Favourite Subject: Break Time!

— Promoting physical Activity through selected Play Equipment for Schoolyards

Berliner
Play equipment for life

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Exercise promotes Health and Intelligence

It is no secret that physical exercise is important for the physical, mental and social development of children. In addition to health promotion, such as the prevention of postural deformities and obesity, there are numerous studies demonstrating the positive correlations between exercise and various mental abilities, such as the intelligence quotient, concentration capacity and linguistic and mathematical skills in children. For the further development of self-assessment and risk competence, appropriate opportunities for physical exercise in the school playground can also offer an ideal learning environment. Exercise spaces which favour role playing or in which there are challenges to be solved collectively also promote social behaviour and the pupils' communicative skills.

Thus it has become clear that physical exercise during break time is not only important as a balance to cognitive learning in class, but in itself can be conducive to development. Various basic forms of physical exercise which demand and promote different skills in children are pertinent in this respect. These include balancing and brachiation, climbing, jumping and bouncing as well as rocking and swinging.

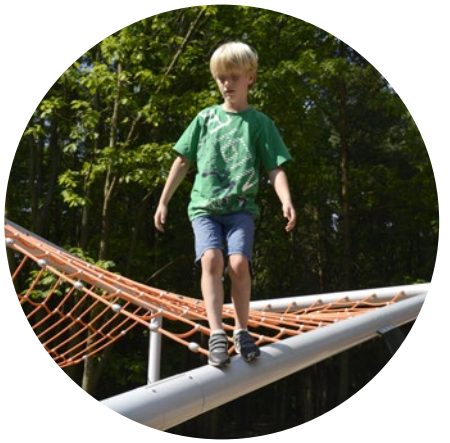
Offering basic Forms of Exercise during Break Times to improve Health

As early as the first attempts to stand during infancy, basic skills are acquired in the act of **balancing**. In order to be able to successfully solve an equilibrium task, skills such as perception, planning, risk assessment, decision making and reacting alternately in quick succession are required. This primarily requires coordination and concentration, i.e. skills that are the basic prerequisites for successful learning at school. Brachiation has similar positive effects on development. When using the arms for locomotion, the legs are employed in balancing movements. In addition to strengthening the arm and shoulder girdle muscles, this also trains the sense of balance and coordination.

Balancing and brachiation illustrate essential physical interrelations, such as the effect of gravity, balance or counterbalance.

These skills and the discovery of such insights can be promoted by an attractive balancing and handrail offer in the school playground, e.g. slacklines, nets, hand ladders and jungle or rubber bridges.

Climbing is a basic need in a child's development. Climbing in a three-dimensional space is particularly beneficial for children, on several levels. On a physical level, posture problems and obesity can be avoided. Climbing trains the sense of balance and body awareness. Motor skills are developed. On a neuronal level, movement in a three-dimensional space stimulates interconnection patterns in the brain, namely those that stimulate the imagination, which in turn are needed in three-dimensional computing. The neurobiologist Gerald Hüther describes climbing trees as the best preparation for math lessons (see Gerald



Hüther in: "Klettern fördert mathematische Fähigkeiten" (Climbing promotes mathematical skills) - Interview with brain researcher Gerald Hüther, 06.08.2012 on www.3sat.de/vivo/154278/index.html).

Jumping and bouncing are also beneficial for school-aged children. As well as the mus-

cle power necessary for a jump, a safe landing requires and promotes coordination and balance. Particularly when jumping down, the climber has to once more independently assess the risk. Corresponding flexible or bouncy play equipment offers a particularly exciting challenge in this regard.

Rocking and swinging particularly develop body sensation and awareness. They also favour development of the child's vestibular system. Active and passive movements in the three-dimensional space result in learning signals that promote the coordination of body movements, eye movements and balance.
Like climbing, swinging supports the development of motor planning and motor control. This includes the detection of the movement position of the body in space or on the play equipment and the resulting necessary coordinated movements. Children experience the principle of cause and effect and observe that: "What comes up must come down", or: "If I let go or jump at this altitude, I could land hard and also hurt myself". The arm, leg and trunk muscles are also thereby strengthened.

Against this background it becomes clear that school playgrounds should offer a wide range of physical activity that is of maximum benefit to the pupils. As a manufacturer of playground equipment, it is therefore important to provide offers that both enable and motivate the basic forms of exercise mentioned here.

Profile of Requirements for Equipment in School Playgrounds

In order to help pupils to develop as healthily as possible, both physically and mentally, the playground must offer a versatile and attractive range of physical exercise and movement. However, what does this mean in concrete terms for the manufacture of playground equipment? What overriding criteria must be fulfilled so that pupils of different age groups who are at different physiological and psychomotor developmental levels can receive the best possible support?

To illustrate this, reference will be made here to a requirement profile of playground equipment that has been developed on the basis of years of experience in the planning and manufacture of playground equipment for educational institutions. The profile is divided into direct and indirect factors.

The direct factors are aimed directly at the users, i.e. the school children and their needs. However, other interest groups are also involved in educational institutions. In schools, for example, teachers and directors are responsible for supervising pupils and are decision-makers for the use of the financial resources. It is therefore essential during the planning phase and production of playground equipment to take into account the practical experience, suggestions, objections and/or specifications by politicians, educational institutions and building authorities within the support network. If these factors are not taken into account, the task of creating a playground with appropriate playground equipment will fail - regardless of how beneficial or attractive this may be for the pupils. The requirement profile of the playground equipment to be selected is therefore extended by such factors that indirectly affect the students.

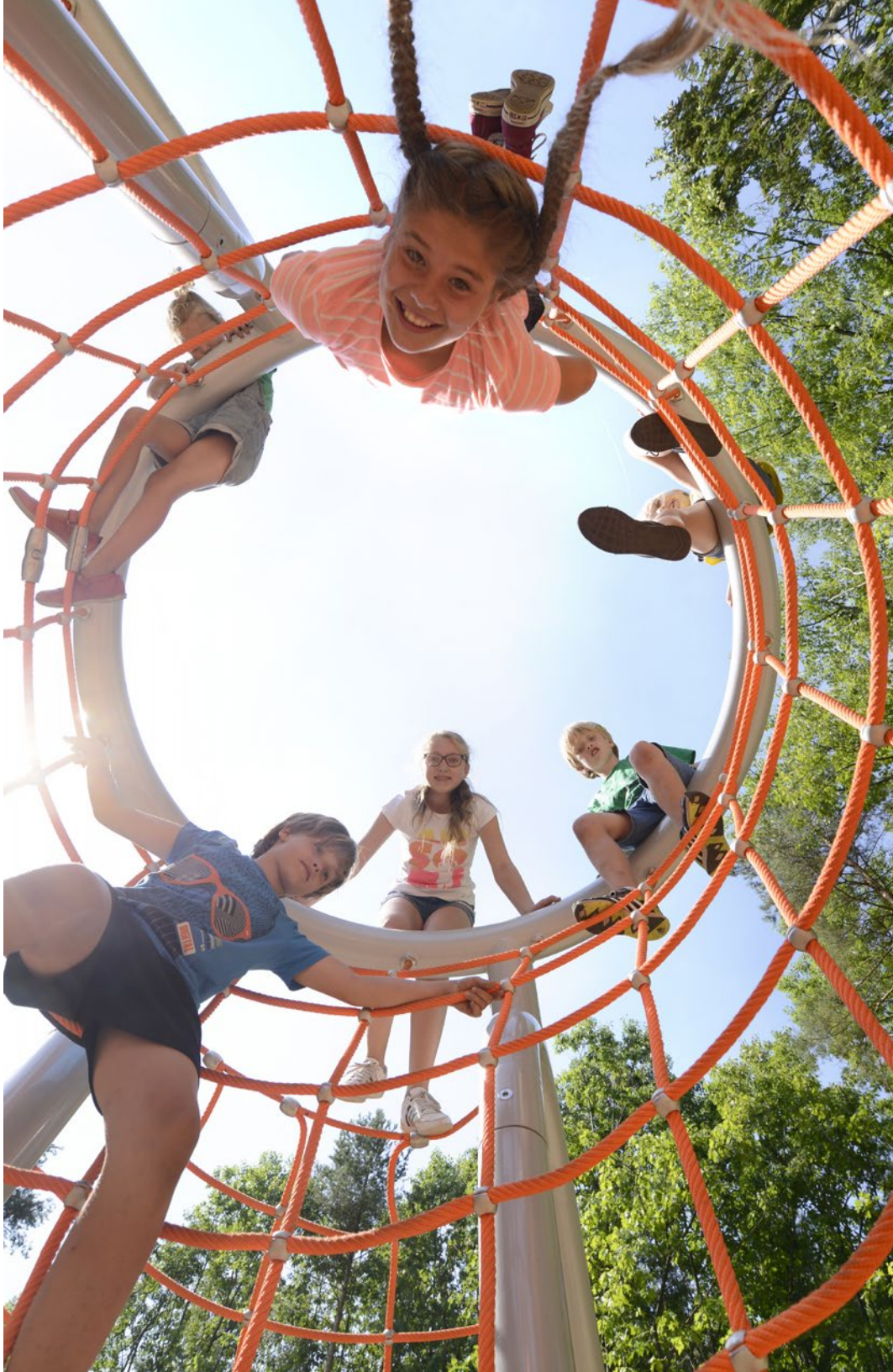
Direct and Indirect Factors of Equipment in School Playgrounds

Direct Factors

- Versatile Range of physical Exercise
- High Degree of Challenge
- Room for as many Children as possible
- Necessary Level of Safety

Indirect Factors

- Ease of Supervision
- Long Service Life
- Simple Maintenance
- Easily extendable



Direct Factors – affecting Pupils directly

According to point one of the requirement profile, play equipment should be built that offers a **versatile range of physical exercise**, in order to enable many of the basic forms of exercise mentioned above and at the same time meet the needs of different age groups. Thus playground equipment should offer a differentiated range of challenges.

For pupils to actually use play equipment that promotes physical exercise, it is essential that the equipment should be as attractive as possible. It should therefore present a **high degree of challenge**. Due to the constant expansion of forms of digital entertainment on offer, it is one of the great challenges of modern society to get children and young people interested in taking exercise. In times of smartphones, game consoles and social media, it is therefore vital to design exercise landscapes in such a way that they can be used sustainably.

Since all pupils at a school generally have a break at the same time, playground equipment must be designed so that there is **enough room to exercise for as many children as possible simultaneously**. This is the only way to ensure that all pupils have the opportunity to take advantage of the full range of exercise during the short breaks at school.

Finally, playground equipment must guarantee the **necessary level of safety**. Play equipment should be designed in such a way that no serious injuries can occur. At the same time, care must be taken to ensure that a calculable risk remains. Only where "dangers" are apparent, do children and adolescents have the opportunity to perceive them, assess them and learn how to deal with them. The standard for playground equipment provides for a calculable degree of risk acceptance because it "gives children the opportunity to learn about dangers and their consequences in a controlled environment". (See DIN EN 1176)

Indirect Factors – affecting Pupils indirectly

An essential factor and justified objection on the part of the teaching staff when choosing playground equipment is the prerequisite **ease of supervision** of pupils during breaks. For this reason, playground equipment with a transparent structure is a significant advantage. This is the only way to ensure that a large number of pupils who are on or behind the play equipment can be supervised simultaneously.

Another very important criterion for the purchase of a piece of play equipment is its **service life**. Attractive playground equipment is used a lot and is subject to high loads. Wear and tear entail additional costs and risks. Therefore, both the quality and the workmanship of the materials used should be appropriate for the high incidence of play as well as weather-related influences. Only sustainable concepts can guarantee the longest possible service life.

Like motor vehicles, playground equipment must also undergo regular **maintenance**. For reasons of cost and time, it is therefore crucial that such maintenance can be carried out as easily as possible. This is dependent equally on the technical solutions and the quality and processing of the materials used.

Finally, playground equipment should be as **easily extendable** as possible. Over the years, the outdoor spaces of educational institutions are often redesigned or enlarged. In such case, it is very useful to be able to connect to existing playground equipment. Nothing has to be demolished and the investment costs are lower than when building a completely new set of equipment.

Play Equipment Designs for Schoolyards

Based on the requirement profile for playground equipment, two playground equipment designs are presented below that best meet the requirements for school playground equipment: **Three-dimensional net play equipment** and **low-rope courses**.

Spatial net play equipment is a three-dimensional net of ropes which is stretched either within an external frame or around a central mast. Three-dimensional net play equipment is available in numerous different shapes and sizes.

Low level rope equipment is a course close to the ground consisting of numerous different climbing elements such as balancing ropes, hand-over-hand rope loops, planar nets, rubber ramps etc. The individual elements can be freely selected and combined and installed regardless of the geographical situation.

In order to test the concepts mentioned here with regard to their suitability for playgrounds, these are to be analysed below in accordance with the requirement profile.

Three-dimensional Net Play Equipment

The central **physical exercise offer** in a playground with a spatial net is climbing in three-dimensional space. This offers all the positive effects in the physical, cognitive and neurological areas mentioned under "Basic forms of exercise during break time to improve health". It sharpens visual perception and motor skills by allowing pupils to decide where to place their hands or feet to move up or down. In addition, three-dimensional nets offer the opportunity to balance, bounce and swing on ropes. Jumping from a self-chosen height is also possible.

Another important aspect for the attractiveness and the **challenging nature** of spatial net devices is the possibility of climbing upwards without having to resort to additional safety measures, such as climbing harnesses. Play equipment with three-dimensional nets is designed in such a way that a fall above the maximum free fall height is always intercepted by the net underneath. This makes it possible to climb to a height of over 10 metres on standard equipment – an incentive that is attractive not only for younger children but also for senior pupils.

At the same time, children learn about risk assessment and their own limitations when climbing. Thus a child has to assess for himself what he is capable of and how he deals with fear in difficult situations, e.g. due to height. A feeling of success has an immediate positive and motivating effect on self-confidence and capacity for self-preservation. Boring playgrounds, on the other hand, can have a negative effect on children's emotional development. In order to overcome fears, a confrontation with altitude and speed may be necessary later on (cf. Ellen Sandseter in: Can a Playground be too safe, 18.07.2011 at https://www.nytimes.com/2011/07/19/science/19tierney.html).

As well of offering the chance to climb to great heights, three-dimensional net climbing equipment has the advantage of being highly versatile. They are abstract and do not center around a specific topic. Thus they offer plenty of space for the pupils´ imaginations in order to act out their own play ideas. This not only promotes creativity among the pupils, but also makes the equipment interesting for different age groups. Sometimes the playground equipment is used as a knight's castle, at other times perhaps a ship – the possibilities are endless.

Unlike individual swings or the classic slide with ladder, play equipment with a three-dimensional net has enough **room for many children at the same time**. This ensures that all pupils have the opportunity for physical exercise on the three-dimensional net during break times. Furthermore, climbing together on the net inevitably leads to interaction between the pupils. Who dares go high up, and how high? Who is the fastest? Or perhaps someone needs help, because it suddenly seems very high to them? This often means

the children help each other, as can frequently be observed in such situations. Thus through the interaction during climbing pupils gain important experience in terms of social behaviour within a group.

According to the fourth direct factor of the requirement profile for playground equipment, all play structures of three-dimensional nets should meet the **necessary safety requirements** of the DIN EN 1176 standard. Such equipment should also be designed in accordance with the standard in such a way that a calculable risk remains. Without this, the equipment would be less exciting and the degree of challenge would not be very high. Where there is no risk, there are also no learning effects with regards to risk assessment: the children would no longer have to think about what they are capable of and where their limits lie. If there were no more subjectively perceived dangers, there would also be no need for mutual help. Thus the interactive nature of the equipment would be significantly diluted.

Due to its open structure, which consists exclusively of nets and a central mast or a steel tube frame, three-dimensional net equipment is as transparent as possible. This makes **supervision by the teachers much easier** than is the case, for example, with solid wooden towers. Even if many children are in or on the net at the same time, they are easy to see from all sides.

The main components of playground equipment with a three-dimensional net by the Berliner Seilfabrik essentially consist of metal and rope. The ropes consist of a steel core wrapped in 4 or 6 polyester yarn-covered steel strands. All in all, this leads to very high quality and therefore to a **high load capacity**. Since the Berliner Seilfabrik rope-making machines were originally designed for the production of steel cables, whereas polyester yarn is now used – a material that is much softer than steel – very high compression of the yarn is achieved. As a result, the maximum abrasion resistance of the non-slip ropes is outstanding.

All supporting elements are made of metal and are protected against corrosion in the long term.
They are either made of stainless steel or are galvanised and powder-coated. All other elements such as balls, nodes and mounting clamps are made of aluminium.
The choice of these robust materials and their high-quality workmanship make Berliner's play equipment highly sustainable and **durable**. This protects the environment and saves follow-up costs for the school.

The **maintenance** of rope play equipment with a three-dimensional net usually involves the re-tensioning of ropes. This is particularly easy thanks to the AstemTT tensioning system and is achieved simply by tightening the screw inside the system ball. And if a rope should come to be so badly damaged by vandalism that it has to be replaced, this is also possible without any problems. The Berliner cloverleaf ring connects ropes at intersections in such a way that the forces are transmitted directly from rope to rope. Since nothing is swaged or welded at the crossing points, individual sections of rope can be replaced directly on the playground without having to replace an entire three-dimensional net.

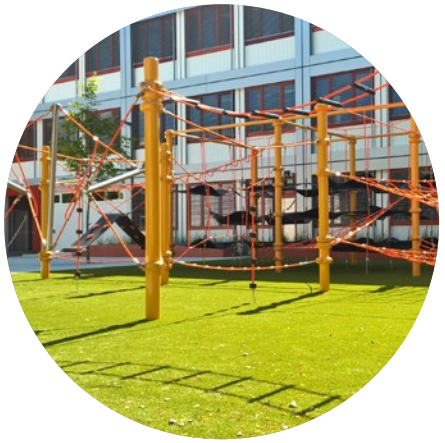
Time and again, a school opts for a three-dimensional net and then a few years later wishes to **expand** the play area of the playground. Since almost all Berliner's equipment is based on a modular system, this is easy to achieve. By combining three-dimensional nets and low-rope courses, for example, which can also take place at a later date, individual play and climbing landscapes are created.

Low-Rope Courses

The almost **unlimited range** of different climbing elements, such as slacklines, hand ladders, various wobbly and rope bridges, climbing ramps made of ropes and rubber membranes, rope rockers, etc. can be combined with each other in the near-natural low-level ropes course. This permits all the **forms of exercise** described above, be it climbing, balancing, brachiation, swinging, rocking or jumping. The individual elements serve different degrees of difficulty of these forms of exercise. A low-rope course is not only attractive for different age groups, but also offers pupils the opportunity to develop further. At first, the smaller children perhaps balance on a rope with a handrail rope. As soon as they are a little more experienced and feel more secure, they use an element on which they can balance freely. In addition, hammocks, planar nets or elements made of rubber membranes offer retreats for chilling and relaxing.

The **challenging nature** of low-rope courses lies in their versatility and unpredictability. Since there is no clear instruction on how to use a particular element and neither is it clear, until using it, how the rope or rubber mat of a particular element will react, pupils are extremely curious about the play equipment. They are keen to find out if they can manage to cross the wobbly bridge without putting a foot down or to grab the hand-over-hand rope loop without touching the floor.
The wide range of movements with different requirement profiles increases the probability that the various exercise needs of the individual pupils are addressed and makes the play equipment attractive for all.

Likewise, on the low-level rope elements **many children have room for play and exercise** at the same time. Depending on their



size, all pupils can pursue their urge to exercise during breaks, without having to wait. As is the case for playground equipment with a three-dimensional net, joint play promotes the social competence of the pupils. The ramp or rope moves in a completely different way when several children are on one climbing element. The pupils realise that their own behaviour influences whether the other person falls or becomes insecure, for example. Thus the influence of their behaviour and ability to communicate have on others is made tangible through the climbing element, in a playful way.

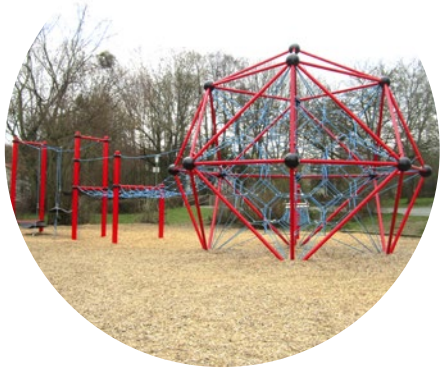
In addition to fulfilling all **safety criteria** of DIN EN 1176, the climbing elements of the low- ropes courses at Berliner are deliberately designed in such a way that **pedagogically responsible risk and adventure situations** are created in order to give pupils the opportunity to experience challenges and thus strengthen their confidence in their own performance. Whether crossing one of the higher ropes or a bridge with an unfamiliar floor made of wobbly rubber membranes, a low-level rope course offers countless opportunities for pupils to experience and overcome their limitations.

Since the low-rope courses also primarily consist of ropes and metal posts, like the three-dimensional net structures they meet all indirect criteria of the requirement profile. Thus the near-natural elements and those close to the ground are extremely transparent and so

allow **easy supervision** of pupils by teachers. The excellent quality and workmanship of the materials used make the low-rope elements **durable, able to bear maximum loads** and **easy to maintain**. Finally, the low-rope courses at Berliner Seilfabrik are highly modular and can be **easily extended** and combined with equipment from other product groups.

After extensive analysis of the two playground equipment designs, it becomes clear that both low-rope courses and play equipment with three-dimensional nets satisfy all factors of the requirement profile for playground equipment in school playgrounds. The two types of playground equipment are thus perfectly suited for the design of outdoor areas that promote physical exercise in educational buildings.

Best Practice Case:
Am Hohen Hagen School in Dransfeld, Germany



"Working together, learning from each other" is the guiding principle of the secondary school at Hohen Hagen in Dransfeld in the district of Göttingen. This gives the school a profile that "focuses on young people with their individual abilities". The school comprises a lower secondary and secondary school as well as a high school. This is a new type of school in Lower Saxony. It follows on from primary school and covers years 5 to 10. It aims to achieve a good general education through standards related to the type of school and nurturing and challenging each individual pupil. The school focuses on quality not just in the classroom, but also outside of it. The school concept provides for the breaks to be used to supplement and support cognitive learning in class through physical exercise. Social interaction is also to be encouraged during the breaks.

No wonder, then, that the Schule am Hohen Hagen offers its pupils a generous range of exercise, relaxation and games. In addition to the areas for ball games with permanently installed basketball hoops and football goalposts, the red rope play equipment stands out in particular. This is the so-called "Spaceball L" by Berliner Seilfabrik, a play structure with a three-dimensional net inside it. A staircase made of rubber membranes can be accessed from the Spaceball via a connected planar net. As a further extension element, a hammock invites pupils to relax and swing together.
Before the climbing equipment was erected on the playground, there was a tubular climbing frame dating from the 1960s. The school wanted something "High for its students to climb", recalls Peter Zeimet, Berliner Certified Specialist and responsible for the Lower Saxony area and the planning of the playground equipment for the school at Hohen Hagen.

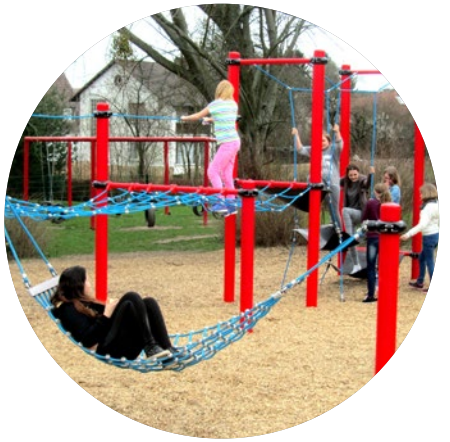
"Three-dimensional nets such as the Spaceball are ideal for school playgrounds. Due to the special shape and the adherence to a certain mesh size, the students can climb high without putting themselves at risk. In this case up to a height of 4.5 metres. The free-fall height of the equipment is to be measured at the outer edge and is only 1.84 metres. Of course, going to these heights makes the equipment very attractive. The more attractive a certain play equipment is, the more it encourages exercise because pupils are motivated to use it. This fits perfectly into the concept of a school that wants to support cognitive learning in class through physical exercise during break time".

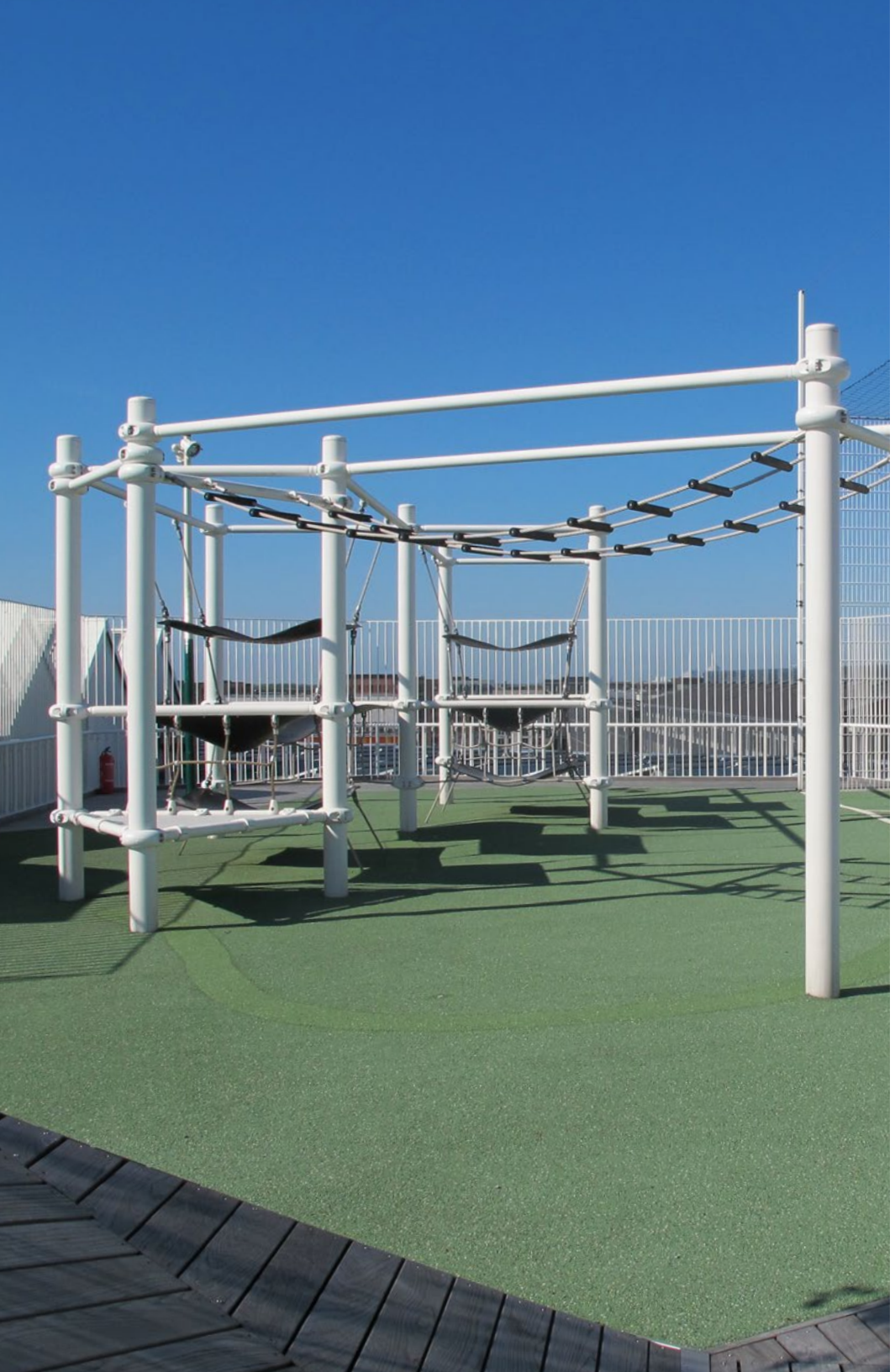
There are good reasons why three-dimensional net structures are so popular in schools. Besides the possibility to climb up high, they allow plenty of room for the imagination. Pupils can enter the play equipment a different way each time in order to climb, play and experience it. Thus rope becomes a play partner and responds to the children's movements.

"Social behaviour is also trained when playing together", Karl Köhler, Managing Owner of Berliner Seilfabrik, has come to realise during his 40+ years of experience: "You don't push someone off a rope, but rather give tips on where your partner can put his foot down next." Another advantage of three-dimensional nets is that they provide enough space for many students to climb at the same time. "This feature makes playground equipment like the Spaceball and other three-dimensional nets such as Cosmo or Pentagodes particularly attractive in comparison with simple slides or swings where only one child has fun at a time, while the other children have to line up and wait their turn", Zeimet asserts.

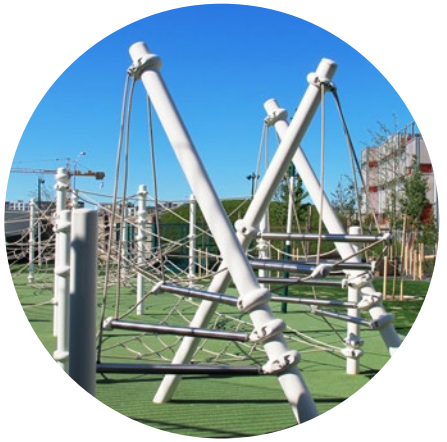
Apart from the play value of a set of equipment, how well the playing pupils can be supervised is also a decisive factor for schools. The completely open facades of the rope play equipment ensure maximum transparency. There is really nowhere to hide. This allows teachers to see their pupils from every angle, even if many children are on the climbing frame at the same time.

In the case of the High School at Hohen Hagen, the modularity of the Berliner system also played a decisive role in the choice of play equipment. At first, only the Spaceball with a hammock was installed. A year later, when new financial resources were made available through a charity run, the modular system, the planar net and the rubber membrane entrance were connected without any problems. Such low-rope elements can be combined with each other at will, so that sometimes entire rope landscapes are created in playgrounds. As the individual elements have different levels of difficulty, they are attractive for children of differing ages. In addition, with elements such as the hammock, they also offer space for retreat and relaxation. "The climbing area in the high school playground at Hohen Hagen has become a popular meeting place for our pupils and the Spaceball, including its extension elements, is well received both in summer and in winter," says a representative of the school.





The Roof as an intensively used Outdoor Space



The 21st century is already the century of urbanisation. More than half of the world's population already lives in cities – in 2050 it is expected that more than two thirds will do so. This inevitably leads to ever-increasing density in urban living spaces. In order to be able to guarantee sufficient space for leisure, play and exercise in the future, innovative solutions are more in demand than ever.

There is significant potential in the use of roofs as play, leisure and movement areas. The installation of play equipment at roof levels creates buildings with a multifunctional character. Despite the increasing density of cities, new, urban free spaces can be created in this way.

One area where this approach is becoming increasingly popular is urban educational institutions. Playgrounds have to be designed in such a way that they offer an attractive range of activities, particularly in the school and preschool sector. At the same time, in ever-growing metropolises there is an ever-diminishing amount of the necessary space for this available to educational institutions. The installation of play and climbing equipment such as three-dimensional nets and low-level rope courses on the roof of a school can thus be the ideal solution to meet the trend of a playground that promotes physical exercise at a time when cities are constantly densifying.

An example is the Convent & Stuart Hall, a Catholic high school in the centre of the American metropolis San Francisco. Since the middle of last year it has had a playground on the roof of the school building. "The urban environment in which our school is located does not offer much space for play and leisure areas. So we decided to maximise the space and install a playground on the roof.", says Geoff De Santis, Plant Operations Director of the Convent & Stuart Hall School.

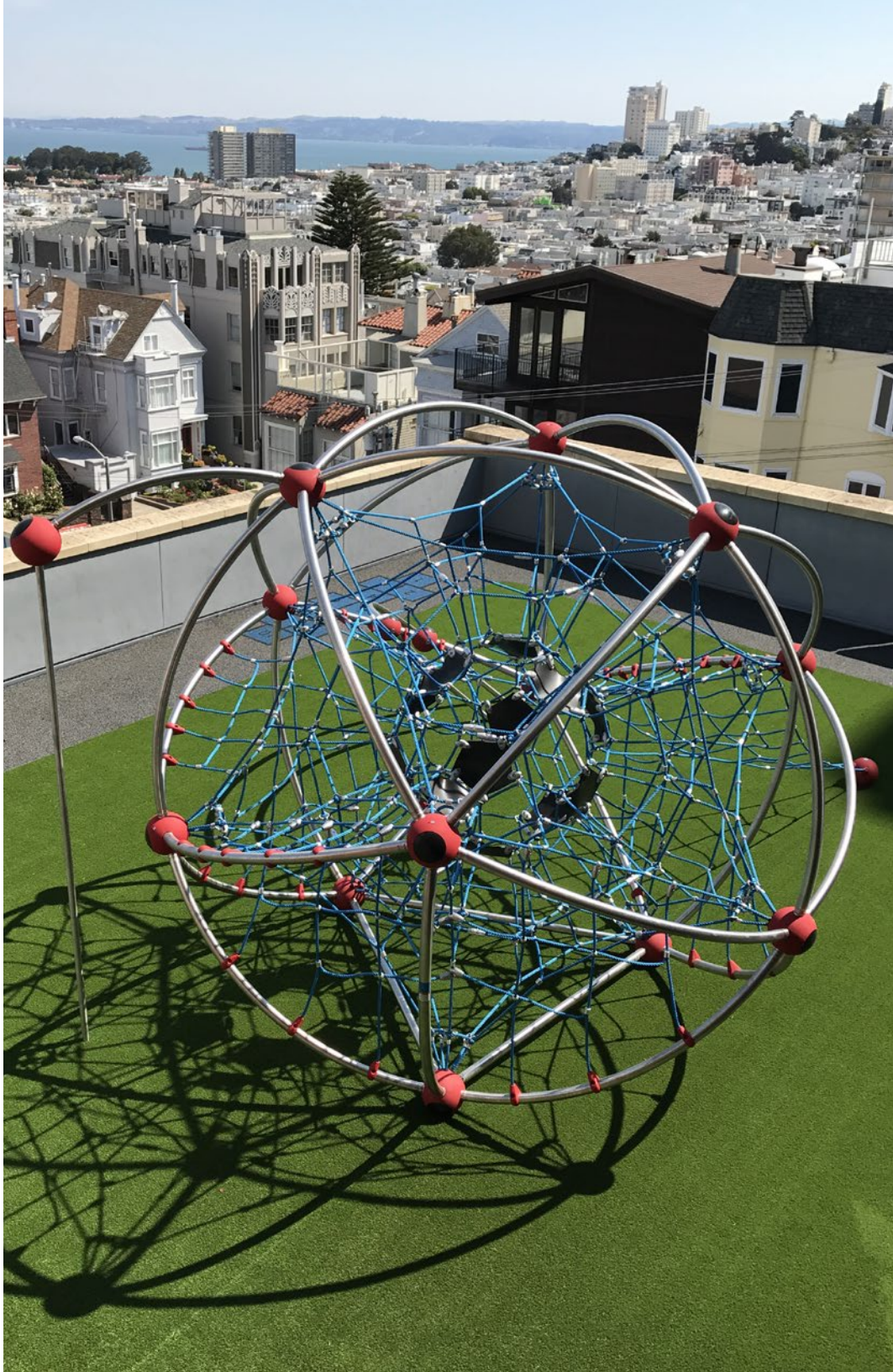
The heart of the roof playground is the Cosmo, the first round rope play structure with a three-dimensional climbing net worldwide by

Berliner Seilfabrik. The external framework of the three-dimensional climbing net consists of curved stainless steel tubes. All tensioning points are equipped with the patented AstemTT tensioning system, which is located inside the aluminium balls, which both serve as connecting elements for the individual pipes and facilitate maintenance. All technical connecting elements such as eyelets, loops, thimbles and hooks are also located inside the ball and are thus completely banished from the children's play area.

Every roof installation requires an individual solution depending on construction, material and also play equipment. The usual foundation work for play equipment on the ground is generally not possible on roofs. At the beginning of such a construction project, the central question is therefore always to what extent the existing structure of a roof can be used. Is a direct, constructive connection to the existing roof structure possible or must damage to the roof cladding be avoided? The development of various roof installation methods by the Berliner Creative Centre of Berliner Seilfabrik, comprising architects, designers, landscape planners and engineers, enables the installation of play equipment without deep concrete foundations and thus independently of whether the roof skin may be damaged.

The challenge in San Francisco, for example, was to install the facility safely on the roof without deep foundations. For this reason, the foundation balls of the tubular frame were screwed onto steel floor slabs with spacer sleeves of the same thickness as the fall protection floor. The slabs could then be anchored directly into the existing reinforced concrete ceiling. Since the waterproofing of the roof was not applied to the supporting layer, the existing drainage could continue to be used.

The San Francisco three-dimensional net structure "above the rooftops" shows that roof installations, especially of rope play equipment, are an excellent solution for creating the badly needed spaces for play and exercise in previously unused areas and thus turning break time into a favourite subject.



Safety Requirements for Rope Play Equipment

Emotions run high when it comes to safety. Terms such as fear, trust and risk proclivity are closely linked to an individual´s personal need for safety. This is especially the case when it comes to our beloved children. It is no wonder that the topic of safety in public children´s playgrounds and school playgrounds is often the subject of heated discussions between play equipment manufacturers, playground operators, playground inspectors and also among parents and teachers. It is not unusual to hear phrases such as "They could fall to the ground from the very top.", or "They could get their heads stuck in it."

A look at the playground standard helps to achieve more objectivity when addressing this emotional topic. The DIN EN 1176 standard specifies safety requirements for playground equipment. The current version of this standard (DIN EN 1176:2008) has been in force since summer 2017, so all playground equipment in publicly accessible playgrounds must meet these requirements. This includes playgrounds in daycare centres and schools. In essence, two issues are at stake:

1. What level of safety is necessary to protect children and young people from unforeseeable dangers?

2. How much risk can there be in order for pupils to have fun and enjoy playing, train self-assured behaviour and develop a sense of danger?

At this point, it becomes clear that the balance between safety and benefits in public and school playgrounds tolerates a certain level of danger to which young people are exposed when playing on the equipment, "because it satisfies a basic human need and gives children the opportunity to learn about dangers and their consequences in a controlled environment" (cf. DIN EN 1176). Therefore, while the standard sets clear criteria to protect children from accidents involving serious injuries, minor injuries such as bruises, compressions or fractures are acceptable within the framework of risk acceptance.

Technical committees with in the DIN Institutes für Normung e. V. are responsible for drawing up the standards. The playground equipment working committee is made up of the various parties of users, the public sector, consumer protection and industry. Berliner Seilfabrik has been a member of the standard committee for many years and, thanks to its expertise in the field of rope play equipment, contributed to the drafting of the standard "Additional special safety requirements and test procedures for three-dimensional nets" (DIN EN 1176-11). In concrete terms, this means, climbing equipment that consists of ropes in a geometric, three-dimensional arrangement and is therefore flexible. Such three-dimensional rope nets can be found, for example, in classic three-dimensional net play equipment with an external frame or central mast, in rope play houses or in custom-made projects by Berliner.

Since a child is always obliged to search for at least three safety points in order to move forward when climbing a three-dimensional net, it can be assumed that the safety level is higher than, for example, when standing freely on a surface. "Our highest rope play equipment is a little over 13 metres high. Of course, it looks dangerous when you look through the meshes from above," says Karl Köhler, managing owner of Berliner Seilfabrik. "However, this is exactly what makes the risk visible to the user and makes him act with greater caution." This is therefore paradoxical: Dangerous-looking play equipment influences the user's behaviour in such a way that the risk of serious injury is reduced by adopting a more cautious approach.

In addition, the mesh size of a three-dimensional net is an important factor in guaranteeing the necessary safety of rope play equipment. The central finding here is that involuntary falling through the meshes is not possible if the mesh is a suitable size, since a fall would be hindered by reflex arm movements. Here the balance between safety and risk becomes particularly clear, as the mesh size becomes the decisive factor in preventing serious injuries. At the same time, however, its selection should be based on an acceptable level of risk. Karl Köhler also supports this approach: "Compliance with safety standards ensures that the child can play with maximum safety. But it is very important that there is a residual risk, for example of light abrasions. Especially in times of smartphones and the like, we see it as a challenge to create an incentive to encourage the kids to move away from their screens towards more physical exercise when playing."

The mesh widths are determined on the basis of the average sizes and gripping widths of the users. The maximum dimension that may fit into the cell structure has been defined as a cylinder with a height of 180 cm and a diameter of 65 cm. The cylinder must not be able to fall vertically through the three-dimensional net, unless the impact surface consists of a fall protection system for the highest possible position of the cylinder. In addition, the maximum drop height of 3 m must be adhered to. Overlapping planar nets are an exception to this. Here the maximum mesh size is 42 cm if the nets are arranged more than one metre above each other.

After all, the law of gravity is decisive for the third set of safety-related knowledge obtained from using three-dimensional nets. Since falls from inclined outer contours of net pyramids do not take place outwards but vertically downwards, constructive parts outside the three-dimensional net are of no relevance. Accordingly, the free fall height in three-dimensional nets corresponds to the

distance between the highest foot position and the floor, if an unhindered fall in a vertical direction to the floor is possible at the corresponding point.
In addition to the findings presented here for evaluation, the angle of converging parts in playground equipment plays a decisive role in terms of safety. In principle, an angle of less than 55° is considered unsafe at a height of more than 60 cm. It may be a catching point and therefore does not comply with the standard. This safety requirement has some influence on the shape of rope play equipment. Both the framework and the three-dimensional net are constructed on the basis of platonic shapes, so that no angles of less than 60° can occur within the cells. Smaller angles can only be found near the tensioning points, where they run to a vanishing point. "In order to ensure appropriate safety at these points as well, we install a small safety net for converging net parts. This makes it impossible to fall into the corner," says Jörg Prechter, production manager and quality manager at Berliner and member of the standard committee for playground equipment and playground inspectors.

Finally, it should be noted that the continuous further development of the requirements for rope play equipment within the framework of the standards committee has ensured that there are no serious accidents in connection with rope play equipment.

Berliner Seilfabrik – The Company

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Our claim means a lot to us. It defines the way we build playgrounds and the way we think. Now, with almost 50 years of experience in the playground equipment industry, combined with our extensive rope manufacturing knowledge we have designed a variety of products for unique playground landscapes which comply with all international safety standards. Our playground landscapes for indoor and outdoor are instantly recognisable, due to the combination of extensive rope design development and creative ideas.

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