

DESIGN OF
A MODULAR PLAYGROUND EQUIPMENT SYSTEM
FOR PHYSICALLY (MOTOR) DISABLED CHILDREN

A THESIS SUBMITTED TO
THE DEPARTMENT OF INTERIOR ARCHITECTURE AND
ENVIRONMENTAL DESIGN
AND INSTITUTE OF FINE ARTS OF BILKENT UNIVERSITY
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF
MASTER OF FINE ARTS

By

Yaprak Savut Sağdıç

February, 1993

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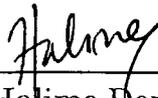
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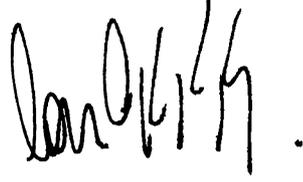
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I certify that I have read this thesis and in my opinion it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Fine Arts.



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ABSTRACT

DESIGN OF A MODULAR PLAYGROUND EQUIPMENT SYSTEM FOR PHYSICALLY (MOTOR) DISABLED CHILDREN

Yaprak Savut Sađdıç

M.F.A. in

Interior Architecture and Environmental Design

Supervisor: Assist. Prof. Dr. Halime Demirkan

February, 1993

The elements of a medium for gathering the able and disable bodied children are examined within the scope of this study. Starting from the importance of play for children, the characteristics and the properties of the middle childhood are chosen as the domain. The play spaces and the playgrounds including the equipment are examined. The types of disabilities with special emphasize on the physically disabled ones are investigated. The motor type of disabled ones are specified as the potential user group. Besides, the assistive devices and rehabilitative apparatus used by the physically (motor) disabled children are pointed out. Finally, a modular playground equipment system is designed for the physically disabled children, which can serve both as a rehabilitation apparatus and a center for gathering all children in a playground to enjoy themselves.

Keywords: Playground Equipment, Disabled/Handicapped People, Play, Child.

ÖZET

FİZİKSEL (MOTOR) ÖZÜRLÜ ÇOCUKLAR İÇİN MODÜLER BİR OYUN BAHÇESİ DONATI SİSTEMİ TASARIMI

Yaprak Savut Sağdıç

İç Mimarlık ve Çevre Tasarımı Bölümü

Yüksek Lisans

Tez Yöneticisi: Yrd. Doç. Dr. Halime Demirkan

Şubat, 1993

Bu çalışmada, normal çocuklarla özürlü çocukların bir araya gelebilecekleri bir ortamın elemanları incelenmiştir. Oyunun çocuklar için öneminden başlayarak, orta çocukluk dönemi özel ilgi alanı olarak seçilmiştir. Oyun alanları ve elemanlarıyla beraber oyun bahçeleri incelenmiştir. Özürlülük çeşitleri ve fiziksel özürlülük çeşitleri belirtilmiş ve motor özürlüler kullanıcı gurubu olarak özelleştirilmiştir. Bunlara ilave olarak, fiziksel (motor) özürlü çocukların kullandıkları yardımcı aletler ve tedavide kullanılan ekipmanlara işaret edilmiştir. Sonuç olarak, fiziksel (motor) özürlü çocuklar için hem tedavi ekipmanı olarak, hem de bütün çocukların biraraya gelip eğlenebilecekleri, her oyun bahçesine konulabilecek modüler bir oyun bahçesi donatısı sistemi tasarlanmıştır.

Anahtar sözcükler: Oyun Bahçesi Donatıları, Özürlü İnsanlar, Oyun, Çocuk.

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TABLE OF CONTENTS

	Page
Signature Page	ii
Abstract	iii
Özet	iv
Acknowledgements	v
Table of Contents	vi
List of Tables	ix
List of Figures	x
1. INTRODUCTION	1
1.1. Problem	1
1.2. Object and Methodology	2
1.3. Structure of Thesis	5
2. PLAY	7
2.1. Definition of 'Play'	8
2.1.1. Varieties of Play	9
2.1.2. Role of Play in Development	10
2.1.3. Quality of Play	12
2.2. Characteristics and Properties of the Potential Age Group	13
2.2.1. Physical Development in Middle Childhood	17
2.2.2. Cognitive Development in Middle Childhood	18
2.2.3. Social and Emotional Development in Middle Childhood	18
3. PLAYGROUND	21
3.1. Play spaces	22
3.1.1. Effects of Play Spaces from Developmental Approaches	

-----	22
3.1.2. Quality of Play Spaces -----	26
3.1.3. Types of Play Spaces -----	27
3.2. Playgrounds (As the Most Popular Play Spaces)	29
3.2.1. Types of Playgrounds -----	29
3.2.2. Activities on Playgrounds -----	31
3.3. Equipment (As Basic Cells of any Playground) -----	33
3.3.1. General Properties of Mostly Used Playground Equipment -----	34
3.3.2. Selecting a Playground Equipment -----	43
3.3.3. Role of Colour -----	46
3.3.4. Safety Factor -----	47
4. DISABLED CHILDREN	51
4.1. Definition of Terms -----	52
4.2. Types of Disabilities -----	54
4.2.1. Types of Physical Disabilities -----	55
4.2.2. Assistive Devices Used by the Physically Disabled Children -----	59
4.2.3. Equipment Used for the Rehabilitation of the Physically Disabled Children -----	65
4.3. Role of Playgrounds in Rehabilitation of Physically Disabled Children -----	69
5. DESIGN OF A MODULAR PLAYGROUND EQUIPMENT SYSTEM FOR PHYSICALLY DISABLED CHILDREN	72
5.1. Necessary Dimensions -----	73
5.1.1. Necessary Anthropometric Dimensions -----	73
5.1.2. Related Dimensions of Elements in System -----	84
5.2. Material -----	93
5.2.1. Surfacing of Ground Floor -----	93
5.2.2. Materials Used in System -----	97
5.3. Assembling the System -----	100

6. CONCLUSION	109
GLOSSARY	117
REFERENCES	118

LIST OF TABLES

	Page
Table 2.1. Stage Theories of Play: Piaget and Parten	9
Table 2.2. Milestones of Motor Development During Early Childhood and Middle Childhood	16
Table 2.3 Piaget's Stages of Cognitive Development	16
Table 3.1. The Matrix Chart of Activities Carried out by Children on Playgrounds	32

LIST OF FIGURES

	Page
Figure 2.1. Graph of Major Types of Postnatal Growth of Body	14
Figure 2.2. Relative Growth Rate	14
Figure 3.1. An Example for Climbing Equipment	36
Figure 3.2. Two of Balance Beams	38
Figure 3.3. An Example for the See-saw	39
Figure 3.4. Badly Positioned and Irrelevant Pipes	41
Figure 3.5. A Large Multi-play Structure at Frankfurt Airport	42
Figure 4.1. Diagram of the Spinal Cord	55
Figure 4.2. Physical Problems Associated with Lesions	56
Figure 4.3. An example of Quad Cane	60
Figure 4.4. An example of Cane	60
Figure 4.5. An example of Auxiliary Crutch	60
Figure 4.6. An example of Non-auxiliary Crutch	60
Figure 4.7. An example of Wheelchair Used in Inner Spaces	61
Figure 4.8. An example of Wheelchair Used in Outer Spaces	62
Figure 4.9. An example of Walkers	62
Figure 4.10. A Spastic Child Using Orthoses	63
Figure 4.11. A Baby Using Orthoses	64
Figure 4.12. A 7 Years Old Child Using Ladder Chair	64
Figure 4.13. A 6 Years Old Child Practising with Ladder on Wall	66
Figure 4.14. An example of See-saw or Swing Board	66
Figure 4.15. A Wooden Aisle That Helps Children Who can not Walk in Balance	68
Figure 4.16. Two Different Stairs at One Equipment	68
Figure 4.17. An Example of Slide for Physical Disabled Children	70
Figure 5.1. Dimensions of 5 % of 7-year-olds	75
Figure 5.2. Dimensions of 95 % of 7-year-olds	76
Figure 5.3. Dimensions of 5 % of 12-year-olds	77
Figure 5.4. Dimensions of 95 % of 12-year-olds	78
Figure 5.5. The Grip Diameters of 7-year-olds	79

Figure 5.6. The Grip Diameters of 12-year-olds	79
Figure 5.7. The Corrections of Physically Disabled Children (6-9 years old)	81
Figure 5.8. The Corrections of Physically Disabled Children (9-12 years old)	82
Figure 5.9. Dimensions of Stairs for Disabled People	83
Figure 5.10. Dimensions of Openings and Closed Zones on Platforms	83
Figure 5.11. The Necessary Angle of Ramps for Disabled People	83
Figure 5.12. Types of Platform A and Assembling Combinations	85
Figure 5.13. Platform B and 3 Possibilities of Turning Angles	86
Figure 5.14. Different Usages of Platform A	88
Figure 5.15. Different Angles That can be Created by Platform B	89
Figure 5.16. Section of Handrail for Smaller Children and Older Children	90
Figure 5.17. Orthographic Views of Vertical Elements (Pipes)	91
Figure 5-18. Handrails Used as Vertical Ladder	92
Figure 5.19. The Layers under Tufted Carpet in Order to Improve Impact Absorbency.....	96
Figure 5.20. Sections of Fiberglass Barriers and Iron Sheet Platforms	99
Figure 5.21. Section of a Rubber Based Painted Pipes Used as Handrail's Material	99
Figure 5.22. The Sectional Drawing of Vertical Elements, Pipes	100
Figure 5.23. 3 Dimensional View of Button	101
Figure 5.24. The Working System of Type A Connectors	101
Figure 5.25. The Sectional Detail of Assembling the Handrails with Pipes	102
Figure 5.26. A 3D Drawing of One of the Equipment	103
Figure 5.27. Top View of Figure 5.26	104
Figure 5.28. One of the Sample Plans of Possible Configurations	105
Figure 5.29. A Possible 3D Drawing of Figure 5.28	106
Figure 5.30. An Other Possible Plan of Configurations	107
Figure 5.31. An Other Example of Plans	108

1. INTRODUCTION

1.1. Problem

Huchingson (1989) mentioned that all of us are handicapped in one way or another. Some of us are too big for an environment designed for an average person. Some are left-handed and given scissors with many other variety of equipment designed for the right-handed people. Some lack the sensory-motor skills to adapt to activities in which they wish to participate.

Many years ago, this important factor was not taken into consideration, but after the World War II., the ergonomic studies being developed and most of the solution are found for these handicaps. Both the equipment and the places (either interior or exterior) are begun to be designed according to the anthropometric dimensions of the people who are going to use them. Moreover; the users also become more conscious of using the right equipment and living in the right places as possible as they can. All the effort to match the right equipment to the right person is a part of designers' world and most of them are dealing with the normal people, who are healthy and have no absence of some body parts.

On the other hand, there is an other group of people whom we called as 'disabled'. In many societies, the disabled people are still discriminated and accepted as problematic 'creatures', because being a handicapped. In fact, these people are in handicap because the environment they have to live is not suitable for their 'different abilities'. The special part of this group is the disabled children who can not be able to control some members of their bodies in a way or another. The disabled children are in need of more care than the any other group of people, because there are 3,161,000 disabled people living in Turkey at the age of 0 - 18 years old

and all these people are the potential of our future. From this point of view, the healthier development (physical, emotional and intellectual) of the disabled children becomes more and more important. When the point is that, there must be something to be done for these people by the designers.

1.2. Object and Methodology of the Study

Each of us can become handicapped in the situations when we are found in an environment which is not suitable to our physical and psychological properties. From this perspective, the disabled people should not be accepted as handicaps and passed on, but their problems should be solved. They should not be separated from the society but should be given opportunities to engage and become a part of the society.

Most of the disabilities are results of diseases or accidents. For example; strokes may produce paralysis and loss of speech. Certain nerve diseases may result in blindness, deafness and lack of coordination. Cerebral palsy is a disorder that damages the brain before, during or after birth. Depending on what part of the brain is damaged, cerebral palsy can cause speech problems, muscular weakness, or involuntary movements of the arms and legs. It also can produce mental retardation. Accidents cause a wide range of impairment, including spinal damage, and loss of limbs.

In most of the societies, the disabled people are seen as aliens and the healthier people do not want to be in contact with them. The worst point is that the separation begins in the childhood period, because many of disabilities happens during this period. Although many people think that the disabled people are burdens of the society, with proper motivation and special training, even severely handicapped people can lead productive and fulfilling lives.

Many famous people have overcome their handicaps to make important contributions to mankind. The English poet John Milton was blind when

he wrote his epic master piece, *Paradise Lost*. The great German composer Ludwig van Beethoven wrote much of his finest music after he became deaf. Franklin D. Roosevelt, paralysed in both legs by polio, became President of United States. Helen Keller became blind, deaf and mute before she was two years old, but she learned to read, write and speak. She devoted her life to helping the deaf and the blind. In other words, in order to overcome handicap, people must learn to live with their disability and desire to be independent.

This projects point is that if the disabled children can be provided to live in the same conditions of normal children, two goals will be achieved as a result. One of them is that the disabled children feel themselves as a part of society and are going to be grown up as differently abled but productive people. The second goal is that the normal children are going to grown up as normal adults who are aware of the problems of handicapped people and accept them as a part of society. Both sides will learn how to behave towards each other. In order to achieve these two goals, the children should be gathered in a medium that they would like to be in and would never be shame of their being different from each other.

At first step, the characteristics and properties of children should be examined and a literature research has been done about child development. The children have been studied from the physical, cognitive, social and emotional developments' point of views. The periods of childhood are compared to each other in order to find a clue for an activity and a place to gather all the children, willingly.

The importance of play is the second step to be examined in child's development, since everyone is the aware of the fact that play is the best medium for the healthier development of all children. The authorities have catagorized many types of play and these groups are compared to each other in order to point out which types of plays should be aimed as the activity to interact the children with each other. Besides the type of play, the quality of play is also very important, since children learn through playing more than any systematic school education. Since play is

a very important factor for children and they learn to be socialized while playing, play can be used as a reason for gathering the normal and disabled children.

The third point is researching the answer of where children can play, because play and play spaces can not be distinguished from each other. Play space is a general term that is used for every place where children play on and each play space effect child development from different points of view. The quality of play space is as important as the quality of play if the children are wanted to possess better play opportunities. It should not be forgotten that providing the quality of play space has a close relationship with the type of play space, because the play spaces are classified according to the conditions they are found in.

Playgrounds have a special property among the other play spaces, since they have different types with respect to the aims for which they are build up. The activities carried out by children on playgrounds are remarkable since they determine the type and the quality of each equipment which is going to be placed. The problem is that disabled children can not make use of the equipment found in many playgrounds. However, in order to socialize the disabled children and gather them with the abled ones, one should not limit them and close in an unpleasant environment. Being careful with the selection of the right equipment in right place can easily solve this problem, with the addition of using suitable colours to motivate all children.

From this perspective, the equipment of the playground is very important, because most of the equipment produced in the market have different properties and the suitability of each equipment to the disabled children should be researched. Eventhough, the normal children can manage to do things and make use of the equipment easier than the disabled ones, the dimensional information and other properties of disabled children becomes more important.

After determining the subject and place in order to create the medium according to the aim of this project, it is obvious that all of the disabled

children can not be put together, because of different disabilities causing different characteristics. The types of disabilities is researched as the fourth point, with respect to the reasons and rehabilitation periods in order to live like the able bodied people. There are also some assistive devices, which are used by most of disabled people, are examined at the Othosis and Prosthesis Polyclinic of Prof. Dr. Hidayet Erdem. At this Polyclinic, also the training methodology is researched and the rehabilitations periods are established. The specifically designed equipment are determined in order to design the right playground equipment system with a rehabilitation value, after the observations made at Ankara Rehabilitation Center and the Polyclinic stated before.

All these examinations and researches are done in order to find a good way to gather the able bodied and disabled children and be sensitive to the problems of each other for better living conditions. Children will learn many things about each other and accept to live in reconciliation, without any kind of discrimination.

1.3. Structure of the Thesis

There are four main chapters which give the information about the researches and the inferences about the related subjects excluding the introduction and conclusion chapters. First chapter is the introduction part of the thesis and the sixth chapter is the conclusion part.

In the second chapter, the meaning of play is discussed besides being a term in dictionary, and the varieties of play are examined from two authorities' point of view. Besides the role of play and the criteria, that must be taken into consideration for a high quality of play in child development are ~~with~~ in short terms, they are analysed from the perspectives of psychoanalytic, learning and cognitive theories. The characteristics and the properties of the age groups are examined in order to decide on the potential age group, and finally, physical, cognitive, social and emotional development of the potential age group are stated.

In the third chapter, the important role of play spaces with respect to the environmental, physiological, creative and educational developments, and social education of the children are explained. The types of play spaces according to the environmental position of the lands and the quality of play spaces are examined. The types of playgrounds, as the most popular play spaces from various points of view are stated and the activities that take place within each playground are specified. The equipment found on the playgrounds, and the required specifications of the equipment are examined. And finally, the role of colour and ways of keeping safety in playgrounds and equipment are mentioned.

In the fourth chapter, definition of terms, (impairment, disability, and handicap) which are related to differently abled people are stated. The type of disabilities are examined later and the emphasis is given to the physical disabilities. The six types of physical disabilities are the subjects; namely, paraplegia, hemiplegia, quadriplegia, amputation, visual-impairment and finally, hearing-impairment. The assistive devices used by the disabled people are examined in detail, since they determine the related measurements of the playground equipment. The role of playgrounds in rehabilitation are discussed as the last issue of the chapter.

In the fifth chapter, the necessary anthropometric dimensions and the measurements of generally used assistive devices are stated which determine the dimensions of the designed modules. The material of the elements used in the system are examined under the second subtitle, and the colour combinations are stated. The assembling process and recommended combinations are the last subtitle of this chapter.

2. PLAY

Although the importance of play has been recognized for many years, its functions have not been understood fully in the wide range of society. As a general belief, education has a superiority and education through play has a lower rank. There is a familiar saying that "It should be better studying instead of playing!". On the other hand, it is a fact that play is a process by which children learn and come to terms with social and physical environments (Heseltine & Holborn 1987).

In the United Nations Declaration of the Child's Right to Play, which was broadcasted in 1959, Principle 7 states:

The child shall have full opportunity for play and recreation which shall be directed to the same purpose as education; society and public authorities shall endeavour to promote the enjoyment of that right.

After 20 years, in 1979, the Malta Declaration of Child's Right to Play which was formulated by the International Association for the Child's Right to Play (IPA), as part of the International Year of the Child declared that;

Play, along with the basic needs of nutrition, health, shelter and education, is vital for development of the potential of all the children.

In this chapter, it is going to be discussed what play means besides being a term in dictionary. Piaget's and Parten's, who are accepted as authorities in child development, point of views on the varieties of play will be examined. Practice, fantasy and sociodrama plays being at one side, and solitary, parallel, associative and cooperative types on the other. Besides, the role of play, and the criteria, that should be taken into consideration for a high quality of play in child development will be told in short terms from the perspectives of psychoanalytic, learning and

cognitive theories. The characteristics and the properties of the age groups will be examined in order to decide on the potential age group. Finally, physical, cognitive, social and emotional development of the potential age group will be stated.

2.1. Definition of 'Play'

'Play' is one of the words, which have more than one meaning, those are found in English, but in this work it will be accepted as not only a word with one of the meanings of;

play 1 something done to amuse oneself; fun; sport; recreation. 2 a turn move or act in a game. 3 act of carrying on or playing a game. 4 manner or style of carrying on or playing a game. 5 story written for or presented as a dramatic or theatrical performance; drama. 6 a dramatic or theatrical performance, as on the stage. 7 action or dealing of a specified kind. 8 activity; operation; working. 9 light, quick movement or change. 10 freedom or opportunity for action; scope of activity. 11 free or unimpeded movement. 12 the proper motion of a piece of mechanism or of a part of the living body. 13 gambling. Etc. (Barnhart, 1974)

but will also be a very important part of any child's physical and psychological development.

The research done on the children for many years let human be aware of the reality that children are in need of playing as much as all the other important necessities as a part of growing up. Some of the researchers accepted 'play' as a spontaneous, pleasurable activity (Bruner, 1972; Garvey, 1977; Rubin, Fein & Vandenberg, 1983).

In fact, the definition of play depends on the varieties which change according to children's developmental stages, and the quality which deals with time, change, challenge, suitability and cooperation. These subjects will be examined during the next three subtitles with the addition of the role of play in child's development.

2.1.1. Varieties of Play

During the preschool period, a developmental progression can be described in the kinds of play most likely to occur (Piaget, 1963). From Piaget's point of view, the child first engages mainly in the practice play, later on develops symbolic play/fantasy play which can be classified as the individual plays. When children coordinate activities with others, it is called social pretended play/sociodramatic play. Finally, the last stage of development of play is the games with rules.

There is another theory which was advanced by Mildred Parten in 1932. Parten observed preschoolers as progressing from unoccupied behaviour through the stages of solitary, parallel, associative and cooperative play. The stage theories of Parten and of Piaget are stated in Table 2.1.

	Stage of Play	Description
PIAGET	Practice play	Repeated movements to consolidate, perfect, or elaborate a skill. Example: Going down a slide. (First, down the right way, feet first. Later, down backwards or head first.)
	Symbolic play	Play in which one thing stands for another. Example: Playing house. (Child uses play materials to represent some imaginary thing.)
	Games with rules	Play involving rules and competition between individuals or groups. Example: Hide-and-seek.
PARTEN	Solitary play	Child plays alone. Example: Child sits alone in the sandbox and fills pail with sand.
	Parallel play	Play in close proximity to other children but without interaction. Example: Two children sit next to each other in a sandbox, each filling a pail.
	Associative play	Children respond to each other during play but maintain separate goals. Example: Two children talked to each other while playing with sand in a sandbox.
	Cooperative play	Play is organized around joint activities. Example: Two children work together to build a sand castle

Table 2.1. Stage Theories of Play: Piaget and Parten
(From FOGEL, A. & MELSON, G. F. Child Development: Individual, Family, and Society. New York; West Publishing Company, 1988. p. 326)

Both of the theories emphasize that complex forms of play emerge from the simple forms. It can not be denied that social play appears later than both parallel and practice play, and with age, play that involves interaction among children increases while non-interactive play declines (Johnson and Ershler, 1981). During the preschool years, social play that involves role coordination, pretend activities, development of common theme, and turn taking frequently increases (Parten, 1932; Smith & Connolly, 1972; Rubin & Maioni, 1975; Rubin & Pepler, 1980).

The type of play which is going to be examined in this work will be the practice play (according to Piaget's theory), since the child have to acquire many practices in order to manage a special kind of movement. On the other hand from Parten's point of view, it is consistent with the associative play because of the child's being in need of respond to each other during play while trying to achieve separate goals.

2.1.2. Role of Play in Development

Heseltine and Holborn (1987) mention that when we compare the children who have the opportunities for good quality play to the children who are deprived of play opportunities, the first group appear to develop a greater creativity, a greater flexibility of approach to problem solving, to have better social skills and to be physically healthier than the second group.

Fogel and Melson (1988) emphasize three theories, related to the role of play in development of children, which can be named as *psychoanalytic theory*, *learning theory*, and *cognitive theory*. If these headlines should be detailed, it can begin from psychoanalytic point of view.

From this perspective young children have the opportunity to act out conflicts and fears in a safe environment, while they are playing. In this way, a boy can express aggressive impulses without fear of punishment, when he experiences an *Oedipal* rivalry with his father. In the game of hide-and-seek fear of abandonment can be experienced and be overcome in

small manageable doses. The works done within this view of social play give the key of developing the techniques of play therapy. In these therapies, young children who have experienced a trauma, like child abuse, are encouraged to express their feelings with playthings.

As an other point, emphasized by psychoanalytic theory, is that the pretended themes of fantasy play let the young child satisfy unrealized desires and overcome frustrations (Fogel & Melson, 1988). The parental roles taken place in a playing house is a good example to the stated situation, since the children become aware of the fact that they are not ready to assume. Finally, since children make-up play themselves and are not imposed, it provides opportunities to build self-esteem. The children can make-up play episodes those are within their capacities and those show off their strengths.

The second theory is learning theory, which should be taken into consideration, because it stresses that play can lead children to reinforce each other's behaviour. Preschoolers' playing with the same-sex peers is a good example of this theory (La Feriere, Strayer & Gauthier, 1984). Generally more positive exchanges and less conflict occur in same-sex play than in mixed-sex peer play (Langlois, Gottfried & Seay, 1973; Jacklin & Maccoby, 1978; Lamb & Roopnarine, 1979).

Social learning theorists mention that social play allow children to observe their peers as models and to imitate them. Imitation of peers is thought to be a good source of learning, since less advanced children can learn more from watching moderately more advanced models than from watching models whose behaviour is much more advanced, like the adults. This is because of children's inability to imitate the behaviours those are completely different from their own skills.

The third and the final theory is the cognitive one which has a perspective to see the social play as a natural training ground for decreasing egocentrism, prompting awareness of the feelings of others, and providing

opportunities for creativity, empathy and pro-social behaviour (Zahn-Waxler, Iannotti & Chapman, 1982).

Although children with already developed perspective-taking and empathic skills may gravitate to social play where they can use these abilities (Hartup, 1983), it is evident that social play, particularly social fantasy play, promotes interpersonal understanding (Selman, 1976) enhanced problem solving (Sylva, Bruner & Genova, 1976; Vandenberg, 1980) and creative thinking in young children (Dansky & Silverman, 1973, 1975).

In other words, because of the developmental significance of social play from a variety of perspectives, there is a concern about young children between three and five years of age in participating regularly in some kind of peer group. Some children are sought out by the others and are frequently involved in social play while others are ignored or actively rejected by their peers.

2.1.3. Quality of Play

Quality of play is important as much as quality of education that is looked for everywhere by the parents, but most of them are not aware of the fact that children learn through playing more than through any systematic school education. This is the basic reason for stating some criteria those should be taken into consideration while directing the children's play.

The quality of play depends on five criteria (Heseltine & Holborn, 1987), which can be named as *time*, *change*, *challenges*, *suitability* and *cooperation*. In other words;

Time - the longer time a non-repetitive play activity takes and attracts the child's attention, the better the play quality is.

Change - the greater the capacity of play space and the equipment to be changed, and the more possibilities are offered to the child, the greater the

play value is.

Challenge - the more opportunities the play space has to offer an increasing level of challenges to children, the better the play value is.

Suitability - the more the play space can match different ages and needs at the right time, the better that play value is.

Cooperation - the more the play space can stimulate cooperation and group play, the greater the play value is .

Until here, the varieties of play and the role of play during the development of child has tried to be explained and the points, which should be taken into consideration while providing the opportunity of playing to children, has been stated. However, the characteristics and properties of different age groups must also be paid attention for healthier solutions. The characteristics and properties of potential age group will be determined under the next title.

2.2. Characteristics and Properties of the Potential Age Group

Since the child grows up as the time passes, his needs and longing change according to physical and psychological development. It cannot be expected all the children to have the same pleasure, performance and properties. Therefore, it is important to determine a specific age group which is going to be worked on.

The researchers studying development of children, generally divide the childhood period into four groups (Clarke-Stewart & Friedman, 1987; Fogel & Melson, 1988); infancy, early childhood/young child (preschool period), middle childhood, adolescence. During each of these periods, different parts of the body reaches maturity and this is called as *asynchronous growth* and is shown on the Figure 2.1.

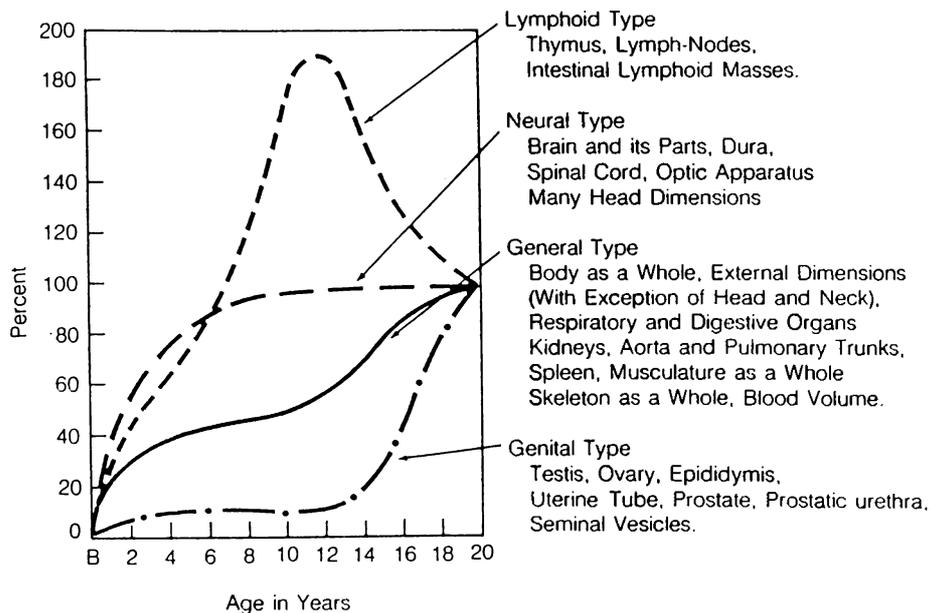


Figure 2.1. Graph of Major Types of Postnatal Growth of Body.
 (From FOGEL, A. & MELSON, G. F. Child Development: Individual, Family, and Society. New York; West Publishing Company, 1988. p. 343)

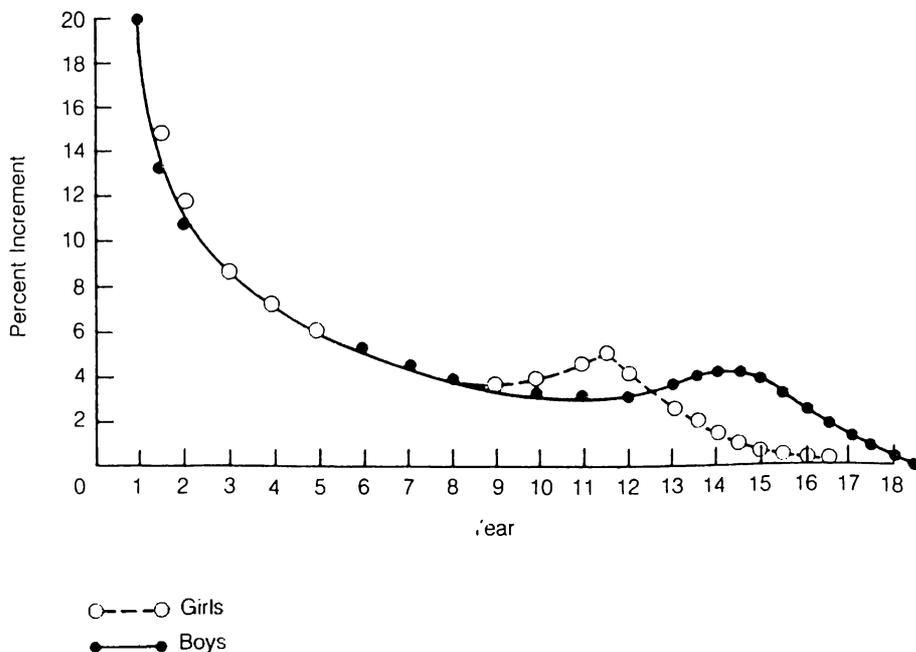


Figure 2.2. Relative Growth Rate.
 (From FOGEL, A. & MELSON, G. F. Child Development: Individual, Family, and Society. New York; West Publishing Company, 1988. p. 343)

The brain, skull, eyes and ears grow slowly and most of the growth in the head occurs pre-natally and in infancy. The sex organs are formed pre-natally and grow little before the onset of puberty (Tanner, 1970). On the other hand, the lymph system, a network of vessels carrying lymph or tissue fluid from tissues into veins, grows more rapidly during middle childhood than at any other time.

As it can be followed on the Figure 2.2, growth rates for boys and girls are not the same, from the end of the age of 8 through the beginning of adolescence period (nearly 13 years old). During this time girls' growth rate is higher than the boys' and by the age of 13 boys' growth rate becomes higher until the age of 18.

Although changes in height and weight are mostly seen, the best indicator of physical growth is skeletal maturity or bone age, which is measured by the extend of hardening of the bones (called *ossification*). The growth of the special regions (called *epiphyses*) cause the lengthening of arms and legs. Height is correlated closely with rate of ossification of the epiphyses.

Besides these changes in height and body weight, children are developing new abilities to use their extra capacities. Boys and girls becoming more skilled in many aspects of motor behaviour during childhood as shown in Table 2.2.

The stages those are shown on Table 2.3 are Piaget's stages of cognitive development. According to Piaget's theory, children are ready to adapt and to learn from the world by birth. They do not have to be taught deliberately to walk or that objects have to obey certain physical laws and people have to obey moral rules. In his opinion, children built-up knowledge as they mentally organize information in the environment.

Infants and children actively participate in their own development. They manipulate and explore their world, guided by their mental structures or mental representations of how things work (Clarke-Stewart & Friedman, 1987).

	Age	Selected Behaviours
Early Childhood	2 years	Walking rhythm stabilizes and becomes even Jumps crudely with 60 cm takeoff Will throw small ball 120-150 cm True running appears Can walk sideward and backward
	3 years	Can walk a line, heel to toe, 3 m long Can hop from two to three steps, on preferred foot Will walk balance beam for short distances Can throw a ball about 3 m
	4 years	Running with good form, leg-arm coordination apparent, can walk a line around periphery of a circle Skilful jumping is apparent Can walk balance beam
	5 years	Can broad-jump from 60-90 cm Can hop 15 m in an about 11 seconds Can balance on one foot for 4-6 seconds Can catch large playground ball bounced to him or her
	6 years	Girls superior in movement accuracy; boys superior in forceful, less complex acts. Skipping acquired. Throwing with proper weight shift and step.
	Middle Childhood	7 years
8 years		6 kg pressure on grip strength by both sexes. The number of games participated in both sexes greatest at this age. Can engage in alternate rhythmical hopping in 2-2, 2-3, 3-3 pattern.
9 years		Girls can throw a small ball 12 m. Girls can vertical jump 20 cm and boys 25 cm over their standing height-plus-reach. Boys can run 5 m per second. Boys can throw a small ball 21 m.
10 years		Can judge and intercept pathways of small balls thrown from a distance. Girls can run 5.1 m per second.
11 years		Standing broad jump of 1.5 m possible for boys, 15 cm less for girls.
12 years		Standing high jump of 90 cm possible.

Table 2.2. Milestones of Motor Development During Early Childhood and Middle Childhood.
(From Cratty, Bryant J., *Perceptual and Motor Development in Infants and Children*, 1979, p. 222)

Stage	Activities and achievements
Sensorimotor Birth to two years	Infants discover aspects of the world through their sensory impression, motor activities, and coordination of the two.
Pre-operational 2 to 7 years	Child can not yet think by operations, by manipulating and transforming information in basic and logical ways. They can think in images symbols and formal representations of objects and events.
Concreteoperational 7 to 11 years	Children can understand logical principles that apply to concrete, external objects.
Formaloperational Over 11 years	Adolescents and adults can think abstractly. Their thinking is not constrained by the given of the immediate situation but can work in probabilities and possibilities.

Table 2.3 Piaget's Stages of Cognitive Development.
(From CLARKE-STEWART, A. & FRIEDMAN, S. *Child Development: Infancy Through Adolescence*. New York; John Wiley and Sons, 1987, p. 19)

Qualitative changes, which take place in these mental structures occur for all children as they make shifts in their organization of knowledge in a particular order of stages.

When all of these informations are being got into consideration, the specific age group which will be examined in this project is the children of the middle childhood. This group has been chosen not only because of the skeletal growth takes place mostly at these ages, but the type of play they practice involves rehabilitation. During the middle childhood, children can be convinced more reasonably than the infants and preschoolers and children from 7 to 12 years can understand logical principles in achieving some certain movements.

In order to give more detailed information about the properties of the middle childhood, the characteristics of physical, cognitive, social and emotional development of this period will be examined in details under the next three subtitles.

2.2.1. Physical Development in Middle Childhood

As they enter middle childhood, boys and girls begin to grow more slowly than they did as younger children. They do not differ much in their physical shape and abilities during this period, although boys' forearms are stronger and girls' bodies are more flexible (Tanner, 1970) and both of them are more physically coordinated than they were in early childhood period. They can throw a ball twice as far as a preschooler, manage a screw-driver, hammer and saw, knit, draw, write, button buttons, ride a bicycle, climb ladders and trees, swim and dive, roller-skate, ice-skate, and skateboard, jump rope, play football, cards and jacks.

All these physical activities help children to develop master skills, raise their self-esteem and increase their competence in the eyes of others. Physically active children do their bodies a favour by developing muscle, keeping in fitness and preventing chronic diseases. Moreover, they also do

something for their minds as an old saying "Healthy mind in healthy body."

2.2.2. Cognitive development in Middle Childhood

Middle childhood is a period, both when children grow physically coordinated and become skilful, and when children mature cognitively. Thinking typical of early childhood is a blend of impressions, intuition and partial logic. As children enter school and middle childhood, the way of their thinking change and they begin to grasp the logical relations of things, the rules and constant properties. Piaget calls reasoning logically about objects as *concrete operational thought* (concrete comes from children's reasoning only about tangible things like milk and cookies and operational comes from children's performing mental manipulations on the things in an organized and systematic way.)

By the middle childhood, some important differences in physical size, strength and vulnerability, in play styles and preferences, in nurturance and aggression, and in cognitive abilities takes place. At the end of many researches, girls are found to have greater verbal abilities than boys. They learn to read sooner and by the end of middle childhood they understand and use language fluently than boys. In contrast, boys have more spatial abilities than girls.

2.2.3. Social and Emotional Development in Middle Childhood

The world of school-age children is full of family members, teachers and classmates, and the other children. Although children are involved in family life, they are independent enough to ride the school bus and play in their neighborhood. All the activities let children to develop social skills.

At this period most children have at least one friend. Friendship is important to children's development. Friends offer opportunities to learn social skills like communication, cooperation, and self-control, emotional and cognitive resources. They provide a context for developing intimacy;

and they serve as precursors of later relationships.

In school, the children work together with their friends. They collaborate in projects, tutor, teach one another, and compete as well. Out of school, they also work together, play games and sports, form clubs, go exploring, sit and talk, and share toys, arguments and fantasies.

With their improved motor skills and their burst of interest in other children, the middle childhood children find in games lots of fun. Some games are spontaneous and informal, some elaborate and formal; some require teams, some a partner. Games help children make the transition into the larger social world and they offer practice in following rules, in cooperating and competing; challenges to rise to and succeed at. As they get older, children get better in understanding others feelings, moods, intentions, and motives. As their social understanding increases, their social competence increases, too.

The way that children perceive themselves change in the middle childhood as they begin to recognize that they have unique qualifications. Children's self-esteem derives in part from others' opinions of them and in part from their mastery of developmental tasks, their performance in school, and their ability to deal with social situations. Some temperamental traits - activity level, intensity, adaptability, and rhythmicity - seem somewhat stable from infancy to early childhood. Across childhood and beyond, the most stable qualities are aggressiveness and sociability.

In the second chapter, the concept of play with respect to the children's development, and the characteristics of the potential age group has been determined. After examining the varieties of play, the most suitable type is decided as the practice play (according to Piaget) and the associative play (according to Parten). The role of play in development has been examined from the points of view of the psychoanalytic theory, the learning theory and the cognitive theory. It has been mentioned that the quality of play depends on time, change, challenge, suitability and

cooperation.

A comparison has been made between the early childhood/young child and middle childhood, under the title of characteristics and properties of the potential age group and as a result, the group of middle childhood has been chosen as the specified age group. While designing the equipment, the properties and characteristics of this age group will be taken into consideration.

3. PLAYGROUND

Piaget (1963) presented *assimilation* and *accommodation*, as two basic functions of human development. Assimilation occurs when a person sees a new situation in terms of something familiar (Dattner, 1969); when one acts in a new situation, as he/she has acted in the past situations. In other words, assimilation is the mastery of familiar or new skills by repetition and practice. It is the inner organization of experience.

Accommodation, on the other side, is complementary to assimilation. It occurs when variations in the environment demand a modification in one's pattern of behaviour. Accommodation occurs when a previously learned response fails to work in a new situation, and the organism modifies its response. When a balance occurs between these two functions, the development of intellect takes place. Piaget named this process as *play*.

On the other hand, 'play space' is as important as play and in most cases it can not be distinguished from play. Play space can be defined as;

an outdoor learning environment designed to support and suggest activities those are the essential part of the child's learning and development (social, emotional, cognitive and physical)' (Ericksen, 1980).

In this part, the important role of play spaces with respect to the environmental, physiological, creative and educational developments, and social education of the children will be explained. The types of play spaces according to the environmental position of the lands and the quality of play spaces will be discussed. The types of playgrounds, as the most popular play spaces from various points of view will be stated. The activities that take place with in each playground will be specified. The equipment found on the playgrounds, and the required specifications of

the equipment will be examined. And finally, the role of colour and ways of keeping safety in playgrounds and equipment will be mentioned.

3.1. Play Spaces

The children, generally, create their own play spaces according to the opportunities given to them. From this point of view, it can not be talked about the equality in playing conditions. In other words, a child playing inside of a house, can have completely different activities than a child playing outside. Especially the need to adventure leads the children to make use of every kind of play spaces, even a shelter that is created by themselves.

In this part, the effects of play spaces on child development will be examined, with the addition of quality of play spaces and the types of play spaces under the following subtitles.

3.1.1. Effects of Play Spaces on Child Development

In relation to play areas, five particular themes - environmental, physiological, creative and educational development, and social education - are developed for interpreting play (Heseltine & Holborn, 1987):

Environmental Development: Children receive information from the surrounding environment, in order to use it in their intellectual development. This information has the properties of life enhancement, providing a range of choices and experiences, and stimulating and challenging. By the implications of this information, children learn many things about texture, colour, sound, aesthetics, etc. These are the beneficial implications and must have to be developed. If a child is brought up in an environment of broken windows, he can not be expected to realise the reality of breaking windows is not permitted.

Von Herten (1971) mentions that where good planting took place and the

natural environment has retained, vandalism was less. On the other hand, a tree placed into an area of concrete can become an alien object and a child's natural exploration of the function and material can become the cause of its destruction.

In designing an environment, which is stimulating the provider faces severe problems, like the requirements of the child may not fit to the requirements of the adult community. Therefore, while designing a playground, even if it is a unit, the children's needs must be taken into consideration, instead of the adult's assumptions. Moreover; it must be accepted that a playground equipment may give many messages to the children as a part of the environmental education.

Physiological Development: Play is a part of a process by which children learn to develop some of the motor skills necessary for intellectual development. If movements are badly co-ordinated, there can be problems. Studies of movement patterns demonstrate how co-ordination increases with constant practice and recurrent use of play spaces equipment (Heseltine & Holborn, 1987). Sand play, toys and the natural environment all help with the process of fine tuning, which is especially necessary at the preschool age. Maher (1982) suggested that gross motor learning may be largely complete by 4 years of age, and it is important since a child younger than 5 years old should not be over-stressed.

Through the use of equipment which is, unpredictable, the child is helped to develop spatial and visual perception. The importance of learning through play is that the child assimilates the concepts, accommodating them at his/her own pace and in his/her own way. The need to experience and experiment are all important and the lessons should be more fully learnt.

Climbing is one of the good examples of this process. Since the steps can be seen and the motion is visual and predictable, going up a climbing structure is relatively simple. However; coming down is more of a problem

and therefore, they can develop these facilities to a limited extent. However, all play spaces have the potential for education. A play space can provide information to identify concepts of shape, size, number, the relationship between parts, and so far so forth. By learning to relate knowledge to experience children begin to build up a body of information on which to base input from other types of learning and from other sources.

Social Education: The function of play is essential during the process of understanding the development of the 'self' idea in relation to the environment and others. The concepts of self-confidence, self-reliance and independence all come about through play experiences and through fantasy play.

Play spaces provide the opportunity to children to meet and interact with each other. The proximity of other children is important for the young children, but the interaction between them is not great. There is a preference for playing in the company of others rather than with them. As children get older, their capacity and need to interact face-to-face increases. All these preferences for grouping have implications for the amount and type of play space provided.

The play spaces create a natural meeting place for older children and at the same time a natural space for developing socialization skills. A child can make use of an item of any equipment on the play space while he/she builds up confidence to rejoin a group.

After examining the contributions of play through the learning process in the previous chapter, the additions of play spaces to the learning facilities are examined under the perspectives of environmental, physiological, creative and educational developments and social education. It is being realized that the characteristics and properties of play spaces are as much important as the characteristics and properties of play itself, through the development of children. The quality of play spaces and the

criteria for deciding on a play space's quality will be examined in the following section.

3.1.2. Quality of Play Spaces

The 'quality of play' was mentioned in the previous chapter. The 'quality of the play space' is also very important, since the children are wanted to possess better play opportunities. Poly Hill (1983) has suggested some properties for playgrounds which can not be fully suggested on every play space; however, it will be very good to gather at least a few of these criteria, while designing a play space. These can be named as;

Physical fitness - by providing equipment which develops muscular growth and coordination,

Intelligence - using equipment and materials which can be adapted and developed,

Creativity and imagination - by providing a variety of equipment, textures and loose materials,

Emotional stability and initiative - through the involvement of adults,

Social assurance and cooperation - by providing suitable materials, spaces and equipment,

Self-confidence and competence - by providing choices and challenges in equipment,

Individuality - through the provision of non-directive leadership,

Sense of responsibility - through the involvement in the design and management of the play areas,

Non-sexist / non-racist outlook - by ensuring that play space meets the needs of both sexes and all ethnic groups,

Sense of humour - by the use of colourful and innovative equipment and materials.

Children from 6 to 12 require an area which is suitable for the informal play activities and low organized games which require a level space where as some of them are needed to be played on a slope or among the trees.

However it is designed, children under ten require relatively little space for most of their activities when compared to the field or team games.

Whatever the play space kind is, the important point to be mentioned is whether the children could find the opportunity to satisfy their need of playing. As Nicholson (1971) says:

In any environment, both the degree of inventiveness and creativity, and the possibility of discovery, are directly proportional to the number and kind of variables in it.

Although it can not be expected a play space to carry all of the stated properties, it will be better to pay attention to the involvement, at least some of them, in playing areas. The fussiness that can be showed at this point will affect the children's development heavily.

It should not be ignored that the types of play spaces determine the effects of any play space on educational, physiological and other developments. The different kinds of play spaces will be stated under the next title.

3.1.3. Types of Play Spaces

The types of play spaces show different characteristics just like the types of plays. The environmental factors and the opportunities which are given to the children by the play spaces determine these characteristics. Many researcher may have done classifications according to their surveys, but in this part, the types of the play spaces will be classified in eight different groups, as Heseltine and Holborn (1987) did:

Natural: The children at the age of 4 to 9 range require many opportunities to utilize the environment for exploration and socializing. In the play activities of this age, the importance of natural play space is reflected by the children's desire to affect, to change, to explore, to experiment with loose materials, to meet and interact with other children.

Under-used land: These are the lands, for example, between a main road and an estate road which access is restricted, either by barriers or by

parental prohibition. The under-used lands are a part of the most attractive play spaces in order to satisfy the spirit of adventure that is found in the nature of children.

Idle or dormant land: These are the ones, which are essentially undamaged and which could easily be made usable, possibly on a temporary basis.

Despoiled land: They require major reclamation treatment.

Operational land: Sometimes local authorities, or nationalized or private industry, held a land which is surplus to their requirements. These can also be interesting for the children with the same reasons as under-used land.

Found space: In development or new housing areas, allowance has to be made for found space for children; small areas of private land - the rear garages, hedges (retained and created), bushes and well-planted areas, screened and semi-private land. These spaces can be used for social activities and as a gathering place by the children.

Amenity areas: These are the spaces on which it is not possible to build and which the designer not allocate any other function.

Woonerven - the living streets: These are the streets which are in use and also very dangerous for the children up to age of 12, since they have not developed their perceptual and intellectual skills to manage safely. While the children are playing, they can easily run through the vehicles and cause various kinds of accidents ended by death.

Playgrounds: These places are the ones created by the human beings artificially in order to provide a safer and more controlled play area for the children. The equipment of playgrounds are specialized according to the aims and the needs of the potential user group.

After having a short look at the types of play spaces, it becomes obvious that playgrounds have to be chosen among the other types of the playing spaces for the children. The most basic reason of this choice is that, as

mentioned before, the equipment, which are going to be used by the children on a playground, are produced artificially, in most cases. The most suitable form of the necessary equipment can be designed according to the specifications of the user, and the most useful and safest apparatuses let parents have confidence in playgrounds.

In next section, in addition to the types of playgrounds which will be stated according to the usability, the materials of the equipment and the potential group as the user, the equipment those are found on the playgrounds will be examined in details.

3.2. Playgrounds (as the Most Popular Play Spaces)

As it was mentioned in the previous part, besides having many opportunities, there is a better chance of satisfying children's need of playing in spaces where are called as 'playgrounds'. The playgrounds are created artificially by human in order to give the occasion to develop children's muscles and intelligence together while they are playing. The playgrounds are accepted as the a small-scale imitation of the world in most cases, but they also supply the basic motives to make the imagination work as much as possible.

In this section, in addition to the types of playgrounds which will be stated according to the usability, the activities those are carried out in the playgrounds will be pointed out.

3.2.1. Types of Playgrounds

From Datta (1969) point of view a playground has to give a chance to children proving themselves in a series of challenges which ranges from simple to experienced level. The other important point is that, there must be a continuity among the elements and the levels, so that each child has a dual experience of having mastered some aspects of his environment

while he is aware of the other aspects that he may still want to master.

According to Flynn (1985) the playgrounds (as the general meaning) can be classified into different groups with respect to the aims for which they are build up. Here are the types of playgrounds:

One-time user: Usually a commercial play area designed to sustain interests for a short time span.

Returning client: Usually a school or public recreation area which is designed to stimulate multiple responses and some elements of unexpected situations.

Adult: Commercial and educational planners are dealing with the equipment designed for adults so the designs are characterized according to the adults (in size and in challenge).

Adventure: The adventure play areas are developed especially in Europe. Children are involved in planning, creating and building an area by the leadership of an adult to facilitate play and construction. Some elements of the adventure playgrounds are build to be fixed, when the others are mobile. Moreover; some parts can be changed daily or periodically.

Creative: This kind of areas motivate the children to examine and learn various answers rather than a single one. There are both loose and fixed objects in the setting.

Junk: These play areas are usually constructed by the adults from the discarded materials, which ensures a wide variety of the available choices and stimulates multiple sensory responses (i.e. tires, telephone cable spools, railroad ties, sand, wood, rope.)

Thematic: The thematic playgrounds usually built around a central idea, like the 'pioneer', 'treasure island', 'Indian', 'safari', etc. Variety is important as much as the appropriateness with the local environment and safety of the objects.

Traditional: This type of playgrounds include metal equipment like the

swings, slides, see-saws, merry-go-rounds, etc. The traditional playgrounds has a single purpose in design and they tend to move children rather than to stimulate children to move.

Vestpocket: They are created by Paul Friedberg (1976) for high school students in New York, and build among the high buildings for the adult scale to be compact and indestructible.

Construction : The construction playgrounds are the ones built, especially for the children, to meet the need of controlling the body movement and developing the muscles as a part of the psychological grow up by learning to feel responsible for themselves. The equipment are, generally, constructed frames.

Therapeutic: They are created in order to be used by the differently abled children as a part of their rehabilitation. All the equipment designed for this special purpose playground has the sizes related to the differently abled children's anthropometry.

The developmental requirements of the 6 to 12 years old age group are met best by the construction playground, in natural play spaces, or by secondary properties of the environment. On the other hand, the type of the playground that is going to be examined in this project will be the therapeutic one, since the potential children will be specified for their being differently abled in the fourth chapter.

3.2.2. Activities on Playgrounds

The activities carried out by the children on playgrounds are also very remarkable since they determine the type and quality of the equipment which are going to be placed. The matrix chart of Table 3.1 is prepared after a survey among children in Michigan by Erickson (1985).

The similarities of the activities of children on the playgrounds between Michigan and Turkey can easily be recognized. Both of them are climbing, sliding, playing in sand-box, jumping, sitting, playing with

ACTIVITIES	Active/ Passive	Quiet/ Noisy	Approx. Group Size	Environmental Needs	Location and Orientation	Equipment	Time Span (min.)	Age	Special Concern
Climbing	active	noisy	small	grass		jungle gym	15	6-12	soft place to land safety
Sliding	active	noisy	small	grass		tunnel slide	15	6-9	
Playing & Building in Sandbox	passive	quiet	large	sand		sandbox	15	6-9	
Jumping	active	noisy	one at a time, small group	grass		spring- board	15	9-12	
Pretending	active &/or passive	noisy &/or quiet	small to large	grass		wooden fort	15-30	6-12	
Sitting	passive	quiet	small or large	grass		benches, trees	5	6-12	
Playing with Toy Cars	active to passive	quiet	small	blacktop		toy cars	15	6-9	
Jumping Rope	active	noisy	1-3	blacktop		rope	15	6-9	
Tag	active	quiet	small	obstacles to move in &out of soft surface	north side		15-30	6-12	safety
Reading	passive	quiet	small	benches, stumps, stools, enclosures	near bldg		15	6-12	
Swinging	active	quiet	small	soft, surface	near bldg	swings	15-30	6-12	safety
Ice skating	active	noisy	varies	hard surface (ice)	rink	watering equipment for ice sleds	15-30	9-12	
Sliding or Sledding	active	quiet	varies	snow, hills or slopes			15-20	6-12	safety
Running/ Jogging	active	quiet	small	soft surface	completely around school		varies	6-12	how big
									an area
Punching Bags	active	quiet	1	covered area, firm ground	close to building	punching bags	5	9-12	to be covered
Climbing & Sliding	active	quiet &lor noisy	varies	soft surface below	sunny area	ropes, poles, platform target	varies	6-12	
Snow Ball Target	active	noisy/ quiet	varies	snow			varies	6-12	
Throwing Bouncing	active	noisy	1-2	soft surface	anywhere	Trampoline resilient soft surface	5-30		
Climbing	active	quiet/ noisy	varies	hill with varied surface			varies	6-12	
Climbing (Objects)	active	quiet	small/ large	varied soft materials, soft surface	anywhere	hill rubber tires, etc.	varies	6-12	
Roller Skating	active	quiet	small	hard		skates, safety pads, skate rest bar	20-30	9-12	

Table 3.1. The Matrix Chart of Activities Carried out by Children on Playgrounds.
(From ERICKSEN, A. Playground Design: Outdoor Environments for Learning and Development. New York:
Van Nostrand Reinhold Company, 1985. pp.68-71)

toy cars, jumping rope, swinging, sledding, running, snow ball target throwing, and skating. There are, of course, some different activities like ice-skating, punching bags, and bouncing, but these are the result of cultural differences. More over, it can not be asserted that the Turkish children will not like the equipment which are not used in Turkey, now. If they are placed properly, they may be very popular among the Turkish children.

As it can be seen from the chart, the similarity is not only with the activities, but also the equipment, although there are some differences. In other words, there is an influential relationship between the activities and equipment. In some cases, the favourite activities of children determines the equipment; whereas, in others the presented equipment determines the activities of children. This reality will be one of the important point to be considered in while designing the equipment. It should answer the needs of differently abled children, while it directs the activities that can be carried out on the equipment.

The types and characteristics of the playground equipment, the role of colour on the playgrounds and equipment and the provision against accidents are the subjects of the following titles.

3.3. Equipment (as Basic Cells of any Playground)

The equipment found on some kinds of playgrounds; especially in traditional and therapeutic ones, are very important since they built the bridge between the children and activities on playgrounds. The properties of equipment determine the answers that it can give to the needs of children which differentiate according to the children's age, sex and abilities.

When these specifications taken into consideration, the properties of any playground equipment becomes more important. From this point of view,

the properties of playground equipment; like, what types of equipment should be selected, the importance of colour and the accidents which can be caused by the children and equipment will be examined in this section.

3.3.1. General Properties of Mostly Used Playground Equipment

Since each of equipment on playgrounds tends to meet different needs of the user, their sizes, measures, material and placement should be completely different from each other. Here are some basic equipment, most of which can be found in many of playgrounds.

Swings: Swing is the most popular playground item and potentially the most dangerous one if it is placed incorrectly. From this point of view, they must never be placed between the other items, in entrances, in main traffic areas or adjacent to pathways. They must never be mixed with small climbing structures and must have safety zones. (Heseltine & Holborn, 1987)

The swing can be found in every playground without any exception with a seat, a seat back (rarely), protecting side and front rungs made in various forms. They are usually made of hardwood and malleable iron, and in some cases reinforced tubular rubber. If there is a leather belting 7.6 cm wide, which allows a comfortable seat for the child, it would be better; since it is almost impossible for the child to fall down from such a swing or to stand up in it.

Heseltine and Holborn (1987) classified the types of swings as:

Standard swings: They have two types as single and multi-bay. In multi-bay swings, a maximum of two is recommended and placing single swings cause less collision accidents. There must be an impact-absorbent surface that let due allowance for the swing area.

The standard swing is the most common and serviceable for the children between 6 to 12 years old (Williams, 1958). The height of the supporting

frame must not higher than 305 cm and 7.8 cm pipe should be used for the frames from which suspensions are hung. The upright supports should be 5 cm in diameter and it is recommended that the frame must be supported at the each end by three poles. Steel chain is generally used for suspensions of the swing seats. Standard swing seats are of hardwood, smooth furnished and with all edges rounded.

Group swings: This type of swings are helpful in encouraging socialization and usually made up of a large tractor tyre suspended horizontally. They require impact-absorbent surface.

Cantilever swings: These are very popular with the children of middle childhood. They should always be sited in their own enclosure with impact-absorbent surface. A governor should be fitted to the shackle unit to stop the tyre swinging to horizontal.

Spring equipment: Some forms of animals, built up artificially, and vehicles mounted on large springs are very popular for under five years and some larger. Multiple spring pieces are suitable for all play areas.

Swings are one of the most popular equipment in therapeutic playgrounds. Some of them especially designed for the children who are lying in bed, however, in most situations someone has to swing the patients. From this point of view, the rehabilitative value of swings is open to any discussion, except for its giving morale to the differently abled children.

Traveller rings: This piece of equipment is more popular among the middle childhood age group. Although it provides healthful exercise, it is less common to be placed in a playground, since it accommodates a few children and occupies a great deal of space.

The cross pipe which support the rings should be 360 cm high and 1080 cm in length (Williams, 1958). The number of rings is preferably six and made of aluminium. The height of the rings is such that the average child

can jump from the ground and seize them. If a low platform is placed at one end of the equipment, the child may have more of a swing at the start.

Traveller rings will be very useful for improving the muscles of upper arm of the children, but for the differently abled ones, there must be a safe way to get down when the child becomes tired of being hung.

Climbing structures (Jungle gym): They are one of the popular and valuable (Williams, 1958) piece of equipment that can be used by many children at one time. The main problem of a climbing structure is that different age groups try to make use of it at once, and cause many accidents. Therefore, at least two different types of climbing structure should be installed in a playground, one for smaller children and the other one for the older ones. The climbing structures encourage the use of large arm, leg and back muscles and offer different levels of challenge. It provides a place for many types of races, stunts and games encouraging skill, ingenuity and physical development.

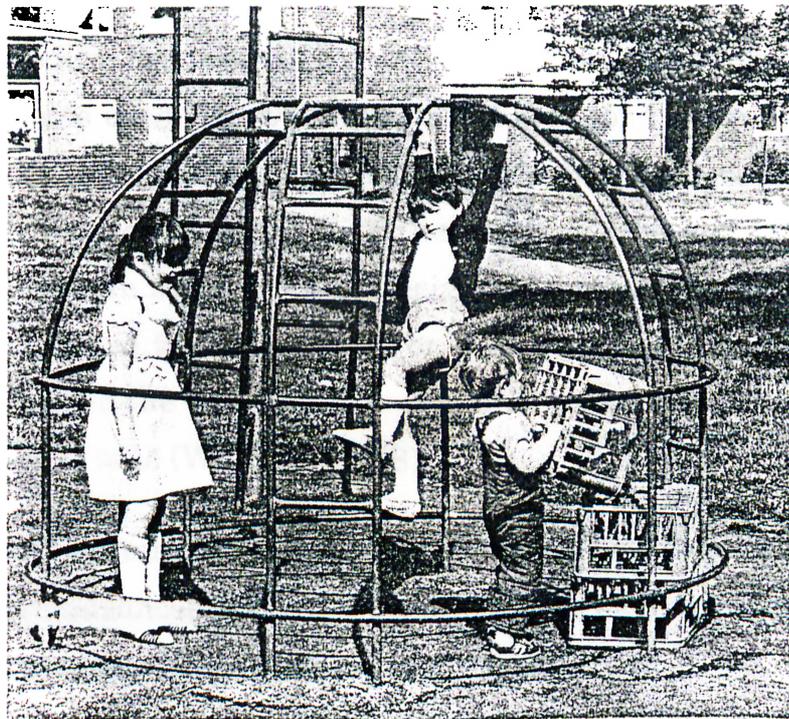


Figure 3.1 An Example for Climbing Equipment.
(From HESELTINE, P. & HOLBORN, J. Playgrounds: The Planning And Construction Of Play Environments.
London; The Mitchell Pub. Co. Ltd., 1987. p. 130)

The climbing structures have the potential of various arrangements of galvanized steel tubing those are bolted, clamped or welded together to form horizontal, vertical or slanting ladders, horizontal bars, climbing poles and other combinations. If multi-structure climbing frames are going to be installed there must be varying height of platforms to develop spatial awareness. Further more, there should be a safe way down as well as a way up to avoid conflict if a child changes his/her mind when climbing. Handhold spacing and diameters must be appropriate for the intended age group (Figure 3.1).

Climbing structures have a great rehabilitative value, unless they are at the height of more than 100 cm from the ground, since the reflex actions of differently abled children are not the same as the normal ones.

Horizontal bars (turning bar): Their being excellence comes from requiring very little space and they can be seen in many playgrounds. The horizontal bars are especially attractive for the older children who can teach interesting stunts upon them and they can be used for badge test events.

In order to produce the bar itself, a galvanized steel pipe from 1.9 to 2.9 cm in diameter is used. The two uprights of 5 cm or 7.5 cm pipe are set from 150 cm to 180 cm apart. The height of the bar changes from 165 to 225 cm, with respect to the ages of the children whom it is primarily intended to serve. In some cases the height of the bar can be adjustable and in order to avoid turning, clamps or U-shaped end fittings are used. The surface under the bar must be soft and be kept clear to prevent injuries in case of falls (Williams, 1958).

Horizontal bars require some more complex activities than the traveller rings. They are advanced level activities and it will be more dangerous for children to make use of them without enough experience.

Balance beams: They are simple piece of equipment, valuable in the development of poise and balance. They consist a plank from 5 to 15 cm

with 360 cm or more in length, placed on edge and securely held in place by short lengths of 5 X 5 cm² section, Figure 3.2. Rope, wire or chain is sometimes used as a substitute for the balance beam. The balance beams are not recommended for the children under four, since they can not walk in a line before four years old (Williams, 1958).

Balance beams are not suitable for the children with disabilities since they are using some assistive devices in order to walk and they can lose their balance very easily on balance beams.

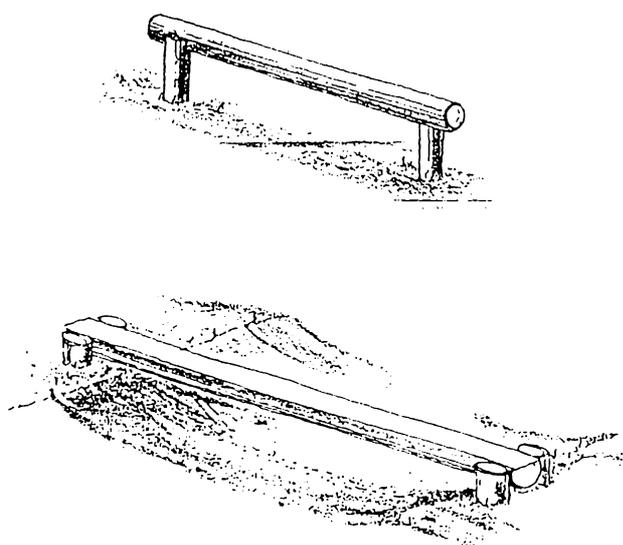


Figure 3.2. Two of Balance Beams.

(From HESELTINE, P., HOLBORN, J. *Playgrounds: The Planning And Construction Of Play Environments*. London; The Mitchell Pub. Co. Ltd., 1987. p. 130)

See-saw: They are recommended especially for small playgrounds, since they occupy less space than many other equipment, Figure 3.3. They are usually more popular among the younger children. The larger spring versions can provide opportunities for cooperative socialization. The horizontal pipe supporting the see-saw should not be more than 55 cm above the ground, and preferably less. The see-saws will be very dangerous for the children under five years old, since they can not control the speed and the height.

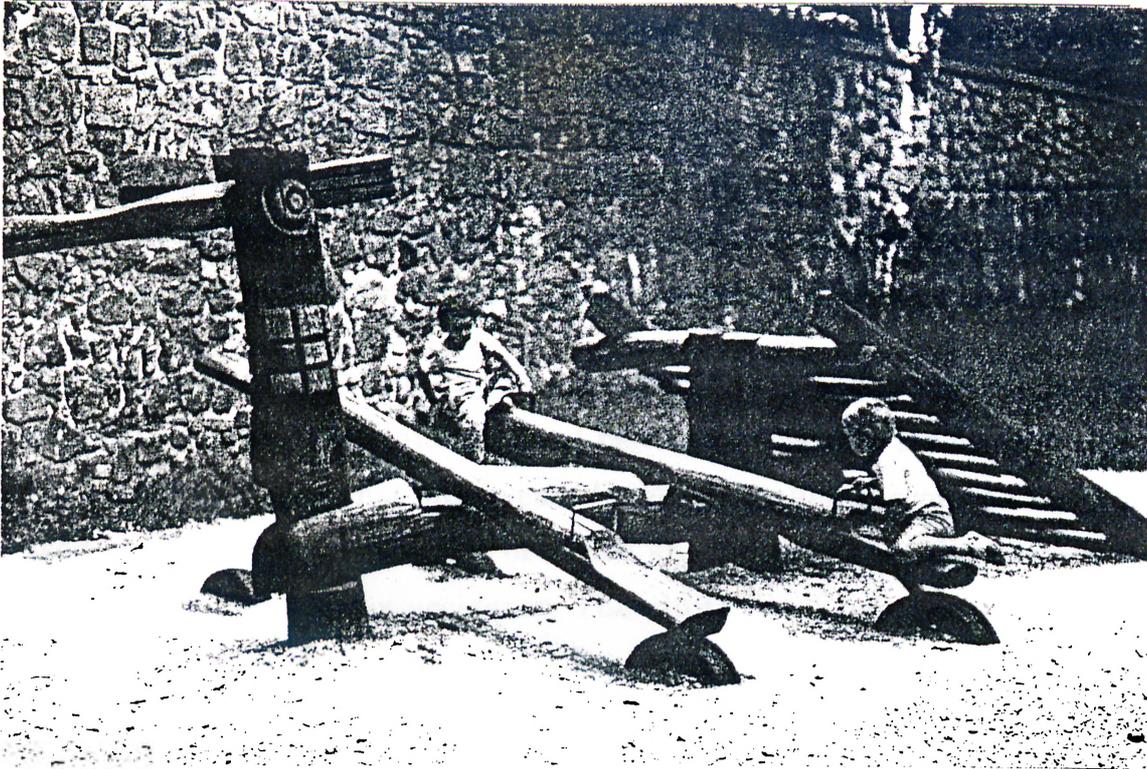


Figure 3.3 An Example for the See-saw Which the Bumpers under the See-saw is not Recommended.
(From HESELTINE, P. & HOLBORN, J. *Playgrounds: The Planning And Construction Of Play Environments*.
London; The Mitchell Pub. Co. Ltd., 1987. p. 144)

The classical see-saws may have some problems for the differently abled children, since they can not control their strength as easily as the normal children. Some special types can be used in different ways, which are going to be explained in the next chapter.

Slides: They attract large numbers of children at varying ages and they are 'self-discharging' (Williams, 1958). They provide valuable exercise, encourage the taking of turns and satisfy the desire of sliding down something. Since it is being used intensively, the slide must be well constructed by using the best materials and careful maintenance.

There are three important parts of a slide; the stairway with platform, the chute and the supporting structure. The slope of the stairway to the top of the chute must never be more than 60° with the ground. The steps should never be too far apart, and if they are made of wood, the wear should be fastened metal plates. The width of the stairway should not permit more than one person to ascend at a time, and the stairway should end by a

platform of at least 20 cm width.

A handrail should be provided on both sides, and the rail along the platform must be high enough to permit a child's body to pass under it. A pressed wood panel fastened to each side of the platform by means of metal straps around the rail provides added safety.

The material of the chute may vary according to the needs, but many authorities prefer the stainless steel bedway, especially for outdoor use. The stainless steel is not only wears longer but when the maple slat are used children can stick nails or other sharp objects in the openings, thereby causing serious accidents. The chute must be curved near the bottom to minimize the shock of landing. The supporting structure varies with the size and type of slide, but braces, usually of galvanized steel pipe sit in concrete, are always required for the top and bottom of the chute. The slide which is most commonly used on the playgrounds is the 480 cm straight slide, and the platform of 240 cm in height.

Although many different types of slides are available in the market, stilt and tower slides are not recommended unless part of a multi-play structure. Mound slides are the most suitable one and should be installed wherever possible and the opportunity should be available for young children to leave safely if they change their minds (Heseltine & Holborn, 1987). The slide should be placed in the shade, since the chute, especially of metal slide, gets very hot after standing for a while in the sun.

Slides are also very popular with the differently abled children, but very serious precautions should be taken for special designs.

Horizontal ladder: The horizontal ladder is accepted as valuable, because it provides excellent body development by its proper use. It permits climbing, swinging, chinning and many other forms of exercise.

The important points in setting up and using a horizontal ladder are its height and the condition of the ground underneath. If intended primarily

for the use of the children, a height of 195 cm is recommended, but if it is placed in a part of the playground for older boys or young men, 225 cm is a preferable height. The length that is preferred for the horizontal ladder is 360 cm for junior. Before galvanizing, the rungs of ladder should be welded or riveted through the sides of the ladder to prevent the turning of rungs while in use. The ground underneath the ladder should be well spaded or excavated and filled with sand, shavings or similar material.

The rehabilitative value is the same as traveller rings and both have the same advantages and disadvantages.

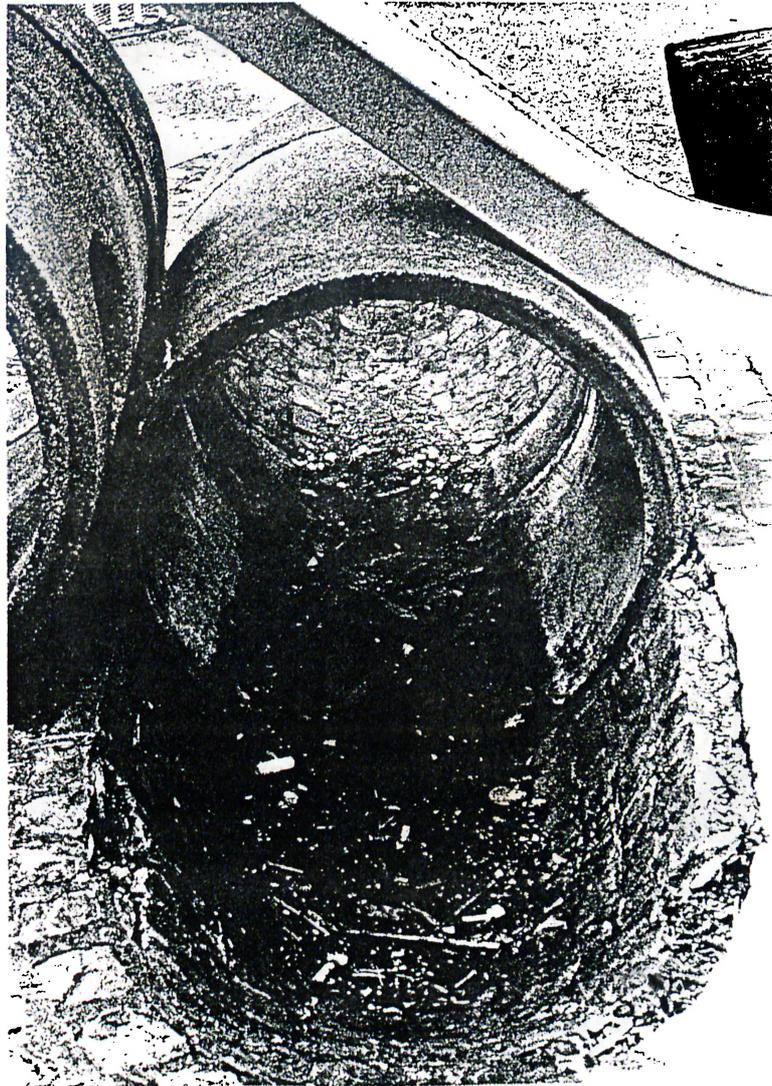


Figure 3.4. Badly Positioned and Irrelevant Pipes.
(From HESELTINE, P., HOLBORN, J. *Playgrounds: The Planning And Construction Of Play Environments.* London; The Mitchell Pub. Co. Ltd., 1987. p. 153)

Tunnels: The ubiquitous concrete sewer or drainage pipe is common on many playgrounds. Although it is a potential for all age group children, their play value is very limited and have no aesthetic value (Figure 3.4). The diameter of a tunnel must be at least 100 cm with a maximum length of 2 metres and many exits. The tunnels have no rehabilitation value for the children with disabilities.

Multi-play Structures: The multi-play structures are the most suitable equipment for heavy use for special areas or on major sites. Placing a multi-play structure, as a general principle, it should be avoided mixing items such as swings, revolving items and climbers in small structures. Moving parts incorporated into the body or size of the structures are not advisable as they create a clash of function. Although excellent for physical and social play, multi-purpose structures are less beneficial for fantasy and creative play owing to the interference factor which restricts some developmental possibilities on crowded structures. (Figure 3.5)

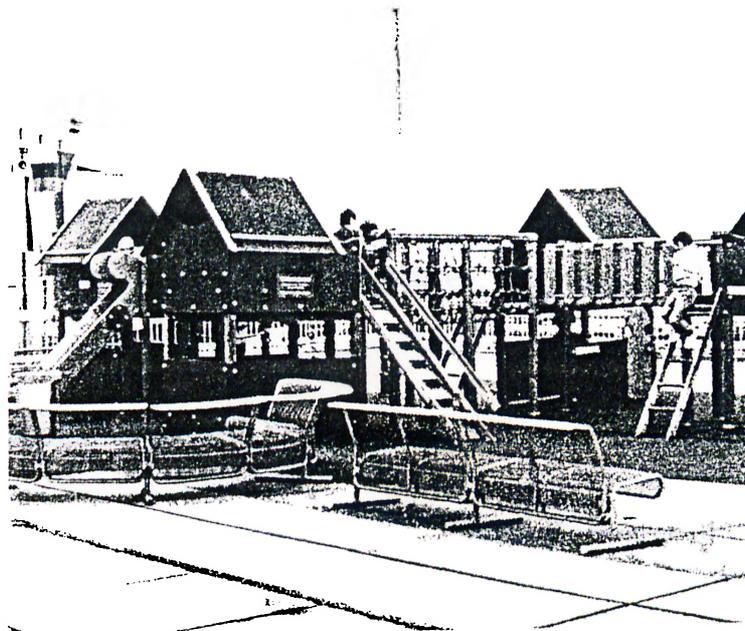


FIGURE 3.5 Large Multi-play Structure at Frankfurt Airport.
(From HESELTINE, P. & HOLBORN, J. *Playgrounds: The Planning And Construction Of Play Environments*. London; The Mitchell Pub. Co. Ltd., 1987. p. 131)

Platforms over 100 cm high should have guard rails unless they are internal to the structure. They should always be sited on a loose-fill or

synthetic impact-absorbent surface. Such units should not be the sole item in a playground as they are not be able to offer opportunities for quiet, individual play. Therefore some single items are essential.

Merry-go-rounds: Generally the platform is over 1.5 m in diameter and it should be impossible for children to get beneath any part of the equipment. The seating platform should be solid with no gaps. The mechanism should contain a steel governor and the whole unit be capable of immobilization if damaged. A minimum use-zone of impact-absorbent surfacing should be laid round the edge.

There may be many other types of playground equipment in different countries and they can give answers to the needs of that countries children. However, in Turkey, although they satisfy the needs of children in limits, items are accepted to be enough. These items are examined in detail during the previous pages.

The equipment that is thought to be designed as a study of this thesis will not be similar to any of these equipment since each of them uniquely can not have the expected properties. Since the chosen group have different abilities than the normal ones, the potential user group is not containing the normal children. As a result, the designed equipment will have some similarities with the multi-play structures, and the climbing structures, but not an imitation of them.

3.3.2. Selecting a Playground Equipment

While selecting equipment for the playground, it would be better to pay attention choosing the types which serve for the various outstanding play interests, provide fun and have definite developmental possibilities. Deciding on which equipment to choose is very difficult for a non-specialist. Williams (1958) stated the points, that should be taken into consideration, in selecting an equipment for playground as:

- *Successful equipment provides some degree of interaction with the child.*
- *Varying the amount of the equipment affects behaviour; increasing the quantity of equipment results in less 'undesirable' behaviour; decreasing equipment results in less gross motor and more social play and conflict.*
- *'Traditional' play equipment reduces the level of creative play.*
- *Playground which include houses, water areas, movable parts and interactive equipment produce a much better balance between dramatic and physical play and less solitary play.*
- *Traditional play equipment is boring for adults to provide, but remains new to successive generations of children.*
- *Equipment is secondary to design - playgrounds offering quality play can not be created by equipment alone.*
- *Children prefer dynamic equipment (equipment which moves)*
- *Equipment imitating weapons (for example, tanks) or designs portraying battles should not be used.*
- *The maximum fall height from equipment is 2.5 m (BS); 2 m (DIN).*

There are some other factors that influence the decision to include or omit a certain piece of equipment in a playground; like size and location of the area, probable volume of use, and the ages of the children who are likely to use the area, etc. For instance, a large area may meet the necessary space for a set of travelling rings, where as in a smaller area this type of equipment should probably be omitted or the circular type can be used. Equipment like slide requires little supervision, but types such as parallel bars require careful and expert supervision. If the ages of majority of the children, who are going to use a given playground, taken into consideration, the types of equipment like slide and climbing apparatus appeal especially to the younger children, whereas the horizontal bar and travelling rings are more popular with the older ones.

As it is mentioned before, a playground equipment and play areas can significantly affect children's psychomotor, affective and cognitive development. In order to meet psychomotor needs, an equipment should stimulate locomotor, non-locomotor, and manipulative (Flynn, 1985) actions which helps to the development of large muscles. Therefore, an equipment should bring out repetitive responses as well as increasingly new complex responses.

The sizes of the equipment should be according to the child

anthropometry, and moreover; some of them should be designed for younger children (preschool age), since they need opportunities to create, build and manipulate the environment; and some others for the older ones (middle childhood), because of their need to play in settings which stimulate multiple responses, like more than one way to move from one piece of equipment to another.

Providing a multi-purpose equipment can meet the cognitive needs of children if it can whet children's curiosity, stimulate exploration and bring out a variety of responses. They please to use a variety of bases of support as well as different kinds of level, direction and range of movement on different pieces of equipment, and it is obvious that non of the equipment can provide adequate variety for all children by itself. As a result a variety of equipment is necessary (Flynn, 1985).

Flynn's (1985) solution to effective needs of children can be stated as by varying the shapes of pieces such as squares, circles and rectangles. Varying spaces increase a variety of responses. In order to provide this variety; some of the spaces should be narrow, wide, large, small, high or low; some pieces should be thick while others should be thin; and finally, textures should vary from loose, soft and smooth such as sand, bark and wood chips to hard, shiny, dull and rough such as metal, wood, plastic, fibreglass and concrete. As a general point, play equipment must be durable, safe, sanitary, and in some cases resilient. Metal pieces may need shade to keep them cool.

Socialization develops in the playgrounds, around the equipment while children are playing but some of them should provide opportunities for quiet activities. Some play apparatus should sustain the interest of individuals, where the others should appear unpredictable in the nature of responses available.

According to Flynn (1985), pieces of equipment should not only be placed by age groups, but, more importantly, they should also stimulate

movement from one piece to another. Since the aim of this study is to give an opportunity for the differently abled children to use a playground equipment, just like the other ones, and providing social relations with all the children is crucial.

3.3.3. Role of Colour

Although Flynn (1985) says that;

In contrast to adults, colour does not affect children's choices of equipment significantly.

Heseltine and Holborn (1987) gives very much importance the role of colour and mention that;

Research suggests children select colours according to their mood and this can be used to stimulate and reinforce feelings and recreation in the play area.

Spaces can be designed and coloured to encourage particular types of activity. Social play areas, where it is intended children should be encouraged to sit and talk quietly, should use curves and flowing lines with in formal planting and a predominance of blues, browns and natural colours. On the other hand, in the physical activity areas of the playground sharp irregular lines combined with bright, primary reds and yellows in equipment and planting should predominate.

Varied environments can be created by the use of colour which stimulates the physical and emotional senses. Good, strong and contrasting colours help the eye to develop, to differentiate between objects and to access depth. Preschool children, because of their visual limitations, prefer colours which stand out (reds, oranges, yellow) and since these are stimulating colours, their provision suggests activity. As changes come in physiological development at about the age of seven, a less frenetic colour will not distract attention in the same way as red. Older children are able to cope with and distinguish more subtle colours and combinations.

In most of the playgrounds, the authorities still insist in painting their

equipment drab green to blend with grass and trees, but this cause difficulty to see the equipment and the overall effect is depressing. However; practical experience suggests that playground equipment which is brightly painted in several bold, primary and strongly contrasted colours is less vandalized than dull, single coloured equipment (Heseltine & Holborn, 1987).

3.3.4. Safety Factor

Playgrounds were stated as the most reliable play spaces, since the equipment are designed according to the users' characteristics. The importance of selecting the correct equipment for the playground is amply reflected in the studies of playground accidents which have been undertaken around the world.

About 20 per cent of accidents are caused by children using equipment in a way not envisaged by the designer. Accidents caused by 'incorrect' use of equipment are generally a result of the designer thinking only of the equipment's primary function and not of the secondary functions (Heseltine & Holborn, 1987).

The majority of accidents are falls, especially from swings and climbers although they are not specifically dangerous. They are the most popular and common items in the playground and special attention has to be paid to their design and seating. Substantial numbers of accidents result from children being hit by other children on swings; they are being struck by the child sitting on the seat or the subsequent fall.

Surfacing is one of the most important points to support a balance between finance, maintenance and suitability to use. In order to reduce the injuries caused by swings and climbers, there is a need to more attention to sitting and to impact-absorbent surfaces. These measures will be better than just fitting rubber tires. The impact-absorbent surface beneath the climbers also prevent the severity of accidents. Heseltine and

Holborn (1987) classified the surfacing materials into four groups:

Grass: For covering large areas, mounds and general landscaping, it is cheap and reliable.

Natural Materials: The easiest, cheapest and most effective surfaces are the loose fill materials of sand, wood bark, chip and shingle -providing with regular maintenance and replacement programmes. Their impact absorbency is superior to the synthetic surfaces, their appearance is better and their play value higher. A 375 mm deep pit should be properly constructed either the material covers the entire surface is restricted to individual items.

For loose-fill and synthetic surfaces the area covered by the minimum use zone plus 25 per cent to supply for the interference factor is most suitable for an impact absorbent surface. Loose-fill materials are not suitable under swings, at the bottom of slides and where there is moving equipment such as roundabout, if there is no daily maintenance.

Sand is the most common surfacing although there are some problems resulting from its abrasive nature - it can increase the wear on wood, strip paint of steps and play damage with plastic. If the play equipment (especially fibre glass and plastics) is expected to last for a very long time, sand should not be used.

Bark can be used as an attractive and safe material for surfacing under equipment but there are maintenance problems. Some of the bark available for play area use is fire, insect and bacteria resistant. It requires regular turning and replacement. If it is provided under a heavy use, multi-play structure it must be kept in good condition, otherwise it loses some of its impact absorbent properties.

Synthetic surfaces: They are mainly made from oil derivatives and they come in various forms; some as tiles linked, bolted and stuck down or to be wrapped round a paving slab. A very few of synthetic tiles meet the

level of impact absorbency required from a 2.5 m fall height and if a child falls from the top of a 2.5 m climbing frame, his or her head height is 3.5 m.

Synthetic surfaces are probably most beneficial under swings and climbers, at the bottom of slides and with roundabout and similar items. All of the synthetic materials are not slip-resistant (especially when wet), and some are sensitive to light damage.

Hard materials: Hard surfaces are an essential part of any play area for wheeled toys, seating and ball games areas, and pathways. Cobbles and setts can be used as tree surrounds, around water and sand play areas, in water to give rippling, and to control the access of wheeled toys in hard-surface areas. Stone and brick are useful in pathways and seating areas to provide visual and textural contrasts. They can be a source of sounds in play areas catering with visual handicaps.

The role of play can not be denied in child's life, and all the families should provide a qualitative play opportunity to their children. This can be supported on the qualitative play spaces. The properties of the play spaces are very important, since; children receive information from the surrounding environment in order to use it in their intellectual development, they are helped to develop spatial and visual perception through the use of equipment in the environment, creative development of children is stimulated by the alternative uses of materials, education means to have the ability to do new things without repeating what previous generations have done, and, all play spaces have potential for education.

Although it is very well known that the properties of play spaces are very important, it is a fact that it is very hard to control the children's playing spaces, because they make use of every place and unit as a play area and equipment. Most of them are playing on found spaces, under-used lands, dormant lands, despoiled lands, operational lands, amenity areas and

living streets where are potential of severe accidents and damages.

Playgrounds own better play values as an alternative to the listed play spaces above, because of their being built artificially. The place and the equipment of a playground can be controlled easily. There are also types of playgrounds according to the needs of children. These can be classified as; one-time user, returning client, adult, adventure, creative, junk, thematic, traditional, vestpocket, construction, and therapeutic. The equipment that is going to be designed in this project will be for the therapeutic playgrounds, since the chosen user group is disabled children.

The activities on every kind of playground are nearly the same, whether the users are disabled or not. There can be some limitations according to the extends of disability, but the needs of children are not changed according to their physical characteristics.

There are many equipment come to mind when a playground is thought, but the quality of the equipment is as important as the quality of play and playground. In other words, the quality of equipment determines the quality of play and playground. The size and placement of equipment are two of the basic properties that should be taken into consideration. In this project, the equipment that is going to be designed will have some similarities with the multi-play structures, the climbing structures, the horizontal ladders and traveller rings. It will be a combination of these equipment with some changes because of therapeutic properties. In addition to all these properties, the previously stated colour and safety criteria will be taken into consideration, while designing this equipment.

4. DISABLED CHILDREN

As it was mentioned in the introduction of Chapter 2, every child (without any exception) has the right to have education and he must have full opportunity to play and recreate which will be directed to the identical purpose of education. This means that the physical characteristics of children should never cause an exception while supporting the opportunity to play of children, whether they are disabled or not.

The limitations in child's ability to play should not be accepted as a problem, because play follows the same pattern for every child to the extend of his/her own abilities. It serves the same function of expanding the children's experience and understanding of the world (Hogan, 1974; Dattner, 1969), and it affords them the same potential for enjoyment and expression. Children with disabilities need specially designed play spaces, but their essential requirements are the same as those of normal children (Dattner, 1969).

The characteristics and properties of the normal children have been examined in Chapter 2 under the subtitles of physical, cognitive, social and emotional developments in the middle childhood, which is the potential age group. However; the main subject of this study is the design of a playground unit for disabled children. Therefore, the physical differences between normal and disabled children should be stated, before designing the equipment.

In this chapter, definition of terms, (e.g. impairment, disability, and handicap) which are related to differently abled people will be stated. Later, the types of disabilities will be examined and the main point will

be physical disabilities. The six types of physical disabilities will be explained as general terms. These are paraplegia, hemiplegia, quadriplegia, amputation, visual-impairment and finally, hearing-impairment. The assistive devices used by the disabled people will be examined in details, since they determine the measurements of playground equipment. The role of playgrounds in rehabilitation will be the last section of this chapter.

4.1. Definition of Terms

There are many terms used to describe the people who have physical abnormalities in one way or another. Manciaux (1982) explains three basic terms; impairment, disability, and handicap.

***Impairment** is any loss or abnormality of psychological, physiological or anatomical structure or function, which disturbs normal structure and functioning. The abnormality may be permanent or transient: missing or defective limbs, tissues, organs or functional defects, including mental systems.*

***Disability** refers to restriction of ability to perform normal activities. It is characterized by excesses or deficiencies of behaviour usually considered normal, arising from an impairment in the individual's responses, especially psychological, to physical or sensory stimuli.*

***Handicap** results from an impairment or disability which limits normal functioning. It is concerned with the value attached to an individual's situation or experience when they deviate from the norm. It is characterized by a discordance between his performance and his expectations, or those of his group. A handicap is then the consequences - socioeconomic and environmental- resulting from impairment and disability.*

Goldsmith (1984) used different terms, instead of special problems, as infirm, deformed, invalid and impaired. He insisted on the words 'disabled' and 'handicapped' and mentioned that 'disability' and 'handicap' are not synonymous:

A disabled person is not automatically handicapped person; whether or not there is, handicap depends on the nature of the individual's impairment and the circumstances in which he is placed.

A disability, whether it is a handicap or not, becomes a handicap if it interferes with the individual's expectations, job performance, or

relationships with his/her family, friends and society in general and the last one is the most important point from the children's point of view. Many common disabilities result from diseases. For example; heart disease may permanently decrease the victim's strength and endurance. Strokes may produce paralysis and loss of speech. Arthritis and many bone diseases can lead to deformity. Certain nerve diseases may result in blindness, deafness and lack of coordination. Cerebral palsy is a disorder that damages the brain before, during or after birth. Depending on what part of the brain is damaged, cerebral palsy can cause speech problems, muscular weakness, or involuntary movements of the arms and legs. It can also produce mental retardation. Accidents cause a wide range of handicaps, including spinal damage and loss of limbs.

Raschko (1985) mentions that even severely disabled people can have productive and fulfilling lives with proper motivation, special training, and providing livable environment suitable to their limitations. The responsibility of the last issue belongs to the designer's of every media. An urban designer can take the disabled people into consideration while planning the towns. An architect can pay attention to the abilities of a wheelchair while designing a building; at least he can put ramps in proper places. An interior architect can design suitable kitchens and bathrooms for disabled people. An industrial designer can think of equipment that can be used also by a disabled person, so far so forth.

Besides the terms stated above, there is an other one which is used recently, especially in United States of America, 'differently abled'. It is nobleness to call the disabled people, who has impairment, as differently abled, since their abilities are different, limited to a range, from the other people. On the other hand, it is a fact that there is some linguistic problems with this term. For this reason, the terms disabled and differently abled will interchangeably be used in this study.

4.2. Types of Disabilities

According to the limitations of people the disabilities can be classified in different categories (Manciaux, 1982; Huchingson, 1981; Dattner, 1969). Huchingson (1981) classified disabilities into four main groups, namely; *physical/motor disabilities* (being without use of one or more limbs), *sensory disabilities* (impaired vision or hearing), *intellectual disabilities* (being mentally retarded) and *emotional disabilities* (being psychologically disturbed).

Manciaux (1982) makes his categorization as three large parts; *motor*, *sensorial* and *mental*. He sometimes connects motor and sensory disabilities as 'somatic' or 'physical'. He mentions that all classification of disabilities must consider their 'seriousness'. This can be measured in terms of functional incapacity, using the various gradations which one follows in examining the requirements of day-to-day living or those for professional integration.

Dattner (1969) specified the disabilities under three main topics as, *physically disabled children*, *emotionally disturbed children* and *mentally retarded children*, while he is examining the playgrounds and rehabilitation of the disabled children. His point of view will be examined under the topic of the role of playgrounds in rehabilitation of disabled children.

The physical disabled (as an intersection point of all writers) children has been chosen as the potential user group of the thesis. These children are using specially designed assistive devices and the characteristics of these devices determine some design considerations. The other type of disabled children are not different from the normal ones in appearance. The types of physical disabilities will be stated under the following topic.

4.2.1. Types of Physical Disabilities

The medical classification of the spinal cord injuries are done according the location of the lesion. The spinal cord extends downward from the neck through the cervical (C), thoracic (T), lumbar (L), and sacral (S) regions as shown in Figure 4.1.

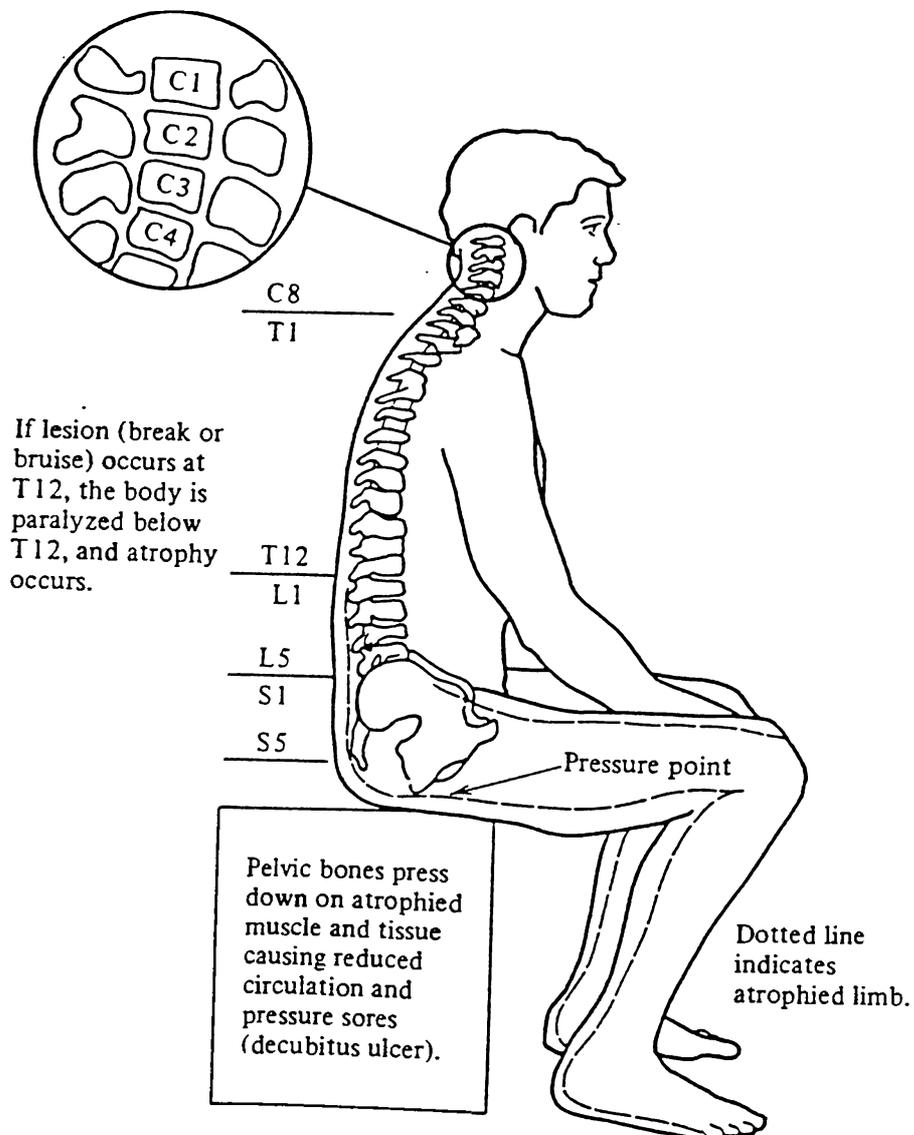


Figure 4.1. Diagram of the Spinal Coru.

(From Huchingson, R. *New Horizons for Human Factors in Design* McGraw-Hill Book Company, 1981. p. 462)

If the break occurs lower on the cord (in the thoracic region), the person can not use chest, abdominal, and leg muscles but retains full use of upper limbs and is classified as paraplegic. However, if the lesion occurs enough

high on the cord (in the cervical region), the person may be either totally disabled or lose of control of the arms as well as the legs. These people are classified as *quadriplegics*. Lesions at C-3 or above are usually fatal.

As shown in Figure 4.2, the exact location of the lesion has implications for the degree of use of the upper limbs. It is practicable to describe the quadriplegic further as a 'C-6', 'C-5', and so on, to indicate the region of the lesion. 'T-1', is the highest thoracic vertebrae, marks the crossover region from paraplegia to quadriplegia (Huchingson, 1981).

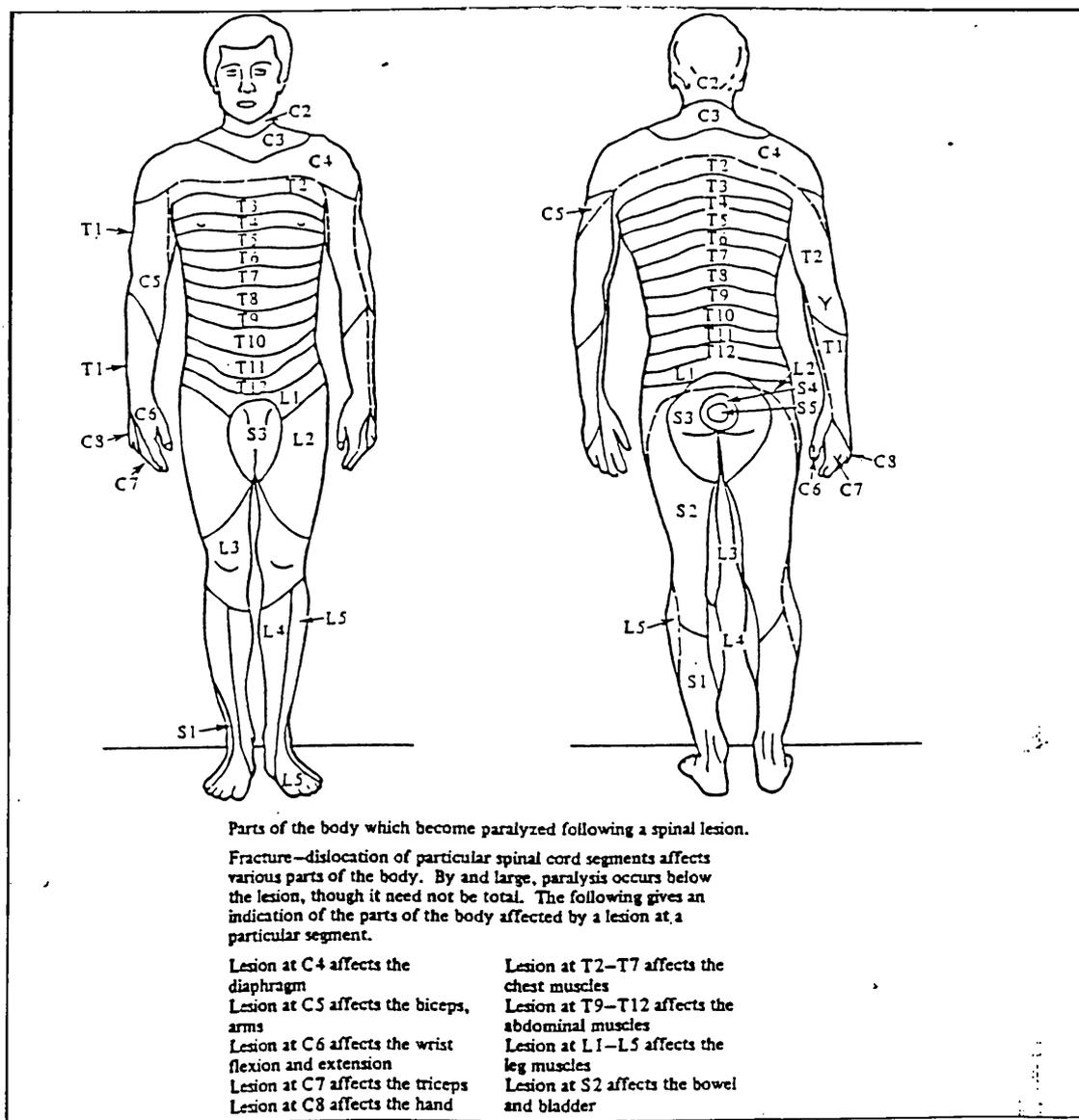


Figure 4.2. Physical Problems Associated with Lesions.

(From Huchingson, R. *New Horizons for Human Factors in Design* McGraw-Hill Book Company, 1981. p.463)

As it is mentioned before, the physical or motor disabilities are generally the result of diseases or accidents. In this part, it is not dealt with the diseases as the reasons, but as consequences, namely, under the following six main titles: *paraplegia*, *hemiplegia*, *quadriplegia*, *amputees*, *visual-impairment*, and *hearing-impairment*.

Paraplegia: The word 'paraplegia' comes from paralysis which is a complete or partial loss of the ability to move and to feel. In fact, muscular motion is produced by the stimulation of certain nerve cells in the brain and the spinal cord. When certain areas of the nervous system are not working properly because of different reasons, the movement of muscles becomes abnormal. Huchingson (1981) explains paraplegics as having their lesion in the thoracic region. People with lesions below T-6 can attain a very high degree of physical and psychological independence (Koppa, 1979) physical stability and many of them develop great muscular strength in the upper part of their body, especially in the arms. Furthermore, some of them are even able to stabilize themselves well enough to use crutches. The people who have paraplegia with lesion above T-6 faced with some problems stability of body and require the use of orthoses (Huchingson, 1981).

Hemiplegia: It is the paralysis of one side of the body due to disease or damage to the upper motor neurones at various levels in the central nervous system (*cerebral cortex*, *internal capsule*, *brain stem*). Lesions in the brain stem may show *crossed hemiplegia*. In some cases of crossed hemiplegia, there is a lesion in the *medulla oblongata* with paralysis of the tongue on one side of the body and limb paralysis on the other side. *Congenital hemiplegia* is due to cerebral damage at birth or to developmental causes during fetal life. *Infantile hemiplegia* occurs in infancy during a febrile illness. The hemiplegics problem is that the healthy part carries all the load, since there is nothing to do with the ill part (Butterworth, 1978).

Quadriplegia: Quadriplegia is the paralysis of all four limbs (both arms and both legs) and the other name of the illness is *tetraplegia* (Dorland,

1974). Much of the movement of the quadriplegics is missing, but they can move their arms a little bit. Since chest and back muscles are not moving, wheelchair sitting is unstable in some cases. The C-4/C-5 quadriplegia is the highest level of spinal lesion for which out-patient maintenance is practical. It should not be ignored that there is no damage to the brain or vocal tract of a quadriplegic (Huchingson, 1981).

Amputation: These are the people who have one or more of their limbs amputated. Amputation is the removal of a limb or other appendage or outgrowth of the body. The amputees are a large group of physically disabled. The ones who lost both lower limbs are functionally similar to some paraplegia and most of them are using wheelchair. Only some exceptions are using *prosthesis*. Those who are missing one or both upper limbs are traditionally fitted with a functional grasping device (Huchingson, 1981).

Visual - Impairment: Many of people living on the world are visually impaired to the limits of using prescriptive lenses for near or distant viewing. The primary focus are always on the people who are totally or functionally blind. These people are using the tactile sensory; like, Braille print and sound in order to communicate with the others.

Hearing - Impairment: Huchingson (1981) reasons hearing loss to congenital problems or associated by aging (*presbycusis*), disease, toxic drugs, head injury, or exposure. The largest part of the hearing-impaired people are using an artificial organ. Deaf children as a group are intelligent just like the children who can hear, but many of them are diagnosed as functionally retarded, since they have a language deficiency associated with their inability to hear or speak.

The type of disability for this project has been chosen as physical disability in general, but when it is specified the physical/motor disabled children (according to Huchingson's classification) are more suitable to the aim of rehabilitation point of view. The paraplegics who can use his/her

upper body; the hemiplegics who is not using a wheelchair but other assistive devices; the quadriplegics who can use his/her upper limbs to an extend and amputees who are able to stand and use his/her arms as well. The assistive devices that are used by this disabled group is going to be stated in details in the following section.

4.2.2. Assistive Devices Used by Physically Disabled Children

Nearly all of the physically disabled children are using different types of devices according to the type of disability and needs of the user. These devices assist the user in order to eliminate the limitations and let user move like the healthy people.

Colston (1991) mentions about a service that directly assists an individual with a disability in the selection, acquisition, or use of assistive technology device:

The role of training in the delivery of technology services is a major provision of the Technology - Related Assistance for Individuals with Disabilities Act of 1988. The patients of service must be trained to better consumers and to safely use the devices they select. The main targets of this training is the self-assessment of personal needs, state-of-the-art technology, techniques of evaluating devices and safe operation of the equipment. Training programs for service providers must provide knowledge and skills on available alternative devices, functional benefits, financial resources and how to access product information. For the increasingly self-reliant disabled consumer, there will be a need for information, procedures and adaptive compensatory strategies.

It can not be denied that every country is in need of this kind of a service in order to serve her disabled people who are in need of help. In fact in Turkey, there are some assistive devices production centres, which help the patients in finding special designed devices according to the anthropometrics of the population. However, their level of satisfaction can be discussed.

In this part, the types of assistive devices are going to be examined which are used by Turkish children.

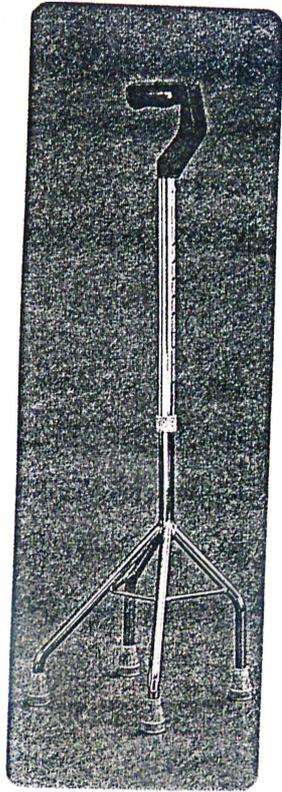


Figure 4.3. Quad Cane.
(From Anonymous. Ortopedia
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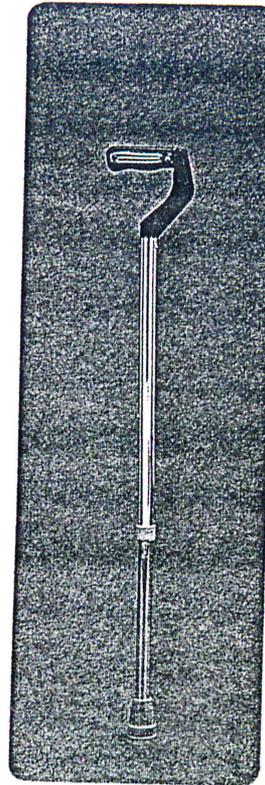


Figure 4.4. Cane.
(From Anonymous. Ortopedia
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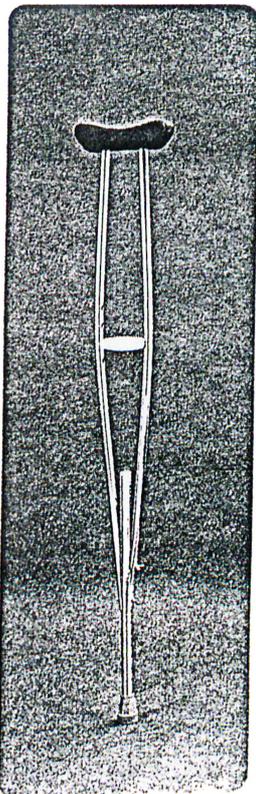


Figure 4.5. Auxiliary Crutch.
(From Anonymous. Ortopedia
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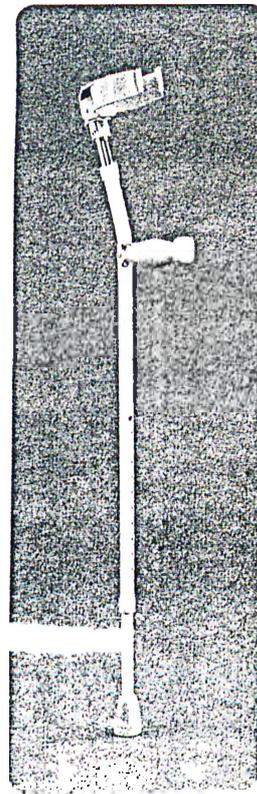


Figure 4.6. Non auxiliary Crutch.
(From Anonymous. Ortopedia
GmbHGermany.iv/3.)

Canes: They are the assistive aids used to reduce stress on leg muscles and joints by shifting a portion of the weight to the arm and shoulder. Canes are generally used by amputees, and orthoses users. There are many types of canes (Figure 4.3, 4.4).

Crutches: They reduce the stress of weight bearing on the lower extremities. Crutches are either *auxiliary* (with an under arm piece to transmit forces to the shoulder as in Figure 4.5) or *non-auxiliary* (disturbing weight to the forearm as in Figure 4.6). Arm crutches require good balance skills for ambulation and for performing hand functions, while maintaining a standing position.

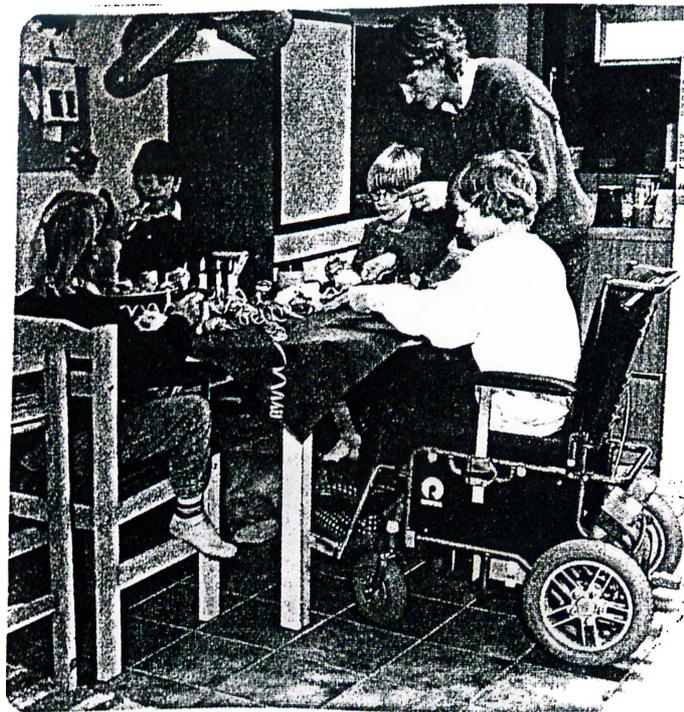


Figure 4.7. . Wheelchair Used in Inner Spaces.
(From Anonymous. Ortopedia GmbHGermany. 1/22.)

Wheelchairs: These are the devices used by the people who have no chance to walk or stand up. There are some different types used in the market. In general, the ones which have small wheels in front are used inner spaces, as shown in Figure 4.7. An other type which has large wheels on back side is used for the outside, Figure 4.8.



Figure 4.8. . Wheelchair Used in Outer Spaces.
(From Anonymous. Ortopedia GmbHGermany. 1/11.)

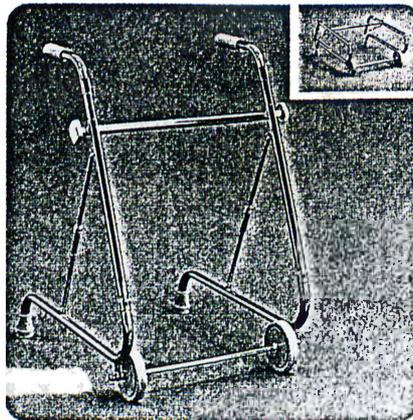


Figure 4.9. . An example of Walkers.
(From Anonymous. Ortopedia GmbHGermany. 1/10.)

Walkers: This kind of assistive devices are used for the people who have some difficulty in walking. They are also used to decrease stress on joints and muscles and as aids to balance. Walkers are often large and heavy, but broader walkers are more stable, Figure 4-9. Walkers are easier to use with ramps, low thresholds, and flush transitions.

Prosthesis: The prosthesis is an artificial replacement, such as an artificial limb or eye or a denture. In order to use a prosthesis, there should not be the member of a body. All the prosthesis are individually made by skilled technicians and are matched to the patients own member of his body for size and shape. They are removable and changeable according to the development of the body.

Orthoses: This kind of devices are used for controlling the co-ordination of the muscles with the bones. In the case of using orthoses, there should be the limb and muscles but they can not be used efficiently. Just like the prosthesis, the orthoses are produced specifically for each client according to the dimension of the client's body. (Figures 4.10, 4.11)



Figure 4.10. A Spastic Child Using Orthoses.



Figure 4.11. A Baby Using Orthoses.
(From Anonymous. Ortopedia GmbH Germany. 1v/34.)

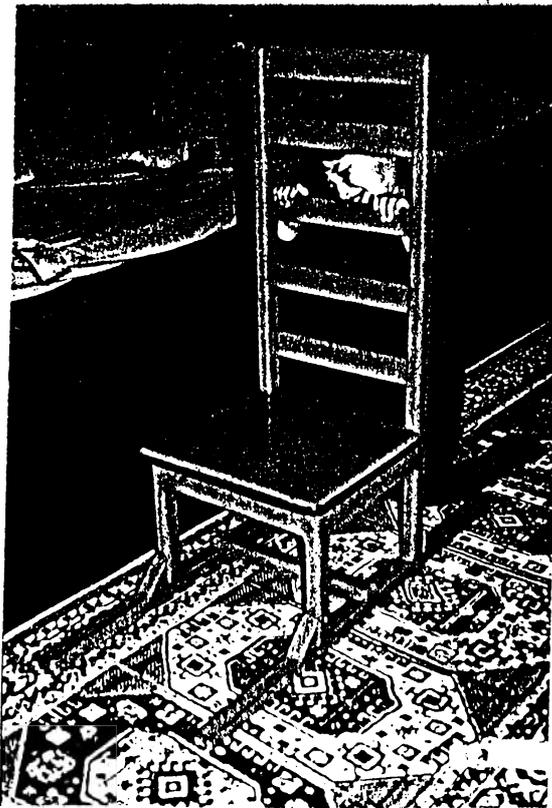


Figure 4.12. A seven years old child Using Ladder Chair.

4.2.3. Equipment Used for Rehabilitation of Physically Disabled Children

Dattner (1969) states the three goals of physical rehabilitation as, to arrest the deterioration of existing abilities; to strengthen skills that are imperfectly developed but capable of further growth; and to provide alternate, compensatory skills to replace those that are lacking or irreparably damaged. Thus, a child with a motor problem can be encouraged to walk to build up his physical power and co-ordination; for a child who can not walk, facilities that help him move around must be provided. In both cases, as with normal children, the environment should present a series of challenges to be mastered gradually.

Ladder chair: This is a kind of equipment that is used in teaching to walk to the spastic children, who can not use their legs in co-ordination (Figure 4.12). At the beginning, the child walks on knees while holding one of the steps at the back of the chair and pushes the chair on sleds. As the time passes, the child masters to walk on feet.

Ladder on Wall: This is an equipment which reminds the climbing structures. It is placed vertically on the wall, and the child is expected to climb up this ladder (Figure 4.13). This ladder teaches using the lower and upper muscles of legs in coordination while using the forearms to pull up their body weight. Just like the ladder chair, the child begins to climb to a certain height, while he/she is on his/her knees.

See-saw: It is generally used to teach the child to be in balance on a moving equipment (Figure 4.14). It also helps to a back muscles work. The child can either sit down or stand up as the see-saw moves. The difference between the ones on the playgrounds and this type of see-saw is that this can be used by only one person at a time. When the child begins to use this equipment he/she needs help from an adult to hold them in order not to fall. Finally, the child learns to be on the equipment by himself/herself.

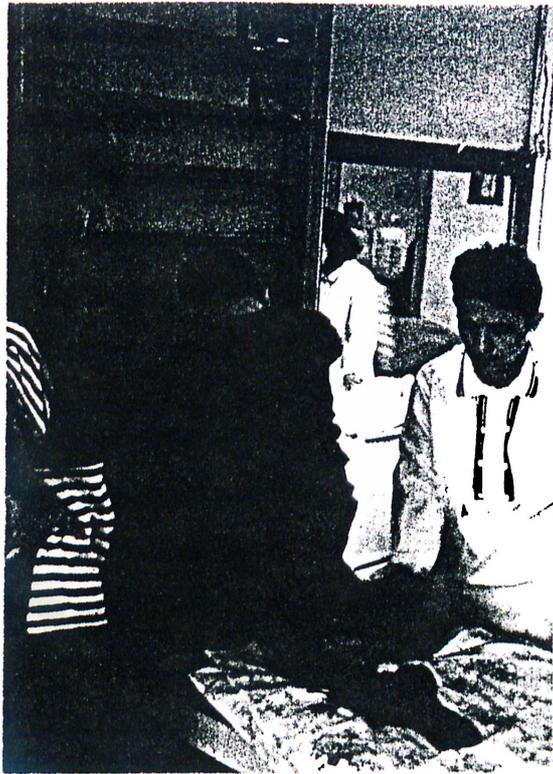


Figure 4.13. A 6 Years Old Child Practising with Ladder on Wall.

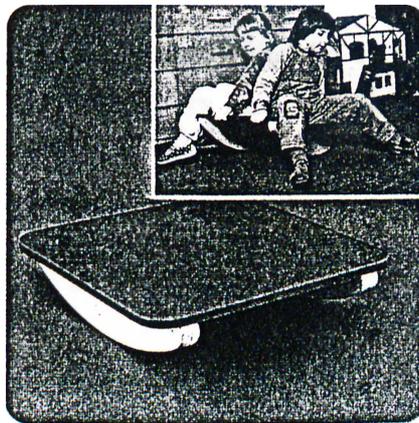


Figure 4.14. An example of See-saw or swing board.
(From Anonymous. Ortopedia GmbHGermany. iv/26.)

Air-tumbler: This is an equipment made of hard rubber filled with air. It looks like a huge basketball. The child lies or sits on the air-tumbler with the help of the physician, and it is very popular among the children.

Horse: It is made of vinyl filled with cotton, so it is very heavy in order not to be moved easily by a child. It can be used when hanged from the ceiling or put on the floor. The child learns to stand up when his legs are open. The equipment helps the child to be in balance while sitting down and standing up by open legs.

Stability Box: This equipment is different from the others, since it is very stabilized and does not let the child move in any way. The child gets in the box from the door at the backside and the door is locked, so the box encloses the child from four sides.. The aim of this equipment is helping the child to stand stable for a long time.

Aisle: This is not an equipment indeed. The aisle is a place that the child learns to walk in a line. The floor of the aisle is covered with wood and there are handrails at both sides with varying heights (Figure 4.15). At the beginning, the child uses the handrails on bothsides, but after a while he/she begins to use only one of them. Finally, he/she has no need to use them in order to walk on a line.

Stairs: This equipment is generally used in connection with the aisle stated above. (Figure 4.16). The stairs have two sides and both sides have different riser height. According to the limitations of the children, the therapist decides on which side to be used. Just like the aisle, the stairs have two handrails on both sides. The usage of the stairs is similar to the aisle.

The equipment those are used in rehabilitation of physically disabled children are listed above. These are, of course, the ones used in Turkey and there may be many other kinds of equipment used in other countries. The equipment that is going to be designed in this project will carry the intersecting properties of the above equipment as; help for stability and convergence of muscles.

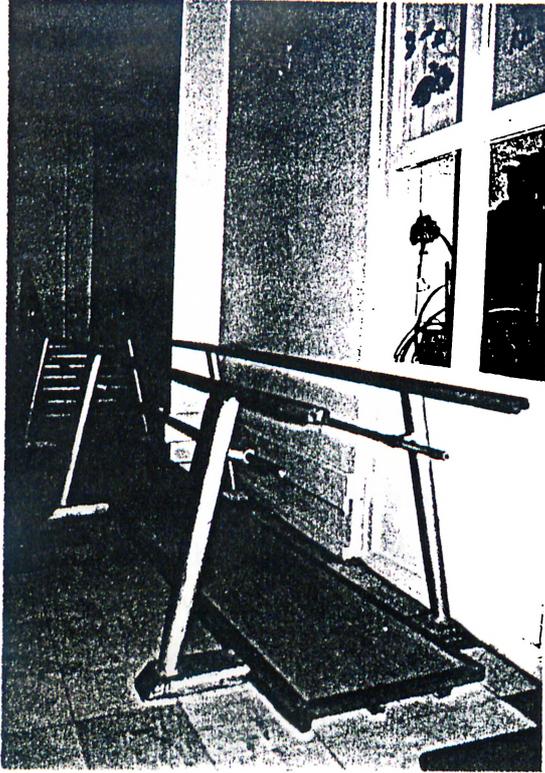


Figure 4.15. A Wooden Aisle That Helps Children Who can not Walk in Balance.

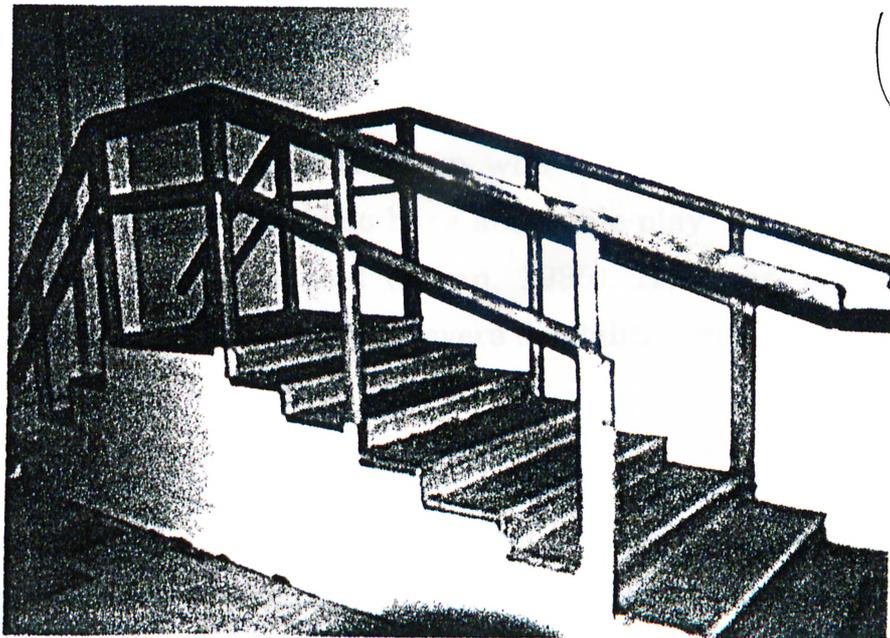


Figure 4.16. Two Different Stairs at One Equipment.

4.3. Role of Playgrounds in Rehabilitation of Physically Disabled Children

As it is recognized in the previous section, the assistive equipment used for rehabilitation of physically disabled children are very similar to many of the equipment found on playgrounds. The main difference that the disabled children can not play outside on a playground with the normal ones whereas they have to play inside the rehabilitation centers within a closed environment.

The environment in which differently abled children play must respond to that part of them which is healthy and capable, with help, of growth and development (Dattner, 1969). For most of these children, the traditional playground presents a series of dangerous and frightening conditions; for instance, bare expanses of hard pavement, hazardous see-saws and swings as mentioned in the previous chapter and insecurely high slides (Figure 4.17). There is an other group of children who are wearing prosthetic devices which can jam if sand gets into the joints.

All these handicaps need therapeutic playgrounds which are designed to help the users develop specific skills (including physical, perceptual, emotional, social and educational ones), (Flynn, 1985). It should be mentioned that the disabled children who engage in play behaviour readily with their peers and who have accessible play facilities do not need a therapeutic playground (Flynn, 1985). However, children in rehabilitation hospitals or who has severe disabilities may need the help of a special facility in learning to play.

While designing a therapeutic playground which serve for a specific group of disabled children, from the medical point of view which activities are therapeutic and which constitute potential dangers must be examined. Different kinds of disabilities require different strategies of treatment (Dattner, 1969). The basic criterion is that the therapeutic playgrounds must be equipped with stable and safe units. Safety on equipment for

these children depends on handholds, footholds, and resting places, providing support and allowing for rest when needed. It is also important that the equipment should not become a barrier to communications between children.

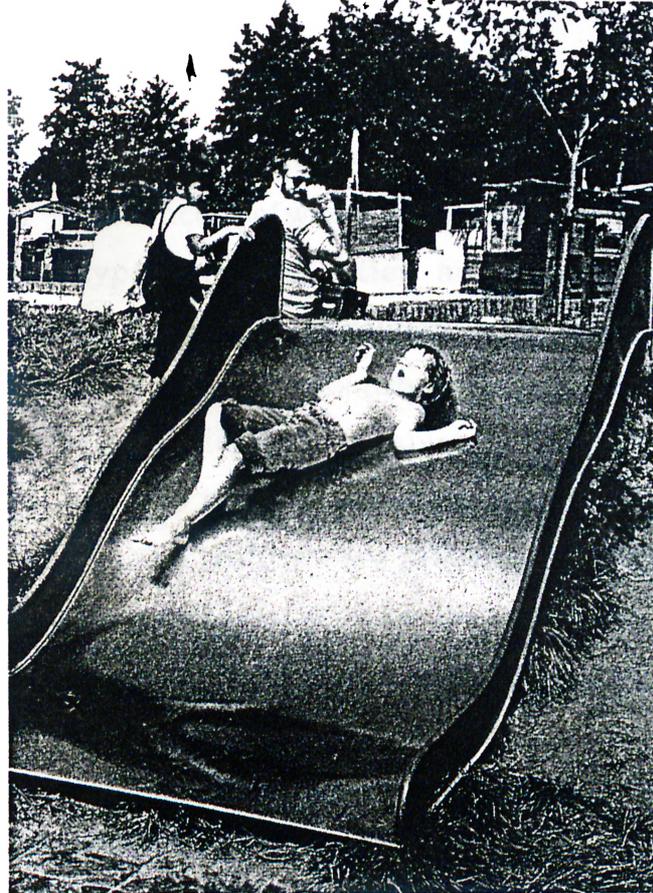


Figure 4.17. An Example of Slide for Physical Disabled Children.
(From HESELTINE, P., HOLBORN, J. Playgrounds: The Planning And Construction Of Play Environments. London; The Mitchell Pub. Co. Ltd., 1987. p. 149)

Flynn (1985) defines the properties of a therapeutic playground as;

Ideally the therapeutic playground will:

- Allow children freedom of movement within a space that takes into consideration their physical abilities and limitations,
- Allow space for both solitary and cooperative play,
- Consist of various textures and shapes that stimulate the child's fantasy life,
- Challenge the child physically and perceptually to enhance development.

There is a specially designed therapeutic playground named as 'Bunlar Bizim Çocuklarımız', in Altındağ, in Ankara. This playground is placed among the schools of hearing impairment, visual impairment and motor disabled children, and the equipment found on this playground are specially designed for the children having education at these schools. The differently abled children are playing with the other ones in this playground and enjoying themselves all together.

In the fourth chapter, the definition of terms, related to the subjects, are stated and the difference between disability and handicapped is emphasized. The types of disabilities are classified and physical disabilities are chosen as the main problem to be serviced. The children with visual and hearing impairments are distinguished from the others, since these type of disabilities need completely different solutions than the motor disabilities. The types of assistive devices which are used by physically (motor) disabled children are presented and the children who are using orthoses and prosthesis with/instead of limbs are specified for the user group of the playground equipment. These type of children are making use of some specially designed equipment during their rehabilitation period. Most of these equipment are similar to the ones on playgrounds and the main difference is that they are generally constructed in buildings and their appearance are not attractive for the children. In other words the children are using them just because they have to use them. However, both in Turkey and in foreign countries there are some other solutions created as therapeutic playgrounds for disabled children. It can not be ignored that there are some problems with these playgrounds. From this point of view the main aim of the design is finding solutions to these problems and designing a system of modular equipment which can be used both in open and closed areas.

5. DESIGN OF A MODULAR PLAYGROUND EQUIPMENT SYSTEM FOR PHYSICALLY (MOTOR) DISABLED CHILDREN

The children of middle childhood own a great deal of energy and have to spend this energy in safe ways in order not to cause harm. Playgrounds are accepted as the safest places to disperse the spare energy and to develop children's physical abilities, while enjoying themselves. However, children having physical (motor) disabilities are generally handicapped, since they can not enjoy themselves like the other children playing in playgrounds. In most cases, this type of children have to be satisfied with the specially designed equipment placed in hospitals. There are of course therapeutic playgrounds for the physically disabled children, but this type of playgrounds are especially designed for severely disabled ones.

As it is stated in the introduction part of this project, the main user group has been chosen as the children who are using orthoses or prosthesis in order to walk and using assistive devices as canes, crutches, or walkers. From this perspective, the necessary anthropometric dimensions and the measures of generally used assistive devices will be stated under the first subtitle of this chapter. The dimensions of the modules will be determined according to these data. The material of the elements used in the system will be examined under the second subtitle. The color combinations will be added to the material section. The assembling process and recommended combinations will be the last subtitle of this chapter.

5.1. Necessary Dimensions

The dimensions of the elements used in this system completely depend on the anthropometric dimensions of the potential user group. In Chapter 2., the user group has been specified as children of middle childhood. The reason has been given as the fast skeletal growth that takes place between the ages 7 and 12. During this period, children's play type has the characteristics of associative and cooperative play (Parten, 1932). In some cases they respond to each other and maintain separate goals and in some other cases, they become organized. From this point of view, the children's characteristics in play suit to games with rules (Piaget, 1963); play involves rules and competition between individuals or groups. As a result, the children like to play together, and enjoy themselves.

The suitability property of the equipment on which children play is the most important point of this project. The children should not be disturbing each other, while they are trying to achieve a special movement on the equipment. Moreover, they should be given opportunity of managing what is expected from them and feel a satisfaction from this ability. They should not get bored from playing on the same equipment as the time passes. Fitting of the equipment to the abilities of the user group can be determined by examining the anthropometric dimensions of the user group. In this section, the necessary dimensions to the user group will be stated and the related dimensions of each element in the system will be determined.

5.1.1. Related Anthropometric Dimensions

One of the basic criteria of a good design is the suitability of form and user group from ergonomics point of view. Unless the product fits to the potential user group, there is no meaning of the other properties, like cheapness, aesthetic and use of convenient material, etc., because the user can not make use of the product. If there is no available use of product, there is no need of it. Therefore, the dimensions of the potential user group

are very important in order to designate the form and decide on the relative dimensions of the product.

In this project, the user group has been chosen as the physically (motor) disabled children in middle childhood using special assistive devices; like, canes, crutches, walkers, and orthoses or prosthesis in order to be able to walk. Since the user group has detailed specifications, the necessary dimensions will be examined at a few steps.

Required dimensions of children in middle childhood: The period of middle childhood contains the children between 7 to 12 years old. The necessary maximum and minimum dimensions of maximum and minimum ages will determine different formal characteristics. In Figure 5.1 to 5.4, (the necessary dimensions) of children 7 and 12 years old in 5th and 95th percentile are given without differentiating boys and girls. The measurements given are stature of not shod children are obtained from Kayış (1987), because there is no other scientific study conducted related to children anthropometry in Turkey. Other relative dimensions are taken from Dreyfuss charts (Duffrient, Tilley & Bardagjy, 1990) according to the previously determined statures. All the stated dimensions will help to designate the necessary clearance and reach dimensions as the width of passages, the height of pipes and and the depth of treads.

In Figure 5.5 - 5.6, the minimum and maximum inside grip diameters can be followed. These dimensionss will determine the diameters of handrails which are placed on both sides of passages, stairs and ramps.

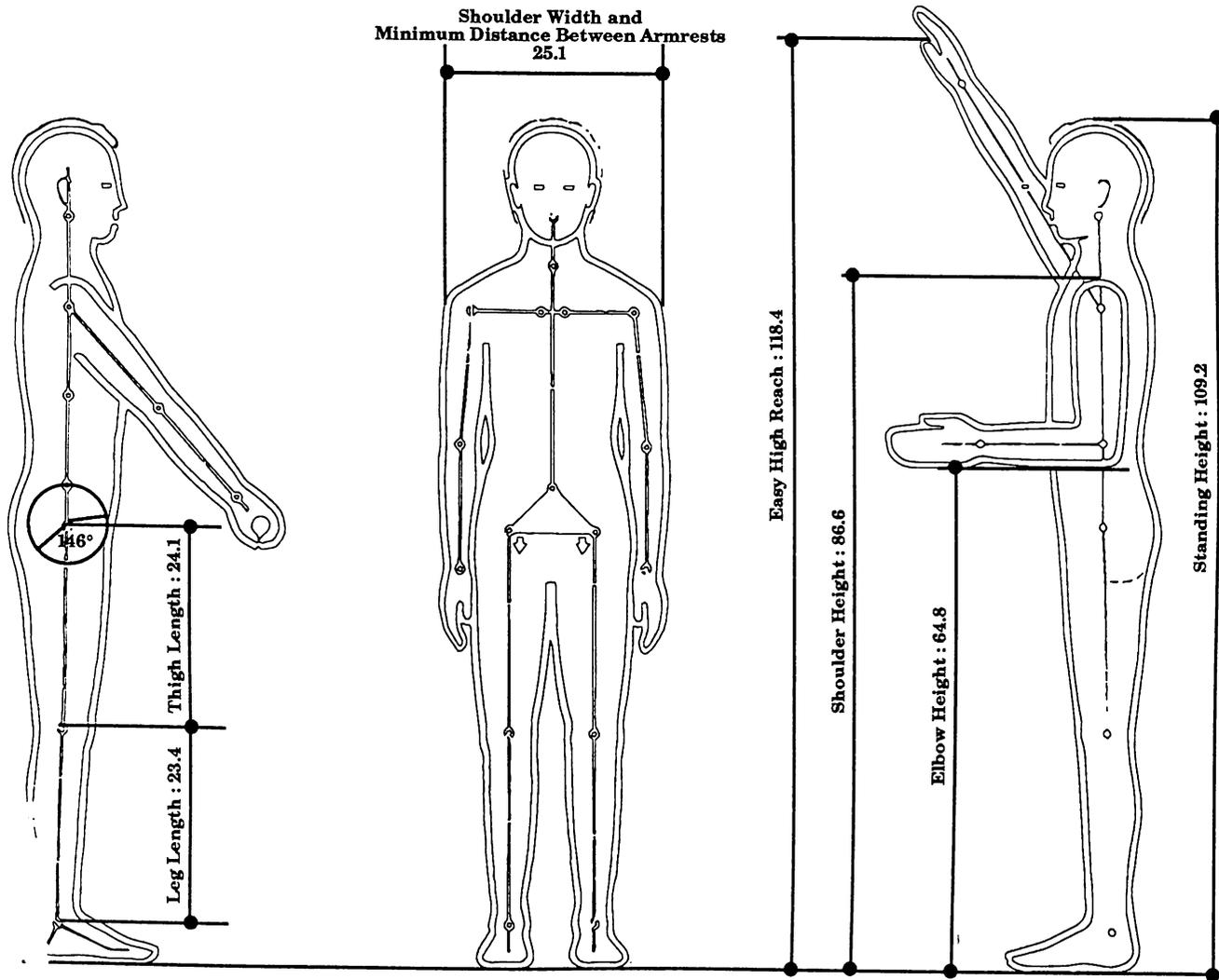


Figure 5.1. Dimensions of 5% 7-year-olds.
(From, Dreyfuss chart (1a, 1b), 1990)

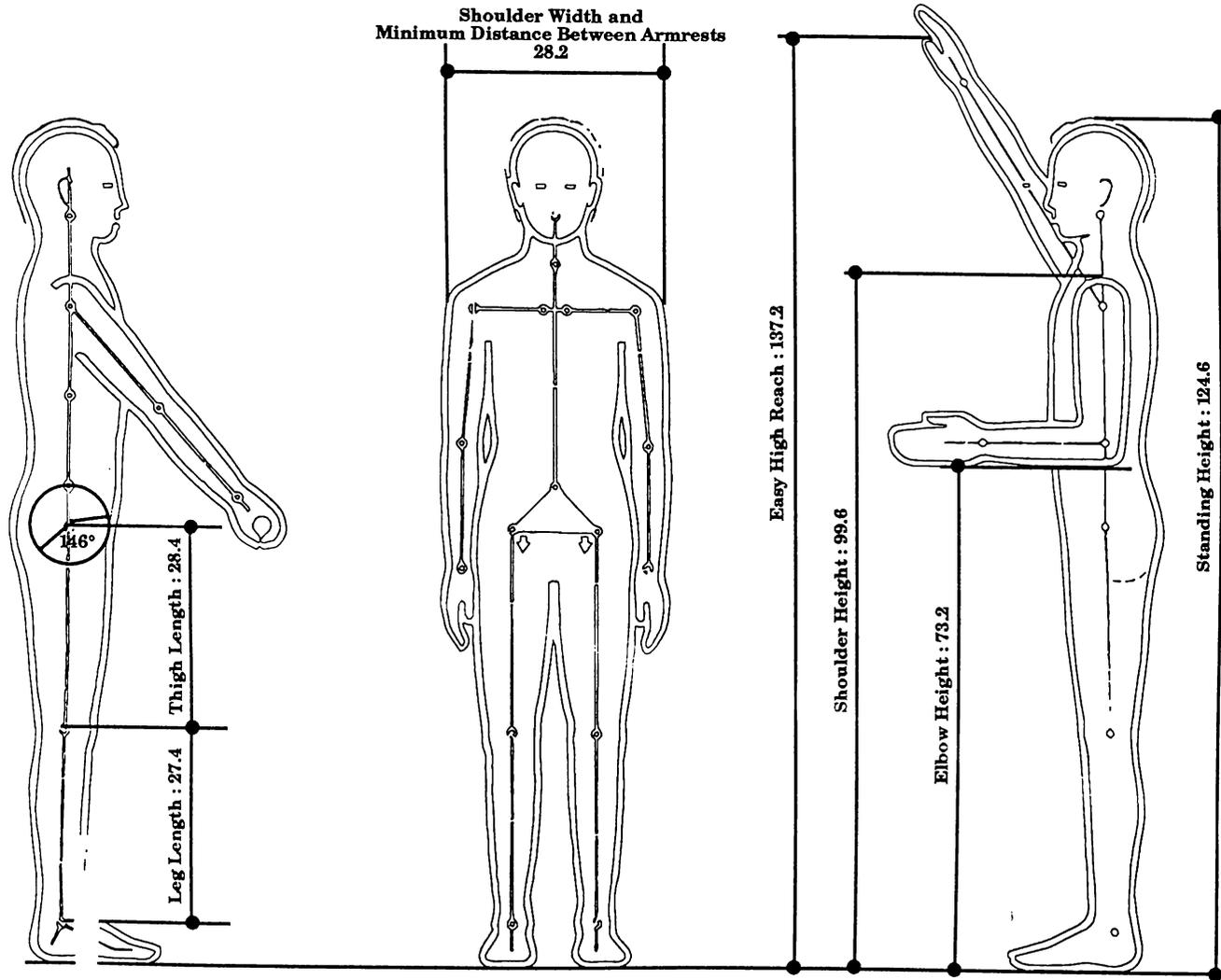


Figure 5.2. Dimensions of 95 % of 7-year-olds.
 (From, Dreyfuss chart (1a, 1b), 1990)

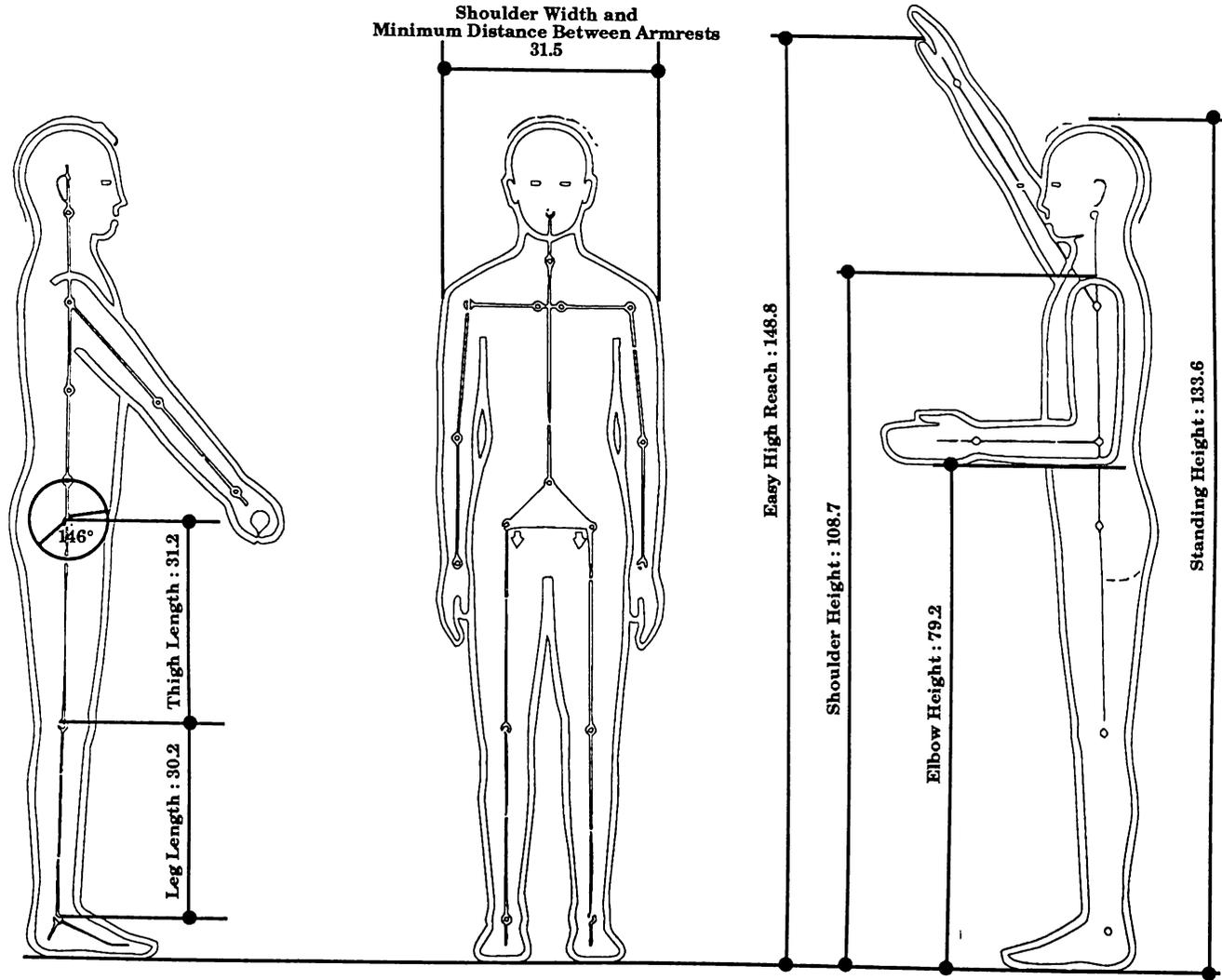


Figure 5.3. Dimensions of 5 % of 12-year-olds.

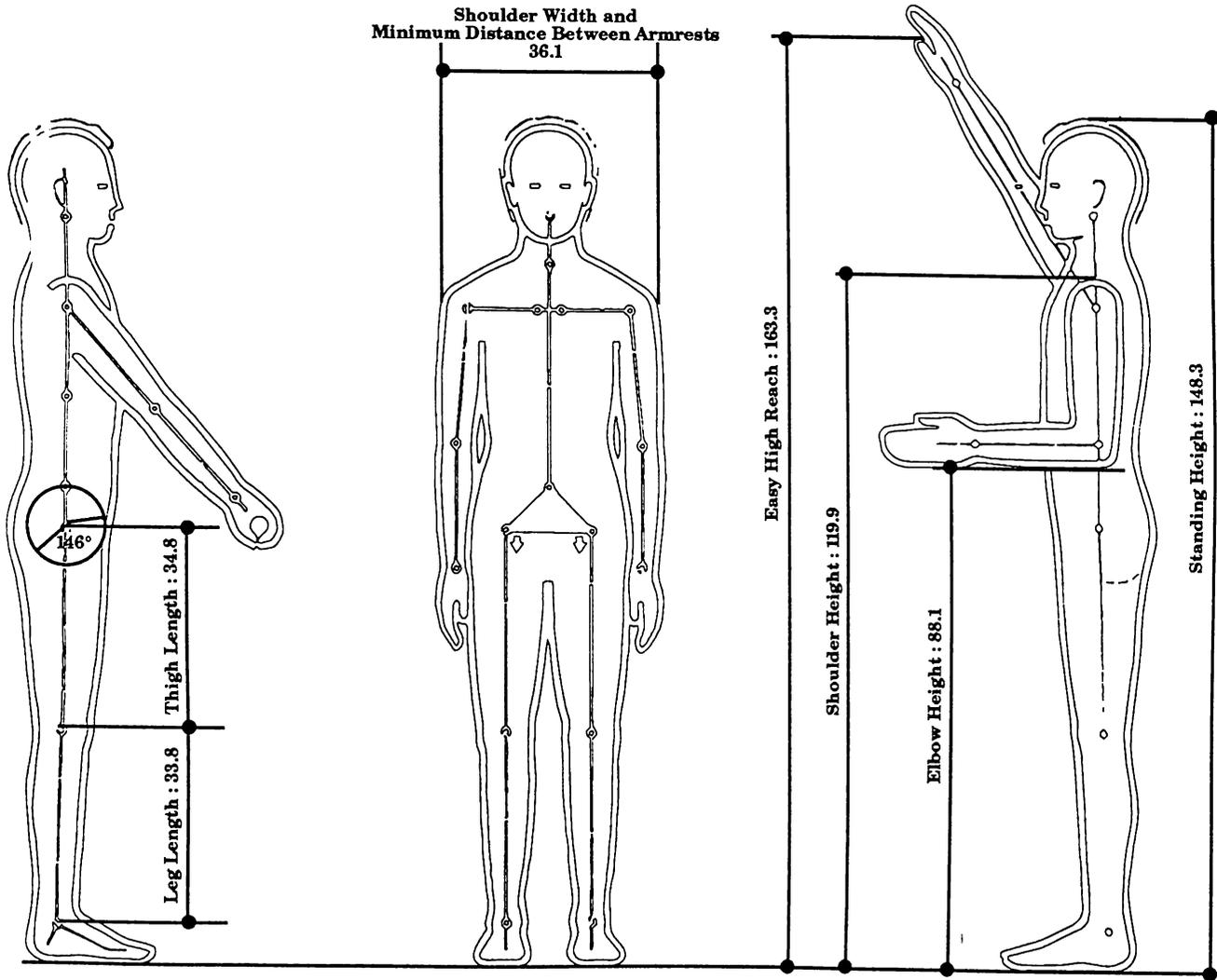


Figure 5.4. Dimensions of 95 % of 12-year-olds.
(From, Dreyfuss chart (1a, 1b), 1990)

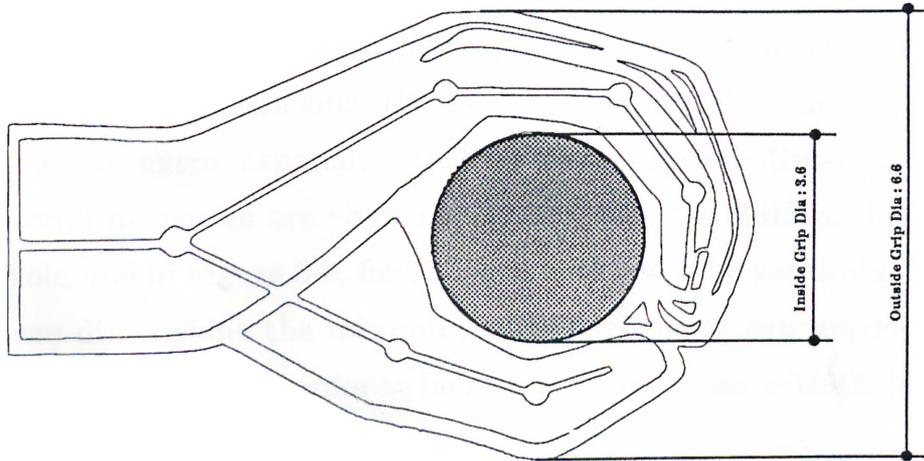


Figure 5.5. The Grip Diameters of 7-year-olds. (From, Dreyfuss chart(6), 1990)

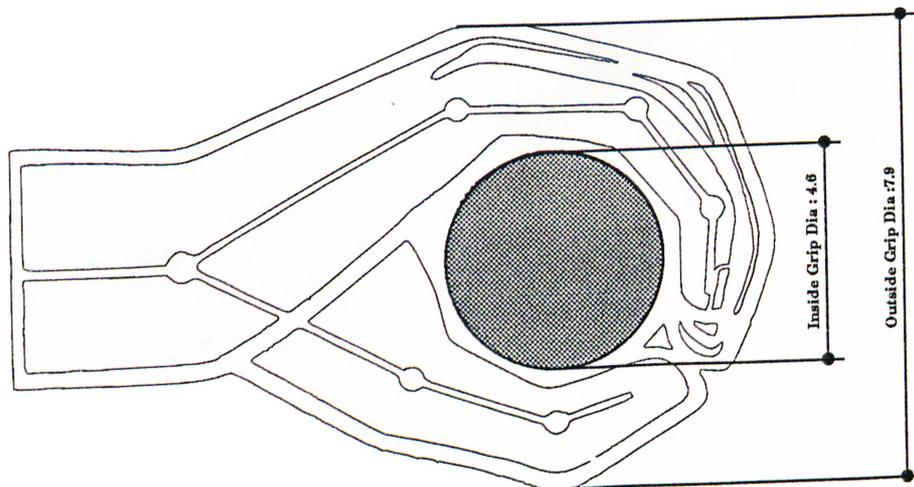


Figure 5.6. The Grip Diameters of 12-year-olds. (From, Dreyfuss chart (6), 1990)

Dimensions related to assistive devices: In the project, the assistive devices are very important since the user group can not walk without them. These devices have been stated as canes, crutches, walking aids, orthoses and prosthesis. For the orthoses and prosthesis there is no need of extra clearance on the equipment, because they are working as a limb of body and their dimensions can not be separated from the children's anthropometric dimensions. However, canes, crutches and walking aids cause some extra expansion in previously stated dimensions. These additional measures are shown in Figure 5-7, for children between 6-9 years old and in Figure 5-8, for children between 9-12 years old. According to these dimensions the minimum clearances that are needed for the potential user group in order to be able to walk either with their assistive devices or without using them are set.

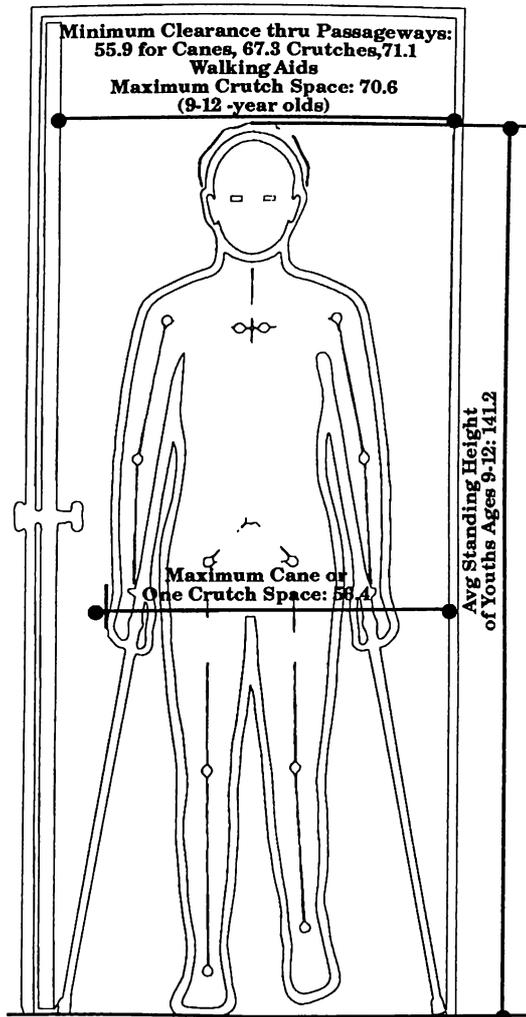


Figure 5.7. The Corrections of Physically Disabled Children (6-9 years old).(Dreyfuss(3B), 1990)

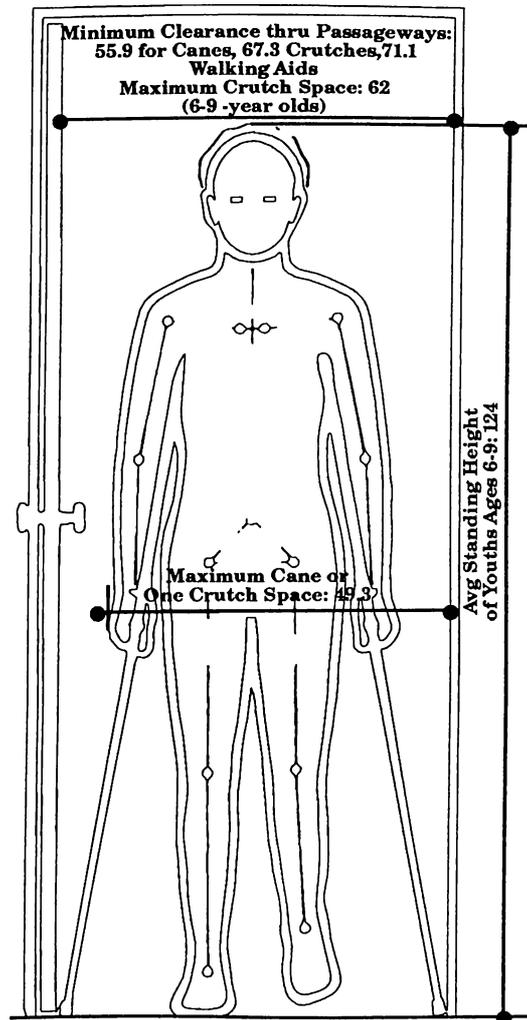


Figure 5.8. The Corrections of Physically Disabled Children (9-12 years old). (Dreyfuss(3B), 1990)

Required dimensions for environmental barriers: For the outdoor steps used by disabled people, the maximum riser height, minimum tread width and maximum nosing are shown in Figure 5.9. The importance of stairs or steps, as rehabilitative aids for controlling the coordination of muscles, has been stated before. If there is a need to make holes over the walking platforms, the maximum openings and minimum closed zones, in order to exclude crutch or cane, are shown in Figure 5.10. If ramps are going to be used, the maximum angle of the ramp with horizontal for walking with assistive devices is shown in Figure 5.11.

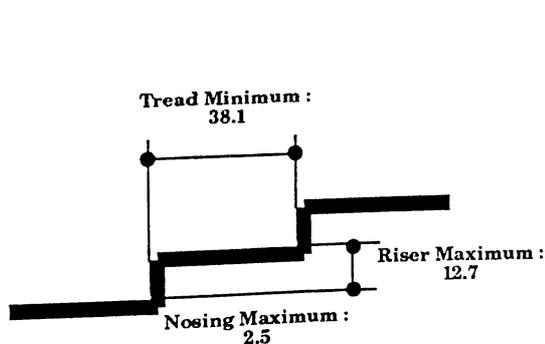


Figure 5.9. Dimensions of Stairs for Disabled People.(From, Dreyfuss chart (3b), 1990)

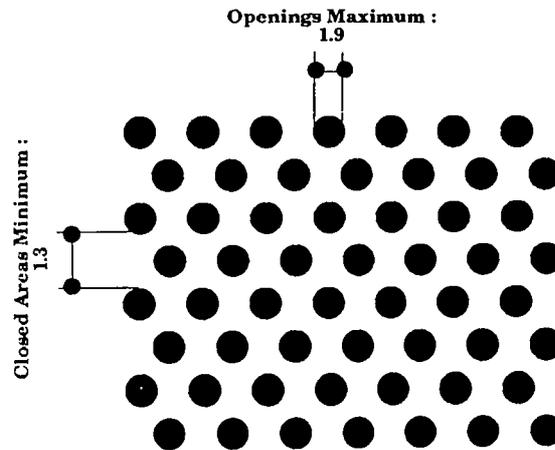


Figure 5.10. Dimensions of Openings and Closed Zones on Platforms.(From, Dreyfuss chart (3b), 1990)

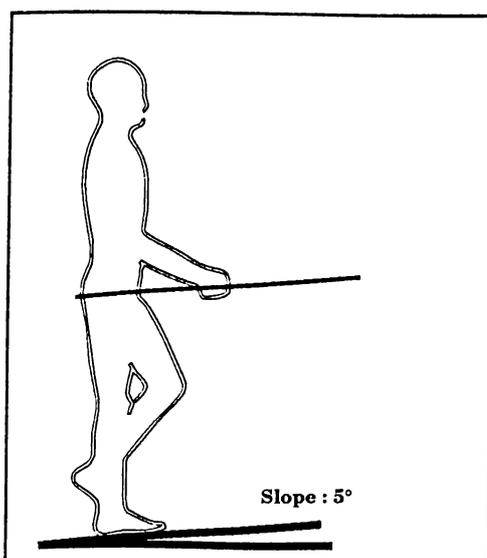


Figure 5.11. The Necessary Angle of Ramps for Disabled People.(From, Dreyfuss chart (9a), 1990)

5.1.2. Related Dimensions of Elements in System

The elements of the modular playground equipment system of the project can be classified as horizontal elements, vertical elements and connectors. The horizontal elements are also categorized in two groups as; platforms on which the disabled child can walk, and handrails which are held by user in order not to fall down. These two groups of elements let the child to go on different heights; sometimes as ramps, sometimes as stairs and sometimes as climbing structures.

On the other hand, the vertical elements, namely pipes, supports the horizontal ones, the platforms and handrails, and provide different heights for climbing up or down for the children. The connectors, as an other group, assemble the horizontal and the vertical elements to each other. This final group is made from pipe clips. The forms and the necessary dimensions of all groups of elements are explained in detail in the following lines.

Horizontal elements (platforms and handrails): Platforms are the elements that the disabled children can walk over them without having any difficulty, either by using their associative devices and/or by holding the handrails. There are two types of platforms with different forms. One type which has a square shape (named as Platform A) can be used as an element in forming aisles, stairs or ramps (Figure 5.12) and can be used as an equipment to change the vertical level. The other type is a sector of a circle (will be named as Platform B) can be used as both the vertical and the horizontal directional element (Figure 5.13) in 30° (with only one element), 60° (with combining two elements) and 90° (with combining three elements).

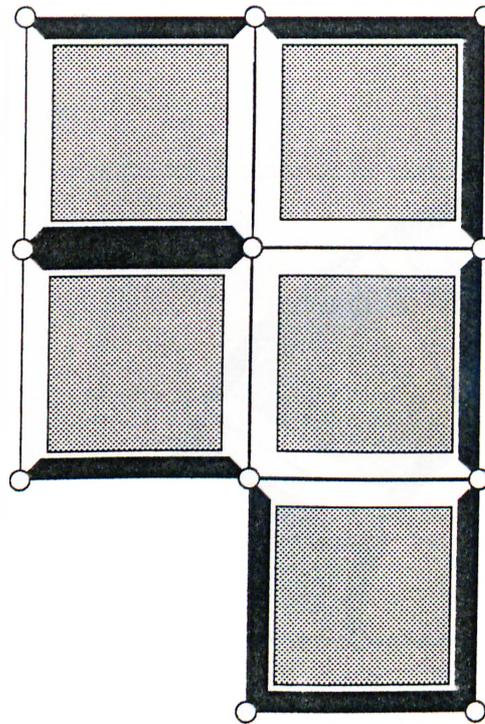
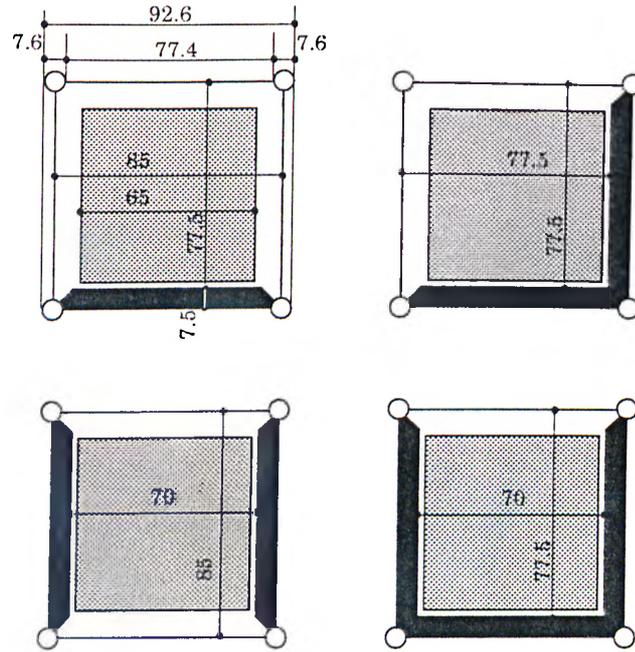


Figure 5.12. Types of Platform A and Assembling Combinations.

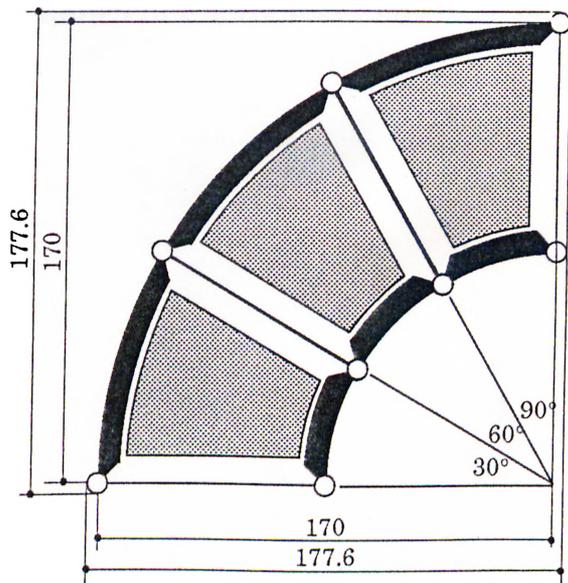
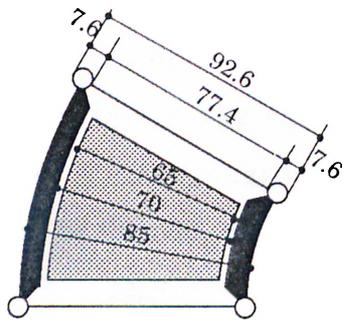


Figure 5.13. Platform B and 3 Possibilities of Turning Angles

The gross width of platform A is 85 cm, but the net width which is the usable space for the children (without the side barriers) is 70 cm, and this is the necessary maximum crutch space for 9-12 years old children (Figure 5.8). The 65 X 65 cm part of platform is perforated in order to have lightweight and for ease of transportation. The diameter of solids and cavities are designated according to Figure 5.10. The width of the side barriers mounted on platforms is 7.5 cm and this is the enough space for preventing the slip of canes or crutches over the edge of platforms. The form of Platform A is a square deformed at the edges. The quadrant forms of edges of platforms are for grasping the vertical elements easily. By placing Platform A at different levels, the ramps (maximum 5° with the horizontal, Figure 5.11), the stairs (maximum riser height of 10 cm, Figure 5.9)) and passages can be formed, as shown in Figure 5.14.

The form of the Platform B is one-twelfth of a circle and the angle between two sides is 30°. By the help of this angle, the equipment can have different angled turns, as shown in Figure 5.15, according to the limitations of space. There are two radius related to the Platform B, and the small radius (r1) is equal to 85 cm, where as the large radius (r2) is equal to 170 cm as shown in Figure 5.13. The area of each sector is nearly 500 cm².

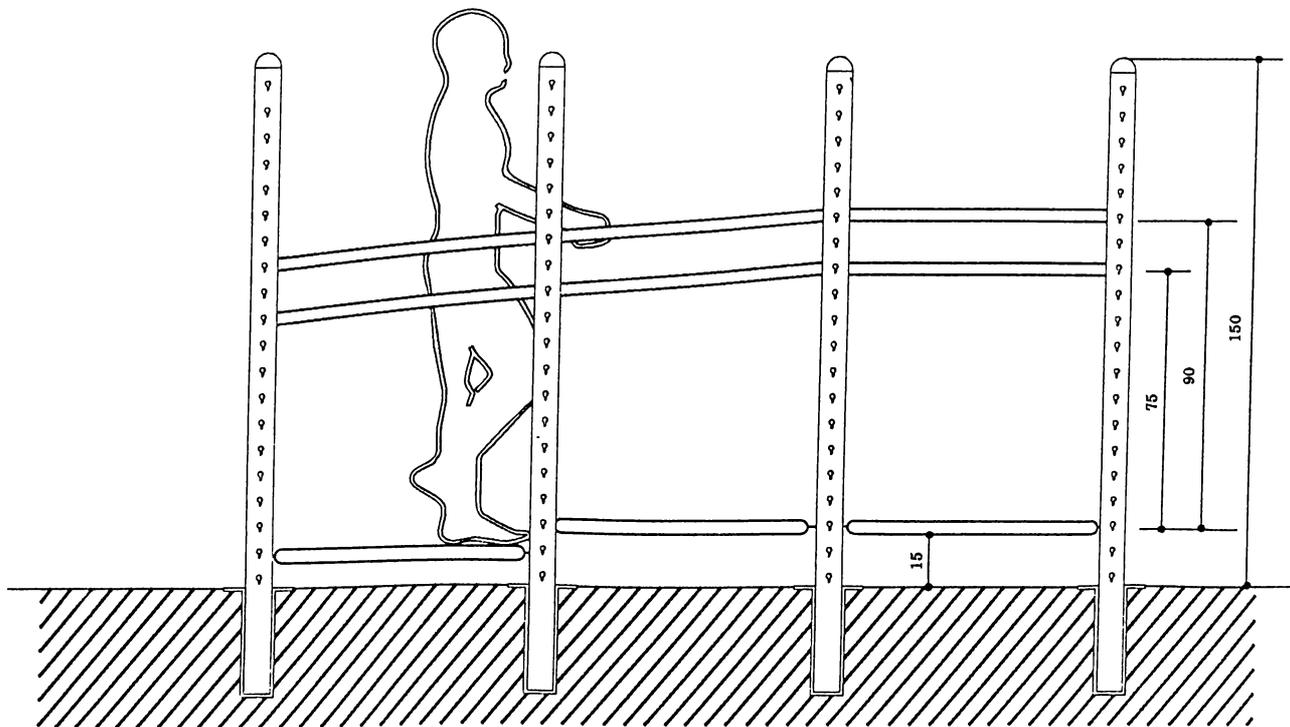
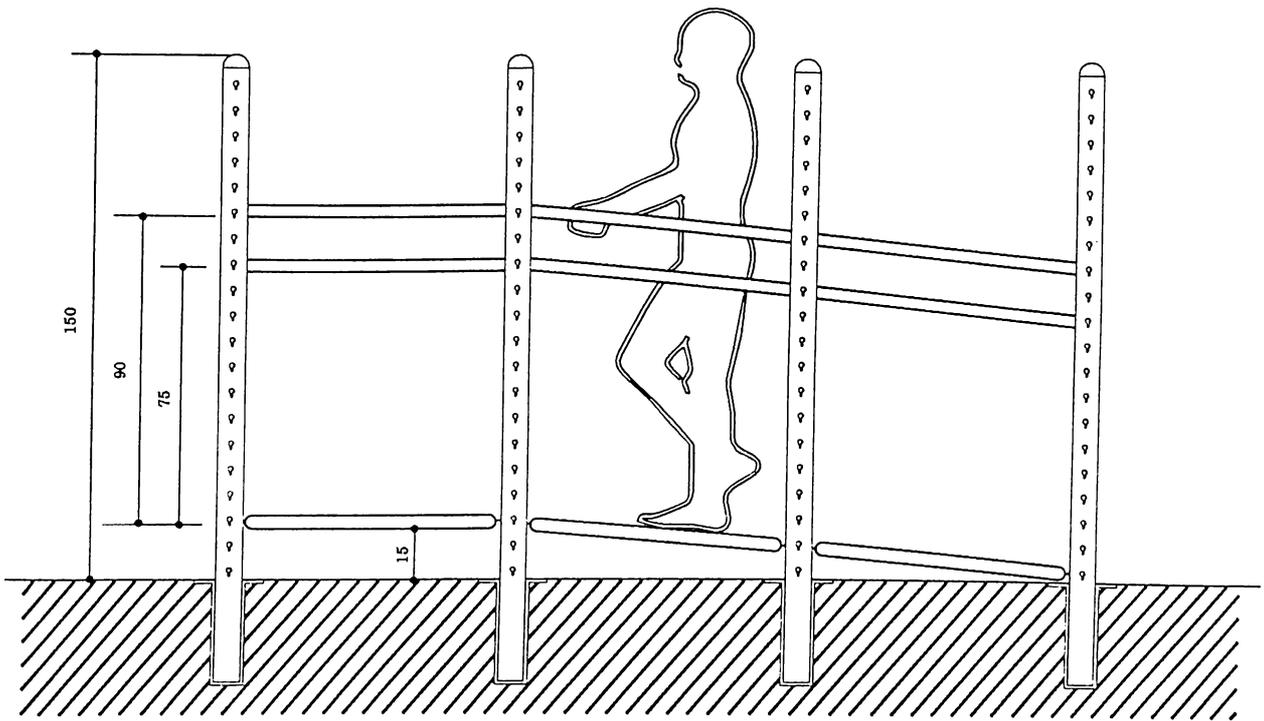


Figure 5.14. Different Usages of Platform A.

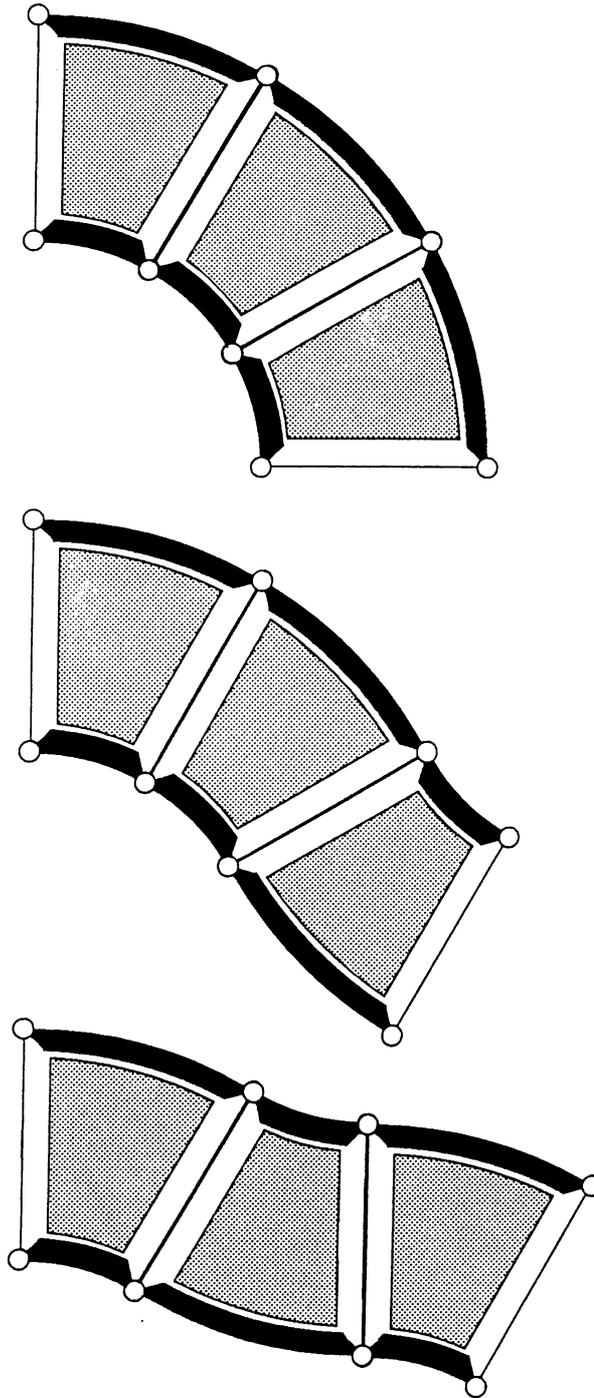


Figure 5.15. Different Angles that can be Created by Platform B.

There are two types of handrails with different diameters. One of them is suggested for the smaller children (Figure 5.5) and have outer diameter of 3.18 cm (4/5" in the market), as shown in Figure 5.16. The second type of handrails' outer diameter is 4.46 cm (4/7" in the market), in Figure 5.16 and suggested for the older children (Figure 5.6). The length of each handrail pipe is 85 cm, and the thickness is 2 mm. Both of these handrails must be used on the equipment at different levels; the smaller one must be placed at the minimum elbow height shown in Figure 5.1 and the larger one must be placed at the maximum elbow height shown in Figure 5.4. By using these two handrails at the same time a kind of parapet can be provided on both sides. This is an other recommendation for preventing fall downs from the equipment. Another due of the handrails of elder children is thought as being used as vertical ladders, like ladder on wall, shown in Figure 4.13. The wider handrails can be placed between two neighbour vertical pipes, with a maximum height of 15 cm, since the disabled children can not climb more than this height at once, Figure 5.18.

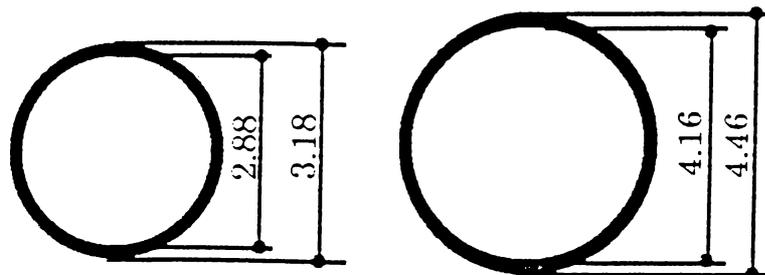


Figure 5.16. Section of Handrail for Smaller Children and Older Children.

Vertical elements (pipes): The vertical elements, namely pipes, let the platforms and handrails be at different heights in order to form passages, stairs or ramps. As shown in Figure 5.18, the outer diameter of each pipe is 7.62 cm (3" in the market) and the thickness is 3 mm. The constant height of each element is 180 cm of which 30 cm is placed in the basement previously grown in the earth. When a platform is on the ground level, the maximum height of handrail is 90 cm from the surface of the platforms and 150 cm of vertical pipe is optimum required height. There are special holes which look like drops and have the dimensions of 1.5 cm width and 2.6 cm height. These holes are placed on four sides of pipe which are on the perpendicular axis, and there is 7.5 cm between two holes. This height is determined according to the recommended slope of ramps, shown in Figure 5.11. The platforms and handrails are attached to the vertical elements by the help of these holes.

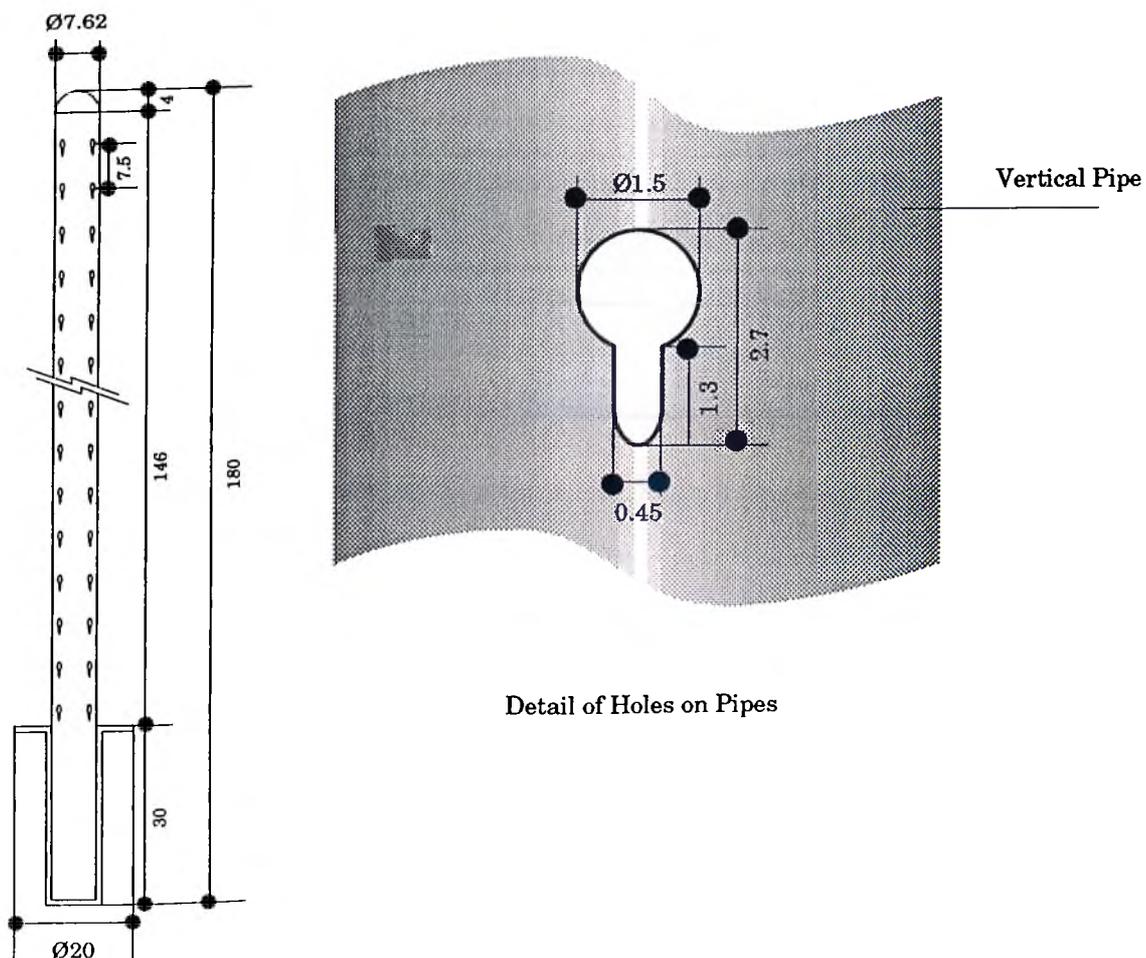


Figure 5.17. Orthographic Views of Vertical Elements (Pipes).

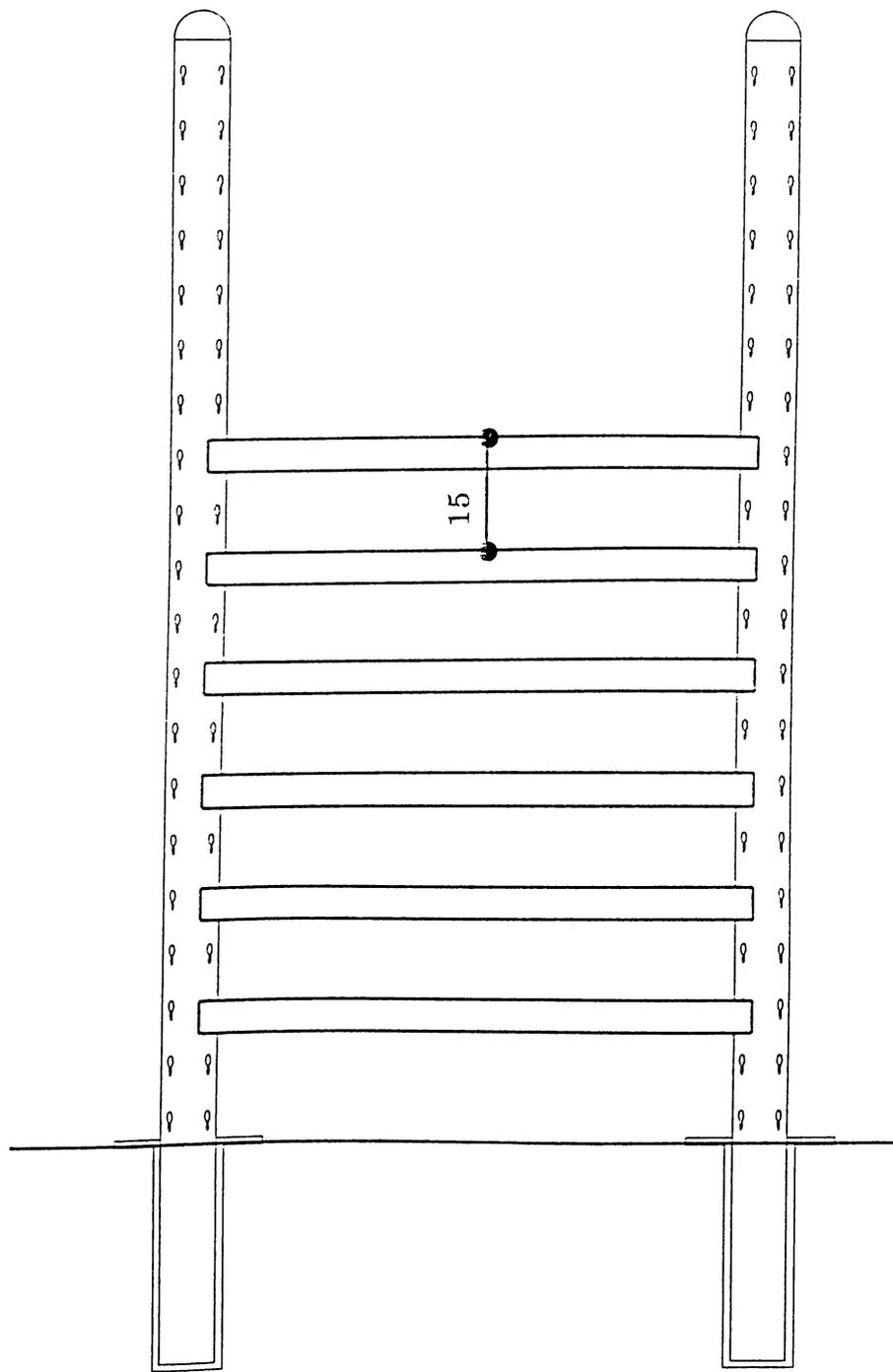


Figure 5.18. Handrails Used as Vertical Ladder.

5.2. Materials

Material is one of the important factors in design of any production, since it determines the safety of children while they are using the equipment and it also influence the forms and manufacturing process. Unlike most belief, durability of the material does not determine the durability of equipment (Heseltine & Holborn, 1987). In most cases, the equipment is destroyed by the children whether they are made of iron or not. Kolçak (1991) mentioned that building any playground is a kind of education both for designers and children, because both of them can not imagine the usability potentials and the capacity of the equipment. As a result , when the equipment is destroyed because of misusing (to the extends of vandalism), the designer learns what kind of precautions he must take and the children learn how to use the equipment, in order to have highest advantage.

Role of color, as stated in Chapter 3, is also very important on psychology of children. In other words, the children can be directed with the use of colors. For example; if the children are intended to be active physically, as in this project, the forms should have sharp and irregular lines combined with bright, primary reds and yellows in equipment and planting should be dominate. Besides, good, strong and contrasting colors help the eye to develop, to differentiate between objects and to access depth.

In this section, the material of elements of modules and of ground floor covering will be examined with the addition of recommended colors. The manufacturing process will be pointed out for each material.

5.2.1. Surfacing of Ground Floor

The generally used surfacing materials for playgrounds has been stated in Chapter 3, and the main groups were named as; grass, natural materials (as sand, wood bark, etc.), synthetic materials (mainly made from oil derivatives), and finally, hard materials (as cobbles, stone, asphalt, etc.)

(Heseltine & Holborn, 1987). All these materials have been examined for the playgrounds of normal children. However; the subject of this project is the differently abled children who have orthoses or prosthesis and are using some assistive devices; like canes, crutches, or walkers. A comparison is made from this point of view in the following lines;

Grass - It is one of the mostly used material for covering large areas, and general landscaping. Moreover; it is cheap and reliable. As a result, grass seems one of the most suitable surfacing element for all of the children in order to create a bridge between the children and nature.

On the other hand, grass is used in open areas and seeded on earth. There is no problem during winter time, because in winter, the earth is frozen and the grass lies under the earth. However; during the other three seasons which makes nearly 7 months there are several problems. One of them is the low slip resistant property of grass, especially when it is wet. This property is very important since, when it is not rainy, the grass should be watered for being green, and the earth becomes muddy. If a child using assistive device does not slip, he will, surely, have some problems with stuck legs of the device.

Natural materials - They are easiest, cheapest and effective surfaces and their impact absorbency is superior, when they are compared to the synthetic surfaces. The mainly used natural materials are sand, wood bark, chip and shingle. Sand is the mostly used one among the others. However; all of these materials are made of small or larger particles and these particles can get into the joints of especially prosthetic devices and create uncomfot for the child. Some of these materials have also abrasive nature, especially the sand. It can increase the wear on wood, strip paint of steps and play damage with plastic.

Hard materials - They are essentially used for the play areas of wheeled toys and seating places. Cobbles, stone and brick and asphalt are some examples of hard materials. Stone and brick can be a source of sounds in

play areas of visually impaired children. In fact, hard materials have no impact absorbency and this property makes them unfavorable materials as surfacing under the equipment.

Synthetic surfaces - They are mainly made from oil derivatives and can be used in various forms; some as tiles linked, bolted and stuck down or to be wrapped around a paving slab. Some of synthetic tiles meet the level of impact absorbency required from a 250 cm fall height. Although some of these materials are sensitive to light damage and are not slip-resistant, the floor surface material in this project will be one of the synthetic surface materials called as tufted carpets. The main reasons of this recommendation can be stated as:

- Tufted carpets can be found in Turkey easily and it is available to renew it, when the carpet is out of use.
- There are very few kinds of different qualifications and the length of tufts are one of the important property which affects the cost. Although the longer tufted carpets have more impact absorbency, they are not recommended, since sand has to be poured on this type of carpets. It has been stated that sand is not a useful material for the disabled children.
- The material of tufted carpets is a kind of man-made fiber; like nylon and the fringes are stuck into another type of plastics, like PVC .

The largest measures of tufted carpets are 400 X 2000 cm in one piece. This means that there is no need to make additions while covering under any of equipment.

- The life time of tufted carpets is 2 years under heavy use.
- Tufted carpets impact absorbency is enough since the fall height of this system is recommended as 75 cm in maximum, and it will be enough to meet the need of impact absorbency under equipment of this system.
- It is very easy to maintain this material, because it can be stuck to the

concrete surfaces. However; in order to improve the impact absorbency an other system of maintenance will be required. In this system, as shown in Figure 5.19., the area where is going to be covered with tufted carpet is firstly covered with cobbles and than with the mixture of earth and particles of rubber. The third material to be used is felt. After these levels have been prepared, a specially produced fiber tile is used under the tufted carpet as the last layer.

-It is easier to take care of tufted carpets than the grass, since there is no need to watering and cutting when it gets long.

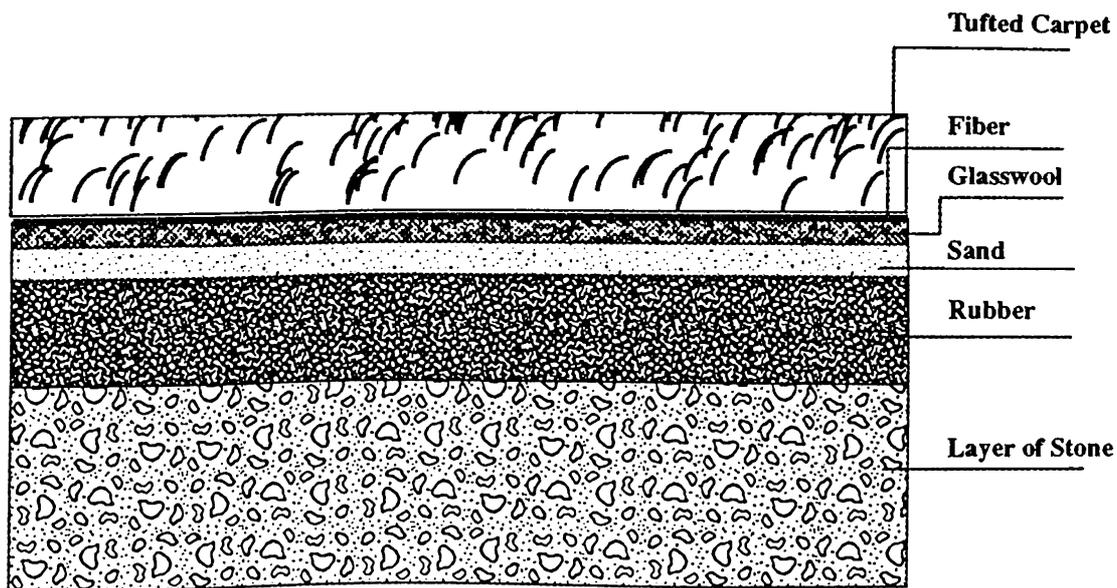


Figure 5.19. The Layers under Tufted Carpet in Order to Improve Impact Absorbency.

5.2.2. Materials Used in the System

As it was mentioned in the section of elements used in the system, there are mainly four types of elements in system; the platforms, the handrails, the pipes and the connectors. The basic materials used with these elements are sheet iron, fiberglass.

The platforms are the elements that child walk over and sit on. There have been three basic materials which can be used in order to produce these elements; wood, fiberglass and metal. However, each of these elements have their own inferiority and superiority to each other. Wood is one of the natural material that can be found in nature in its pure form, and it is the best material to meet the children with nature. The child can touch and feel the sense of being a part of it, but the woods are not so durable since they are organic. When they are painted for protection, they loose the natural appearance. Another point is that they can not be replaced easily and instead of walking over them, it is better to make use of their shadow.

Fiberglass, in general, have the property of corrosion resistance and a high strength-to-weight ratio. They can be formed into almost any shape and size. The most common fiber used is glass, and although many types of fiber and resin are used the most common plastic is thermosetting polyester resin.

Two new types of fiberglass products have been developed. In one, glass fibers impregnated with a resin are continuously pulled through and heated in a die which polymerizes the resin and produces frames, like door or window frames. These frame units can be shaped to any size and form and also are available in a wide range of colors. The same combination of glass fibers and plastics have introduced a type of structural material which is available in square and round tubes, channels, I-beams, angles, and plates for use as a structural system for buildings, platforms, ladders, railings and various decorative elements. Although fiberglass

seems as the other suitable material for the platforms, the children who are thought to be as users are using canes, crutches or walkers as assistive devices and fiberglass can not bear pointed weights.

Metal is one of the unfavorite materials for equipment of children, but it is very durable and can bear high ranges of weights, even it is pointed. It can not be damaged easily and can be stabilized. The platforms of this project is decided to be made from iron sheet of 3 mm thick. The sides are bended 4 cm with the angle of 90° downwards. For finishing the surface, epoxy dye is used, because epoxy is a chemical dye and it can not be removed when it is applied once. The color of iron sheet of platforms will be dark gray (Pantone, Cool Gray 10).

The fiberglass, on the other hand, is used as side barriers for preventing to fall down from the platforms. The reason of using fiberglass is that it is very easy to give any amorphous forms in any color. The recommended color of fiberglass elements are red (Pantone, 193). The sectional drawing of barriers and platforms can be seen, in Figure 5.20.

The children are always in touch with the handrails while they are walking or climbing. The handrails must be durable, neither hot in summer, nor cold in winter and never hurt hands of children because of slivers. When we come to the point from these views, the material of handrails are decided as iron pipes painted with a rubber base paint, as shown in Figure 5.21. The color of handrails are recommended as yellow (Pantone, 130).

The material of pipes, the vertical elements, are galvanized iron with the reason of galvanization preventing the corrotion because of holes found over the pipes. The sectional drawing of pipes can be seen in Figure 5.22. The color of pipes are decided as blue (Pantone, 266)

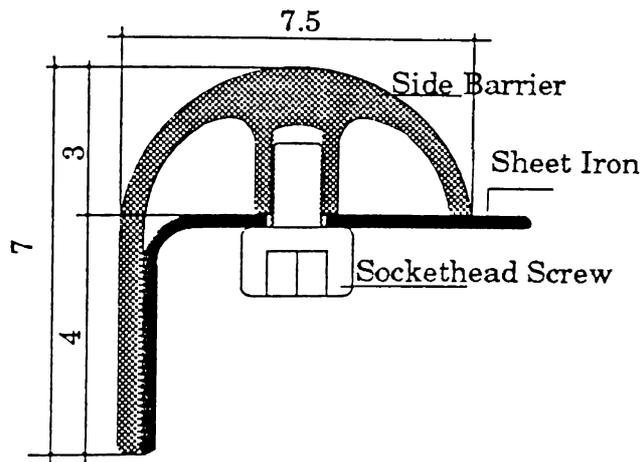


Figure 5.20. Sections of Fiberglass Barriers and Iron Sheet Platforms.

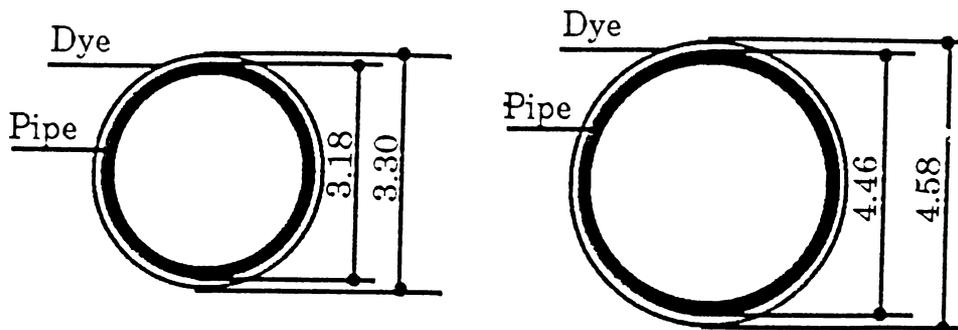


Figure 5.21. Section of a Rubber Base Painted Pipes Used as Handrail's Material.

lock outward and finally, a lock, which passes through the holes on the vertical pipes. 3 Dimensional view of button can be seen in Figure 5. 23. and the working system of Type A connectors can be seen in Figure 5.24.

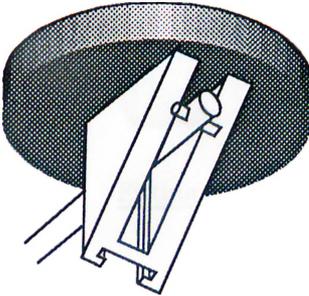


Figure 5.23. 3 Dimensional View of Button.

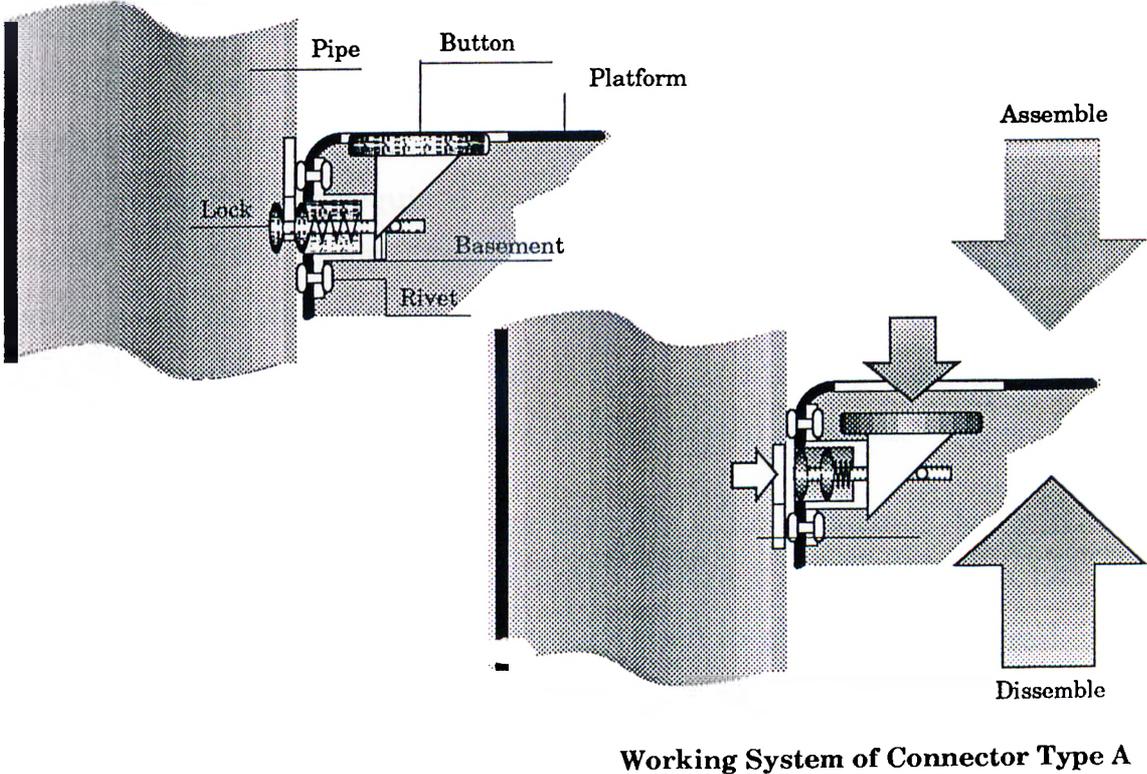


Figure 5.24. The Working System of Type A Connectors.

The Type B, on the other hand, is more of a fitting unit and is designed to be used in connecting the handrails to the pipes. Figure 5.25 shows the usage of Type B.

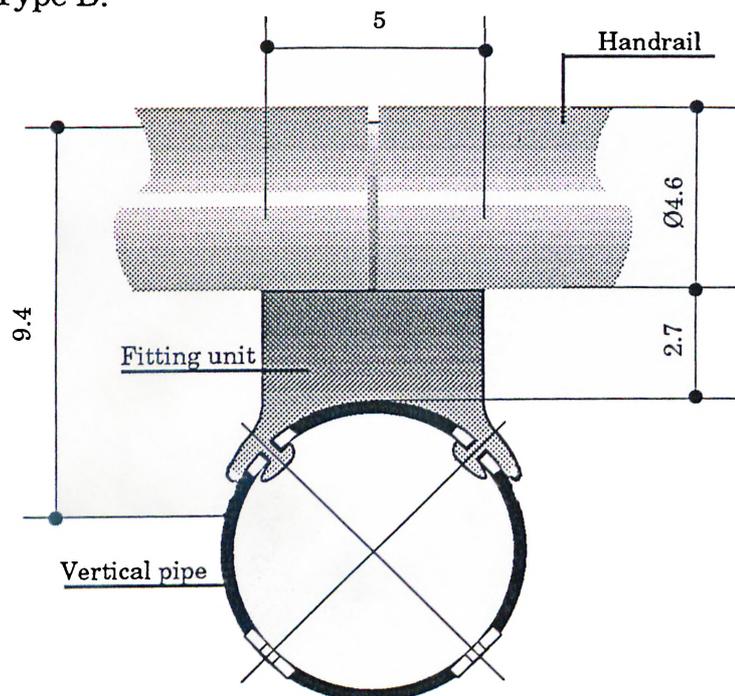


Figure 5.25. The Sectional Detail of Assembling the Handrails with Pipes.

In Chapter 5, the importance of anthropometric dimensions have been discussed and the necessary dimensions have been given according to the younger and the older user groups. In addition, the dimensions related to assistive devices and the required dimensions for environmental barriers are stated. All these dimensions have determined the dimensions of elements used in the system. After giving information about the platforms and handrails as horizontal elements, and the pipes as vertical elements, the importance of connectors have been told in detail.

The materials used in the system have been the other important factor in design and they have been categorized in two different groups as; material used as ground floor covering and materials used in platforms, handrail, pipes, and connectors. The assembling of system has been the final point stated in this chapter.

In the following pages, there are some recommended plans, elevations and three dimensional drawings of configurations of the system.

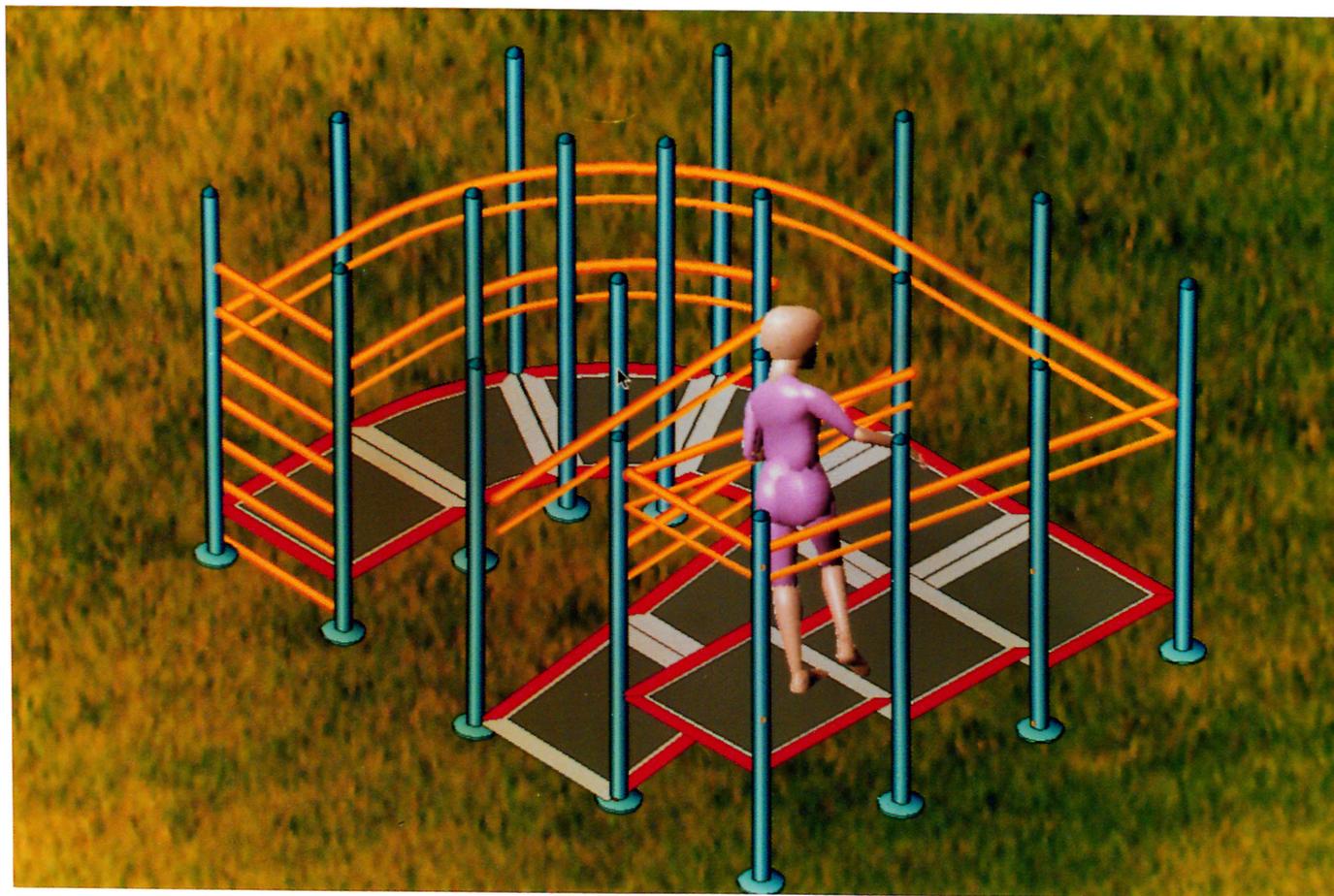


Figure 5.26. A 3D Drawing of One of the Equipment.

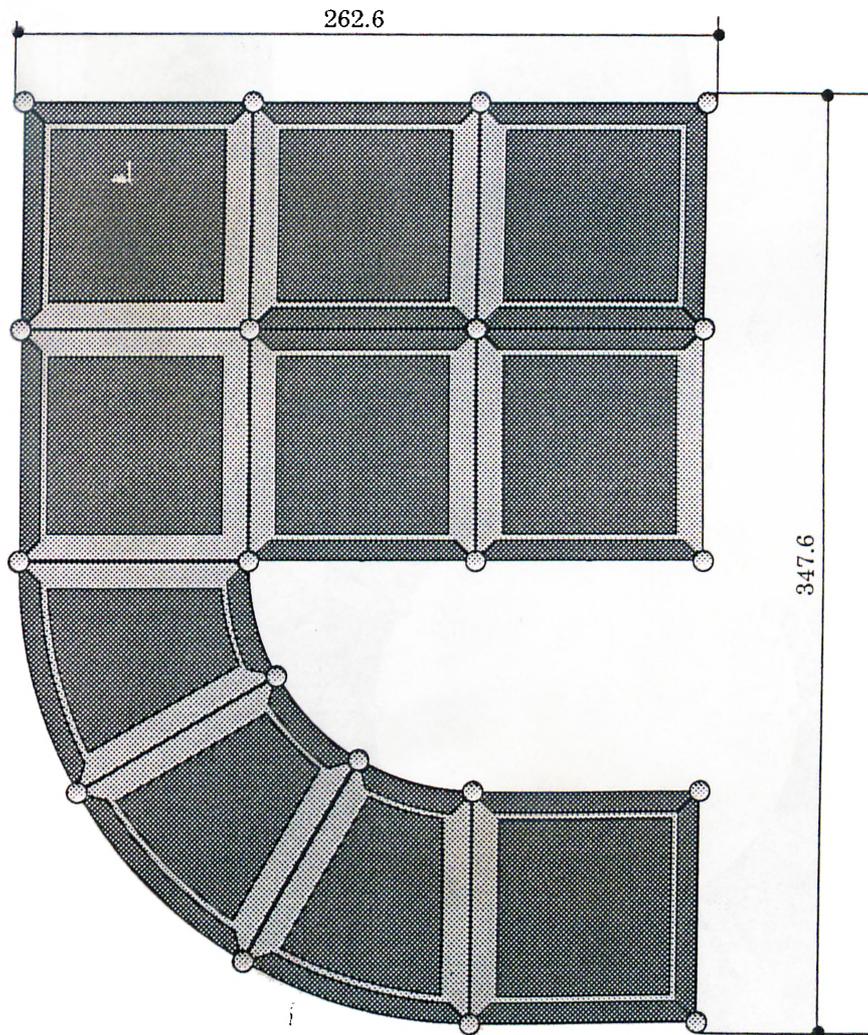


Figure 5.27. Top View of Figure 5.26.

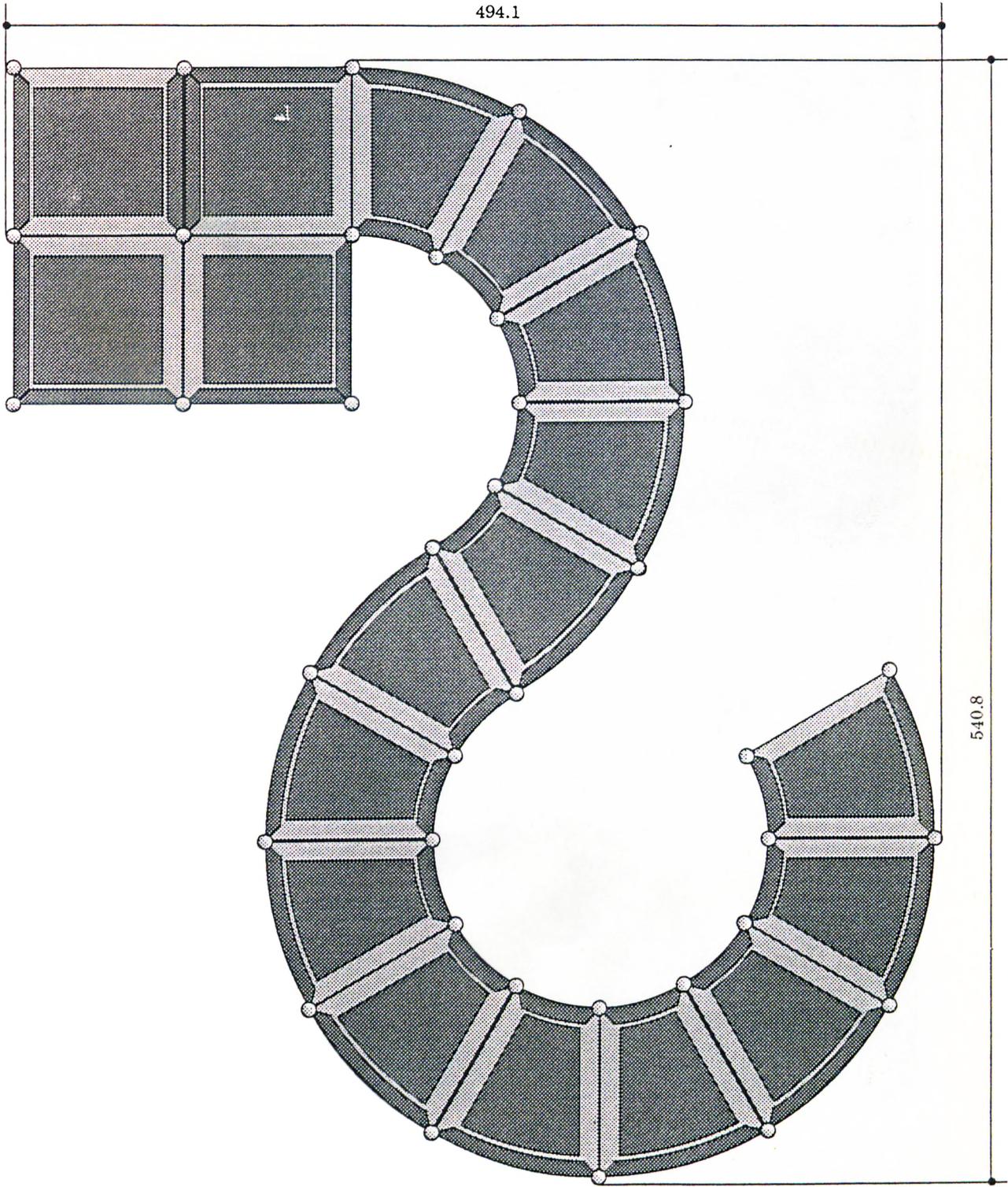


Figure 5.28. One of the Sample Plans of Possible Configurations

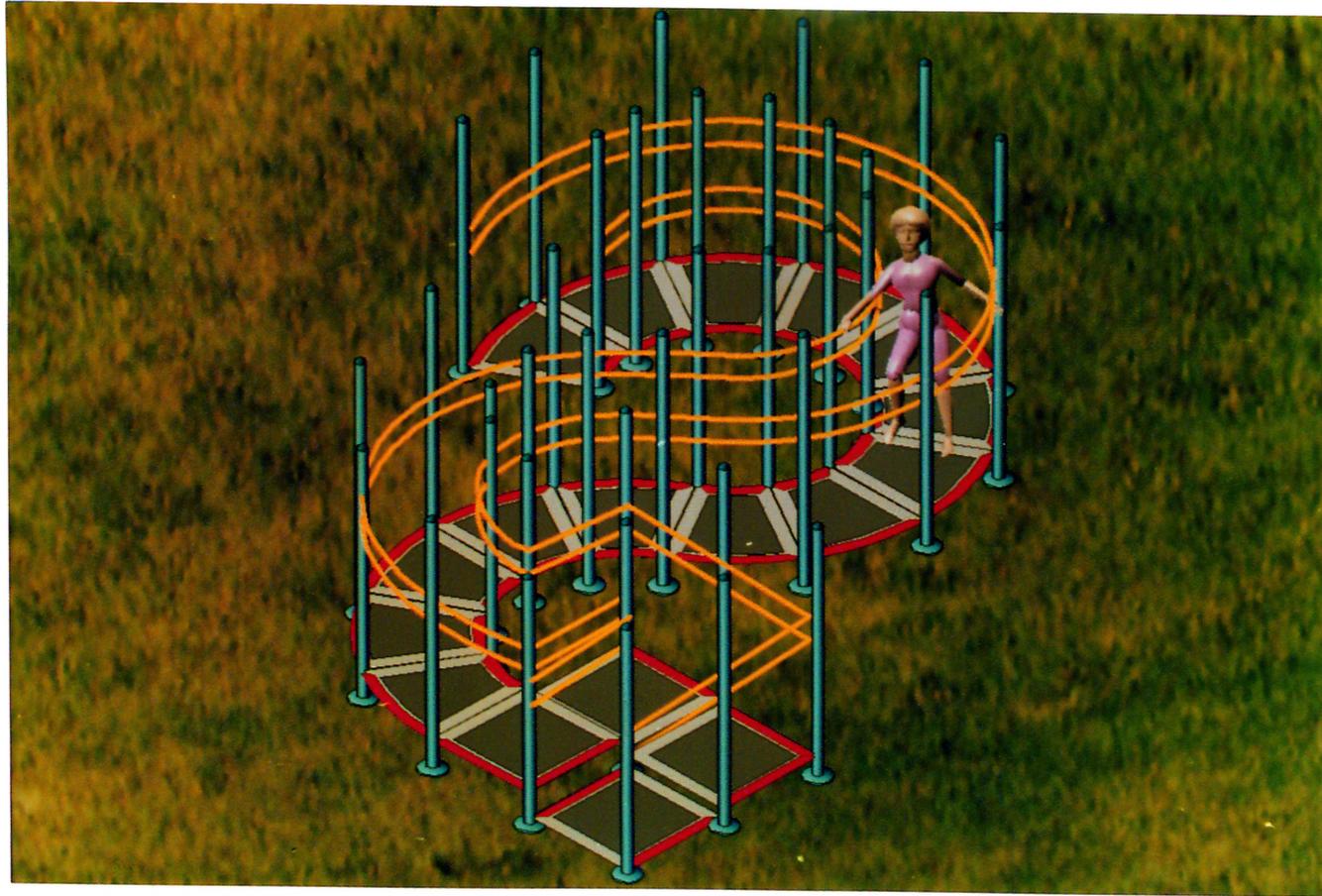


Figure 5.29. A Possible 3D Drawing of Figure 5.28.

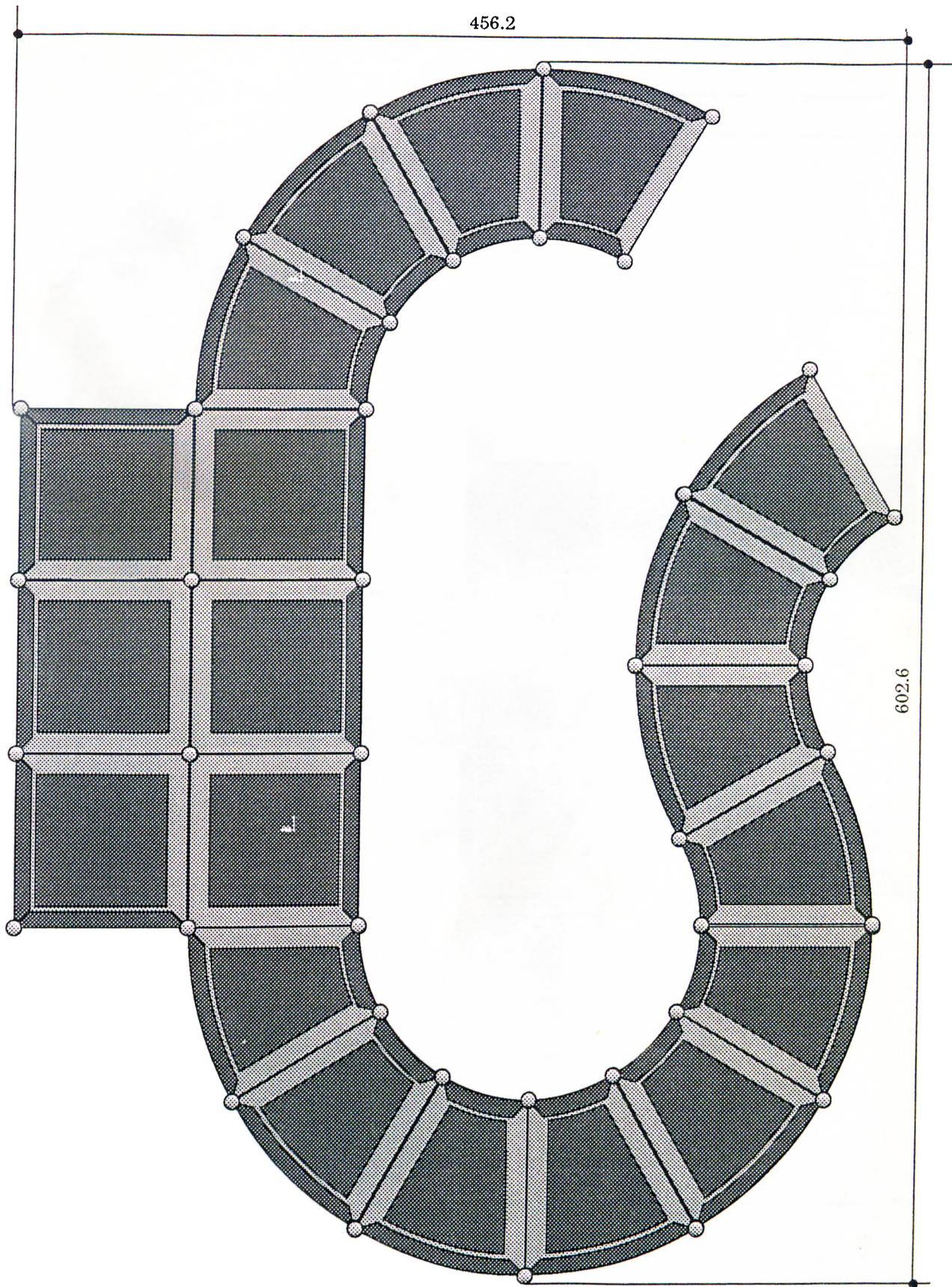


Figure 5.30. Another Possible Plan of Configurations.

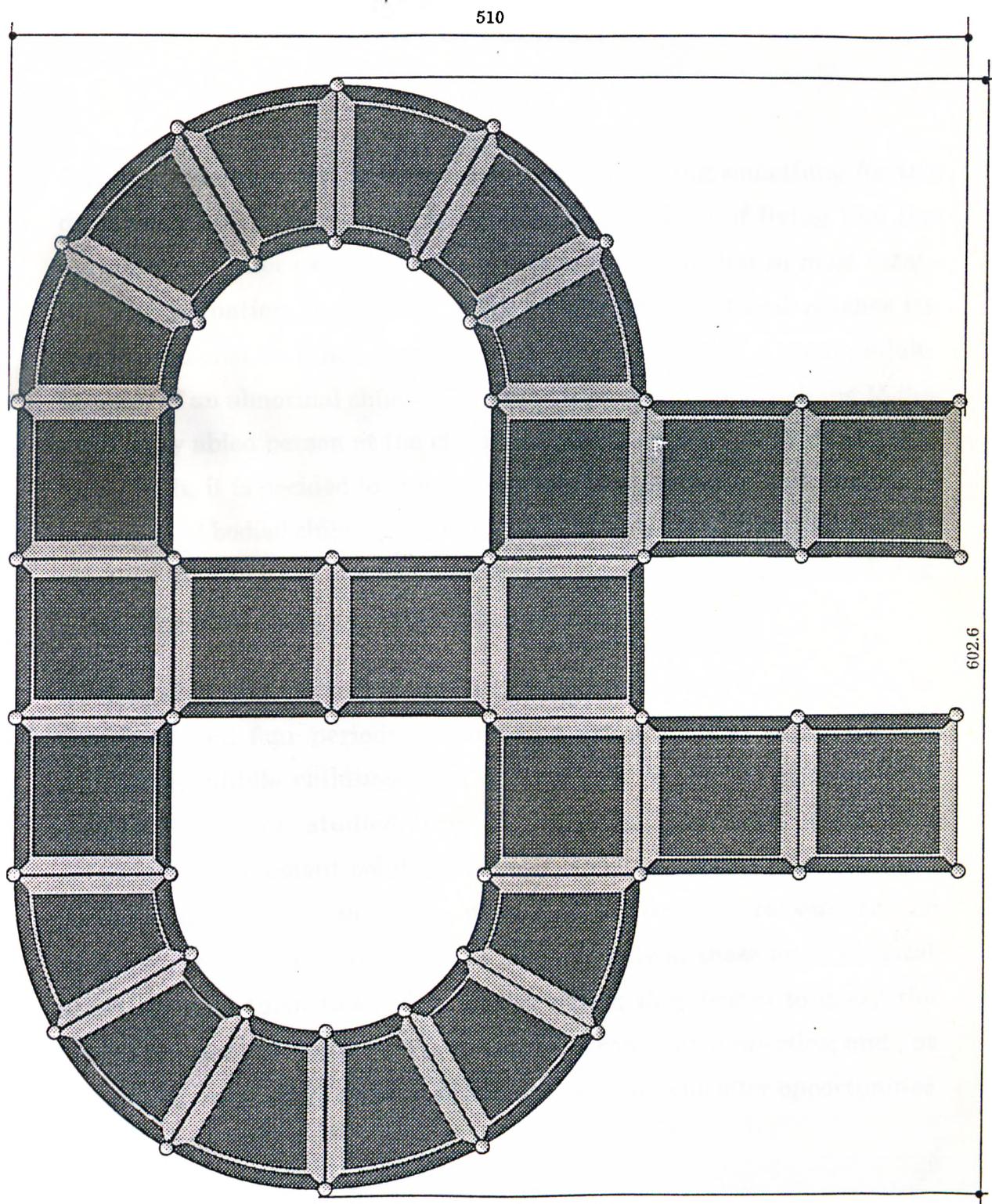


Figure 5.31. Another Example of Plans.

6. CONCLUSION

Initially, the main aim has been determined as doing something for the differently abled people who have very little chance of living like the normal ones. After examining the problem, it is seen that in most cases, the discrimination begins during the childhood period and reaches its largest dimensions when the differently abled person is a young adult, because of an abnormal childhood. From this point of view, helping to the differently abled person at the childhood period appears more important. As a result, it is decided to create a medium for gathering both the abled and unabled bodied children being aware of each other and learning to live together. Besides, the unabled ones can be given the opportunity of living a better childhood like any other able bodied children.

At first step, the characteristics and properties of children have to be examined and four periods of childhood are argued as infancy, early childhood, middle childhood and adolescence. When all of these four groups have been studied from the physical, cognitive, social and emotional development points of view, it emerges that middle childhood period is the most suitable group for this project. The reasons can be stated as; the skeletal growth takes place mostly at these ages; physical activities help them to develop master skills; they began to grasp the logical relations of things and the rules with constant properties; and , at this period most children have at least one friend, who offer opportunities to learn social skills.

The importance of play has been the second step to be examined in child's development. There have been many types of play pointed out as practice, symbolic and ruled play on one hand and solitary, parallel, associative

and cooperative plays on the other. When these types are studied in detail, practice and associative types of play come out as the fitting ones to the aim of the project, since the first one contains repeated movements to consolidate, perfect or elaborate a skill and in the second one children respond to each other during play but maintain separate goals.

Depending on five criteria as time, change, challenge, suitability and cooperation, the type and quality of play are taken into consideration, three types of theories can be told about the role of play in development of children. In psychoanalytic theory, the child has the opportunity to act out conflicts and fears in a safe environment. In learning theory, play allows children to observe their peers as models to imitate them. Finally in cognitive theory, play promotes interpersonal understanding, enhanced problem solving and creative thinking. In other words, play can be summarized as a process by which children learn and come to terms with the social and physical environment and this is why play, along with the basic needs of nutrition, health shelter and education, is accepted vital for development of the potential of all the children. Since play is a very important factor for children and they learn to be socialized while playing, it can be used as a reason for gathering the normal and disabled children. The third point has been searching the answer for the question of where the children can play, because play and play spaces are indistinguishable. Play space is a general term that is used for every place where children play on and each play space affects child's development from five points of view. These are the environmental (children receive information from the surrounding environment and use it in their intellectual development), physiological (coordination increases with constant practice and recurrent use of play spaces), creative (creative play spaces offer opportunities to develop a flexible approach to problem solving), educational (any play space can provide information to identify concepts of shape, size, number and relationship between parts) developments and social education (play spaces provide the opportunity to children to meet and interact with each other).

The quality of play space, which depends on few points like; physical fitness, intelligence, creativity and imagination, is as important as the quality of play, if the children have to possess better play opportunities. It should not be forgotten that providing the quality of play space has a close relationship with the type of play space. In general the types of play spaces are classified in eight groups as natural space, under-used land, dormant land, despoiled land, operational land, found space, amenity areas, woonerven and playgrounds. Except for the last group all the other play spaces are used without any intervention; however, the playgrounds are created artificially by human as a small scale imitation of the world, in order to give opportunity to develop children's muscles and intelligence together while they are playing. As a result the playgrounds are chosen as the most suitable play space for gathering both the normal and disabled children as safe as possible.

There are also some types of playgrounds with respect to the aims for which they are build up. Flynn (1985) classified the playgrounds in eleven different groups; one-time user, returning client, adult, adventure, creative junk, thematic, traditional, vestpocket, construction and therapeutic playgrounds. Although the activities carried out by children on playgrounds are remarkable since they determine the type and the quality of the equipment which are going to be placed, the developmental requirements of the middle childhood are met best by the construction playground. The problem is that the disabled children can not make use of the equipment found in construction playgrounds (climbing structures, horizontal bars, balance beams, horizontal ladder, and multi-play structures). The therapeutic playgrounds, on the other hand, are built up for the severely handicapped children, and found generally in hospitals or institutions. In order to socialize the disabled children and gather them with the abled ones, one should not limit them and close in an unpleasant environment. Being careful with the selection of the right equipment in right place can easily solve this problem, with the addition of using suitable colours to motivate all children.

From this perspective, equipment of the playground is very important, because most of the equipment produced in the market are not suitable to even the abled children that the disabled children can never use them. The solution of this problem can only be found in designing an equipment or an equipment system which is modular and can be assembled in different ways in order not to bore the user and the dimensions of each equipment should be suitable for both the normal and disabled children. Eventhough the normal children can manage to do many things and make use of the equipment easier than the disabled ones, the dimensional information and other properties of disabled children becomes more important.

After having determined the subject and place in order to create the medium according to the aim of this project, it became obvious that all of the disabled children can not be put together, because of the different disabilities causing different characteristics. For example; a child who can not be able to move and has to lie can only make use of therapeutic playgrounds; whereas, a child who has only broken one of his legs can make use of many equipment found in traditional playgrounds after a certain rehabilitation period.

The type of disabilities have been researched as the fourth point, three main groups of disabilities are emerged as; physically disabled (concern both the sensorial and motor disabilities), emotionally disturbed and mentally retarded children. The second and third type of disabilities need a special education and rehabilitation and meeting them with the abled children may cause severe damages. The physical disabled children are more convenient for this project, since their social problems can be coped with creating an appropriate environment for both groups.

There are also types of physical disabilities which can be divided into two main groups; motor disabilities and sensorial disabilities. Both the motor and sensorial disabilities are the consequences of diseases or accidents and the subgroups of motor disabilities can be named as; paraplegia (it happens when certain areas of the nervous system are not

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The type of disabilities have been researched as the fourth point, three main groups of disabilities are emerged as; physically disabled (concern both the sensorial and motor disabilities), emotionally disturbed and mentally retarded children. The second and third type of disabilities need a special education and rehabilitation and meeting them with the abled children may cause severe damages. The physical disabled children are more convenient for this project, since their social problems can be coped with creating an appropriate environment for both groups.

There are also types of physical disabilities which can be divided into two main groups; motor disabilities and sensorial disabilities. Both the motor and sensorial disabilities are the consequences of diseases or accidents and the subgroups of motor disabilities can be named as; paraplegia (it happens when certain areas of the nervous system are not

working), hemiplegia (it is the paralysis of one side of the body), quadriplegia (it is the paralysis of all four limbs) and amputation (it is the removal of a limb or other appendage). Visual and hearing impairments are the subgroups of sensorial disabilities that they are not suitable to the aim of this project from the rehabilitation point of view.

Since the physical (motor) disabled children can not use some of their limbs properly, they are in need of some assistive devices in order to move from one place to another. These assistive devices are canes, crutches, walkers, wheelchairs, prosthesis and orthoses. The only contrary device which can not be accepted in this project is the wheelchair, since whatever is designed for this group, the abilities of wheelchair is very important than the ability of the user. For example; if the breaks are not strong enough, the wheelchair can easily slip down on any kind of slope.

Deciding on the properties of the appropriate equipment that can be used by the physically (motor) disabled children using some assistive devices, like canes, crutches and the others, the equipment used for the rehabilitation of physically (motor) disabled children in hospitals attracted the attention. The specifically designed equipment, both used in Turkey and foreign countries, have been examined in order to design the playground equipment system with a rehabilitation value. The common points of these equipment are supporting the coordination between muscles and helping to the patient for being in balance either standing up or walking. These points have been the main perspectives of designing process of equipment system.

The necessary dimensions have been researched in order to determine the dimensions of each module of the system, since ergonomics is the most important criterion for a functional design. In fact, this project's aim was designing the equipment which are suitable to the anthropometric dimensions of Turkish children. However, because of having no other scientific study except Kayış's (1987), which was made for providing better school units for primary school children. The measurements of standing

children in shod between ages 7 to 12 have been obtained from the stated source. Other relative dimensions have been taken from Dreyfuss (1990) charts, according to the determined statures, even though the body proportions can be changed according to the countries, because of the same reasons stated above.

In addition to the previous information, the assistive devices used by the potential group have a special importance because the user group can not walk without them. Within this scope, the minimum clearances needed for the potential user group in order to be able to walk in both cases of using their assistive devices and holding one or both of the handrails have been stated. The required dimensions for environmental barriers have been stated according to the specifications of the user group. And finally, the dimensions of elements used in the system (platforms, handrails, pipes) have been determined.

The materials used in the system have been the second important criterion for a proper design, so the materials were chosen as safe and durable as possible. Tufted carpet has been recommended as ground surfacing material because its resemblance to grass, ease of maintenance and having enough impact absorbancy in the cases of falling down. The system has been made from four main elements including, platforms, handrails, vertical pipes and clips. After examining the properties of three materials(wood, fiber glass and metal) which seem suitable to the aim of the project, the main material of the platforms have been decided as sheet iron, whereas fiberglas is the most suitable material from the safety of children and ease of production. However, fiber glass can not stand to heavy pointed weights and the potential user group of this project is using some assistive devices like canes, crutches or walkers. On the other hand sheet iron is the most durable material and it can bear high ranges of pointed weights. However, fiberglass has been chosen as side barriers placed on the required edges of platforms, in order to prevent falling down from the platforms. The materials of handrails have been decided as

painted with a rubber based dye pipes, because of durability and heat and cold resistance. Finally, the material of vertical pipes has been decided as casted iron, since the pipes have some holes and fittings have special designs for holding the handrails and galvanizing the vertical pipes was the best solution against corrosion

The modularity of the system causes the ease of assembling the elements and the possibility of obtaining different alternative designs according to the properties of the area specified for the equipment. The system with its minimum limits covers an area under ten square meters or multiples of ten square meters. One of the main points to be paid attention while assembling the equipment is that the entrance and exit of equipment must never be at the same point. This precaution will prevent the crowding of the entrance and exit. Another main point is that the designed equipment must have at least two exits (except for the entrance) or one exit with secondary paths, so a child who changes his mind and wants to get out of the equipment can easily leave it, without disturbing the other children.

The color combinations are also very important, since the choice of color can affect the activities that take place on the playgrounds and attract the attention of children for a very long time. These are only two out of five points which determine the quality of a play. In order to motivate the children to be active on playground bright, primary colors must be used, so the color combinations have been decided according to this reality and bright, primary colors have been recommended for the elements of equipment.

It should be emphasized that the main purpose of this project was not to design a brand new equipment which is completely different from the ones which have been designed previously in the market, but to design a place for gathering both the able and the disabled children in order to enjoy themselves. Except for the connection detail, all other materials and details can be seen over the previously designed playground equipment.

After the researches about the playgrounds and playground equipment, it became obvious that many people around the world work for both the normal and differently abled children and create many designs for them. However, many few things have been done on this subject in Turkey. The disabled children can not make use of the playgrounds, like the normal ones and the rehabilitative equipments are unpleasant in appearance. As a result of this study, a modular equipment system is designed which may look like the other equipment that can be seen around. However, some modifications have been done about the anthropometric dimensions related to the equipment and some precautions are taken according to the main potential user group.

Further Study

This project shows that a scientific study must be done for the disabled Turkish people, and the anthropometric dimensions of these people must be determined in order to do proper studies and designs for them. If they need help and doing something to make life easier for them is due to all the designers of all kinds, this study must be done and let the designs suitable to the differently abled people's properties. It should not be forgotten that most of the designs for the disabled people are also preferred by the normal people. The reasons can be stated as ease of use and ergonomic properties of the designs.

An other point which should be taken into consideration is that the adolescence period is also very important during the development of personality, and this period includes 12 to 18 years of age. However, the differently abled children are educated by the government during the age of 16, and then left alone. There must be something done for these people and they must be sure of still being a part of the society after the age of 16. Some other centers can be designed in which many of them come together with the many normal people. At least, the already build up places can be renovated and all the barriers can be eliminated for the sake of society.

GLOSSARY

- accomodation:** In Piaget's theory, the process of adjusting existing ways of thinking, of reworking schemes, to encompass new information, ideas or objects.
- assimilation:** In Piaget's theory, the process of adjusting new information and objects to make them fit existing ways of thinking or scheming.
- asynchrony:** Want of coincidence in time; the coordination of two or more events not happening together.
- asynchronous growth:** Growth of different parts of the body or different aspects of the individual at different rates.
- brain stem:** The cells in the genital ridge which give rise to the primordial ova present at birth.
- bone age:** Skeletal maturity.
- cerebral cortex:** The outer layer of gray matter covering the brain; responsible for complex information and conscious thoughts.
- cerebral palsy:** A disorder of movement or posture that appears during very early childhood and is caused by a malfunction or direct or in direct damage to the motor centers of the brain, usually before or during birth.
- cognitive style:** The way an individual conceptualizes or approaches tasks; a distinctive way of perceiving, feeling and solving problems that constitutes part of an individual's personality.
- concrete operations:** Piaget's stage of cognitive development between the age about 6 to 12 years in which children can think logically about concrete or observable concepts.
- egocentrism:** One's inability to take another person's point of view; this imbues and colors thinking in early childhood.
- internal capsule:** A broad band of fibers passing to and from the cerebral cortex, lying against the convex medial surface of the lentiform nucleus and therefore V-shaped when seen in horizontal sections of the brain.
- intuition:** In Piaget's theory, the pre-conceptual or prelogical thought of children from about 4 to 6 or 7 years of age, when children reason by guesses not logic.
- lymph system:** A network of vessels in the body that carry lymph of tissue fluid from tissues to veins.
- medulla oblongata:** The tapering caudal portion of the hind-brain, extending from the posterior border of the pons to the first segment of the spinal cord.
- motor coordination:** Skills involved in coordinating physical movements.
- nurture:** In developmental psychology, the factors in the environment that can affect development of the individual.
- Oedipal rivalry:** In Freud's theory, the erotic attachment little boys in the phallic stage have for mother and their fear that father will find them out. These feelings are usually repressed.
- ossification:** The process of bone information in which, beginning in the center of each prospective bone, cartilage cells are replaced by bone cells.
- presbycusis:** The natural failure of hearing with advancing years, caused by degenerative changes in the internal ear.

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