Assessment of safety and accessibility in children’s playgrounds- SAFEPLAY

Although the figures to hand on children’s playground accidents do not make overly alarming reading, the risks do need to be properly addressed in the interests of adopting the best accident- and injury-prevention measures. Most of these accidents and injuries stem from poor installation of the playground equipment and faulty maintenance. The main aim of this study is to give a general overview of Spain’s playgrounds, in order to take stock of the situation and suggest improvements of any aspects that might turn out to be hazardous while children are entering or playing in a playground in a public park.


Children’s playgrounds are attractive to children due to their combination of fun and risk. Risk taking is an essential feature of play in any area where youngsters spend time playing, but these risks have to be kept down to acceptable levels as part of an overall scheme of stimulating, challenging and controlled learning [1]. If a child is capable of recognising and interpreting a risk and reacting properly, then the risk is not dangerous. All too often, however, these hazards are not recognised by youngsters, who remain blissfully unaware of the risks they run. In a worst-case scenario these risks may lead to incapacity or even death.

The report called Detection of Domestic and Leisure Accidents (Detección de Accidentes Domésticos y de Ocio: DADO 2007)[2], drawn up by the National Consumer Affairs Institute (Instituto Nacional de Consumo) from a 65,000-household survey, shows the hospitalisation rate and injuries caused to children and adults (although here we are concentrating on children) in different environments and also the type of accident and/or injury they are most prone to suffer. This report analyses the accidents of any nature suffered by people of any age. This study, conducted systematically since 2001, forms part of the EU initiative Decision 372/1999/EC of the European Parliament and of the Council adopting a programme of Community action on injury prevention in the framework for action in the field of public health (1999-2003).

It aims to promote the following:

- The epidemiological monitoring of injuries by means of a Community system for the collection of data and the exchange of information on injuries based on strengthening and improving on the achievements of the former EHLASS system.
- Information exchanges on the use of those data to contribute to the definition of priorities and better preventio
The findings of this report show that c. 230,402 accidents occurred in the 0-1 age bracket, about 15% of the total accidents occurring in the Spanish population. An analysis of children’s accidents in the DADO report reveals that 6.5% of them happen to babies less than 1 year old, 24.26% to toddlers aged 1 to 4 and 69.24% to children aged 5 to 14. In the group of babies aged less than one the male-female ratio is 1.43, whereas in the 1 to 4 and 5 to 14 year brackets, boys have almost twice as many accidents as girls.

Another of the factors with a different age breakdown in the DADO 2007 report is the accident- or injury-causing vector. For babies under 1 falls are the most frequent accident, accounting for 76.9% of the cases. Falls are also the most frequent injury-causing event in toddlers aged 1 to 4 and children aged 5 to 14, albeit accounting for a lower percentage of 53.4% and 55.3%, respectively. In the 1 to 4 year age bracket, impacts and bumping into other objects account for 14.8% of the accidents, followed by crushing, cuts or perforation (10%) and thermal effects (6.6%).

Playgrounds are the places par excellence where children aged 3 to 7 spend most time and where a great number of accidents occur, such as impacts, falls, etc., according to the report Study of Children’s Accidents Dealt with in Health Centres (Estudios sobre accidentes infantiles atendidos en los centros de salud) [3]. We need to bear in mind, therefore, that safe playgrounds depend not only on the maintenance and the sound state of each piece of playing equipment but also education of parents and the behavioural rules they should pass on to their children. On many occasions accidents and/or injuries occur due to improper behaviour or misuse of the various pieces of playing equipment.

Safety in children’s playgrounds has long been a matter of discussion and debate. Precedents are the German 1974 standard DIN 7926, which laid down a series of safety requisites.

For children aged under 15 falls are the most common accident leading to hospitalisation.

Did you know that falls are the commonest cause of hospitalisation-causing injuries in the under 15s?

Following on from this, the European Committee for Standardisation (Comité Européen de Normalisation: CEN) set up a study committee to fill the safety loophole in children’s playgrounds. This committee, responsible for conducting the study and the publication of European standards, was and still is the Technical Committee CEN/TC 136 (Sports, playgrounds and other recreational facilities and equipment), which published from 1997 to 1998 the first European Playground Safety Standards [5-17]. Since 1 January 1998 playground areas and equipment have had to meet new standards of wide-ranging scope, updated in 2008. These standards are especially important since they facilitate product safety assessment by manufacturers, installers, maintenance technicians and government authorities. They are preventive in essence, designed as they are to enforce a series of safety-guaranteeing conditions for the use of playground areas and equipment with the overall aim of avoiding risks that children might be exposed to while using them.

These criteria were then phased into Spain’s norms by the Spanish Association for Standardization and Certification (Asociacion Española de Normalizacion y Certificacion: AENOR) as UNE standards, drawn up in their first version by the national standardisation technical committee AEN/CTN 147 for Sports, playgrounds and other recreational facilities and equipment (Deportes, campos de juego y otros equipos de recreo) and in the second version by the national standardisation technical committee AEN/CTN 172 Childhood (Infancia), the committee itself acting as its own secretariat. These standards are representative of what are known today as «normas técnicas» (technical standards). This development ever more widespread today, is based on the creation of a series of very specific standards dealing with technical questions in specific professional fields, drawn up with the collaboration of manufacturers, labs, government authorities, consumers and users. This level of consensus aims to guarantee proper enforcement and compliance from the start, since these standards are not in themselves binding and need subsequent legislation to make them obligatory.

Government authorities in the various regions, if they deem it fitting, are empowered to transpose these criteria into regulations, decrees, ordinances, etc., of binding effect.

In Spain these playground safety standards have been made compulsory in the regions of Andalucia and Galicia by passing the corresponding regional decree: [18-19]. The logic of these legislative processes is based on the premise that the greater the involvement of all the various stakeholders in drawing up the standard, the more likely they are to be enforced and observed. In the case of playgrounds and playground equipment the standards represent guarantees that
Of the 168 play areas inspected in various Spanish towns, 75% showed some non-conformity and 44% maintenance shortfalls.

The conclusion we might draw from this is that the aim of this set of standards is to guarantee the safety of children. Purchasers, users and government authorities, mindful of the fact that playgrounds are designed for a population as vulnerable and sensitive as children, are increasingly well informed and aware of the need for a safe play area.

Current legislation serves as a splendid guide for the manufacturer, installer and maintenance technician to guarantee that in most cases only safe playground equipment is marketed and the play area is properly inspected and maintained, with the consequent peace of mind for the professionals involved.

These standards lay down the requisites to be met by playground equipment (swings, slides, roundabouts, zip-lines, seesaws and rocking platforms, multiplay units, rope pyramids and fully enclosed play equipment) and the materials used the dimensions of holes and gaps to prevent entrapment, free spaces to avoid entanglement hazards, safety gaps and heights and fall protection, etc. They also refer to surfacing thickness (sand, pea gravel, etc.) within the fall zones of each piece of playground equipment, installation requirements, obstacle-free distances and subsequent playground maintenance.

But these safety requisites and technical standards do not lay down any specific requirements for disabled children. For example, the EN 1176 family of standards lays down a maximum access ramp gradient of 38 degrees but makes no particular specification of the recommended slope to ensure access for a child in a wheelchair. Within the field of children’s playground equipment the European Committee CEN/TC 136/ SC 1 “Children’s playground equipment”, acting on a German proposal based on its national standard DIN 33942 “Barrier-free playground equipment”, has drawn up a technical report to be used in conjunction with the European standard EN 1176. This report does not have standard status; rather it offers some guidelines for the design of accessible play areas and equipment, since each European country is bound to have its own standards and legislation that can override this technical report. This guide-report, as yet unpublished, sets forth the requisites to be met by children’s playground equipment, designed to ensure accessibility for everyone (“play for all”), both disabled and non-disabled, and taking into account anthropometric and ergonomic measures.

As well as the requisites laid down in EN 1176 and EN 1177, the decrees of Andalucía and Galicia contain additional information not included in these technical standards. Decrees 127/2001 of 5 June (Andalucía) and 245/2003 of 2 April (Galicia) lay down the safety measures to be taken by children’s playgrounds to ensure that youngsters can play in them without running risks to their health and physical integrity. As well as the playground equipment safety requisites, therefore, they also consider, among others, the following additional specifications to be met by any children’s playground:

- **Separation from road traffic**, either by means of a minimum 30-metre safety gap or separation by natural or artificial means to protect minors from the danger of straying onto the road.
- **Separation of areas** by age bracket.
- **Adult supervision obligation** for children aged under 36 months.
- **Obligation** of playground tenure holders to ensure proper maintenance and upkeep thereof, with compulsory annual inspections carried out by skilled technicians.
- **Proper signage** (specifying the information to be shown in each sign).
- **Accessibility for disabled minors**. All children’s playgrounds have to make due arrangements to ensure disabled access. This section can be interpreted in the sense that any child is entitled to access the play zone (means of access such as itineraries, playground access ramps, etc.), but does not actually specify their entitlement to use the playground equipment. It is quite possible that children, parents and/or carers who wish to have total access to any play area may in fact be balked from using most of it.

When a children’s playground is being designed, due consideration must be given to the fact that it will be used by all children regardless of their mobility limitations (20). Play is for children one of the best and simplest ways of learning to interrelate with others, acquiring skills that will stand them in good stead in the future. Park play areas must therefore meet a series of stipulated features in terms of layout, shape, components (both vegetable and constructions), and the design of the playground equipment itself. To be able to play, after all, it is necessary to be able to access the area in
Two working concepts are crucial here: integration and adaptation. Integration means that the playground equipment must be suitable for all children, with or without difficulties, avoiding the exclusion of any minors who want to play and fostering good relations and sociability between all of them \[21\]. Adaptation means that children with difficulties can use the equipment like any other children without running any danger or suffering any complication; hence the need for careful planning both of the itinerary and entrances to all children’s playgrounds.

The National Accessibility Plan (Plan Nacional de Accesibilidad) 2004-2012 \[22\], approved by the Government on 25 July 2003, could well represent the definitive endorsement and support of all-round accessibility to the physical environment in Spain, besides laying down playground safety rules, taking in both the equipment and the surfacing and therefore increasing the safety of children.

Each year, all too often, news breaks of accidents in some children’s playground with more or less serious results due to slack safety or accessibility provisions. This is usually because:

- the playground equipment does not comply with current legislation
- the impact-absorbing surface does not have sufficient shock-absorbing capacity to break the fall from the maximum height of each piece of equipment
- obstacles within the fall zone
- inspection and maintenance activities are not carried out
- the itineraries have unforeseen obstacles

If the playground is designed and run correctly with good standards of safety and accessibility, it will serve its purpose all the better. Keeping these parameters within set limits guarantees the permanent safety of everyone using it, regardless of the physical characteristics and age of the user, in this case children.

**Carrying out the project**

A mixed methodology has been used for carrying out this project, employing techniques of both a quantitative and qualitative character. The quantitative methodology involves the use of several check lists.

The different aspects of the play area were analysed by means of these check lists, to ensure objective assessment of any shortfalls and possible improvements. To draw up these lists a thoroughgoing analysis was first made of all existing information, standards and studies carried out to date, to draw up a check list as detailed as possible for culling the desired information. A total of 168 play areas were chosen from different parts of Spain; these were then analysed and the findings weighed up and assessed.

Study variables were two: dependent variable (the quality and safety of the play areas) and independent variable (the facilities, equipment and surfaces of the playground and auxiliary elements).

**Project Results**

Of the 168 play areas inspected in various Spanish towns, 75% showed some non-conformity; only 25% of the play areas abided by all specifications of the European standard EN 1176 and the corresponding decrees to implement it into Spanish legislation; most of them were newly built playgrounds.

The project findings are outlined below:

**Playground safety assessment**

Inspections showed that the most important aspects and key risk-minimising factors are sound installation of the playground equipment, proper maintenance and periodical checks. Playgrounds often fall down in these key areas. Any member of public can easily see for him/herself that the maintenance and upkeep of many children’s playgrounds are clearly improvable. Graffiti, rubbish and broken, torn or burnt elements have become habitual sights in many playgrounds often putting children off from using them.

But over and above cleanliness and sightlines is the concern that playground owners and users should have for playgroun
safety. The study findings show that entrapment of some part of the body and the impact surface are the two most important hazards to be taken on board, since they can cause serious injuries and/or accidents or even death.

**Entrapments**
Defective installation and maintenance of the playground equipment result in a high possibility of some part of the children’s body being trapped. Of the areas inspected with some shortfall, 47% recorded some type of entrapment; this is therefore the highest percentage anomaly in this study.

Entrapments can be broken down into the following types: head and neck, fingers, hair and clothes, body and feet. The entrapments posing the biggest injury risk are head and neck, as shown in figure 1. For example, a protection panel fitted with a gap between it and the posts or a slide chute not firmly fitted to its support could both pose an entrapment hazard.

![Figure 1. Percentage breakdowns of entrapment body-areas in playgrounds](image)

The finger and head entrapment hazards shown in Figure 2 are due mainly to installation problems. Another significant problem stems from the failure of playground-equipment purchasing or maintenance managers, at the design stage, to demand a proper type-approval certification of the playground products.

Figures 2 and 3 show different types of entrapment hazards found in some of the playgrounds inspected.
Figure 2. Head and neck entrapment hazards posed by gaps allowing passage of parts of the body. (a) Gauge C (torso) and (b) gauge D (large head) to determine the head entrapment hazard in fully enclosed openings. (c) and (d) forms of applying the testing template for assessing head and neck entrapment hazard in partially-enclosed and V-shaped openings.
Playground surfacing

Playground surfacing is responsible for a great number of non-conformities and accidents. A study conducted by the US Consumer Product Safety Commission [23], found that 70% of playground accidents were due to lack of any impact absorbing surface or poor upkeep thereof. This anomaly accounts for the second biggest percentage in this study.
Playground surfacing should reduce the chances of a child suffering a head injury, considered to be the gravest injury of all. The type of surface and the material used will depend on the degree of shock-absorption required, in turn dependent on the height of the playground equipment in each case.

Fall-induced playground injuries may stem from various causes, but the worst of all are considered to be those affecting the head.

Non-conformities found were due mainly to three factors: low impact absorption capacity, especially in playground equipment with possible falls from heights of over 1.5 metres; lack of any absorption surface within the impact areas of each piece of equipment (see Figure 4); and overlapping playground equipment impact areas inducing strained movements, i.e., seesaws and rocking platforms installed without the requisite impact areas, swings, slides, roundabouts and zip-lines too close to other playground equipment or even structures like walls, trees, etc.

The findings were the following:

Seventy five per cent of the areas inspected showed some defaulting aspect and 45% of these breached a surfacing requisite laid down in the standards EN 1176-1 and EN 1177, usually involving insufficiently thick or poorly maintained layers of natural surfacing like sand. Figure 5 breaks down the non-conformities in a percentage pie chart.
Other standout problems
Forty four per cent of the inspected play areas showed lack of maintenance; this percentage would have been even higher but for the fact that many of the inspected play areas were new and had not yet been opened. Government authorities have become more aware of this problem since the coming into force of the new version of the standards EN 1176: 2008 and EN 1177: 2008, but there is still some way to go. Lack of proper maintenance leads to chipped or flaky paintwork, rust on some parts of the playground equipment, broken or loose parts, splinters, uncleanliness, uncovered foundations posing a risk of tripping, break-up of impact surfaces and graffiti. Vandalism is without any doubt the cause of much of this deterioration, but this should not blind us to the fact that some playground equipment has become obsolete and the poor state of a lot of other equipment is due to deficient maintenance and lack of periodic checks. Figures 6 and 7 show some of the deficiencies brought to light in the playground inspections.
Assessment of playground equipment safety
Another important non-conformity that came to light was playground equipment design faults (9%). Some equipment has fallen out of phase with new legislation or was not properly type approved in the first place. Design problems may also be due to incorrect installation. For example, the biggest problem is fall protection measures incorrectly configured for the age groups to use the equipment. Equipment to be used by all ages needs protection barriers for fall heights of 600 mm or more; this does not obtain for playground equipment designed for children over 36 months. At times the manufacturer's instructions indicated that the equipment should be designated as of difficult access but these instructions were ignored at the moment of installation. This means that the fall protection measures do not tally with the actual users of the equipment, i.e., younger children without the proper protection according to the standard.

Another very important point, although it does not really pose any danger, is the marking of the playground equipment. Forty per cent of inspected playground equipment had no marking whatsoever, either lacking it from the start or losing it due to acts of vandalism. Ten per cent of playground equipment did not show the minimum information required under the standard EN 1176-1:2009.

Assessment of play zone accessibility
Accessibility was ascertained by assessing the following factors:

Access
The biggest problem found, accounting for 80% of the cases, was lack of any parking places for disabled people, lack of any public-transport stops near the play zone and/or park and lack of signage for visually handicapped people showing the layout of the playground equipment or garden spaces.

Pathways
Seventy per cent of garden spaces and play zones have no constant guidance items showing the visually handicapped which direction to follow. Furthermore, 30% of the inspected areas showed some obstacle in the playground access route.

Urban Furniture
Twenty five per cent of drinking fountains around the play area (not all play zones and/or parks and gardens have drinking fountains) were not placed at varying heights, though the activating mechanisms were all easy to open and close.

Playground signage
Hardly any inspected playgrounds had any embossed and/or braille signage or signs with strong colour contrasts indicating safety information and handy telephone numbers. Neither was there a suitable layout of the various playground facilities to enable a visually handicapped child to find his or her way about and avoid potential hazards.

Playground Equipment
Playground equipment is overly uniform. Ideally a greater variety is needed with combined play equipment and different flooring and heights to meet the needs of all children and/or parents, educators and carers. There tends to be a one-size fits-all approach with an almost total lack of playground equipment designed for all types of children. Nonetheless, 10% of inspected play areas did have a bird’s nest swing (see figure 8) that is well designed for widespread use by all types of
Figure 8. Inspected play area with a bird’s nest swing suitable for use by all types of children

Conclusions
The most important conclusions to be drawn from this study are the following:

- Play areas inspected to date have been found to breach Real Decreto 505/2007, in force since 1 January 2010 approving the basic non-discriminatory accessibility conditions for disabled persons to ensure free access and use of built-up areas and buildings.
- Playground equipment is overly uniform. Ideally a greater variety is needed with combined play equipment and different flooring and heights to meet the needs of all children and/or parents, educators and carers. There tends to be a one-size-fits-all approach with an almost total lack of playground equipment designed for children aged 11 to 14.
- Most playgrounds have no type of signage for visually handicapped people though zones are increasingly being designed with accessibility guides, especially the bigger areas with parks and gardens.
- Most playground equipment is not accessible to the disabled although there is a growing concern, as yet in a very low percentage, to provide a combination of symbolic games and height games.
- The upkeep of the playground equipment and surfacing is insufficient; most of it has deteriorated at a faster rate than might have been expected.
- Most non-conformities found in inspected play areas stemmed from equipment installation problems. Poor installation causes all the following problems:
  - Equipment design problems with dangerous openings and lack of any fall protection measures.
  - Projecting and cutting parts with no protection, such as unprotected nuts and bolts, splinters in wood and/or slides, handrails with no end protection to avoid eye injuries, etc.
  - Overlapping in playground equipment impact areas without proper safety gaps.
  - Existence of obstacles in impact areas due to the presence of fixation items above the impact surface.
- Playground surfacing without sufficient shock-absorption capacity in the event of any falls from the equipment.
- Insufficient impact surfacing within the safety areas for each piece of play equipment.

- Playground equipment design problems due to equipment that has fallen out of phase with new legislation or was never properly type approved in the first place.
- Hardening of synthetic surfaces with the passing of time, reducing their fall-absorption capacity below the necessary level in the event of a fall.
- A high percentage of government authorities fail to have yearly inspections carried out by external firms to check that playground equipment and surfacing still meets required safety standards. This is basically due to money problems, because no sums are earmarked for this purpose in the budget.
- No periodical checks of play zones or equipment and surfacing are programmed by the parties responsible for running them, with the aim of making proper repairs or replacements before they deteriorate to their current state.

This study shows that play areas have huge deficiencies, especially in terms of maintenance. It would therefore be a very positive move for playground safety standards to be made obligatory and enforceable. This would be conducive to better control and monitoring by the authorities that be. It would also be a very good idea for consumer goods inspections to be carried out, as with other children’s products, since playgrounds, at the end of the day, are the places where children spend most time and are therefore most likely to suffer accidents.

By way of conclusion, and as a final reflection, we consider that playground planning should abide more closely by standards, both those that are already binding (in the case of Andalucía and Galicia), and also those that should be adopted and enforced if we want really safe and top-quality play areas. The moot point here is not law abidance per se (it is taken for granted that all laws should always be observed) but the avoidance of unforeseen injuries and/or accidents to children, even with fatal consequences. Because safety depends on all of us.
BY WAY OF A GLOSSARY

Critical fall height. Maximum free fall height for which the playground surface provides an acceptable impact-absorption level. The critical fall height is determined by the most favourable result of the EN 1177 standard test.

Free fall height. Maximum vertical distance between the highest part clearly designed to support the body and the impact-absorbing surface directly below.

Impact absorption. A surface’s properties of dissipating an impact’s kinetic energy by means of a local, acceleration reducing deformation or displacement.

Impact area. Area in which a user might hit the ground after falling through the falling space.

Impact attenuation. A surface’s property of dissipating an impact’s kinetic energy by means of a local, acceleration reducing deformation or displacement.

Playground equipment. The children's play equipment and structures, including construction elements and components in covered or open spaces, single or in groups with playing rules and reasons established by the children themselves at any one moment.

Falling space. The space within or around the play equipment through which a user might fall from a high part of the equipment.

Head Injury Criterion. A specific integral relating acceleration with time during any impact. It is used to determine the relative risk of head injuries.

Strained movement. Any moment not controlled by the user, for example when sliding, swinging, rocking, etc.

Overlap. When two independent play equipment impact surfaces superimpose on each other, cramping the minimum space.

Poured in place playground surfaces. Rubber surfacing poured on the spot, forming a smooth and uniform surface with no chamfers or joints. It consists of a base black BSR layer made from recycled end-of-use tyres, to which a layer of coloured rubber is added to form the decorative paving. A wide range of colours can be used for the decorative layer. The rubber pellets are stuck together by a polyurethane base adhesive.

Play surface. Playground surface from which use of its equipment starts, taking in at least the impact area.

TO FIND OUT MORE


3. Estudio sobre accidentes infantiles atendidos en los centros de salud. FUNDACIÓN MAPFRE y Sociedad Española de Medicina de Familia y Comunitaria (semFYC).


15. Asociación Española de Normalización y Certificación (AENOR). UNE 147102 «Equipamiento de las áreas de juego. Guía para la aplicación de la norma UNE-EN 1176-7 para la inspección y el mantenimiento».

16. Asociación Española de Normalización y Certificación (AENOR). UNE 147103 «Planificación y gestión de las áreas y parques de juego al aire libre».

17. Asociación Española de Normalización y Certificación (AENOR). UNE 172001 IN «Señalización en las áreas de juego».

18. Decreto 127/2001, de 5 de junio, sobre medidas de seguridad de los parques infantiles de la Junta de Andalucía.

19. Decreto 245/2003, de 24 de abril, sobre medidas de seguridad de los parques infantiles de la Xunta de Galicia.


