed		0
no accessible pinch, crush or shear points by two moving components		0
no opening or distance between two parts > 76mm but < 254mm		0
gripping surfaces should be splinter free		0
no surfaces should contain rough textures or joints capable of cutting or abrading		0
where vertical rise of stairs or ladders exceeds 1800mm, should have int. landing		0
if platform decking is > 40mm thick, openings not >13mm		0
if platform decking is </= 40mm thick, openings not > 6mm		0
height difference between two platforms not > 300mm (preschoolers)		0
height difference between two platforms not >610 (5-14)		0
entry and exit from intermediate landings should be offset by 90-180 degrees		0
dimensions of intermediate landings (min 900 by 900)		0
no hard, sharp equipment parts in zone fo uswe that a child can hit in a free fall		0
PS 1800mm in all relevant directions		
NE zone in all relevant directions when adjacent to moving equipment		
adequacy of PS type		0
adequacy of PS depth directly beneath platform or intermediate landing		0
adquacy of depth throughout PS area		0
TOTAL (PLATFORMS AND INTERMEDIATE LANDINGS)	0	0
GUARDRAILS AND HANDRAILS		
NUMBER OF SETS OF CONTINUOUS HAND/GUARDRAILS (COMPONENT)		
no accessible sharp edges, points or projections		0
woodwork should be chamfered or rounded		0
sheet materials should be finished on exposed edge with roll or rounded capping		0
open ends of all tubing should be finished with smooth caps or plugs		0
all bolts & screws should be countersunk or dome headed		0
no opening or distance between two parts > 76mm but < 254mm		0
gripping surfaces should be splinter free		0
no surfaces should contain rough textures or joints capable of cutting or abrading		0
all stairs, steps & ramps rising > 450mm should have two continuous handrails		0
stepladders require only a single handrail both sides		0
handrails should be immediately contiguous with the stepping surface		0
all platforms > 450mm should have perimeter guardrails		0
all platforms >1200mm need panel -style or vertical fence-style guardrails		0
horizontal openings in guardrails for access should be <380 or have top guardrail		0
height of top guardrail min = 610mm		0
max clearance below panel or vertical guardrails = 300mm		0
lower rail 300mm above the step tread (preschoolers)		0
lower rail 500mm above step tread (5-14)		0
upper or single rail 700mm above step tread (preschoolers)		0
upper or single rail 1000mm above step tread (5-14)		0
perp. distance between rails should be <76mm or >254mm)		0
clearance between platform and bottom of guardrail (max=300mm) not <76, >254		0

space between vertical railings in fence-style guardrails should be <76mm		0
TOTAL (HANDRAILS AND GUARDRAILS)	0	0
GENERAL CONSIDERATIONS		
POTENTIAL = ONE		1
no accessible sharp edges , points or projections		1
woodwork should be chamfered or rounded		1
sheet materials should be finished on exposed edges with roll or rounded capping		1
open ends of all tubing should be finished with smooth caps or plugs		1
all bolts and screws should be countersunk or dome headed		1
no accessible pinch, crush or shear points by two moving components		1
no suspended lateral elements <25mm diameter		1
if suspended lateral elements >25mm, should be bright coloured		1
balance cables if protected from lateral access are OK, diameter min = 9mm		1
no opening or distance between any two parts >76mm but < 254mm		1
no surface should contain rough textures or joints capable of cutting or abrading		1
gripping surfaces should be splinter free		1
no hard, sharp equipment parts in zone of use that a child can hit in a free fall		1
site not located near high voltage power lines or transformer stations		1
play area has visually defined boundaries		1
any enclosed space >1800mm deep should have min of 2 openings		1
crawl space should be min of 610mm high & 610mm wide		1
crawl space with any interior diameter < 760 should be max. length of 1800mm		1
all standing surfaces 450mm above finished grade should have guardrails		1
for elevations >1800mm, more than one method of exit provided		1
angles formed by adjacent surfaces should be >/= 55 degrees (unless lower leg > 10 degrees below horizontal, or angle filled such that surfaces of angle are > 254mm apart		1
TOTAL GENERAL CONSIDERATIONS	0	21
OTHER		
TOTAL OTHER	0	0
MAINTENANCE		
TODDLER- SINGLE AXIS		
NUMBER OF TODDLER SWING SETS (STRUCTURE)		
NUMBER OF TODDLER SWINGS (COMPONENT)		
stability in ground		0
tilting		0
support bars/legs		0
pivot point for wear		0
ground clearance		0
surface below equipment		0
debris/broken glass		0
chains		0
s-hooks		0
seats		0
hanger bearings		0
grease fitting		0
chain pipe covers		0
fastening points		0
entrapment point areas		0

exposed concrete		1
end/centre fittings		1
sidewalls & bedways		1
sharp edges/points		1
cracking /damage		1
nuts & bolts		1
locking devices int/ext		1
wood checking		1
protrusions		1
protective caps/plugs		1
wooden borders		1
TOTAL (toddler single axis swing)	0	11
CHILD- SINGLE AXIS		
NUMBER OF CHILD SINGLE AXIS SWING SETS (STRUCTURE)		
NUMBER OF CHILD SINGLE AXIS SWINGS (COMPONENT)		
stability in ground		0
tilting		0
support bars/legs		0
pivot point for wear		0
ground clearance		0
surface below equipment		0
debris/broken glass		0
chains		0
s-hooks		0
seats		0
hanger bearings		0
grease fitting		0
chain pipe covers		0
fastening points		0
entrapment point areas		0
exposed concrete		1
end/centre fittings		1
sidewalls & bedways		1
sharp edges/points		1
cracking /damage		1
nuts & bolts		1
locking devices int/ext		1
wood checking		1
protrusions		1
protective caps/plugs		1
wooden borders		1
TOTAL (child single axis swings)	0	11
MULTIPLE AXIS SWINGS		
NUMBER OF MULTIPLE AXIS SWING SETS (STRUCTURE)		
NUMBER OF MULTIPLE AXIS SWINGS (COMPONENT)		
stability in ground		0
tilting		0
support bars/legs		0
pivot point for wear		0
ground clearance		0
surface below equipment		0
debris/broken glass		0
chains		0
s-hooks		0
seats		0
hanger bearings		0
grease fitting		0
chain pipe covers		0
fastening points		0
entrapment point areas		0
exposed concrete		1
end/centre fittings		1
sidewalls & bedways		1

sharp edges/points		1
cracking /damage		1
nuts & bolts		1
locking devices int/ext		1
wood checking		1
protrusions		1
protective caps/plugs		1
wooden borders		1
TOTAL (multiple axis swings)	0	11
OTHER SWINGING EQUIPMENT		
NUMBER OF OTHER SWINGING EQUIPMENT SETS (STRUCTURES)		
NUMBER OF OTHER SWINGING EQUIPMENT SWINGS (COMPONENT)		
stability in ground		0
tilting		0
support bars/legs		0
pivot point for wear		0
ground clearance		0
surface below equipment		0
debris/broken glass		0
chains		0
s-hooks		0
seats		0
hanger bearings		0
grease fitting		0
chain pipe covers		0
fastening points		0
entrapment point areas		0
exposed concrete		1
end/centre fittings		1
sidewalls & bedways		1
sharp edges/points		1
cracking /damage		1
nuts & bolts		1
locking devices int/ext		1
wood checking		1
protrusions		1
protective caps/plugs		1
wooden borders		1
TOTAL (other swinging equipment)	0	11
SLIDES		
TOTAL NUMBER OF SLIDES		
NUMBER OF FREESTANDING SLIDES		
NUMBER OF SLIDES AS PART OF CREATIVE PLAYSTRUCTURE		
stability in ground		0
tilting		0
hand railings		0
support bars/legs		0
stairs of slide		0
tube slide		0
ground clearance		0
surface below equipment		0
debris/broken glass		0
entrapment point areas		0
exposed concrete		1
sidewalls & bedways		1
sharp edges/points		1
cracking /damage		1
nuts & bolts		1
locking devices int/ext		1
wood checking		1
protrusions		1
protective caps/plugs		1
wooden borders		1

TOTAL (slides)	0	10
SLIDING POLES		
NUMBER OF SLIDING POLES		
stability in ground		0
tilting		0
hand railings		0
stairs of slide		0
ground clearance		0
surface below equipment		0
debris/broken glass		0
entrapment point areas		0
exposed concrete		1
end/centre fittings		1
sharp edges/points		1
cracking /damage		1
nuts & bolts		1
locking devices int/ext		1
wood checking		1
protrusions		1
protective caps/plugs		1
wooden borders		1
TOTAL (sliding poles)	0	10
ROCKING EQUIPMENT		
NUMBER OF ROCKING EQUIPMENT PIECES (STRUCTURE)		
stability in ground		0
tilting		0
support bars/legs		0
spring & bar		0
handles		0
pivot point for wear		0
ground clearance		0
surface below equipment		0
debris/broken glass		0
seats		0
grease fittings		0
fastening points		0
entrapment point areas		0
exposed concrete		1
sidewalls & bedways		1
sharp edges/points		1
cracking /damage		1
nuts & bolts		1
locking devices int/ext		1
wood checking		1
protrusions		1
protective caps/plugs		1
wooden borders		1
TOTAL (rocking equipment)	0	10
TEETER TOTTERS		
NUMBER OF TEETER TOTTERS (STRUCTURE)		
stability in ground		0
tilting		0
support bars/legs		0
spring & bar		0
handles		0
pivot point for wear		0
ground clearance		0
surface below equipment		0
debris/broken glass		0
seats		0
grease fittings		0
fastening points		0
entrapment point areas		1

exposed concrete		1
end/centre fittings		1
sidewalls & bedways		1
sharp edges/points		1
cracking /damage		1
nuts & bolts		1
locking devices int/ext		1
wood checking		1
protrusions		1
protective caps/plugs		1
wooden borders		1
TOTAL (teeter totters)	0	12
CLIMBERS		
NUMBER OF CLIMBERS		
stability in ground		0
tilting		0
hand railings		0
support bars/legs		0
ground clearance		0
surface below equipment		0
debris/broken glass		0
entrapment point areas		0
exposed concrete		1
end/centre fittings		1
sidewalls & bedways		1
sharp edges/points		1
cracking /damage		1
nuts & bolts		1
locking devices int/ext		1
wood checking		1
protrusions		1
protective caps/plugs		1
wooden borders		1
TOTAL (climbers)	0	11
MERRY-GO-ROUNDS/WHIRLERS		
NUMBER OF MERRY-GO-ROUNDS/WHIRLERS (STRUCTURE)		
stability in ground		0
tilting		0
hand railings		0
support bars/legs		0
spring & bar		0
handles		0
pivot point for wear		0
ground clearance		0
surface below equipment		0
debris/broken glass		0
seats		0
grease fittings		0
fastening points		0
entrapment point areas		0
exposed concrete		1
sidewalls & bedways		1
sharp edges/points		1
cracking /damage		1
nuts & bolts		1
locking devices int/ext		1
wood checking		1
protrusions		1
protective caps/plugs		1
wooden borders		1
TOTAL (merry-go-round/whirlers)	0	10
CREATIVE PLAYSTRUCTURES		
NUMBER OF CREATIVE PLAYSTRUCTURES		

APPENDIX 6 CHECKLIST DATA TEMPLATE

stability in ground		0
tilting		0
hand railings		0
support bars/legs		0
stairs of slide		0
ground clearance		0
surface below equipment		0
debris/broken glass		0
entrapment point areas		0
exposed concrete		1
sidewalls & bedways		1
sharp edges/points		1
cracking /damage		1
nuts & bolts		1
locking devices int/ext		1
wood checking		1
protrusions		1
protective caps/plugs		1
wooden borders		1
TOTAL (creative playstructures)	0	10
SANDBOXES		
NUMBER OF SANDBOXES		
stability in ground		0
tilting		0
surface below equipment		0
debris/broken glass		0
seats		0
fastening points		0
entrapment point areas		0
exposed concrete		1
sidewalls & bedways		1
sharp edges/points		1
cracking /damage		1
nuts & bolts		1
locking devices int/ext		1
wood checking		1
protrusions		1
protective caps/plugs		1
wooden borders		1
benches		1
TOTAL (sandboxes)	0	11
GENERAL SITE CONDITIONS		
POTENTIAL ALWAYS = 1		1
hand railings		1
surface below equipment		1
debris/broken glass		1
entrapment point areas		1
exposed concrete		1
wood checking		1
wooden borders		1
benches		1
asphalt paths etc		1
lighting		1
signs		1
fencing		1
TOTAL (general site conditions)	0	11

APPENDIX 7 HEIGHTS AND SURFACE DEPTHS

TEMPLATE

EQUIPMENT TYPE	SURFACE TYPE	A/I	DEPTH DBE	A/I	DEPTH T/O PS	A/I	MAX HT POT FALL
TODDLER SWINGS							
CHILD SWINGS							
MULTIAXIS SWINGS							
OTHER SWINGING EQUIPMENT							
ave for all swinging equipment							
SLIDES							
SLIDING POLES							
ave for all sliding equipment							
ROCKING EQUIPMENT							
ave for all rocking equipment							
TEETER TOTTERS							
ave for all teeter totters							
CLIMBERS							
ave for all climbers							
MERRY-GO-ROUND/WHIRLERS							
ave for all merry-go-round/whirlers							
CREATIVE PLAYSTRUCTURES							
stairs (straight)							
ave for all straight stairs							
stairs (spiral)							
ave for all spiral stairs							
ramps							
ave for all ramps							
rung ladders							
ave for all rung ladders							
stepladders							
ave for all stepladders							
cargo nets or other							
ave for all cargo nets or other							
platforms and intermediate landings							
ave for all platforms and intermediate landings							
ave surface depth whole site							

APPENDIX 8 SUMMARY TEMPLATE

DESIGN ITEMS	#HAZARDS	#POTENTIAL	SCORE
toddler single axis swings			
child single axis swings			
multiple axis swings			
other swings			
SUBTOTAL ALL SWINGS	0	0	
slides			
sliding poles			
slide access- straight stairs			
slide access- spiral stairs			
slide access- ramps			
slide access- rung ladders			
slide access-stepladders			
slide access- cargo nets or other			
SUBTOTAL ALL SLIDE ACCESS	0	0	
rocking equipment			
teeter totters			
climbers			
merry-go-rounds			
sandboxes			
cps access -straight stairs			
cps access- spiral stairs			
cps access- ramps			
cps access- rung ladders			
cps access- stepladders			
cps access- cargo nets or other			
SUBTOTAL ALL CPS ACCESS	0	0	
platorms and landings in cps			
guardrails and handrails in cps			
general considerations			
other			
SUBTOTAL -ALL DESIGN ITEMS	0	0	
MAINTENANCE ITEMS			
toddler swings			
child swings			
multiaxis swings			
other swings			
SUBTOTAL ALL SWINGS	0	0	
slides			
sliding poles			
rocking equipment			
teeter totters			
climbers			
merry-go-rounds			
creative playstructures			
sandboxes			
general site conditions			
SUBTOTAL ALL MAINTENANCE	0	0	
OVERALL SITE TOTAL	0	0	

APPENDIX 9 CONSOLIDATED CRITERIA FOR ALL SITES

SWINGS	# hazards	# potential	criteria met (%)
TODDLER -SINGLE AXIS			
NUMBER OF TODDLER SWING SETS (STRUCTURES)		26	
NUMBER OF TODDLER SWINGS (COMPONENTS)		120	
woodwork should be chamfered or rounded	0	2	100%
common coil or machine chain link or chain enclosed in protective cover	0	120	100%
designed for only one user at a time	0	120	100%
bearing hangers should be hung wider than overall loaded length of seat	1	120	99%
seat made of impact absorbing material	3	120	98%
adequacy of PS type	1	26.5	96%
no accessible sharp edges, points or projections	2	26.5	92%
no hard, sharp equipment parts in zone of use that a child can hit in a free fall	2	26.5	92%
NE zone back	3	26.5	89%
NE zone front	4	26.5	85%
open ends of all tubing should be finished with smooth caps or plugs	2	8	75%
swing holds shape so adult can remove child w/o holding swing open	43	120	64%
located in nontraffic area	10	26.5	62%
no moveable/adjustable elements that would permit child to fall off seat	57	120	53%
gripping surfaces should be splinter free	2	4	50%
support on all sides and between legs	60	120	50%
PS length in front of swing when arc of 60 degrees or max distance usual arc	13.5	26.5	49%
seat height when occupied	67	120	44%
no surfaces should contain rough textures or joints capable of cutting or abrading	15.5	26.5	42%
PS length to left side of last swing	16	26.5	40%
PS length to right side of last swing	16.5	26.5	38%
distance between swings & between swing & frame at seat level	76	120	37%
side clearance from chain to side frame at height of swing height + 860mm (min 600mm)	17	26.5	36%
no accessible pinch, crush or shear points by two moving components	20	26.5	25%
PS length in rear of swing when arc of 60 degrees or max distance usual arc	22.5	26.5	15%
all bolts & screws should be countersunk or dome headed	24.5	25.5	4%
no opening or distance between two parts > 76mm but < 254mm	26.5	27.5	4%
adequacy of depth directly below swings	26.5	26.5	0%
adequacy of depth throughout PS area	26.5	26.5	0%
TOTAL (TODDLER SINGLE AXIS)	558	1544.5	64%
CHILD -SINGLE AXIS			
NUMBER OF CHILD SWING SETS (STRUCTURES)		40	
NUMBER OF CHILD SWINGS (COMPONENTS)		177	
woodwork should be chamfered or rounded	0	2	100%
bearing hangers should be hung wider than overall loaded length of seat	0	174	100%
designed for only one user at a time	0	177	100%
common coil or machine chain link (not double loop) or chain enclosed in protective cover	1	177	99%
seat surface width	2	174	99%
seat surface depth	2	174	99%
seat made of impact absorbing material	3	177	98%
no accessible sharp edges, points or projections	1	39.5	97%
adequacy of PS type	1	39.5	97%
no hard, sharp equipment parts in zone of use that a child can hit in a free fall	3	39.5	92%
open ends of all tubing should be finished with smooth caps or plugs	1	8	88%
no opening or distance between two parts > 76mm but < 254mm	5	39.5	87%
NE zone front	5	39.5	87%
NE zone back	6	39.5	85%
gripping surfaces should be splinter free	1	5	80%
no accessible pinch, crush or shear points by two moving components	9	38.5	77%
no surfaces should contain rough textures or joints capable of cutting or abrading	14.5	37.5	61%
side clearance from chain to side frame at height of swing height + 860mm (min 600mm)	17	39.5	57%
PS length to right side of last swing	17.5	39.5	56%
located in nontraffic area	17	38	55%
PS length to left side of last swing	19	39.5	52%
seat height when occupied	93	175	47%
PS length in front of swing when arc of 60 degrees or max distance usual arc	21.5	39.5	46%
PS length in rear of swing when arc of 60 degrees or max distance usual arc	24.5	39.5	38%
distance between swings & between swing & frame at seat level	120	177	32%
all bolts & screws should be countersunk or dome headed	26.5	33.5	21%
adequacy of depth directly below swings	38.5	39.5	3%
adequacy of depth throughout PS area	39.5	39.5	0%
TOTAL (CHILD SINGLE AXIS)	488.5	2081	77%

APPENDIX 9 CONSOLIDATED CRITERIA FOR ALL SITES

MULTIPLE AXIS			
NUMBER OF MULTIPLE AXIS SWING SETS (STRUCTURES)		6	
NUMBER OF MULTIPLE AXIS SWINGS (COMPONENT)		8	
woodwork should be chamfered or rounded	0	6	100%
no surfaces should contain rough textures or joints capable of cutting or abrading	0	6	100%
common coil or machine chain link (not double loop) or chain enclosed in protective cover	0	8	100%
no protrusions or sharp edges if steel-belted tires are used	0	8	100%
no possible entrapment of fingers or head	0	8	100%
distance between undersurface of swing and protective surface	0	8	100%
NE zone front	0	6	100%
NE zone back	0	6	100%
adequacy of PS type	0	6	100%
no opening or distance between two parts > 76mm but < 254mm	1	6	83%
not combined with other swings or no danger of collision with other swings	1	6	83%
no hard, sharp equipment parts in zone of use that a child can hit in a free fall	1	6	83%
PS area in front of swing	1	6	83%
PS area in back of swing	1	6	83%
NE zone left side	1	6	83%
PS area: distance between right side of frame and edge of protective surface	1	5	80%
open ends of all tubing should be finished with smooth caps or plugs	1	4	75%
no accessible pinch, crush or shear points by two moving components	2	6	67%
located in a nontraffic area	2	6	67%
NE zone right side	2	6	67%
all bolts & screws should be countersunk or dome headed	3	6	50%
distance between frame and swing	4	8	50%
distance between underside of swing support and protective surface	4	8	50%
PS area: distance between left side of frame and edge of protective surface	3	6	50%
no accessible sharp edges, points or projections	4	6	33%
gripping surfaces should be splinter free	6	6	0%
adequacy of depth directly below swing(s)	6	6	0%
adequacy of depth throughout PS area	6	6	0%
TOTAL (MULTIPLE AXIS)	50	177	72%
OTHER SWINGING EQUIPMENT			
NUMBER OF OTHER SWINGING EQUIPMENT STRUCTURES		10	
NUMBER OF OTHER SWINGING EQUIPMENT SWINGS (COMPONENTS)		49	
woodwork should be chamfered or rounded	0	8	100%
no surfaces should contain rough textures or joints capable of cutting or abrading	0	9	100%
distance between suspended element and protective surface (preschoolers)	0	37	100%
PS area: distance between left side of frame and edge of protective surface	0	7	100%
PS area in front of swing	0	8	100%
PS area in back of swing	0	7	100%
adequacy of PS type	0	9	100%
no accessible sharp edges, points or projections	1	9	89%
PS area: distance between right side of frame and edge of protective surface	1	9	89%
no accessible pinch, crush or shear points by two moving components	2	10	80%
NE zone right	2	10	80%
distance between suspended element and protective surface (5-14 yr.)	8	38	79%
no hard, sharp equipment parts in zone of use that a child can hit in a free fall	2	9	78%
open ends of all tubing should be finished with smooth caps or plugs	1	4	75%
all bolts & screws should be countersunk or dome headed	2	8	75%
gripping surfaces should be splinter free	2	6	67%
NE zone back	4	10	60%
no opening or distance between two parts > 76mm but < 254mm	4	9	56%
located in a nontraffic area	5	10	50%
NE zone left	5	10	50%
NE zone front	5	10	50%
no possible entrapment of fingers or head	22	43	49%
any single rope should be attached at both ends	2	3	33%
adequacy of depth directly below swing(s)	8	9	11%
adequacy of depth throughout PS area	8	9	11%
TOTAL (OTHER SWINGING EQUIPMENT)	84	301	72%
SLIDES			
NUMBER OF FREESTANDING SLIDES		25	
NUMBER OF SLIDES AS PART OF CREATIVE PLAYSTRUCTURE		57	
# STRAIGHT		50	
#TUBE		17	

APPENDIX 9 CONSOLIDATED CRITERIA FOR ALL SITES

#CURVY		17	
#SPIRAL		10	
woodwork should be chamfered or rounded	0	38	100%
sidewall edges are rounded	0	80	100%
slope of sitting section	1	28	96%
adequacy of PS type	3	82	96%
no zero gravity	5	82	94%
end of slide rounded	5	82	94%
side enclosures blend from guardrail to sidewall (if has sitting section)	2	29	93%
NE zone in front of slide	6	82	93%
width of starting platform	6	81	93%
length of sitting section	2	27	93%
PS area: in front of slide exit	11	82	87%
length of exit section	14	82	83%
length of starting platform	15	82	82%
open ends of all tubing should be finished with smooth caps or plugs	7	36	81%
radius of curvature adequate	19	81	77%
no surfaces should contain rough textures or joints capable of cutting or abrading	22	80	73%
no hard, sharp equipment parts in zone of use that a child can hit in a free fall	23	82	72%
PS area: length to left of slide	22	78	72%
PS area: length to right of slide	23	81	72%
exit declination between 1-5 degrees	24	82	71%
height of sidewalls	24	80	70%
no accessible sharp edges, points or projections	27	82	67%
metal slides located in shade or facing north	18	38	53%
height of exit above the finished grade (5-14 yrs)	38	80	53%
height of exit above the finished grade (preschoolers)	44	79	44%
gripping surfaces should be splinter free	21	37	43%
no opening or distance between two parts > 76mm but < 254mm	47	82	43%
sheet materials should be finished on exposed edge with roll or rounded capping	31	52	40%
all bolts & screws should be countersunk or dome headed	57	82	30%
PS area: length in rear of slide access	21	27	22%
adequacy of depth directly below slide exit	81	82	1%
adequacy of depth throughout PS area	82	82	0%
TOTAL ALL SLIDES	701	2180	68%
SLIDING POLES			
NUMBER OF SLIDING POLES (STRUCTURE)		32	
woodwork should be chamfered or rounded	0	29	100%
no surfaces should contain rough textures or joints capable of cutting or abrading	0	32	100%
sliding section of poles should be continuous with no welds or joints	0	32	100%
set on a protective surface	0	32	100%
diameter of the pole	0	32	100%
adequacy of PS type	0	32	100%
footing at bottom (if provided) at least 300mm below finished grade	4	32	88%
no accessible sharp edges, points or projections	5	32	84%
no hard, sharp equipment parts in zone of use that a child can hit in a free fall	6	32	81%
no opening or distance between two parts > 76mm but < 254mm	7	32	78%
open ends of all tubing should be finished with smooth caps or plugs	3	9	67%
distance from pole to platform or structure	15	32	53%
access to sliding pole from one point only	17	32	47%
sliding poles not located in a preschool play area	18	32	44%
designed to avoid interference from surrounding traffic	21	32	34%
distance beween lower surface of the horizontal section of the pole to platform surface	22	32	31%
gripping surfaces should be splinter free	20	29	31%
all bolts & screws should be countersunk or dome headed	23	29	21%
access to sliding pole through opening in the gaurdrail (not >380mm)	30	32	6%
adequacy of depth at pole landing area	32	32	0%
adequacy of depth throughout PS area	32	32	0%
TOTAL ALL SLIDING POLES	255	640	60%
ACCESS TO SLIDES AND SLIDING POLES			
STAIRS (Straight)			
NUMBER OF STRAIGHT STAIRS (STRUCTURE)		2	
# CLOSED		2	
# OPEN		0	
woodwork should be chamfered or rounded	0	0	NA
open ends of all tubing should be finished with smooth caps or plugs	0	0	NA

APPENDIX 9 CONSOLIDATED CRITERIA FOR ALL SITES

gripping surfaces should be splinter free	0	0	NA
no accessible sharp edges, points or projections	0	2	100%
sheet materials should be finished on exposed edge with roll or rounded capping	0	2	100%
no opening or distance between two parts > 76mm but < 254mm	0	2	100%
no surfaces should contain rough textures or joints capable of cutting or abrading	0	2	100%
steps should be evenly spaced	0	2	100%
handrails should be immediately contiguous with the stepping surface	0	2	100%
inclination between 30-50 degrees	0	2	100%
rise from one step to next	0	2	100%
depth of step	0	2	100%
stairs should be enclosed if rise is between 76 and 254mm	0	2	100%
stairs with no intermediate landing should not have > 1800mm vertical rise	0	2	100%
if stairs rise more than 450 mm should have 2 continuous handrails both sides	0	2	100%
step nosing (max = 25mm)	0	2	100%
all bolts & screws should be countersunk or dome headed	2	2	0%
lower rail should be 300mm above step tread for preshchoolers	2	2	0%
lower rail should be 500mm above step tread for 5-14 yr olds	2	2	0%
upper rail should be 700mm avove the step tread for preschoolers	2	2	0%
upper rail should be 1000mm above the step tread for 5-14 yr olds	2	2	0%
perp. distance between upper and lower rail or rail and stair should be <76 or> 254mm	2	2	0%
TOTAL (STRAIGHT STAIRS)	12	38	68%
STAIRS (Spiral)			
NUMBER OF SPIRAL STAIRS (STRUCTURE)		0	
# CLOSED		0	
#OPEN		0	
no accessible sharp edges, points or projections	0	0	NA
woodwork should be chamfered or rounded		0	NA
sheet materials should be finished on exposed edge with roll or rounded capping		0	NA
open ends of all tubing should be finished with smooth caps or plugs		0	NA
all bolts & screws should be countersunk or dome headed		0	NA
no opening or distance between two parts > 76mm but < 254mm		0	NA
gripping surfaces should be splinter free		0	NA
no surfaces should contain rough textures or joints capable of cutting or abrading		0	NA
steps should be evenly spaced		0	NA
handrails should be immediately contiguous with the stepping surface		0	NA
rise from one step to next		0	NA
depth of step at inner edge		0	NA
stairs should be enclosed if rise is between 76-254mm		0	NA
stairs with no intermediate landing should not have > 1800mm vertical rise		0	NA
if stairs rise more than 450mm, should have two continuous handrails on both sides		0	NA
lower rail should be 300mm above step tread for preshchoolers		0	NA
lower rail should be 500mm above step tread for 5-14 yr olds		0	NA
upper rail should be 700mm avove the step tread for preschoolers		0	NA
upper rail should be 1000mm above the step tread for 5-14 yr olds		0	NA
perp. distance between upper and lower rail or rail and stair should be <76 or> 254mm		0	NA
step nosing (max = 25mm)		0	NA
outside radius (min = 500mm)		0	NA
inclination between 15 and 65 degrees		0	NA
TOTAL (STAIRS SPIRAL)	0	0	NA
RAMPS			
NUMBER OF RAMPS (STRUCTURE)		0	
no accessible sharp edges, points or projections		0	NA
woodwork should be chamfered or rounded		0	NA
sheet materials should be finished on exposed edge with roll or rounded capping		0	NA
open ends of all tubing should be finished with smooth caps or plugs		0	NA
all bolts & screws should be countersunk or dome headed		0	NA
no opening or distance between two parts > 76mm but < 254mm		0	NA
gripping surfaces should be splinter free		0	NA
no surfaces should contain rough textures or joints capable of cutting or abrading		0	NA
handrails should be immediately contiguous with the stepping surface		0	NA
inclination max = 30 degrees		0	NA
ramps with no intermediate landing should not have > 1800mm vertical rise		0	NA
if ramp rises more than 450mm, should have two continuous handrails on both sides		0	NA
lower rail should be 300mm above the ramp for preschoolers		0	NA
lower rail should be 500 mm above the ramp for 5-14 yr olds		0	NA
upper rail should be 700mm above the ramp for preshoolers		0	NA

upper rail should be 1000mm above the ramp for 5-14 yr olds		0	NA
perpendicular distance between rails or rail and ramp should be <76mm or > 254mm		0	NA
TOTAL (RAMPS)	0	0	NA
RUNG LADDERS			
NUMBER OF RUNG LADDERS (STRUCTURE)		0	
no accessible sharp edges, points or projections		0	NA
woodwork should be chamfered or rounded		0	NA
open ends of all tubing should be finished with smooth caps or plugs		0	NA
all bolts & screws should be countersunk or dome headed		0	NA
no opening or distance between two parts > 76mm but < 254mm		0	NA
gripping surfaces should be splinter free		0	NA
no surfaces should contain rough textures or joints capable of cutting or abrading		0	NA
rungs should be evenly spaced		0	NA
rungs should not turn when grasped		0	NA
rung ladders should not be closed		0	NA
angle of inclination between 50-90 degrees		0	NA
rung ladders with no intermediate landing not have >1800mm vertical rise		0	NA
spacing of rungs <76mm or >254mm		0	NA
rung diameter between 25-35 mm for preschoolers		0	NA
rung diameter 25-45mm for 5-14 year olds		0	NA
width of ladder (min = 300mm)		0	NA
distance between finished grade and top of first rung (max = 450mm)		0	NA
TOTAL (RUNG LADDERS)	0	0	NA
STEPLADDERS			
NUMBER OF STEPLADDERS (STRUCTURE)		21	
woodwork should be chamfered or rounded	0	1	100%
gripping surfaces should be splinter free	0	3	100%
inclination between 50-90 degrees	0	21	100%
step ladders with no intermediate landings not have > 1800mm vertical rise	0	1	100%
rise from step to step when closed between 76-254mm	0	4	100%
step depth when open min = 76mm	0	18	100%
step width (min = 300mm)	0	21	100%
if stepladder rises more than 450mm, should have one continuous handrail both sides	0	21	100%
step nosing (max = 25mm)	4	17	76%
step depth when closed min = 120mm	1	4	75%
no accessible sharp edges, points or projections	7	21	67%
steps should be evenly spaced	8	21	62%
open ends of all tubing should be finished with smooth caps or plugs	6	11	45%
no opening or distance between two parts > 76mm but < 254mm	8	13	38%
rails should be max of 700mm above the step tread for preschoolers	13	21	38%
no surfaces should contain rough textures or joints capable of cutting or abrading	15	21	29%
rail should be max of 1000mm above the step tread for 5-14yr olds	17	21	19%
perp dimension between rail and step tread nosing never < 254mm	18	20	10%
all bolts & screws should be countersunk or dome headed	20	21	5%
rise from step to step when open <76 or > 254mm	18	18	0%
TOTAL (STEPLADDERS)	135	299	55%
CARGO NETS, MOVING LADDERS AND SIMILAR DEVICES			
NUMBER OF CARGO NETS (STRUCTURE)		0	
no accessible sharp edges, points or projections		0	NA
woodwork should be chamfered or rounded		0	NA
open ends of all tubing should be finished with smooth caps or plugs		0	NA
all bolts & screws should be countersunk or dome headed		0	NA
no opening or distance between two parts > 76mm but < 254mm		0	NA
gripping surfaces should be splinter free		0	NA
no surfaces should contain rough textures or joints capable of cutting or abrading		0	NA
should be securely fastened		0	NA
any single rope should be attached at both ends		0	NA
TOTAL (CARGO NETS)	0	0	NA
ROCKING EQUIPMENT			
NUMBER OF ROCKING EQUIPMENT PIECES (STRUCTURE)		26	
woodwork should be chamfered or rounded	0	13	100%
hand grips and footrests should be fixed	0	26	100%
any projections should have a min. diameter of 18mm	0	26	100%

APPENDIX 9 CONSOLIDATED CRITERIA FOR ALL SITES

hand grips and foot rests should not turn when grasped	1	26	96%
gripping surfaces should be splinter free	1	15	93%
adequacy of PS type	2	26	92%
no surfaces should contain rough textures or joints capable of cutting or abrading	3	26	88%
open ends of all tubing should be finished with smooth caps or plugs	3	23	87%
no hard, sharp equipment parts in zone of use that a child can hit in a free fall	4	26	85%
hand grips and foot rests should not project beyond max of 125 mm	5	25	80%
distance from ground to seat for preschoolers should be 350-600mm	5	25	80%
no accessible sharp edges, points or projections	7	25	72%
NE zone if adjacent to moving equipment	1	3	67%
all bolts & screws should be countersunk or dome headed	10	26	62%
PS to right side of rocker (1800mm)	10	26	62%
no accessible pinch, crush or shear points by two moving components	12	26	54%
PS in front of rocker (1800mm)	12	26	54%
PS to left side of rocker (1800mm)	12	26	54%
adequacy of PS depth directly below rocker	14	26	46%
adequacy of PS depth throughout PS area	14	26	46%
PS in rear of rocker (1800mm)	17	26	35%
no opening or distance between two parts > 76mm but < 254mm	18	26	31%
diameter of hand grips and foot rests 5-14 yr olds (25-45)	17	24	29%
diameter of hand grips and foot rests preschoolers (25-35mm)	18	25	28%
TOTAL ROCKING EQUIPMENT	186	568	67%
TEETER TOTTERS			
NUMBER OF TEETER TOTTERS (STRUCTURE)		7	
if beam allowed to hit ground, an impact cushion should be provided	0	0	NA
woodwork should be chamfered or rounded	0	5	100%
open ends of all tubing should be finished with smooth caps or plugs	0	2	100%
no surfaces should contain rough textures or joints capable of cutting or abrading	0	7	100%
handles designed to prevent entrapment	0	7	100%
hand grips or foot rests should not turn when grasped	0	7	100%
hand grips should be fixed	0	7	100%
protruding hand grips not permit knee entrapment between grip and ground	0	7	100%
no hard, sharp equipment parts in zone of use that a child can hit in a free fall	0	7	100%
should be set on a protective surface	0	7	100%
pivot height (max = 760mm)	0	7	100%
diameter of hand grips (min = 18mm)	0	7	100%
adequacy of PS type	0	7	100%
no accessible sharp edges, points or projections	1	7	86%
gripping surfaces should be splinter free	3	7	57%
adequacy of PS depth directly beneath teeter totter	3	7	57%
adequacy of PS depth throughout the PS area	3	7	57%
no accessible pinch, crush or shear points by two moving components	5	7	29%
no opening or distance between two parts > 76mm but < 254mm	5	7	29%
all bolts & screws should be countersunk or dome headed	7	7	0%
TOTAL TEETER TOTTERS	27	126	79%
CLIMBERS			
NUMBER OF CLIMBERS (UNIT OF STRUCTURE)		145	
woodwork should be chamfered or rounded	0	77	100%
rungs and bars should not turn when grasped	6	139	96%
rung diameter (5-14 yr olds not > 45mm)	9	136	93%
adequacy of PS type	10	145	93%
no accessible sharp edges, points or projections	12	145	92%
NE zone (1800 mm if adjacent to moving equipment)	3	15	80%
open ends of all tubing should be finished with smooth caps or plugs	15	68	78%
sheet materials should be finished on exposed edge with roll or rounded capping	20	83	76%
rung diameter (preschoolers 25-35mm)	33	136	76%
all rungs should permit fall fo protective surface without striking any obstruction	39	143	73%
no hard, sharp equipment parts in zone of use that a child can hit in a free fall	40	145	72%
PS area in front of climber	34	118	71%
no surfaces should contain rough textures or joints capable of cutting or abrading	41	139	71%
PS area on left side of climber	43	138	69%
PS area in back of climber	39	112	65%
no opening or distance between two parts > 76mm but < 254mm	53	144	63%
PS area on right side of climber	48	123	61%
over head ladders allow children to grasp first rung from standing position	24	56	57%
all bolts & screws should be countersunk or dome headed	54	103	48%

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clear distance between successive rungs (300-400mm)	42	79	47%
gripping surfaces should be splinter free	53	82	35%
adequacy of PS depth directly beneath climber	137	144	5%
adequacy of PS depth throughout the PS area	137	144	5%
TOTAL CLIMBERS	892	2614	66%
MERRY-GO -ROUND /WHIRLERS			
NUMBER OF MERRY-GO-ROUND/WHIRLERS (STRUCTURE)		1	
woodwork should be chamfered or rounded	0	0	NA
all bolts & screws should be countersunk or dome headed	0	0	NA
gripping surfaces should be splinter free	0	0	NA
no accessible sharp edges, points or projections	0	1	100%
sheet materials should be finished on exposed edge with roll or rounded capping	0	1	100%
open ends of all tubing should be finished with smooth caps or plugs	0	1	100%
no accessible pinch, crush or shear points by two moving components	0	1	100%
no opening or distance between two parts > 76mm but < 254mm	0	1	100%
no surfaces should contain rough textures or joints capable of cutting or abrading	0	1	100%
secure means of holding on provided	0	1	100%
hand grips should not turn when grasped	0	1	100%
no projections beyond the outside diameter of the platform	0	1	100%
hand grip diameter (preschoolers) 25-35mm	0	1	100%
hand grip diameter (5-14) 25-45	0	1	100%
no accessible space >5mm between moving parts within rotation device	0	1	100%
space between underside of platform and ps <76mm or >254mm	0	1	100%
NE zone right side	0	1	100%
NEzone left side	0	1	100%
adequacy of PS type	0	1	100%
apparatus located in a supervised area	1	1	0%
apparatus located in a nontraffic area	1	1	0%
no hard, sharp equipment parts in zone of use that a child can hit in a free fall	1	1	0%
PS front	1	1	0%
PS rear	1	1	0%
PS right side	1	1	0%
PS left side	1	1	0%
NE zone front	1	1	0%
NE zone rear	1	1	0%
adequacy of depth directly surrounding rotating apparatus	1	1	0%
adequacy of depth throughout PS area	1	1	0%
TOTAL MERRY -GO-ROUND/WHIRLERS	11	27	59%
SANDBOXES			
NUMBER OF SANDBOXES (STRUCTURES)		32	
open ends of all tubing should be finished with smooth caps or plugs	0	0	NA
no accessible pinch, crush or shear points by two moving components	0	0	NA
sheet materials should be finished on exposed edge with roll or rounded capping	0	1	100%
sand should be free of contaminants	0	1	100%
sandbox covers, if used, designed to be safely secured open and closed	0	1	100%
sand play area exposed to some sun and rain	0	32	100%
total sand play area 6-7 sq. m.	0	32	100%
sand should pack together for moulding	1	32	97%
no opening or distance between two parts >76mm but <254mm	3	29	90%
height of sandbox ledge above the finished grade (max 280mm)	4	31	87%
sand should appear clean	5	32	84%
woodwork should be chamfered or rounded	7	26	73%
width of sandbox ledge (min 85mm)	10	32	69%
no accessible sharp edges, points or projections	12	32	63%
some shade and shelter provided	13	32	59%
not located in a physical play zone	14	32	56%
seating for adults near the sandbox	17	32	47%
all bolts & screws should be countersunk or dome headed	7	13	46%
no surfaces should contain rough textures or joints capable of cutting or abrading	20	31	35%
TOTAL SANDBOXES	113	421	73%
CREATIVE PLAYSTRUCTURES			
NUMBER OF CREATIVE PLAYSTRUCTURES (STRUCTURE)		43	
ACCESS - STRAIGHT STAIRS			
NUMBER OF STRAIGHT STAIRS (COMPONENT)		14	
#CLOSED		8	

#OPEN		6	
step nosing (max = 25mm)	0	0	NA
NE zone in all relevant directions	0	0	NA
no surfaces should contain rough textures or joints capable of cutting or abrading	0	6	100%
depth of step	0	14	100%
stairs with no intermediate landing should not have > 1800mm vertical rise	0	12	100%
woodwork should be chamfered or rounded	1	14	93%
steps should be evenly spaced	2	14	86%
handrails should be immediately contiguous with the stepping surface	2	14	86%
inclination between 30-50 degrees	2	14	86%
adequacy of PS type	2	14	86%
PS 1800mm in all relevant directions	6	39	85%
if stairs rise more than 450 mm should have 2 continuous handrails both sides	3	14	79%
no hard, sharp equipment parts in zone fo use that a child can hit in a free fall	4	17	76%
stairs should be enclosed if rise is between 76 and 254mm	3	11	73%
no accessible sharp edges, points or projections	4	14	71%
rise from one step to next	5	14	64%
open ends of all tubing should be finished with smooth caps or plugs	2	5	60%
no opening or distance between two parts > 76mm but < 254mm	5	11	55%
sheet materials should be finished on exposed edge with roll or rounded capping	3	6	50%
upper rail should be 700mm avove the step tread for preschoolers	6	12	50%
gripping surfaces should be splinter free	8	14	43%
all bolts & screws should be countersunk or dome headed	9	14	36%
perp. distance between upper and lower rail or rail and stair should be <76 or> 254mm	8	12	33%
lower rail should be 300mm above step tread for preshchoolers	8	11	27%
upper rail should be 1000mm above the step tread for 5-14 yr olds	9	11	18%
lower rail should be 500mm above step tread for 5-14 yr olds	9	10	10%
adequacy of PSdepth directly beneath stairs	14	14	0%
adquacy of depth throughout PS area	14	14	0%
TOTAL (STRAIGHT STAIRS)	129	345	63%
STAIRS (Spiral)			
NUMBER OF SPIRAL STAIRS (COMPONENT)		0	
#CLOSED		0	
#OPEN		0	
no accessible sharp edges, points or projections		0	NA
woodwork should be chamfered or rounded		0	NA
sheet materials should be finished on exposed edge with roll or rounded capping		0	NA
open ends of all tubing should be finished with smooth caps or plugs		0	NA
all bolts & screws should be countersunk or dome headed		0	NA
no opening or distance between two parts > 76mm but < 254mm		0	NA
gripping surfaces should be splinter free		0	NA
no surfaces should contain rough textures or joints capable of cutting or abrading		0	NA
steps should be evenly spaced		0	NA
handrails should be immediately contiguous with the stepping surface		0	NA
rise from one step to next		0	NA
depth of step at inner edge		0	NA
stairs should be enclosed if rise is between 76-254mm		0	NA
stairs with no intermediate landing should not have > 1800mm vertical rise		0	NA
if stairs rise more than 450mm, should have two continuous handrails on both sides		0	NA
lower rail should be 300mm above step tread for preshchoolers		0	NA
lower rail should be 500mm above step tread for 5-14 yr olds		0	NA
upper rail should be 700mm avove the step tread for preschoolers		0	NA
upper rail should be 1000mm above the step tread for 5-14 yr olds		0	NA
perp. distance between upper and lower rail or rail and stair should be <76 or> 254mm		0	NA
step nosing (max = 25mm)		0	NA
outside radius (min = 500mm)		0	NA
inclination between 15 and 65 degrees		0	NA
no hard, sharp equipment parts in zone fo use that a child can hit in a free fall		0	NA
PS 1800mm in all relevant directions			NA
NE zone in all relevant directions when adjacent to moving equipment			NA
adequacy of PS type		0	NA
adequacy of PSdepth directly beneath stairs		0	NA
adquacy of depth throughout PS area		0	NA
TOTAL (STAIRS - SPIRAL)	0	0	NA
RAMPS			
NUMBER OF RAMPS (COMPONENT)		33	

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NE zone in all relevant directions when adjacent to moving equipment	0	0	NA
open ends of all tubing should be finished with smooth caps or plugs	0	13	100%
no surfaces should contain rough textures or joints capable of cutting or abrading	0	21	100%
inclination max = 30 degrees	0	31	100%
ramps with no intermediate landing should not have > 1800mm vertical rise	0	22	100%
adequacy of PS type	0	33	100%
handrails should be immediately contiguous with the stepping surface	1	33	97%
PS 1800mm in all relevant directions	4	67	94%
woodwork should be chamfered or rounded	2	32	94%
perpendicular distance between rails or rail and ramp should be <76mm or > 254mm	4	24	83%
if ramp rises more than 450mm, should have two continuous handrails on both sides	6	31	81%
no accessible sharp edges, points or projections	7	33	79%
no hard, sharp equipment parts in zone fo uswe that a child can hit in a free fall	10	35	71%
all bolts & screws should be countersunk or dome headed	10	31	68%
sheet materials should be finished on exposed edge with roll or rounded capping	6	18	67%
no opening or distance between two parts > 76mm but < 254mm	11	33	67%
gripping surfaces should be splinter free	21	32	34%
lower rail should be 300mm above the ramp for preschoolers	18	26	31%
upper rail should be 700mm above the ramp for preshoolers	21	30	30%
lower rail should be 500 mm above the ramp for 5-14 yr olds	20	26	23%
upper rail should be 1000mm above the ramp for 5-14 yr olds	25	31	19%
adequacy of PSdepth directly beneath ramp	33	33	0%
adquacy of depth throughout PS area	33	33	0%
TOTAL (RAMPS)	232	669	65%
RUNG LADDERS			
NUMBER OF RUNG LADDERS (COMPONENT)		53	
woodwork should be chamfered or rounded	0	45	100%
rung ladders should not be closed	0	52	100%
angle of inclination between 50-90 degrees	0	52	100%
width of ladder(min = 300mm)	0	53	100%
adequacy of PS type	1	53	98%
rungs should not turn when grasped	2	53	96%
PS 1800mm in all relevant directions	6	120	95%
no surfaces should contain rough textures or joints capable of cutting or abrading	2	38	95%
open ends of all tubing should be finished with smooth caps or plugs	2	22	91%
no accessible sharp edges, points or projections	6	53	89%
all bolts & screws should be countersunk or dome headed	8	49	84%
distance between finished grade and top of first rung (max = 450mm)	10	53	81%
rung ladders with no intermediate landing not have >1800mm vertical rise	13	53	75%
rung diameter 25- 45mm for 5-14 year olds	15	51	71%
no hard, sharp equipment parts in zone fo uswe that a child can hit in a free fall	17	53	68%
rung diameter between 25-35 mm for preschoolers	22	49	55%
no opening or distance between two parts > 76mm but < 254mm(esp. rung spacing)	32	53	40%
rungs should be evenly spaced	36	53	32%
gripping surfaces should be splinter free	34	48	29%
NE zone in all relevant directions when adjacent to moving equipment	3	3	0%
adequacy of PSdepth directly beneath rung ladder	53	53	0%
adquacy of depth throughout PS area	53	53	0%
TOTAL (RUNG LADDERS)	315	1112	72%
STEPLADDERS			
NUMBER OF STEPLADDERS (COMPONENT)		26	
step nosing (max = 25mm)	0	0	NA
NE zone in all relevant directions when adjacent to moving equipment	0	0	NA
woodwork should be chamfered or rounded	0	23	100%
open ends of all tubing should be finished with smooth caps or plugs	0	4	100%
no surfaces should contain rough textures or joints capable of cutting or abrading	0	6	100%
inclination between 50-90 degrees	0	26	100%
rise from step to step when closed between 76-254mm	0	3	100%
step depth when closed min = 120mm	0	3	100%
step width (min = 300mm)	0	26	100%
step ladders with no intermediate landings not have > 1800mm vertical rise	1	26	96%
step depth when open min = 76mm	1	23	96%
PS 1800mm in all relevant directions	4	57	93%
no accessible sharp edges, points or projections	3	26	88%
adequacy of PS type	4	26	85%
no hard, sharp equipment parts in zone of use that a child can hit in a free fall	10	26	62%

perp dimension between rail and step tread nosing never < 254mm	2	4	50%
steps should be evenly spaced	17	26	35%
no opening or distance between two parts > 76mm but < 254mm	16	23	30%
all bolts & screws should be countersunk or dome headed	23	26	12%
if stepladder rises more than 450mm, should have one continuous handrail both sides	23	26	12%
gripping surfaces should be splinter free	21	23	9%
rise from step to step when open <76 or > 254mm	22	23	4%
rails should be max of 700mm above the step tread for preschoolers	5	5	0%
rail should be max of 1000mm above the step tread for 5-14yr olds	5	5	0%
adequacy of PS depth directly beneath stepladder	26	26	0%
adquacy of depth throughout PS area	26	26	0%
TOTAL (STEPLADDERS)	209	488	57%
CARGO NETS, MOVING LADDERS AND SIMILAR DEVICES			
NUMBER OF CARGO NETS (COMPONENTS)		49	
NE zone in all relevant directions when adjacent to moving equipment	0	0	NA
woodwork should be chamfered or rounded	0	45	100%
open ends of all tubing should be finished with smooth caps or plugs	0	12	100%
adequacy of PS type	0	49	100%
should be securely fastened	1	49	98%
PS 1800mm in all relevant directions	7	124	94%
no accessible sharp edges, points or projections	8	49	84%
no surfaces should contain rough textures or joints capable of cutting or abrading	12	49	76%
any single rope should be attached at both ends	5	12	58%
all bolts & screws should be countersunk or dome headed	26	49	47%
no hard, sharp equipment parts in zone fo uswe that a child can hit in a free fall	29	49	41%
gripping surfaces should be splinter free	28	47	40%
no opening or distance between two parts > 76mm but < 254mm	39	49	20%
adequacy of PS depth directly beneath cargo net	49	49	0%
adquacy of depth throughout PS area	49	49	0%
TOTAL (CARGO NET)	253	681	63%
PLATFORMS AND INTERMEDIATE LANDINGS			
NUMBER OF PLATFORMS AND INTERMEDIATE LANDINGS (COMPONENT)		204	
adequacy of PS type	0	202	100%
woodwork should be chamfered or rounded	1	200	100%
open ends of all tubing should be finished with smooth caps or plugs	2	75	97%
no surfaces should contain rough textures or joints capable of cutting or abrading	3	65	95%
height difference between two platforms not >610 (5-14)	7	95	93%
PS 1800mm in all relevant directions	22	288	92%
entry and exit from intermediate landings should be offset by 90-180 degrees	17	193	91%
NE zone in all relevant directions when adjacent to moving equipment	1	8	88%
no accessible sharp edges, points or projections	26	203	87%
sheet materials should be finished on exposed edge with roll or rounded capping	16	86	81%
all bolts & screws should be countersunk or dome headed	40	186	78%
dimensions of intermediate landings (min 900 by 900)	45	195	77%
no opening or distance between two parts > 76mm but < 254mm	52	203	74%
no accessible pinch, crush or shear points by two moving components	17	48	65%
no hard, sharp equipment parts in zone fo uswe that a child can hit in a free fall	105	213	51%
where vertical rise of stairs or ladders exceeds 1800mm, should have int. landing	5	9	44%
height difference between two platforms not > 300mm (preschoolers)	56	90	38%
gripping surfaces should be splinter free	135	194	30%
if platform decking is > 40mm thick, openings not >13mm	38	54	30%
if platform decking is </= 40mm thick, openings not > 6mm	125	147	15%
adequacy of PS depth directly beneath platform or intermediate landing	202	202	0%
adquacy of depth throughout PS area	202	202	0%
TOTAL (PLATFORMS AND INTERMEDIATE LANDINGS)	1117	3158	65%
GUARDRAILS AND HANDRAILS			
NUMBER OF SETS OF CONTINUOUS HAND/GUARDRAILS (COMPONENT)		177	
stepladders require only a single handrail both sides	0	0	NA
woodwork should be chamfered or rounded	0	134	100%
open ends of all tubing should be finished with smooth caps or plugs	0	59	100%
all stairs, steps & ramps rising > 450mm should have two continuous handrails	0	3	100%
no accessible sharp edges, points or projections	10	151	93%
height of top guardrail min = 610mm	8	64	88%
max clearance below panel or vertical guardrails = 300mm	10	72	86%
handrails should be immediately contiguous with the stepping surface	21	142	85%

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no surfaces should contain rough textures or joints capable of cutting or abrading	19	118	84%
perp. distance between rails should be <76mm or >254mm)	9	41	78%
sheet materials should be finished on exposed edge with roll or rounded capping	22	83	73%
no opening or distance between two parts > 76mm but < 254mm	47	147	68%
all platforms > 450mm should have perimeter guardrails	62	188	67%
all bolts & screws should be countersunk or dome headed	47	139	66%
clearance between platform and bottom of guardrail (max=300mm) not <76, >254	52	116	55%
upper or single rail 700mm above step tread (preschoolers)	58	108	46%
gripping surfaces should be splinter free	85	135	37%
all platforms >1200mm need panel -style or vertical fence-style guardrails	69	107	36%
space between vertical railings in fence-style guardrails should be <76mm	20	30	33%
lower rail 300mm above the step tread (preschoolers)	32	46	30%
horizontal openings in guardrails for access should be <380 or have top guardrail	122	164	26%
lower rail 500mm above step tread (5-14)	41	48	15%
upper or single rail 1000mm above step tread (5-14)	79	90	12%
TOTAL (HANDRAILS AND GUARDRAILS)	813	2185	63%
GENERAL CONSIDERATIONS			
POTENTIAL = ONE		46	
site not located near high voltage power lines or transformer stations	0	48	100%
any enclosed space >1800mm deep should have min of 2 openings	0	10	100%
woodwork should be chamfered or rounded	1	31	97%
no suspended lateral elements <25mm diameter	3	49	94%
crawl space should be min of 610mm high & 610mm wide	1	9	89%
open ends of all tubing should be finished with smooth caps or plugs	3	12	75%
no accessible sharp edges , points or projections	12	44	73%
no surface should contain rough textures or joints capable of cutting or abrading	11	37	70%
play area has visually defined boundaries	16	50	68%
crawl space with any interior diameter < 760 should be max. length of 1800mm	2	6	67%
for elevations >1800mm, more than one method of exit provided	3	9	67%
sheet materials should be finished on exposed edges with roll or rounded capping	4	11	64%
no hard, sharp equipment parts in zone of use that a child can hit in a free fall	9	20	55%
balance cables if protected from lateral access are OK, diameter min = 9mm	1	2	50%
no opening or distance between any two parts >76mm but < 254mm	25	48	48%
all bolts and screws should be countersunk or dome headed	14	25	44%
no accessible pinch, crush or shear points by two moving components	6	10	40%
if suspended lateral elements >25mm, should be bright coloured	2	3	33%
gripping surfaces should be splinter free	22	28	21%
angles formed by adjacent surfaces should be >/= 55 degrees (unless lower leg > 10 degrees below horizontal, or angle filled such that surfaces of angle are > 254mm apart	16	19	16%
all standing surfaces 450mm above finished grade should have guardrails	22	24	8%
TOTAL GENERAL CONSIDERATIONS	173	495	65%
MAINTENANCE			
TODDLER- SINGLE AXIS			
NUMBER OF TODDLER SWING SETS (STRUCTURE)		27	
NUMBER OF TODDLER SWINGS (COMPONENT)		119	
sidewalls & bedways	0	0	NA
fastening points	0	115	100%
exposed concrete	0	26	100%
locking devices int/ext	0	6	100%
wooden borders	0	8	100%
hanger bearings	4	119	97%
stability in ground	1	27	96%
tilting	1	26	96%
nuts & bolts	1	24	96%
pivot point for wear	2	27	93%
end/centre fittings	2	26	92%
sharp edges/points	2	26	92%
protrusions	2	25	92%
cracking /damage	3	24	88%
s-hooks	16	117	86%
debris/broken glass	4	27	85%
seats	24	119	80%
protective caps/plugs	2	9	78%
chains	29	119	76%
support bars/legs	7	27	74%
chain pipe covers	14	52	73%

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wood checking	1	3	67%
grease fitting	59	119	50%
entrapment point areas	115	119	3%
ground clearance	27	27	0%
surface below equipment	27	27	0%
TOTAL (toddler single axis swing)	343	1244	72%
CHILD- SINGLE AXIS			
NUMBER OF CHILD SINGLE AXIS SWING SETS (STRUCTURE)		37	
NUMBER OF CHILD SINGLE AXIS SWINGS (COMPONENT)		178	
stability in ground	0	37	100%
protrusions	0	34	100%
wooden borders	0	11	100%
fastening points	1	176	99%
entrapment point areas	2	178	99%
pivot point for wear	1	37	97%
hanger bearings	5	178	97%
end/centre fittings	1	34	97%
sharp edges/points	1	34	97%
tilting	2	37	95%
exposed concrete	2	34	94%
nuts & bolts	2	33	94%
seats	22	178	88%
protective caps/plugs	1	6	83%
cracking /damage	6	34	82%
locking devices int/ext	2	11	82%
chain pipe covers	19	94	80%
chains	41	178	77%
debris/broken glass	9	36	75%
sidewalls & bedways	1	4	75%
wood checking	1	4	75%
support bars/legs	11	37	70%
s-hooks	58	176	67%
grease fitting	92	178	48%
ground clearance	38	38	0%
surface below equipment	38	38	0%
TOTAL (child single axis swings)	356	1833	81%
MULTIPLE AXIS SWINGS			
NUMBER OF MULTIPLE AXIS SWING SETS (STRUCTURE)		6	
NUMBER OF MULTIPLE AXIS SWINGS (COMPONENT)		8	
locking devices int/ext	0	0	NA
stability in ground	0	6	100%
hanger bearings	0	8	100%
entrapment point areas	0	8	100%
exposed concrete	0	4	100%
nuts & bolts	0	4	100%
protrusions	0	4	100%
wooden borders	0	3	100%
seats	1	8	88%
fastening points	1	8	88%
tilting	1	6	83%
support bars/legs	1	6	83%
pivot point for wear	1	6	83%
debris/broken glass	1	6	83%
sharp edges/points	1	4	75%
wood checking	1	4	75%
grease fitting	3	8	63%
s-hooks	3	7	57%
chains	4	8	50%
end/centre fittings	2	4	50%
cracking /damage	2	4	50%
protective caps/plugs	1	2	50%
ground clearance	6	6	0%
surface below equipment	6	6	0%
chain pipe covers	1	1	0%
sidewalls & bedways	2	2	0%
TOTAL (multiple axis swings)	38	133	71%
OTHER SWINGING EQUIPMENT			

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NUMBER OF OTHER SWINGING EQUIPMENT SETS (STRUCTURES)		10	
NUMBER OF OTHER SWINGING EQUIPMENT SWINGS (COMPONENT)		44	
chain pipe covers	0	0	NA
locking devices int/ext	0	0	NA
stability in ground	0	8	100%
tilting	0	8	100%
support bars/legs	0	8	100%
chains	0	39	100%
hanger bearings	0	41	100%
grease fitting	0	6	100%
fastening points	0	44	100%
exposed concrete	0	7	100%
end/centre fittings	0	4	100%
sidewalls & bedways	0	1	100%
cracking /damage	0	7	100%
protrusions	0	7	100%
protective caps/plugs	0	2	100%
wooden borders	0	7	100%
pivot point for wear	1	9	89%
sharp edges/points	1	7	86%
wood checking	1	7	86%
nuts & bolts	1	6	83%
s-hooks	7	32	78%
debris/broken glass	3	9	67%
seats	1	2	50%
entrapment point areas	23	44	48%
ground clearance	9	9	0%
surface below equipment	9	9	0%
TOTAL (other swinging equipment)	56	323	83%
SLIDES			
TOTAL NUMBER OF SLIDES		82	
NUMBER OF FREESTANDING SLIDES		25	
NUMBER OF SLIDES AS PART OF CREATIVE PLAYSTRUCTURE		52	
locking devices int/ext	0	1	100%
stability in ground	2	82	98%
tilting	2	82	98%
support bars/legs	2	79	97%
wooden borders	1	27	96%
nuts & bolts	3	47	94%
debris/broken glass	10	79	87%
tube slide	7	38	82%
hand railings	15	73	79%
cracking /damage	10	48	79%
exposed concrete	10	47	79%
protective caps/plugs	4	18	78%
protrusions	11	48	77%
wood checking	5	21	76%
stairs of slide	6	23	74%
sidewalls & bedways	22	46	52%
sharp edges/points	27	48	44%
entrapment point areas	51	82	38%
surface below equipment	79	82	4%
ground clearance	82	82	0%
TOTAL (slides)	349	1053	67%
SLIDING POLES			
NUMBER OF SLIDING POLES		32	
stairs of slide	0	1	100%
locking devices int/ext	0	1	100%
protrusions	0	24	100%
wooden borders	0	19	100%
stability in ground	1	32	97%
tilting	1	32	97%
entrapment point areas	2	32	94%
hand railings	2	24	92%
end/centre fittings	2	24	92%
nuts & bolts	2	23	91%
debris/broken glass	3	32	91%
exposed concrete	3	24	88%

sharp edges/points	3	24	88%
cracking /damage	3	24	88%
wood checking	4	20	80%
protective caps/plugs	2	7	71%
ground clearance	32	32	0%
surface below equipment	32	32	0%
TOTAL (sliding poles)	92	407	77%
ROCKING EQUIPMENT			
NUMBER OF ROCKING EQUIPMENT PIECES (STRUCTURE)		26	
locking devices int/ext	0	0	NA
pivot point for wear	0	10	100%
grease fittings	0	3	100%
fastening points	0	20	100%
nuts & bolts	0	12	100%
wood checking	0	6	100%
protrusions	0	12	100%
wooden borders	0	6	100%
stability in ground	1	26	96%
support bars/legs	1	24	96%
tilting	2	26	92%
spring & bar	2	26	92%
handles	3	26	88%
debris/broken glass	3	26	88%
seats	3	26	88%
cracking /damage	2	12	83%
exposed concrete	3	12	75%
sharp edges/points	3	12	75%
protective caps/plugs	2	8	75%
sidewalls & bedways	1	3	67%
surface below equipment	18	26	31%
entrapment point areas	19	26	27%
ground clearance	20	26	23%
TOTAL (rocking equipment)	83	374	78%
TEETER TOTTERS			
NUMBER OF TEETER TOTTERS (STRUCTURE)		7	
locking devices int/ext	0	0	NA
stability in ground	0	7	100%
tilting	0	7	100%
support bars/legs	0	7	100%
spring & bar	0	7	100%
handles	0	7	100%
pivot point for wear	0	5	100%
debris/broken glass	0	7	100%
seats	0	7	100%
grease fittings	0	2	100%
fastening points	0	7	100%
exposed concrete	0	6	100%
end/centre fittings	0	5	100%
sidewalls & bedways	0	1	100%
sharp edges/points	0	6	100%
nuts & bolts	0	5	100%
protrusions	0	6	100%
wooden borders	0	5	100%
wood checking	1	3	67%
cracking /damage	3	6	50%
entrapment point areas	4	6	33%
ground clearance	5	7	29%
surface below equipment	5	7	29%
protective caps/plugs	1	1	0%
TOTAL (teeter totters)	19	127	85%
CLIMBERS			
NUMBER OF CLIMBERS		145	
locking devices int/ext	0	1	100%
stability in ground	1	145	99%
wooden borders	1	26	96%
tilting	7	145	95%
support bars/legs	12	145	92%
exposed concrete	4	46	91%

APPENDIX 9 CONSOLIDATED CRITERIA FOR ALL SITES

nuts & bolts	3	34	91%
protrusions	4	43	91%
end/centre fittings	4	40	90%
debris/broken glass	20	145	86%
hand railings	31	144	78%
sharp edges/points	10	44	77%
cracking /damage	12	43	72%
protective caps/plugs	6	21	71%
entrapment point areas	48	145	67%
sidewalls & bedways	2	5	60%
wood checking	9	22	59%
ground clearance	144	145	1%
surface below equipment	144	145	1%
TOTAL (climbers)	462	1484	69%
MERRY-GO-ROUNDS/WHIRLERS			
NUMBER OF MERRY-GO-ROUNDS/WHIRLERS (STRUCTURE)		1	
spring & bar	0	0	NA
seats	0	0	NA
grease fittings	0	0	NA
nuts & bolts	0	0	NA
locking devices int/ext	0	0	NA
wood checking	0	0	NA
protective caps/plugs	0	0	NA
wooden borders	0	0	NA
stability in ground	0	1	100%
handles	0	1	100%
debris/broken glass	0	1	100%
fastening points	0	1	100%
entrapment point areas	0	1	100%
exposed concrete	0	1	100%
sidewalls & bedways	0	1	100%
sharp edges/points	0	1	100%
cracking /damage	0	1	100%
protrusions	0	1	100%
tilting	1	1	0%
hand railings	1	1	0%
support bars/legs	1	1	0%
pivot point for wear	1	1	0%
ground clearance	1	1	0%
surface below equipment	1	1	0%
TOTAL (merry-go-round/whirlers)	6	16	63%
CREATIVE PLAYSTRUCTURES			
NUMBER OF CREATIVE PLAYSTRUCTURES		43	
stability in ground	0	43	100%
stairs of slide	0	6	100%
locking devices int/ext	0	2	100%
tilting	3	43	93%
support bars/legs	3	42	93%
wooden borders	2	28	93%
exposed concrete	6	32	81%
protrusions	6	32	81%
nuts & bolts	9	32	72%
hand railings	15	43	65%
sharp edges/points	13	32	59%
sidewalls & bedways	9	19	53%
protective caps/plugs	8	16	50%
debris/broken glass	22	43	49%
cracking /damage	20	32	38%
wood checking	20	31	35%
entrapment point areas	40	43	7%
ground clearance	42	43	2%
surface below equipment	42	43	2%
TOTAL (creative playstructures)	260	605	57%
SANDBOXES			
NUMBER OF SANDBOXES		31	
stability in ground	0	29	100%
locking devices int/ext	0	1	100%
protective caps/plugs	0	2	100%

APPENDIX 9 CONSOLIDATED CRITERIA FOR ALL SITES

benches	0	16	100%
tilting	1	29	97%
entrapment point areas	2	31	94%
protrusions	2	30	93%
fastening points	2	21	90%
wooden borders	1	8	88%
debris/broken glass	5	30	83%
cracking /damage	5	30	83%
sidewalls & bedways	4	20	80%
nuts & bolts	3	15	80%
surface below equipment	6	29	79%
exposed concrete	7	31	77%
sharp edges/points	7	29	76%
wood checking	7	23	70%
seats	8	26	69%
TOTAL (sandboxes)	60	400	85%
GENERAL SITE CONDITIONS			
POTENTIAL ALWAYS = 1		49	
asphalt paths etc	3	33	91%
wooden borders	3	26	88%
signs	2	16	88%
benches	5	37	86%
fencing	6	44	86%
hand railings	3	20	85%
lighting	2	13	85%
exposed concrete	9	48	81%
wood checking	11	35	69%
debris/broken glass	20	49	59%
entrapment point areas	22	49	55%
surface below equipment	40	48	17%
TOTAL (general site conditions)	122	410	70%
NOTE: The total scores for each equipment type are not exactly the same as the total scores previously reported, as these are calculated from grand totals of total hazards and total potential hazards.			
(Previous scores were means of equipment scores from all sites)			

APPENDIX 10 CONSOLIDATED DATA FOR 3 NEW SITES

SWINGS	tot haz	tot pot haz	criteria met (%)
TODDLER -SINGLE AXIS			
NUMBER OF TODDLER SWING SETS (STRUCTURES)		1	
NUMBER OF TODDLER SWINGS (COMPONENTS)		2	
woodwork should be chamfered or rounded	0	0	N/A
open ends of all tubing should be finished with smooth caps or plugs	0	0	N/A
no accessible sharp edges, points or projections	0	1	100%
no accessible pinch, crush or shear points by two moving components	0	1	100%
gripping surfaces should be splinter free	0	1	100%
no surfaces should contain rough textures or joints capable of cutting or abrading	0	1	100%
located in nontraffic area	0	1	100%
seat made of impact absorbing material	0	2	100%
support on all sides and between legs	0	2	100%
no moveable/adjustable elements that would permit child to fall off seat	0	2	100%
swing holds shape so adult can remove child w/o holding swing open	0	2	100%
common coil or machine chain link or chain enclosed in protective cover	0	2	100%
bearing hangers should be hung wider than overall loaded length of seat	0	2	100%
designed for only one user at a time	0	2	100%
side clearance from chain to side frame at height of swing height + 860mm (min 600mm)	0	1	100%
seat height when occupied	0	2	100%
distance between swings & between swing & frame at seat level	0	2	100%
no hard, sharp equipment parts in zone of use that a child can hit in a free fall	0	1	100%
PS length in front of swing when arc of 60 degrees or max distance usual arc	0	1	100%
PS length to right side of last swing	0	1	100%
PS length to left side of last swing	0	1	100%
NE zone front	0	1	100%
NE zone back	0	1	100%
adequacy of PS type	0	1	100%
all bolts & screws should be countersunk or dome headed	1	1	0%
no opening or distance between two parts > 76mm but < 254mm	1	1	0%
PS length in rear of swing when arc of 60 degrees or max distance usual arc	1	1	0%
adequacy of depth directly below swings	1	1	0%
adequacy of depth throughout PS area	1	1	0%
TOTAL (TODDLER SINGLE AXIS)	5	36	86%
CHILD -SINGLE AXIS			
NUMBER OF CHILD SWING SETS (STRUCTURES)		4	
NUMBER OF CHILD SWINGS (COMPONENTS)		10	
woodwork should be chamfered or rounded	0	0	N/A
open ends of all tubing should be finished with smooth caps or plugs	0	0	N/A
no accessible sharp edges, points or projections	0	4	100%
all bolts & screws should be countersunk or dome headed	0	4	100%
no accessible pinch, crush or shear points by two moving components	0	4	100%
no opening or distance between two parts > 76mm but < 254mm	0	4	100%
gripping surfaces should be splinter free	0	4	100%
no surfaces should contain rough textures or joints capable of cutting or abrading	0	4	100%
located in nontraffic area	0	4	100%
seat made of impact absorbing material	0	10	100%
common coil or machine chain link (not double loop) or chain enclosed in protective cover	0	10	100%
bearing hangers should be hung wider than overall loaded length of seat	0	10	100%
designed for only one user at a time	0	10	100%
side clearance from chain to side frame at height of swing height + 860mm (min 600mm)	0	4	100%
seat surface width	0	10	100%
seat surface depth	0	10	100%
distance between swings & between swing & frame at seat level	0	10	100%
no hard, sharp equipment parts in zone of use that a child can hit in a free fall	0	4	100%
PS length to right side of last swing	0	4	100%
PS length to left side of last swing	0	4	100%
NE zone front	0	4	100%
NE zone back	0	4	100%
adequacy of PS type	0	4	100%
seat height when occupied	3	10	70%
PS length in front of swing when arc of 60 degrees or max distance usual arc	2	4	50%
PS length in rear of swing when arc of 60 degrees or max distance usual arc	3	4	25%
adequacy of depth directly below swings	4	4	0%
adequacy of depth throughout PS area	4	4	0%
TOTAL (CHILD SINGLE AXIS)	16	152	89%

APPENDIX 10 CONSOLIDATED DATA FOR 3 NEW SITES

MULTIPLE AXIS			
NUMBER OF MULTIPLE AXIS SWING SETS (STRUCTURES)		3	
NUMBER OF MULTIPLE AXIS SWINGS (COMPONENT)		3	
woodwork should be chamfered or rounded	0	3	100%
all bolts & screws should be countersunk or dome headed	0	3	100%
no accessible pinch, crush or shear points by two moving components	0	3	100%
no opening or distance between two parts > 76mm but < 254mm	0	3	100%
no surfaces should contain rough textures or joints capable of cutting or abrading	0	3	100%
located in a nontraffic area	0	3	100%
not combined with other swings or no danger of collision with other swings	0	3	100%
common coil or machine chain link (not double loop) or chain enclosed in protective cover	0	3	100%
no protrusions or sharp edges if steel-belted tires are used	0	3	100%
no possible entrapment of fingers or head	0	3	100%
distance between frame and swing	0	3	100%
distance between undersurface of swing and protective surface	0	3	100%
no hard, sharp equipment parts in zone of use that a child can hit in a free fall	0	3	100%
PS area: distance between right side of frame and edge of protective surface	0	3	100%
PS area in front of swing	0	3	100%
PS area in back of swing	0	3	100%
NE zone right side	0	3	100%
NE zone left side	0	3	100%
NE zone front	0	3	100%
NE zone back	0	3	100%
adequacy of PS type	0	3	100%
open ends of all tubing should be finished with smooth caps or plugs	1	3	67%
PS area: distance between left side of frame and edge of protective surface	1	3	67%
no accessible sharp edges, points or projections	3	3	0%
gripping surfaces should be splinter free	3	3	0%
distance between underside of swing support and protective surface	3	3	0%
adequacy of depth directly below swing(s)	3	3	0%
adequacy of depth throughout PS area	3	3	0%
TOTAL (MULTIPLE AXIS)	17	84	80%
OTHER SWINGING EQUIPMENT			
NUMBER OF OTHER SWINGING EQUIPMENT STRUCTURES		4	
NUMBER OF OTHER SWINGING EQUIPMENT SWINGS (COMPONENTS)		13	
any single rope should be attached at both ends	0	0	N/A
no accessible sharp edges, points or projections	0	4	100%
woodwork should be chamfered or rounded	0	3	100%
no accessible pinch, crush or shear points by two moving components	0	4	100%
gripping surfaces should be splinter free	0	3	100%
no surfaces should contain rough textures or joints capable of cutting or abrading	0	4	100%
located in a nontraffic area	0	4	100%
distance between suspended element and protective surface (preschoolers)	0	7	100%
distance between suspended element and protective surface (5-14 yr.)	0	7	100%
no hard, sharp equipment parts in zone of use that a child can hit in a free fall	0	4	100%
PS area: distance between left side of frame and edge of protective surface	0	4	100%
PS area in front of swing	0	4	100%
PS area in back of swing	0	4	100%
NE zone right	0	4	100%
NE zone left	0	4	100%
adequacy of PS type	0	4	100%
open ends of all tubing should be finished with smooth caps or plugs	1	4	75%
all bolts & screws should be countersunk or dome headed	1	4	75%
no opening or distance between two parts > 76mm but < 254mm	1	4	75%
PS area: distance between right side of frame and edge of protective surface	1	4	75%
NE zone front	1	4	75%
NE zone back	1	4	75%
adequacy of depth directly below swing(s)	3	4	25%
adequacy of depth throughout PS area	3	4	25%
no possible entrapment of fingers or head	13	13	0%
TOTAL (OTHER SWINGING EQUIPMENT)	25	109	77%
SLIDES			
NUMBER OF FREESTANDING SLIDES		0	
NUMBER OF SLIDES AS PART OF CREATIVE PLAYSTRUCTURE		7	
# STRAIGHT		2	
#TUBE		1	

APPENDIX 10 CONSOLIDATED DATA FOR 3 NEW SITES

#CURVY		1	
#SPIRAL		3	
metal slides located in shade or facing north	0	0	N/A
PS area: length in rear of slide access	0	0	N/A
no accessible sharp edges, points or projections	0	7	100%
woodwork should be chamfered or rounded	0	1	100%
sheet materials should be finished on exposed edge with roll or rounded capping	0	6	100%
open ends of all tubing should be finished with smooth caps or plugs	0	4	100%
no surfaces should contain rough textures or joints capable of cutting or abrading	0	7	100%
no zero gravity	0	7	100%
sidewall edges are rounded	0	7	100%
side enclosures blend from guardrail to sidewall (if has sitting section)	0	5	100%
length of sitting section	0	5	100%
slope of sitting section	0	5	100%
length of exit section	0	7	100%
end of slide rounded	0	7	100%
PS area: length to right of slide	0	7	100%
NE zone in front of slide	0	7	100%
adequacy of PS type	0	7	100%
length of starting platform	1	7	86%
width of starting platform	1	7	86%
height of sidewalls	1	7	86%
PS area: in front of slide exit	1	7	86%
PS area: length to left of slide	1	7	86%
all bolts & screws should be countersunk or dome headed	2	7	71%
exit declination between 1-5 degrees	2	7	71%
gripping surfaces should be splinter free	1	3	67%
height of exit above the finished grade (5-14 yrs)	2	6	67%
no opening or distance between two parts > 76mm but < 254mm	3	7	57%
radius of curvature adequate	3	7	57%
no hard, sharp equipment parts in zone of use that a child can hit in a free fall	3	7	57%
height of exit above the finished grade (preschoolers)	4	6	33%
adequacy of depth directly below slide exit	7	7	0%
adequacy of depth throughout PS area	7	7	0%
TOTAL ALL SLIDES	39	188	79%
SLIDING POLES			
NUMBER OF SLIDING POLES (STRUCTURE)		3	
no accessible sharp edges, points or projections	0	3	100%
woodwork should be chamfered or rounded	0	1	100%
open ends of all tubing should be finished with smooth caps or plugs	0	2	100%
no opening or distance between two parts > 76mm but < 254mm	0	3	100%
gripping surfaces should be splinter free	0	3	100%
no surfaces should contain rough textures or joints capable of cutting or abrading	0	3	100%
access to sliding pole from one point only	0	3	100%
sliding section of poles should be continuous with no welds or joints	0	3	100%
set on a protective surface	0	3	100%
no hard, sharp equipment parts in zone of use that a child can hit in a free fall	0	3	100%
diameter of the pole	0	3	100%
footing at bottom (if provided) at least 300mm below finished grade	0	3	100%
adequacy of PS type	0	3	100%
all bolts & screws should be countersunk or dome headed	1	3	67%
sliding poles not located in a preschool play area	1	3	67%
distance from pole to platform or structure	2	3	33%
access to sliding pole through opening in the gaurdrail (not >380mm)	2	3	33%
designed to avoid interference from surrounding traffic	3	3	0%
distance beween lower surface of the horizontal section of the pole to platform surface	3	3	0%
adequacy of depth at pole landing area	3	3	0%
adequacy of depth throughout PS area	3	3	0%
TOTAL ALL SLIDING POLES	18	60	70%
ACCESS TO SLIDES AND SLIDING POLES			
STAIRS (Straight)			
NUMBER OF STRAIGHT STAIRS (STRUCTURE)		0	
# CLOSED		0	
# OPEN		0	
no accessible sharp edges, points or projections		0	N/A
woodwork should be chamfered or rounded		0	N/A

sheet materials should be finished on exposed edge with roll or rounded capping		0	N/A
open ends of all tubing should be finished with smooth caps or plugs		0	N/A
all bolts & screws should be countersunk or dome headed		0	N/A
no opening or distance between two parts > 76mm but < 254mm		0	N/A
gripping surfaces should be splinter free		0	N/A
no surfaces should contain rough textures or joints capable of cutting or abrading		0	N/A
steps should be evenly spaced		0	N/A
handrails should be immediately contiguous with the stepping surface		0	N/A
inclination between 30-50 degrees		0	N/A
rise from one step to next		0	N/A
depth of step		0	N/A
stairs should be enclosed if rise is between 76 and 254mm		0	N/A
stairs with no intermediate landing should not have > 1800mm vertical rise		0	N/A
if stairs rise more than 450 mm should have 2 continuous handrails both sides		0	N/A
lower rail should be 300mm above step tread for preshchoolers		0	N/A
lower rail should be 500mm above step tread for 5-14 yr olds		0	N/A
upper rail should be 700mm avove the step tread for preschoolers		0	N/A
upper rail should be 1000mm above the step tread for 5-14 yr olds		0	N/A
perp. distance between upper and lower rail or rail and stair should be <76 or> 254mm		0	N/A
step nosing (max = 25mm)		0	N/A
TOTAL (STRAIGHT STAIRS)	0	0	N/A
STAIRS (Spiral)			
NUMBER OF SPIRAL STAIRS (STRUCTURE)		0	
# CLOSED		0	
#OPEN		0	
no accessible sharp edges, points or projections		0	N/A
woodwork should be chamfered or rounded		0	N/A
sheet materials should be finished on exposed edge with roll or rounded capping		0	N/A
open ends of all tubing should be finished with smooth caps or plugs		0	N/A
all bolts & screws should be countersunk or dome headed		0	N/A
no opening or distance between two parts > 76mm but < 254mm		0	N/A
gripping surfaces should be splinter free		0	N/A
no surfaces should contain rough textures or joints capable of cutting or abrading		0	N/A.
steps should be evenly spaced		0	N/A
handrails should be immediately contiguous with the stepping surface		0	N/A
rise from one step to next		0	N/A
depth of step at inner edge		0	N/A
stairs should be enclosed if rise is between 76-254mm		0	N/A
stairs with no intermediate landing should not have > 1800mm vertical rise		0	N/A
if stairs rise more than 450mm, should have two continuous handrails on both sides		0	N/A
lower rail should be 300mm above step tread for preshchoolers		0	N/A
lower rail should be 500mm above step tread for 5-14 yr olds		0	N/A
upper rail should be 700mm avove the step tread for preschoolers		0	N/A
upper rail should be 1000mm above the step tread for 5-14 yr olds		0	N/A
perp. distance between upper and lower rail or rail and stair should be <76 or> 254mm		0	N/A
step nosing (max = 25mm)		0	N/A
outside radius (min = 500mm)		0	N/A
inclination between 15 and 65 degrees		0	N/A
TOTAL (STAIRS SPIRAL)	0	0	N/A
RAMPS			
NUMBER OF RAMPS (STRUCTURE)		0	
no accessible sharp edges, points or projections		0	N/A
woodwork should be chamfered or rounded		0	N/A
sheet materials should be finished on exposed edge with roll or rounded capping		0	N/A
open ends of all tubing should be finished with smooth caps or plugs		0	N/A
all bolts & screws should be countersunk or dome headed		0	N/A
no opening or distance between two parts > 76mm but < 254mm		0	N/A
gripping surfaces should be splinter free		0	N/A
no surfaces should contain rough textures or joints capable of cutting or abrading		0	N/A
handrails should be immediately contiguous with the stepping surface		0	N/A
inclination max = 30 degrees		0	N/A
ramps with no intermediate landing should not have > 1800mm vertical rise		0	N/A
if ramp rises more than 450mm, should have two continuous handrails on both sides		0	N/A
lower rail should be 300mm above the ramp for preschoolers		0	N/A
lower rail should be 500 mm above the ramp for 5-14 yr olds		0	N/A
upper rail should be 700mm above the ramp for preshoolers		0	N/A

APPENDIX 10 CONSOLIDATED DATA FOR 3 NEW SITES

upper rail should be 1000mm above the ramp for 5-14 yr olds		0	N/A
perpendicular distance between rails or rail and ramp should be <76mm or > 254mm		0	N/A
TOTAL (RAMPS)	0	0	N/A
RUNG LADDERS			
NUMBER OF RUNG LADDERS (STRUCTURE)		0	
no accessible sharp edges, points or projections		0	N/A
woodwork should be chamfered or rounded		0	N/A
open ends of all tubing should be finished with smooth caps or plugs		0	N/A
all bolts & screws should be countersunk or dome headed		0	N/A
no opening or distance between two parts > 76mm but < 254mm		0	N/A
gripping surfaces should be splinter free		0	N/A
no surfaces should contain rough textures or joints capable of cutting or abrading		0	N/A
rungs should be evenly spaced		0	N/A
rungs should not turn when grasped		0	N/A
rung ladders should not be closed		0	N/A
angle of inclination between 50-90 degrees		0	N/A
rung ladders with no intermediate landing not have >1800mm vertical rise		0	N/A
spacing of rungs <76mm or >254mm		0	N/A
rung diameter between 25-35 mm for preschoolers		0	N/A
rung diameter 25-45mm for 5-14 year olds		0	N/A
width of ladder (min = 300mm)		0	N/A
distance between finished grade and top of first rung (max = 450mm)		0	N/A
TOTAL (RUNG LADDERS)	0	0	N/A
STEPLADDERS			
NUMBER OF STEPLADDERS (STRUCTURE)			
no accessible sharp edges, points or projections		0	N/A
woodwork should be chamfered or rounded		0	N/A
open ends of all tubing should be finished with smooth caps or plugs		0	N/A
all bolts & screws should be countersunk or dome headed		0	N/A
no opening or distance between two parts > 76mm but < 254mm		0	N/A
gripping surfaces should be splinter free		0	N/A
no surfaces should contain rough textures or joints capable of cutting or abrading		0	N/A
steps should be evenly spaced		0	N/A
inclination between 50-90 degrees		0	N/A
step ladders with no intermediate landings not have > 1800mm vertical rise		0	N/A
rise from step to step when closed between 76-254mm		0	N/A
rise from step to step when open <76 or > 254mm		0	N/A
step depth when closed min = 120mm		0	N/A
step depth when open min = 76mm		0	N/A
step width (min = 300mm)		0	N/A
if stepladder rises more than 450mm, should have one continuous handrail both sides		0	N/A
rails should be max of 700mm above the step tread for preschoolers		0	N/A
rail should be max of 1000mm above the step tread for 5-14yr olds		0	N/A
perp dimension between rail and step tread nosing never < 254mm		0	N/A
step nosing (max = 25mm)		0	N/A
TOTAL (STEPLADDERS)	0	0	N/A
CARGO NETS, MOVING LADDERS AND SIMILAR DEVICES			
NUMBER OF CARGO NETS (STRUCTURE)		0	
no accessible sharp edges, points or projections		0	N/A
woodwork should be chamfered or rounded		0	N/A
open ends of all tubing should be finished with smooth caps or plugs		0	N/A
all bolts & screws should be countersunk or dome headed		0	N/A
no opening or distance between two parts > 76mm but < 254mm		0	N/A
gripping surfaces should be splinter free		0	N/A
no surfaces should contain rough textures or joints capable of cutting or abrading		0	N/A
should be securely fastened		0	N/A
any single rope should be attached at both ends		0	N/A
TOTAL (CARGO NETS)	0	0	N/A
ROCKING EQUIPMENT			
NUMBER OF ROCKING EQUIPMENT PIECES (STRUCTURE)		3	
woodwork should be chamfered or rounded	0	0	N/A
NE zone if adjacent to moving equipment	0	0	N/A
no accessible sharp edges, points or projections	0	3	100%
open ends of all tubing should be finished with smooth caps or plugs	0	1	100%

APPENDIX 10 CONSOLIDATED DATA FOR 3 NEW SITES

all bolts & screws should be countersunk or dome headed	0	3	100%
gripping surfaces should be splinter free	0	3	100%
no surfaces should contain rough textures or joints capable of cutting or abrading	0	3	100%
hand grips and footrests should be fixed	0	3	100%
hand grips and foot rests should not turn when grasped	0	3	100%
diameter of hand grips and foot rests preschoolers (25-35mm)	0	2	100%
hand grips and foot rests should not project beyond max of 125 mm	0	3	100%
any projections should have a min. diameter of 18mm	0	3	100%
PS in front of rocker (1800mm)	0	3	100%
PS in rear of rocker (1800mm)	0	3	100%
PS to right side of rocker (1800mm)	0	3	100%
PS to left side of rocker (1800mm)	0	3	100%
adequacy of PS type	0	3	100%
no opening or distance between two parts > 76mm but < 254mm	1	3	67%
distance from ground to seat for preschoolers should be 350-600mm	1	3	67%
no accessible pinch, crush or shear points by two moving components	3	3	0%
diameter of hand grips and foot rests 5-14 yr olds (25-45)	1	1	0%
no hard, sharp equipment parts in zone of use that a child can hit in a free fall	3	3	0%
adequacy of PS depth directly below rocker	3	3	0%
adequacy of PS depth throughout PS area	3	3	0%
TOTAL ROCKING EQUIPMENT	15	61	75%
TEETER TOTTERS			
NUMBER OF TEETER TOTTERS (STRUCTURE)		2	
woodwork should be chamfered or rounded	0	0	N/A
if beam allowed to hit ground, an impact cushion should be provided	0	0	N/A
no accessible sharp edges, points or projections	0	2	100%
open ends of all tubing should be finished with smooth caps or plugs	0	2	100%
no opening or distance between two parts > 76mm but < 254mm	0	2	100%
gripping surfaces should be splinter free	0	2	100%
no surfaces should contain rough textures or joints capable of cutting or abrading	0	2	100%
handles designed to prevent entrapment	0	2	100%
hand grips or foot rests should not turn when grasped	0	2	100%
hand grips should be fixed	0	2	100%
protruding hand grips not permit knee entrapment between grip and ground	0	2	100%
no hard, sharp equipment parts in zone of use that a child can hit in a free fall	0	2	100%
should be set on a protective surface	0	2	100%
pivot height (max = 760mm)	0	2	100%
diameter of hand grips (min = 18mm)	0	2	100%
adequacy of PS type	0	2	100%
all bolts & screws should be countersunk or dome headed	2	2	0%
no accessible pinch, crush or shear points by two moving components	2	2	0%
adequacy of PS depth directly beneath teeter totter	2	2	0%
adequacy of PS depth throughout the PS area	2	2	0%
TOTAL TEETER TOTTERS	8	36	78%
CLIMBERS			
NUMBER OF CLIMBERS (UNIT OF STRUCTURE)		19	
NE zone (1800 mm if adjacent to moving equipment)	0	0	N/A
woodwork should be chamfered or rounded	0	14	100%
open ends of all tubing should be finished with smooth caps or plugs	0	16	100%
no surfaces should contain rough textures or joints capable of cutting or abrading	0	19	100%
rung diameter (5-14 yr olds not > 45mm)	0	16	100%
clear distance between successive rungs (300-400mm)	0	8	100%
PS area in front of climber	0	12	100%
PS area in back of climber	0	11	100%
PS area on left side of climber	0	17	100%
adequacy of PS type	0	19	100%
no accessible sharp edges, points or projections	1	19	95%
rungs and bars should not turn when grasped	1	19	95%
rung diameter (preschoolers 25-35mm)	1	15	93%
PS area on right side of climber	1	14	93%
all bolts & screws should be countersunk or dome headed	2	19	89%
sheet materials should be finished on exposed edge with roll or rounded capping	3	19	84%
all rungs should permit fall fo protective surface without striking any obstruction	6	19	68%
no hard, sharp equipment parts in zone of use that a child can hit in a free fall	6	19	68%
over head ladders allow children to grasp first rung from standing position	2	6	67%
no opening or distance between two parts > 76mm but < 254mm	7	19	63%

APPENDIX 10 CONSOLIDATED DATA FOR 3 NEW SITES

gripping surfaces should be splinter free	8	17	53%
adequacy of PS depth directly beneath climber	19	19	0%
adequacy of PS depth throughout the PS area	19	19	0%
TOTAL CLIMBERS	76	355	79%
MERRY-GO -ROUND /WHIRLERS			
NUMBER OF MERRY-GO-ROUND/WHIRLERS (STRUCTURE)		0	
no accessible sharp edges, points or projections		0	N/A
woodwork should be chamfered or rounded		0	N/A
sheet materials should be finished on exposed edge with roll or rounded capping		0	N/A
open ends of all tubing should be finished with smooth caps or plugs		0	N/A
all bolts & screws should be countersunk or dome headed		0	N/A
no accessible pinch, crush or shear points by two moving components		0	N/A
no opening or distance between two parts > 76mm but < 254mm		0	N/A
gripping surfaces should be splinter free		0	N/A
no surfaces should contain rough textures or joints capable of cutting or abrading		0	N/A
apparatus located in a supervised area		0	N/A
apparatus located in a nontraffic area		0	N/A
secure means of holding on provided		0	N/A
hand grips should not turn when grasped		0	N/A
no projections beyond the outside diameter of the platform		0	N/A
hand grip diameter (preschoolers) 25-35mm		0	N/A
hand grip diameter (5-14) 25-45		0	N/A
no accessible space >5mm between moving parts within rotation device		0	N/A
space between underside of platform and ps <76mm or >254mm		0	N/A
no hard, sharp equipment parts in zone of use that a child can hit in a free fall		0	N/A
PS front		0	N/A
PS rear		0	N/A
PS right side		0	N/A
PS left side		0	N/A
NE zone front		0	N/A
NE zone rear		0	N/A
NE zone right side		0	N/A
NEzone left side		0	N/A
adequacy of PS type		0	N/A
adequacy of depth directly surrounding rotating apparatus		0	N/A
adequacy of depth throughout PS area		0	N/A
TOTAL MERRY -GO-ROUND/WHIRLERS	0	0	N/A
SANDBOXES			
NUMBER OF SANDBOXES (STRUCTURES)		1	
sheet materials should be finished on exposed edge with roll or rounded capping	0	0	N/A
open ends of all tubing should be finished with smooth caps or plugs	0	0	N/A
no accessible pinch, crush or shear points by two moving components	0	0	N/A
sandbox covers, if used, designed to be safely secured open and closed	0	0	N/A
no accessible sharp edges, points or projections	0	1	100%
woodwork should be chamfered or rounded	0	1	100%
no surfaces should contain rough textures or joints capable of cutting or abrading	0	1	100%
sand should pack together for moulding	0	1	100%
sand should appear clean	0	1	100%
sand should be free of contaminants	0	1	100%
sand play area exposed to some sun and rain	0	1	100%
total sand play area 6-7 sq. m.	0	1	100%
height of sandbox ledge above the finished grade (max 280mm)	0	1	100%
width of sandbox ledge (min 85mm)	0	1	100%
all bolts & screws should be countersunk or dome headed	1	1	0%
no opening or distance between two parts >76mm but <254mm	1	1	0%
some shade and shelter provided	1	1	0%
seating for adults near the sandbox	1	1	0%
not located in a physical play zone	1	1	0%
TOTAL SANDBOXES	5	15	67%
CREATIVE PLAYSTRUCTURES			
NUMBER OF CREATIVE PLAYSTRUCTURES (STRUCTURE)		4	
ACCESS - STRAIGHT STAIRS			
NUMBER OF STRAIGHT STAIRS (COMPONENT)		1	
#CLOSED		0	
#OPEN		1	

stairs should be enclosed if rise is between 76 and 254mm	0	0	N/A
lower rail should be 500mm above step tread for 5-14 yr olds	0	0	N/A
upper rail should be 1000mm above the step tread for 5-14 yr olds	0	0	N/A
step nosing (max = 25mm)	0	0	N/A
NE zone in all relevant directions	0	0	N/A
no accessible sharp edges, points or projections	0	1	100%
sheet materials should be finished on exposed edge with roll or rounded capping	0	1	100%
open ends of all tubing should be finished with smooth caps or plugs	0	1	100%
all bolts & screws should be countersunk or dome headed	0	1	100%
gripping surfaces should be splinter free	0	1	100%
no surfaces should contain rough textures or joints capable of cutting or abrading	0	1	100%
steps should be evenly spaced	0	1	100%
handrails should be immediately contiguous with the stepping surface	0	1	100%
inclination between 30-50 degrees	0	1	100%
depth of step	0	1	100%
stairs with no intermediate landing should not have > 1800mm vertical rise	0	1	100%
if stairs rise more than 450 mm should have 2 continuous handrails both sides	0	1	100%
no hard, sharp equipment parts in zone of use that a child can hit in a free fall	0	1	100%
PS 1800mm in all relevant directions	0	3	100%
adequacy of PS type	0	1	100%
woodwork should be chamfered or rounded	1	1	0%
no opening or distance between two parts > 76mm but < 254mm	1	1	0%
rise from one step to next	1	1	0%
lower rail should be 300mm above step tread for preshchoolers	1	1	0%
upper rail should be 700mm avove the step tread for preschoolers	1	1	0%
perp. distance between upper and lower rail or rail and stair should be <76 or> 254mm	1	1	0%
adequacy of PSdepth directly beneath stairs	1	1	0%
adquacy of depth throughout PS area	1	1	0%
TOTAL (STRAIGHT STAIRS)	8	25	68%
STAIRS (Spiral)			
NUMBER OF SPIRAL STAIRS (COMPONENT)		0	
#CLOSED		0	
#OPEN		0	
no accessible sharp edges, points or projections		0	N/A
woodwork should be chamfered or rounded		0	N/A
sheet materials should be finished on exposed edge with roll or rounded capping		0	N/A
open ends of all tubing should be finished with smooth caps or plugs		0	N/A
all bolts & screws should be countersunk or dome headed		0	N/A
no opening or distance between two parts > 76mm but < 254mm		0	N/A
gripping surfaces should be splinter free		0	N/A
no surfaces should contain rough textures or joints capable of cutting or abrading		0	N/A
steps should be evenly spaced		0	N/A
handrails should be immediately contiguous with the stepping surface		0	N/A
rise from one step to next		0	N/A
depth of step at inner edge		0	N/A
stairs should be enclosed if rise is between 76-254mm		0	N/A
stairs with no intermediate landing should not have > 1800mm vertical rise		0	N/A
if stairs rise more than 450mm, should have two continuous handrails on both sides		0	N/A
lower rail should be 300mm above step tread for preshchoolers		0	N/A
lower rail should be 500mm above step tread for 5-14 yr olds		0	N/A
upper rail should be 700mm avove the step tread for preschoolers		0	N/A
upper rail should be 1000mm above the step tread for 5-14 yr olds		0	N/A
perp. distance between upper and lower rail or rail and stair should be <76 or> 254mm		0	N/A
step nosing (max = 25mm)		0	N/A
outside radius (min = 500mm)		0	N/A
inclination between 15 and 65 degrees		0	N/A
no hard, sharp equipment parts in zone of use that a child can hit in a free fall		0	N/A
PS 1800mm in all relevant directions			N/A
NE zone in all relevant directions when adjacent to moving equipment			N/A
adequacy of PS type		0	N/A
adequacy of PSdepth directly beneath stairs		0	N/A
adquacy of depth throughout PS area		0	N/A
TOTAL (STAIRS - SPIRAL)	0	0	N/A
RAMPS			
NUMBER OF RAMPS (COMPONENT)		7	
NE zone in all relevant directions when adjacent to moving equipment	0	0	N/A

APPENDIX 10 CONSOLIDATED DATA FOR 3 NEW SITES

no accessible sharp edges, points or projections	0	7	100%
woodwork should be chamfered or rounded	0	7	100%
open ends of all tubing should be finished with smooth caps or plugs	0	6	100%
all bolts & screws should be countersunk or dome headed	0	7	100%
no surfaces should contain rough textures or joints capable of cutting or abrading	0	7	100%
handrails should be immediately contiguous with the stepping surface	0	7	100%
inclination max = 30 degrees	0	7	100%
ramps with no intermediate landing should not have > 1800mm vertical rise	0	7	100%
perpendicular distance between rails or rail and ramp should be <76mm or > 254mm	0	7	100%
no hard, sharp equipment parts in zone fo uswe that a child can hit in a free fall	0	7	100%
adequacy of PS type	0	7	100%
sheet materials should be finished on exposed edge with roll or rounded capping	1	7	86%
no opening or distance between two parts > 76mm but < 254mm	1	7	86%
if ramp rises more than 450mm, should have two continuous handrails on both sides	1	7	86%
lower rail should be 300mm above the ramp for preschoolers	1	6	83%
upper rail should be 700mm above the ramp for preshoolers	1	6	83%
PS 1800mm in all relevant directions	3	14	79%
gripping surfaces should be splinter free	5	7	29%
lower rail should be 500 mm above the ramp for 5-14 yr olds	6	7	14%
upper rail should be 1000mm above the ramp for 5-14 yr olds	6	7	14%
adequacy of PSdepth directly beneath ramp	7	7	0%
adquacy of depth throughout PS area	7	7	0%
TOTAL (RAMPS)	39	158	75%
RUNG LADDERS			
NUMBER OF RUNG LADDERS (COMPONENT)		7	
NE zone in all relevant directions when adjacent to moving equipment	0	0	N/A
no accessible sharp edges, points or projections	0	7	100%
woodwork should be chamfered or rounded	0	4	100%
open ends of all tubing should be finished with smooth caps or plugs	0	4	100%
no surfaces should contain rough textures or joints capable of cutting or abrading	0	7	100%
rungs should not turn when grasped	0	7	100%
rung ladders should not be closed	0	7	100%
angle of inclination between 50-90 degrees	0	7	100%
rung ladders with no intermediate landing not have >1800mm vertical rise	0	7	100%
rung diameter between 25-35 mm for preschoolers	0	4	100%
rung diameter 25- 45mm for 5-14 year olds	0	7	100%
width of ladder(min = 300mm)	0	7	100%
distance between finished grade and top of first rung (max = 450mm)	0	7	100%
PS 1800mm in all relevant directions	0	15	100%
adequacy of PS type	0	7	100%
all bolts & screws should be countersunk or dome headed	1	7	86%
gripping surfaces should be splinter free	2	7	71%
no hard, sharp equipment parts in zone fo uswe that a child can hit in a free fall	2	7	71%
no opening or distance between two parts > 76mm but < 254mm(esp. rung spacing)	3	7	57%
rungs should be evenly spaced	4	7	43%
adequacy of PSdepth directly beneath rung ladder	7	7	0%
adquacy of depth throughout PS area	7	7	0%
TOTAL (RUNG LADDERS)	26	146	82%
STEPLADDERS			
NUMBER OF STEPLADDERS (COMPONENT)		1	
woodwork should be chamfered or rounded	0	0	N/A
open ends of all tubing should be finished with smooth caps or plugs	0	0	N/A
gripping surfaces should be splinter free	0	0	N/A
rise from step to step when open <76 or > 254mm	0	0	N/A
step depth when open min = 76mm	0	0	N/A
step nosing (max = 25mm)	0	0	N/A
NE zone in all relevant directions when adjacent to moving equipment	0	0	N/A
no accessible sharp edges, points or projections	0	1	100%
no opening or distance between two parts > 76mm but < 254mm	0	1	100%
no surfaces should contain rough textures or joints capable of cutting or abrading	0	1	100%
steps should be evenly spaced	0	1	100%
inclination between 50-90 degrees	0	1	100%
step ladders with no intermediate landings not have > 1800mm vertical rise	0	1	100%
rise from step to step when closed between 76-254mm	0	1	100%
step depth when closed min = 120mm	0	1	100%
step width (min = 300mm)	0	1	100%

APPENDIX 10 CONSOLIDATED DATA FOR 3 NEW SITES

If stepladder rises more than 450mm, should have one continuous handrail both sides	0	1	100%
perp dimension between rail and step tread nosing never < 254mm	0	1	100%
no hard, sharp equipment parts in zone of use that a child can hit in a free fall	0	1	100%
adequacy of PS type	0	1	100%
PS 1800mm in all relevant directions	1	3	67%
all bolts & screws should be countersunk or dome headed	1	1	0%
rails should be max of 700mm above the step tread for preschoolers	1	1	0%
rail should be max of 1000mm above the step tread for 5-14yr olds	1	1	0%
adequacy of PS depth directly beneath stepladder	1	1	0%
adquacy of depth throughout PS area	1	1	0%
TOTAL (STEPLADDERS)	6	21	71%
CARGO NETS, MOVING LADDERS AND SIMILAR DEVICES			
NUMBER OF CARGO NETS (COMPONENTS)		5	
any single rope should be attached at both ends	0	0	N/A
NE zone in all relevant directions when adjacent to moving equipment	0	0	N/A
no accessible sharp edges, points or projections	0	5	100%
woodwork should be chamfered or rounded	0	3	100%
open ends of all tubing should be finished with smooth caps or plugs	0	3	100%
should be securely fastened	0	5	100%
adequacy of PS type	0	5	100%
PS 1800mm in all relevant directions	1	15	93%
all bolts & screws should be countersunk or dome headed	1	5	80%
gripping surfaces should be splinter free	1	5	80%
no surfaces should contain rough textures or joints capable of cutting or abrading	1	5	80%
no opening or distance between two parts > 76mm but < 254mm	2	5	60%
no hard, sharp equipment parts in zone fo uswe that a child can hit in a free fall	3	5	40%
adequacy of PS depth directly beneath cargo net	5	5	0%
adquacy of depth throughout PS area	5	5	0%
TOTAL (CARGO NET)	19	71	73%
PLATFORMS AND INTERMEDIATE LANDINGS			
NUMBER OF PLATFORMS AND INTERMEDIATE LANDINGS (COMPONENT)		31	
NE zone in all relevant directions when adjacent to moving equipment	0	0	N/A
no accessible sharp edges, points or projections	0	31	100%
woodwork should be chamfered or rounded	0	31	100%
open ends of all tubing should be finished with smooth caps or plugs	0	22	100%
all bolts & screws should be countersunk or dome headed	0	31	100%
no surfaces should contain rough textures or joints capable of cutting or abrading	0	28	100%
height difference between two platforms not >610 (5-14)	0	18	100%
adequacy of PS type	0	31	100%
PS 1800mm in all relevant directions	1	29	97%
entry and exit from intermediate landings should be offset by 90-180 degrees	1	27	96%
dimensions of intermediate landings (min 900 by 900)	1	27	96%
no hard, sharp equipment parts in zone fo uswe that a child can hit in a free fall	6	40	85%
no opening or distance between two parts > 76mm but < 254mm	7	31	77%
gripping surfaces should be splinter free	6	25	76%
sheet materials should be finished on exposed edge with roll or rounded capping	7	28	75%
if platform decking is > 40mm thick, openings not >13mm	4	6	33%
height difference between two platforms not > 300mm (preschoolers)	10	13	23%
where vertical rise of stairs or ladders exceeds 1800mm, should have int landing	5	6	17%
if platform decking is </= 40mm thick, openings not > 6mm	17	20	15%
no accessible pinch, crush or shear points by two moving components	2	2	0%
adequacy of PS depth directly beneath platform or intermediate landing	31	31	0%
adquacy of depth throughout PS area	31	31	0%
TOTAL (PLATFORMS AND INTERMEDIATE LANDINGS)	129	508	75%
GUARDRAILS AND HANDRAILS			
NUMBER OF SETS OF CONTINUOUS HAND/GUARDRAILS (COMPONENT)		27	
all stairs, steps & ramps rising > 450mm should have two continuous handrails	0	0	N/A
stepladders require only a single handrail both sides	0	0	N/A
no accessible sharp edges, points or projections	0	26	100%
woodwork should be chamfered or rounded	0	19	100%
sheet materials should be finished on exposed edge with roll or rounded capping	0	20	100%
open ends of all tubing should be finished with smooth caps or plugs	0	20	100%
all bolts & screws should be countersunk or dome headed	0	26	100%
no surfaces should contain rough textures or joints capable of cutting or abrading	0	26	100%
height of top guardrail min = 610mm	0	8	100%

APPENDIX 10 CONSOLIDATED DATA FOR 3 NEW SITES

lower rail 300mm above the step tread (preschoolers)	0	1	100%
perp. distance between rails should be <76mm or >254mm)	0	3	100%
clearance between platform and bottom of guardrail (max=300mm) not <76, >254	0	20	100%
gripping surfaces should be splinter free	3	25	88%
all platforms >1200mm need panel -style or vertical fence-style guardrails	1	8	88%
all platforms > 450mm should have perimeter guardrails	4	27	85%
space between vertical railings in fence-style guardrails should be <76mm	1	6	83%
no opening or distance between two parts > 76mm but < 254mm	5	26	81%
handrails should be immediately contiguous with the stepping surface	4	20	80%
max clearance below panel or vertical guardrails = 300mm	4	17	76%
upper or single rail 700mm above step tread (preschoolers)	2	6	67%
horizontal openings in guardrails for access should be <380 or have top guardrail	10	19	47%
upper or single rail 1000mm above step tread (5-14)	3	4	25%
lower rail 500mm above step tread (5-14)	1	1	0%
TOTAL (HANDRAILS AND GUARDRAILS)	38	328	88%
GENERAL CONSIDERATIONS			
POTENTIAL = ONE		4	
if suspended lateral elements >25mm, should be bright coloured	0	0	N/A
balance cables if protected from lateral access are OK, diameter min = 9mm	0	0	N/A
crawl space with any interior diameter < 760 should be max. length of 1800mm	0	0	N/A
for elevations >1800mm, more than one method of exit provided	0	0	N/A
angles formed by adjacent surfaces should be >/= 55 degrees (unless lower leg > 10 degrees below horizontal, or angle filled such that surfaces of angle are > 254mm apart	0	0	N/A
woodwork should be chamfered or rounded	0	3	100%
sheet materials should be finished on exposed edges with roll or rounded capping	0	4	100%
open ends of all tubing should be finished with smooth caps or plugs	0	4	100%
no suspended lateral elements <25mm diameter	0	4	100%
no hard, sharp equipment parts in zone of use that a child can hit in a free fall	0	2	100%
site not located near high voltage power lines or transformer stations	0	4	100%
any enclosed space >1800mm deep should have min of 2 openings	0	1	100%
crawl space should be min of 610mm high & 610mm wide	0	1	100%
no accessible sharp edges , points or projections	1	4	75%
no opening or distance between any two parts >76mm but < 254mm	1	4	75%
no surface should contain rough textures or joints capable of cutting or abrading	1	4	75%
play area has visually defined boundaries	1	4	75%
all bolts and screws should be countersunk or dome headed	1	2	50%
gripping surfaces should be splinter free	2	3	33%
all standing surfaces 450mm above finished grade should have guardrails	2	3	33%
no accessible pinch, crush or shear points by two moving components	2	2	0%
TOTAL GENERAL CONSIDERATIONS	11	49	78%
MAINTENANCE			
TODDLER- SINGLE AXIS			
NUMBER OF TODDLER SWING SETS (STRUCTURE)		1	
NUMBER OF TODDLER SWINGS (COMPONENT)		2	
sidewalls & bedways	0	0	N/A
stability in ground	0	1	100%
tilting	0	1	100%
support bars/legs	0	1	100%
pivot point for wear	0	1	100%
debris/broken glass	0	1	100%
chains	0	2	100%
s-hooks	0	2	100%
seats	0	2	100%
hanger bearings	0	2	100%
grease fitting	0	2	100%
chain pipe covers	0	2	100%
fastening points	0	2	100%
exposed concrete	0	1	100%
end/centre fittings	0	1	100%
sharp edges/points	0	1	100%
cracking /damage	0	1	100%
nuts & bolts	0	1	100%
locking devices int/ext	0	1	100%
wood checking	0	1	100%
protrusions	0	1	100%

APPENDIX 10 CONSOLIDATED DATA FOR 3 NEW SITES

protective caps/plugs	0	1	100%
wooden borders	0	1	100%
ground clearance	1	1	0%
surface below equipment	1	1	0%
entrapment point areas	2	2	0%
TOTAL (toddler single axis swing)	4	33	88%
CHILD- SINGLE AXIS			
NUMBER OF CHILD SINGLE AXIS SWING SETS (STRUCTURE)		3	
NUMBER OF CHILD SINGLE AXIS SWINGS (COMPONENT)		10	
sidewalls & bedways	0	0	N/A
stability in ground	0	3	100%
tilting	0	3	100%
support bars/legs	0	3	100%
pivot point for wear	0	3	100%
debris/broken glass	0	3	100%
chains	0	10	100%
s-hooks	0	10	100%
seats	0	10	100%
hanger bearings	0	10	100%
grease fitting	0	10	100%
chain pipe covers	0	10	100%
fastening points	0	10	100%
entrapment point areas	0	10	100%
exposed concrete	0	1	100%
end/centre fittings	0	1	100%
sharp edges/points	0	1	100%
cracking /damage	0	1	100%
nuts & bolts	0	1	100%
locking devices int/ext	0	1	100%
wood checking	0	1	100%
protrusions	0	1	100%
protective caps/plugs	0	1	100%
wooden borders	0	1	100%
ground clearance	3	3	0%
surface below equipment	3	3	0%
TOTAL (child single axis swings)	6	111	95%
MULTIPLE AXIS SWINGS			
NUMBER OF MULTIPLE AXIS SWING SETS (STRUCTURE)		3	
NUMBER OF MULTIPLE AXIS SWINGS (COMPONENT)		3	
chain pipe covers	0	0	N/A
sidewalls & bedways	0	0	N/A
locking devices int/ext	0	0	N/A
stability in ground	0	3	100%
[illegible]	0	3	100%
support bars/legs	0	3	100%
pivot point for wear	0	3	100%
s-hooks	0	3	100%
seats	0	3	100%
hanger bearings	0	3	100%
grease fitting	0	3	100%
fastening points	0	3	100%
entrapment point areas	0	3	100%
exposed concrete	0	3	100%
end/centre fittings	0	1	100%
cracking /damage	0	1	100%
nuts & bolts	0	1	100%
wood checking	0	1	100%
protrusions	0	1	100%
wooden borders	0	1	100%
debris/broken glass	1	3	67%
chains	1	3	67%
ground clearance	3	3	0%
surface below equipment	3	3	0%
sharp edges/points	1	1	0%
protective caps/plugs	1	1	0%
TOTAL (multiple axis swings)	10	51	80%
OTHER SWINGING EQUIPMENT			

APPENDIX 10 CONSOLIDATED DATA FOR 3 NEW SITES

NUMBER OF OTHER SWINGING EQUIPMENT SETS (STRUCTURES)		4	
NUMBER OF OTHER SWINGING EQUIPMENT SWINGS (COMPONENT)		8	
s-hooks	0	0	N/A
seats	0	0	N/A
grease fitting	0	0	N/A
chain pipe covers	0	0	N/A
sidewalls & bedways	0	0	N/A
locking devices int/ext	0	0	N/A
stability in ground	0	4	100%
tilting	0	4	100%
support bars/legs	0	4	100%
pivot point for wear	0	4	100%
chains	0	8	100%
hanger bearings	0	8	100%
fastening points	0	8	100%
exposed concrete	0	2	100%
end/centre fittings	0	1	100%
sharp edges/points	0	2	100%
cracking /damage	0	2	100%
nuts & bolts	0	1	100%
wood checking	0	2	100%
protrusions	0	2	100%
protective caps/plugs	0	2	100%
wooden borders	0	2	100%
debris/broken glass	2	4	50%
ground clearance	4	4	0%
surface below equipment	4	4	0%
entrapment point areas	8	8	0%
TOTAL (other swinging equipment)	18	76	76%
SLIDES			
TOTAL NUMBER OF SLIDES		7	
NUMBER OF FREESTANDING SLIDES		0	
NUMBER OF SLIDES AS PART OF CREATIVE PLAYSTRUCTURE		7	
stairs of slide	0	0	N/A
locking devices int/ext	0	0	N/A
stability in ground	0	7	100%
tilting	0	7	100%
hand railings	0	5	100%
support bars/legs	0	7	100%
tube slide	0	4	100%
exposed concrete	0	4	100%
sidewalls & bedways	0	4	100%
sharp edges/points	0	4	100%
cracking /damage	0	4	100%
nuts & bolts	0	4	100%
wood checking	0	3	100%
protrusions	0	4	100%
protective caps/plugs	0	3	100%
wooden borders	0	4	100%
debris/broken glass	1	7	86%
entrapment point areas	3	7	57%
ground clearance	7	7	0%
surface below equipment	7	7	0%
TOTAL (slides)	18	92	80%
SLIDING POLES			
NUMBER OF SLIDING POLES		3	
stairs of slide	0	0	N/A
locking devices int/ext	0	0	N/A
stability in ground	0	3	100%
tilting	0	3	100%
hand railings	0	1	100%
debris/broken glass	0	3	100%
entrapment point areas	0	3	100%
exposed concrete	0	2	100%
end/centre fittings	0	2	100%
sharp edges/points	0	2	100%
cracking /damage	0	2	100%
nuts & bolts	0	2	100%

APPENDIX 10 CONSOLIDATED DATA FOR 3 NEW SITES

wood checking	0	1	100%
protrusions	0	2	100%
protective caps/plugs	0	1	100%
wooden borders	0	2	100%
ground clearance	3	3	0%
surface below equipment	3	3	0%
TOTAL (sliding poles)	6	35	83%
ROCKING EQUIPMENT			
NUMBER OF ROCKING EQUIPMENT PIECES (STRUCTURE)		3	
sidewalls & bedways	0	0	N/A
locking devices int/ext	0	0	N/A
wood checking	0	0	N/A
protective caps/plugs	0	0	N/A
stability in ground	0	3	100%
tilting	0	3	100%
support bars/legs	0	3	100%
spring & bar	0	3	100%
handles	0	3	100%
pivot point for wear	0	3	100%
debris/broken glass	0	3	100%
seats	0	3	100%
grease fittings	0	3	100%
fastening points	0	3	100%
sharp edges/points	0	1	100%
cracking /damage	0	1	100%
nuts & bolts	0	1	100%
protrusions	0	1	100%
wooden borders	0	1	100%
entrapment point areas	1	3	67%
ground clearance	3	3	0%
surface below equipment	3	3	0%
exposed concrete	1	1	0%
TOTAL (rocking equipment)	8	45	82%
TEETER TOTTERS			
NUMBER OF TEETER TOTTERS (STRUCTURE)		2	
sidewalls & bedways	0	0	N/A
locking devices int/ext	0	0	N/A
wood checking	0	0	N/A
protective caps/plugs	0	0	N/A
stability in ground	0	2	100%
tilting	0	2	100%
support bars/legs	0	2	100%
spring & bar	0	2	100%
handles	0	2	100%
pivot point for wear	0	2	100%
debris/broken glass	0	2	100%
seats	0	2	100%
grease fittings	0	2	100%
fastening points	0	2	100%
entrapment point areas	0	1	100%
exposed concrete	0	1	100%
end/centre fittings	0	1	100%
sharp edges/points	0	1	100%
cracking /damage	0	1	100%
nuts & bolts	0	1	100%
protrusions	0	1	100%
wooden borders	0	1	100%
ground clearance	2	2	0%
surface below equipment	2	2	0%
TOTAL (teeter totters)	4	32	88%
CLIMBERS			
NUMBER OF CLIMBERS		19	
sidewalls & bedways	0	0	N/A
locking devices int/ext	0	0	N/A
stability in ground	0	19	100%
tilting	0	19	100%
hand railings	0	19	100%
support bars/legs	0	19	100%

APPENDIX 10 CONSOLIDATED DATA FOR 3 NEW SITES

exposed concrete	0	4	100%
end/centre fittings	0	4	100%
sharp edges/points	0	4	100%
cracking /damage	0	4	100%
nuts & bolts	0	4	100%
wood checking	0	3	100%
protrusions	0	4	100%
protective caps/plugs	0	3	100%
wooden borders	0	4	100%
debris/broken glass	2	19	89%
entrapment point areas	5	19	74%
ground clearance	19	19	0%
surface below equipment	19	19	0%
TOTAL (climbers)	45	186	76%
MERRY-GO-ROUNDS/WHIRLERS			
NUMBER OF MERRY-GO-ROUNDS/WHIRLERS (STRUCTURE)		0	
stability in ground		0	N/A
tilting		0	N/A
hand railings		0	N/A
support bars/legs		0	N/A
spring & bar		0	N/A
handles		0	N/A
pivot point for wear		0	N/A
ground clearance		0	N/A
surface below equipment		0	N/A
debris/broken glass		0	N/A
seats		0	N/A
grease fittings		0	N/A
fastening points		0	N/A
entrapment point areas		0	N/A
exposed concrete		0	N/A
sidewalls & bedways		0	N/A
sharp edges/points		0	N/A
cracking /damage		0	N/A
nuts & bolts		0	N/A
locking devices int/ext		0	N/A
wood checking		0	N/A
protrusions		0	N/A
protective caps/plugs		0	N/A
wooden borders		0	N/A
TOTAL (merry-go-round/whirlers)	0	0	N/A
CREATIVE PLAYSTRUCTURES			
NUMBER OF CREATIVE PLAYSTRUCTURES		5	
stability in ground	0	5	100%
tilting	0	5	100%
hand railings	0	5	100%
support bars/legs	0	5	100%
stairs of slide	0	1	100%
sidewalls & bedways	0	2	100%
sharp edges/points	0	4	100%
nuts & bolts	0	4	100%
locking devices int/ext	0	1	100%
protrusions	0	4	100%
wooden borders	0	4	100%
debris/broken glass	1	5	80%
exposed concrete	1	4	75%
cracking /damage	1	4	75%
wood checking	1	3	67%
protective caps/plugs	1	3	67%
ground clearance	5	5	0%
surface below equipment	5	5	0%
entrapment point areas	5	5	0%
TOTAL (creative playstructures)	20	74	73%
SANDBOXES			
NUMBER OF SANDBOXES		1	
locking devices int/ext	0	0	N/A
protective caps/plugs	0	0	N/A
benches	0	0	N/A

APPENDIX 10 CONSOLIDATED DATA FOR 3 NEW SITES

stability in ground	0	1	100%
tilting	0	1	100%
surface below equipment	0	1	100%
debris/broken glass	0	1	100%
seats	0	1	100%
fastening points	0	1	100%
entrapment point areas	0	1	100%
exposed concrete	0	1	100%
sidewalls & bedways	0	1	100%
sharp edges/points	0	1	100%
cracking /damage	0	1	100%
nuts & bolts	0	1	100%
wood checking	0	1	100%
protrusions	0	1	100%
wooden borders	0	1	100%
TOTAL (sandboxes)	0	15	100%
GENERAL SITE CONDITIONS			
POTENTIAL ALWAYS = 1		4	
hand railings	0	3	100%
exposed concrete	0	4	100%
wood checking	0	4	100%
wooden borders	0	4	100%
benches	0	4	100%
asphalt paths etc	0	4	100%
lighting	0	3	100%
signs	0	2	100%
debris/broken glass	1	4	75%
entrapment point areas	1	4	75%
fencing	1	3	67%
surface below equipment	3	4	25%
TOTAL (general site conditions)	5	43	88%

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