

DESIGNING OF CHILDREN PLAYGROUNDS FROM THE ASPECT OF USED SURFACING WITH A GOAL OF CHILDREN SAFETY ON THE EXAMPLE OF THE CITY OF NIŠ

UDC 712.257-053.2(497.11)

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Abstract. *When designing children playgrounds, one should take into consideration numerous factors dictating safety of the children spending time on the playground. Accessibility of individual parts of the playground, and quality of the equipment, types of used materials in terms of durability, non-toxicity, are only some of the factors which can have impact on the safety. Also important are separation of children age-groups as well as of the conflicting activities, visible labels and supervision. Also, the spacing between the individual parts of equipment and types of used surfaces should be considered. This paper analysis materials of the playground as an element in designing, aimed at children safety. The research includes areas for children play in the city of Niš, The analysis of children playgrounds was performed on the most frequented parks in Niš – in Čair park, Sveti Sava park and Fortress park. Also, there is an analysis of the children playground in the retail park Stop Shop in Niš, which has been built most recently. The goal of the paper is finding the actual condition of the children playgrounds in Niš, from the mentioned aspect, as well as building awareness about the importance of designing of safe children playgrounds.*

Key words: *children playgrounds, surfaces, equipment, designing*

1. INTRODUCTION

The children's desire and need to play is innate. It is very important for a child to satisfy this need from the beginning for the proper development of its personality. Self-recognition of own abilities, self-esteem, team spirit, potential for solving of conflicting situations, development of different verbal and social skills are only some of the things learned through the play with their peers. Children play, and learn through it, depending on the age, almost all day long. Firstly at home, with the parents, then in a kindergarten with their peers and teachers, and during the day on children playgrounds and play houses [1,2].

Received January 23, 2019 / Accepted February 15, 2019

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Considering the time every child spends on a playground and importance of the time spent on the development of psycho-motor abilities of a child it is very important to create a good, and primarily, safe design of children playgrounds [3,4].

When designing children playgrounds, numerous factors should be taken into consideration. Children using playgrounds are most often 1-12 years old. Assessment of the children age – of future users is very important in designing, because the type of equipment that will be designed, which will provide different types-levels of games, depends on it. Different types of games, i.e. different playing zones will be attractive to different groups of children.

The following key factors are important for the playground design:

- Accessibility
- Age separation
- Conflicting activities
- Lines of visibility
- Labels and/or labelling
- Supervision [5]

In particular, potential injuries must be taken into consideration, so as to minimize the risk. One should take into consideration:

- Potential falls off and around equipment
- Need for a protective surface layer which absorbs the impact around and under the equipment
- Size of openings in order to prevent heads becoming trapped in them
- Range of equipment and other design characteristics, connected to the age of the users and arrangement of equipment on the playground
- Procedures during installation and maintenance
- General hazard presented by the sharp edges [5].

The selection of materials must be based on many characteristics of the individual play areas: height of equipment; age of users; dispersion of elements; normal weather conditions; maintenance costs; installation costs; equipment life expectancy; and environmental concerns. The functionality of the different types of materials is the most significant concern for a school or public entity that is installing or upgrading a playground [6,2]. In this paper, we are primarily dealing with materials used as surfacing of children playgrounds.

2. THE PLAYGROUND SURFACE AND SELECTING A SURFACING MATERIAL

The playground surface is one of the most important safety aspects in preventing and avoiding serious injuries resulting from falls and tumbles. Hard surfaces such as concrete and asphalt are inappropriate for underneath swings and jungle-gyms. Even soil or grass is an inadequate surface for a playground because constant use compacts the ground and diminishes its shock absorbing ability [3,7]. An even, resilient surface that offers protection to children's limbs and attenuates impact is required. Children should always be closely supervised in any playground by a responsible adult [8,4].

Vivid colours to reflect natural light and increase visibility, colour contrast between playground equipment and surfacing to avoid tripping hazards, changes in surface elevation can also be highlighted with designs or colour change [9]. The surface of the impact area shall be free from sharp edged parts or projections and shall be installed without creating any entrapment situation.

There are two types of surfacing options for playgrounds: loose-fill and unitary materials. The most frequently used loose fill surfacing materials are tree bark, woodchips and shredded rubber mulch. In addition, the most frequently used unitary materials are rubber matting (either as tiles or poured rubber surface), turf and topsoil and carpet surfacing (with sand and similar material underneath). Moreover, it is important to visually accentuate these areas. Protective surfacing must be maintained in an appropriate way. Every deviation can result in a considerable reduction of protective function.

2.1. Loose-fill surfacing materials

Important advice when considering loose-fill materials:

1. Loose-fill materials become compacted in time for at least 25% because of usage and weather effects.
2. Surfacing often requires frequent maintenance to ensure that the depth is always maintained above the minimal value. The areas under swings and at the exits are prone to dispersing, which requires constant maintenance of these areas.
3. The perimeter of the playground should provide a method of containing the loose-fill materials.
4. Install the marks showing the minimal depth of loose-fill materials in order to retain the original material depth.
5. Good drainage must be provided because the standing water reduces efficiency and causes compaction and disintegration of material.
6. Critical depth can be reduced in winter, during the ground freezing periods.
7. No wood mulch containing wood products treated with copper-chrome-arsenic (CCA) can be used.

Sand is one of the easiest products to maintain. It is easy to smooth out its surface and children love playing in it. However, the downside of this surfacing is that cats often soil it, while crushed glass or some other materials can be buried in the sand and can represent a hazard to children. In addition, in the freezing conditions, sand can become hard as concrete and can be used only after the sun warms up the surface or if materials is manually broken and made suitable for use [3].

Pea gravel is an old surfacing material for children playgrounds. It consists of large aggregate grains, the size of pea kernels. Pea gravel is still popular, but is increasingly being replaced with synthetic materials.

The advantages of pea gravel are: economy, easy maintenance and evening of surface. In addition, it does not attract animals like sand. The downside of pea gravel is that it can be a severe choking hazard for children under age of three, because they swallow the grains of the surfacing, and put them in the nose or ears.

It creates a problem for maintenance of the grass and surfaces surrounding the playground. Lawn mowers can throw the gravel significant distances [3].

Wood Chips - This material is cheaper than the other so it is suitable for playgrounds with limited budget. This material is easy to find, it is easy to move from one place to another. It is not toxic, does not contain colour or additives. It is good for fall attenuation and impact absorption [11]. The downside of this material is that it requires constant maintenance. It is water absorbent, so it is difficult to drain. It is prone to rotting, and according to some research, on average 25 % of material must once a year be replaced (figure 1) [3].



Fig. 1 Wooden playground mulch [12]

Recycled Loose Fill Rubber consists of 100% pure recycled rubber. Even though it is somewhat more expensive than the wood based surfacing, it is more economic in a long run, because it does not disperse so the maintenance cost is lower. Considering that it is loose, it is easily drained, does not attract insects or animals. It has one of the highest impact attenuation ratings. It is soft to touch and splinter free. It does not decompose [11].

2.2. Unitary surfacing materials

Unitary materials are generally rubber mats and tiles or a combination of energy-absorbing materials held in place by a binder that may be poured in place at the playground site and then cured to form a unitary shock absorbing surface. Unitary materials are available from a numbers of different manufacturers, many of whom have a range of materials with differing shock absorbing properties. New surfacing materials, such as bonded wood fibre and combinations of loose-fill and unitary, are being developed [13,14].

Poured in Place Rubber (PIP) surfaces are most common. A wide range of colours allows you to add an element of graphic fun to the playground by creating inlaid shapes and themed design. In most cases, it consists of two layers, a cushion layer made of clean, recycled tire rubber and a decorative wear course layer comprised of fine virgin EPDM or TPV granules. It is installed over asphalt, concrete or compacted aggregate on a base of soil. The depth of the layer varies depending on the need – place where it is installed and predicted wear and fall height. Advantages of this type of surfacing are easy installing, availability in different colours and potential for subsequent colouring and decoration, as well as easy maintenance (figure 2) [11].

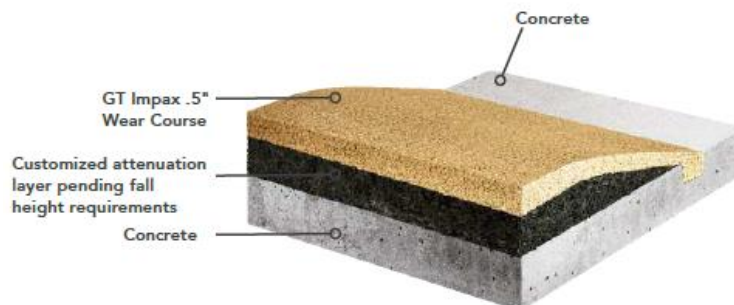


Fig. 2 Poured in place rubber surfacing example [11]

Synthetic turf brings the look of nature to your play environment. In playground applications, we include a cushion layer that provides fall protection. After the Synthetic Grass layer is installed, infill is worked in among the blades to discourage blade flattening and help reduce surface temperature [11]. Such type of surface offers a natural look, colder surface in relation to other types of surfaces, does not require a high level of maintenance – it is not mown, watered and quickly dries out so children can play on it earlier after rainfall than on other types (figure 3).

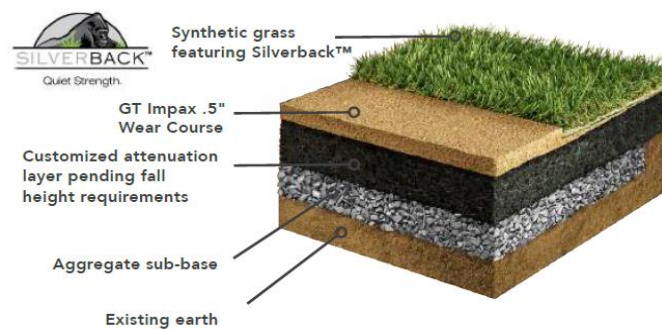


Fig. 3 Synthetic grass [14]

Recycled rubber interlocking tiles are also easy to maintain, they are durable and accessible. They are also suitable for indoor use, because they are not poured in place. They can be found in different colours and thicknesses depending on the needs. The surface is easy to repair, by replacing the damaged tiles with new ones (figure 4).

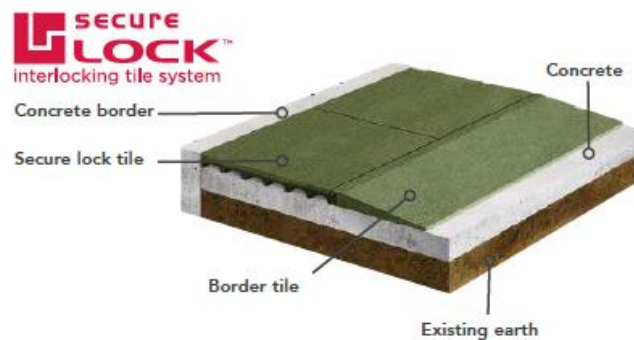


Fig. 4 Recycled rubber tiles [11]

Recycled Bonded Rubber – coarser grains of recycled rubber than in case of the poured rubber are used. There are no seams as in rubber tiles. Such type of the surfacing is cheaper than the previously mentioned. The surface is porous and provides water penetration. It is comprised of a precise combination of wire free, cleaned pigmented recycled rubber and a polyurethane binder. It is installed and troweled by hand to provide a resilient, seamless appearance. Larger rubber strands provide the natural look of loose fill surfacing without the disadvantages of displacement (figure 5) [11].

Carpet surfacing with sand and similar material underneath is also the possible type of surfacing that is rarely used.



Fig. 5 Recycled Bonded Rubber [11]

3. NIŠ PLAYGROUNDS CASE STUDY ANALYSIS

The city of Niš has a large number of park spaces in its territory. The largest are Čair park, the Fortress complex which, even though occupies a large surface has a relatively small number of amenities for children, and Sveti Sava park in the Nemanjić Boulevard. In addition, almost every building block has an inner yard with a minimum of equipment intended for children play – seesaws, swings, slides and jungle-gym.

3.1. Čair park

Čair park is positioned in the central part of Niš. It occupies an area of 16,4 hectares [15]. The complex itself is made of two entities, one large green area with various amenities intended mostly for children, and a sport and recreational complex composed of outdoor and indoor pools, football pitches, fitness center, ice rink. The complex is intended for a wide variety of users, containing indoor and outdoor areas where various health, recreation, education, culture, art, entertainment, trading activities are taking place. As early as in the period of Ottoman domination it was named - Čair – a garden - for the lush greenery in it. Next to the complex, there is a large number of cafés and sweet shops.

The section intended for children playground changed in time. Individual parts of the park are being added playground equipment, which changed their purpose. Therefore, there is a number of subareas in Čair, earmarked for these activities. The older children playgrounds, i.e. equipment installed before a number of years is in a rather poor condition, figure 6. Mostly, the surfacing under the swings and slides are damaged, so the children jump or fall on asphalt or concrete instead of on rubber when they play. The foundation zones of equipment in time became visible, regarding that topsoil is removed due to swinging, so these concrete pieces represent an additional hazard for children safety [16].



Fig. 6 Equipment in Čair park – inadequate surface, photo A. M. Petronijević

A part of the park which is equipped with the equipment relatively recently, by the donation of the Forum shopping centre, was designed in, 2011 so that it largely meets the mentioned standards, figure 7 and figure 8. An enclosed area which was built in this campaign has climbing equipment, seesaws, swings, huts, artificial rock for climbing. Very commendable is usage of rubber tiles as surfacing, which minimizes the injuries of children on jumping, falling etc. The downside is that the individual parts of the equipment are mutually very narrowly spaced [16].

There is a problem because of the lack of maintenance. After years of usage, the rubber tiles are missing, so now, instead of rubber surface, the topsoil prevails.



Fig. 7 Newer part of the park renewed with the Forum donation. Current condition. Čair, photo A. M. Petronijević

Also problematic is the narrow spacing between individual pieces of equipment.

In 2015, City Municipality of Mediana installed a playground item in a form of a pirate ship, so called „The Nis Galley“, figure 9. The supporting structure is made of steel sections, and floor of the ship and outer skin of wooden planks. One can also observe the absence of adequate surfacing between the slides and swings, and of protective sheathing of the steering wheel, which makes it a potentially dangerous place for children [16].



Fig. 8 Newer part of the park renewed with the Forum donation. Current condition. Čair, photo A. M. Petronijević



Fig.9 Galley in Čair. Čair, photo A. M. Petronijević

3.2. Sveti Sava Park

Sveti Sava park is one of the largest and most visited parks in the city. In the park, with finely organized green park areas, the central position is occupied by the Church of Holy Emperor Constantine and Empress Helena. There is different children equipment, a fountain with a bridge, small theatre for the smallest children, a building of the City Municipality of Mediana, elementary school Sveti Sava and multitude of cafes, shops and sports facilities on the park periphery.

Both here and in Čair park, there is a problem of inadequate equipment maintenance. The City Municipality of Mediana, arranged a plateau north of the church in 2009, by building a fountain and a bridge and an entire complex for children play [16].

The steel structure of the central composition intended for playing is clad in chipboards painted in light colours, with Cyrillic letter motifs, figure 10. The platform floor, and the staircase is made of wooden planks. Here also, the surfacing the children land on after coming down the slide is worn out. The wooden steps are decrepit. Also, the rubber surface under the swings around the ring is dilapidated and worn out in places (figure 11) [16].



Fig. 10 Equipment in Sveti Sava Park, installed in 2009., photo A. M. Petronijević



Fig. 11 Equipment in Sveti Sava Park, installed in 2009, photo A. M. Petronijević

The situation in the newer area, equipped in 2016 is better. The first playground built as a result of Imlek company campaign "Moja Kravica - Rasti srećno", was built exactly in this park, figure 12. The entire equipment is placed on the rubber surfacing, and the used materials are adequate for the stated purpose.



Fig. 12 Equipment in Sveti Sava Park, installed in 2016. photo A. M. Petronijević

3.3. The Fortress

The Fortress of Niš is certainly the most attractive area in the city. It is a city hallmark. There are numerous amenities in the Fortress, from cultural, tourist, educational to the entertaining. The relatively small area inside the walls is intended for child play. The individual cafés east of the Fortress gate install such equipment in the summer season. Permanently constructed equipment exists at only few places in the fort. It is installed directly on soil, without any layers of sand or rubber, figure 13 [16].



Fig.13 Equipment in the Fort, installed directly on the soil, photo A. M. Petronijević

3.4. Stop Shop retail park

It becomes increasingly common to install the playgrounds in the shopping malls either indoor or outdoor. The concept is that one of the parents would spend time with the children, while the other would go shopping. So, in Nis, in the Roda center, there is a children playground inside the building, and in the Stop-Shop retail park, there is an outdoor area. The Stop-Shop retail park can boast of safe equipment, proper spacing and complete rubber surface, figure 14. Time will tell whether this will disappear in time, like that in other playgrounds in the city, or it will be better maintained. The area is completely enclosed, which facilitates the parent supervision of the children movements and activities [16].



Fig. 14 Good practice example, Retail park in Niš, photo A. M. Petronijević

4. DISCUSSION AND CONCLUSIONS

The paper presents a number of playgrounds in the area of the city of Niš. The largest complexes have been chosen, both in terms of the area and the number of users, in order to provide the truest possible idea of their condition. The presented data suggest the following: the playgrounds which are older, such as Čair park, or some of its older parts, then children playgrounds in the Fort, feature inadequate surfacing. It is most often asphalt, concrete or soil. If it is soil, it is very frequent case that it is displaced from the impact areas (beneath the swings, seesaws, slide landings), which increased the fall height, making the specific equipment unsafe (also found on the playground within Čair park) Also, because of this, the foundation elements of the equipment became exposed, leaving the concrete protruding from the earth, thus presenting a severe hazard for children.

The playgrounds designed in the previous ten years already have incorporated rubber elements, such rubber tiles or poured rubber, usually placed in places, under the seesaws and slides. Considering the long usage of such playgrounds, and the lack of maintenance, the surfacing is partially or fully damaged – in the part of Čair park built with the donation by the Forum shopping centre, as well as in the parts of Sveti Sava park. A third group of playgrounds are those constructed in the last 5 years, with adequate and still well-maintained surfacing – part of the playground in Sveti Sava park built during the campaign „Moja kravica - rasti zdravo”, and the entire playing area in the retail park Stop Shop.

Nowadays, with easily available adequate materials, and with a large number of recommendations about the usage of material in the world and locally, and with the regulations on safety on children playgrounds [16], there is no excuse for the designers to ignore this aspect while designing. Safely designed playground, and usage of safe materials, maintained according to the recommendations, is a guarantee of children safety when they use these areas, which is the primary task of any of us.

Acknowledgement *This research is supported by the Ministry of education, science and technological development of the Republic of Serbia for project cycle 2011-2017, within the framework of the project TR 36042 and project TR 36045. The authors wish to thank Mr Zoran Bakić from the Ministry of Economy of the Republic of Serbia on the necessary and important assistance.*

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PROJEKTOVANJE DEČJIH IGRALIŠTA SA ASPEKTA PRIMENJENJIH PODLOGA SA CILJEM BEZBEDNOSTI DECE NA PRIMERU GRADA NIŠA

Prilikom projektovanja dečjih igrališta u obzir treba uzeti brojne faktore koji utiču na to da vreme koje deca provedu na igralištu bude pre svega bezbedno. Pristupačnost pojedinih delova igrališta, zatim kvalitet samog mobilijara, vrste primenjenih materijala u smislu trajnosti, netoksičnosti su samo neki od faktora koji mogu uticati na bezbednost. Bitni su takođe i razdvajanje starosnih grupa dece, konfliktne aktivnosti, vidne oznake, nadzor. Treba se, takođe, voditi računa o međusobnim razmacima pojedinih delova mobilijara, kao i o vrstama primenjenih podloga. U ovom radu je vršena analiza materijalizacije igrališta kao elementa projektovanja, sa ciljem bezbednosti dece. Istraživanjem su obuhvaćeni prostori za igru dece u gradu Nišu. Analiza dečjih igrališta je vršena na najfrekventnijim parkovima u Nišu – u parku Čair, parku Svetog Save i parku u Tvrđavi. Takođe je urađena analiza dečjeg igrališta u okviru ritejl parka Stop Shop u Nišu, koje je najnovijeg datuma izgradnje. Cilj rada je utvrđivanje stvarnog stanja dečjih igrališta u Nišu, sa spomenutog aspekta, kao i podizanje svesti o važnosti projektovanja bezbednih dečjih igrališta.

Ključne reči: dečja igralista, podloge, bezbednost, oprema, projektovanje