Tribhuvan University

Institute of Engineering

DEPARTMENT OF ARCHITECTURE

PULCHOWK CAMPUS

A THESIS REPORT

ON

CENTRE FOR CHILDREN WITH AUTISM

BY

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(074-BAE-211)

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR
THE DEGREE OF

BACHELORS IN ARCHITECTURE

DEPARTMENT OF ARCHITECTURE

PULCHOWK CAMPUS

PULCHOWK,

LALITPUR

CERTIFICATE

This is to certify that this thesis entitled "Centre For Children With Autism" at Budhanilkantha, Kathmandu, submitted by Ms. Dikshya Gupta has been examined and it has been declared successful for the partial fulfillment of the academic requirement towards the completion of the degree of Bachelor of Architecture.

…….

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Declaration

I declare that this dissertation has not been previously accepted in substance for any degree and is not being concurrently submitted in candidature for any degree. I state that this dissertation is the result of my independent investigation/work, except where otherwise stated. I hereby give consent for my dissertation, if accepted to be available for photocopying and understanding that any reference to or quotation from my thesis will receive an acknowledgment.

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074BAE211

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Acknowledgment

Firstly, I would like to express my deepest appreciation to my thesis supervisor **Ar. Ritu Raj Rai** for his invaluable guidance, support, and criticism on every step of the process, which led to this report. My sincere gratitude for his continuous guidance of research methodology, and critical thinking, and for pushing me to gain more understanding of the topic at every step of the process. I would also like to thank **Mr. Anish Kc**, the principal of SERC (Special Education and Rehabilitation Center), and other staff members who welcomed me and shared their valuable experiences in the respective areas which have been invaluable input for my thesis. I would also like to acknowledge **Ms. Sangita Karki**, principal of HOPE child development and research center for providing me with valuable information to understand various aspects that are useful in my thesis project.

Furthermore, I would also like to acknowledge with much appreciation the crucial role of Jurors for their critical comments that have fostered my growth in developing this report. I would also like to express my deepest gratitude to my seniors and friends for taking part in the useful decision and giving necessary advice and suggestions.

At last, I would like to express my gratefulness to all those contributors for the depth and diversity of the ideas reflected in the preparation of this report.

Dikshya Gupta

2074/BAE/211

Abstract

Autism spectrum disorder is a neurodevelopmental disability caused due to differences in the brain. People with ASD often have problems with social communication and interaction, and restricted or repetitive behaviors or interests. People with ASD may also have different ways of learning, moving, or paying attention. The cases of autism spectrum disorder are increasing at an exponential rate. In April 2018, the CDC reported that 1 in 59 children in the US had a diagnosis of autism. The current study, however, updates this figure and estimates that roughly 1 in 40 children in the US have a diagnosis of autism spectrum disorder. According to the World Health Organization (WHO), approximately 1 in 160 children worldwide has ASD.

According to a report by the Autism Care Nepal Society, about 300,000 children suffer from autism in Nepal. Awareness about autism is very scarce and next to nonexistent in most parts of the nation. ASD affects the way people communicate, behave, or interact with others, and generally, these symptoms manifest at the young age of 12 months to 2 years. In lack of awareness and diagnosis of ASD these young children when in need of more attention and help are shunned and isolated from the community. There is a very limited number of NGOs working for the welfare and rehabilitation of children with autism, which are not properly designed. The focus is given only on the therapies and skill development while the environmental factors are considered to be neglected.

The study will explore the physical and psychological needs of children with autism. The necessary tools and guidelines to architecturally address the specific sensory requirements of individuals with autism will be studied. The center will be a positive learning and therapeutic space imparting academic, vocational, and life skill training to children with autism for their adjustment to society.

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1 BACKGROUND

1.1 INTRODUCTION

Autism spectrum disorder (ASD) is a developmental disability caused by differences in the brain. Some people with ASD have a known difference, such as a genetic condition. Other causes are not yet known. Scientists believe multiple causes of ASD act together to change the most common ways people develop. People with ASD may behave, communicate, interact, and learn in ways that are different from most other people. There is often nothing about how they look that sets them apart from other people. The abilities of people with ASD can vary significantly.

People with ASD often have problems with social communication and interaction, and restricted or repetitive behaviors or interests. People with ASD may also have different ways of learning, moving, or paying attention. It is important to note that some people without ASD might also have some of these symptoms. For people with ASD, these characteristics can make life very challenging.

Diagnosing ASD can be difficult since there is no medical test, like a blood test, to diagnose the disorder. Doctors look at the child's behavior and development to make a diagnosis. ASD can sometimes be detected at 18 months of age or younger. By age 2, a diagnosis by an experienced professional can be considered reliable. However, many children do not receive a final diagnosis until they are much older. Some people are not diagnosed until they are adolescents or adults. This delay means that people with ASD might not get the early help they need.

Autism is one such disorder that is by far the most challenging developmental disorder which has been overlooked by architects as a condition that influences building design. In April 2018, the CDC reported that 1 in 59 children in the US had a diagnosis of autism. The current study, however, updates this figure and estimates that roughly 1 in 40 children in the US have a diagnosis of autism spectrum disorder. According to the World Health Organization (WHO), approximately 1 in 160 children worldwide has ASD. According to a report by the Autism

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1.2 The rationale of the research.

Autism spectrum disorder is a lifelong disorder. Autistic people face difficulty in communication and coping with outside people. Very few adults with autism are partnered, live independently, and work full-time in fulfilling jobs, compared poorly to adults with other disabilities. meanwhile, Some are unable to function in the workplace and spend their days in sheltered settings. The rates of suicide attempts and suicide are increased among individuals with autism spectrum disorder (ASD), A new study says that autistic people have more than three-fold higher rates of suicide and suicide attempt than the general population. Autistic females as well as people with additional psychiatric conditions are disproportionately affected. The study highlights gaps in care for autistic people, especially when it comes to diagnosis and resources for autistic adults.

In the present context, autistic people are often treated as an outsider. Due to the inability to cope with the world, some have unsuccessful jobs and relationships and even end their life. As a designer, the need for the research was to gather information on the following question.

- Can architecture help children with autism? If yes, how?
- What is the sensory design approach in architecture? How architecture can control
- How can autism-friendly design change the lives of autistic children?

In conclusion, the primary goal of this research is to correct this exclusion by developing a preliminary framework of architectural design guidelines for autism. However the need for research is not limited to the above question, there is much more beyond it.

1.3 Importance of research

Architecture, as a science, deals with the manipulation of the physical environment to facilitate certain functions and elicit intended behavior. This environment is comprised primarily of sensory elements- textures, colors, patterns, acoustics, etc. Under the sensory definition of autism, these elements play an important role in autistic behavior and their cognition and integration are at the core of the disorder.

The research on autism spectrum disorder (ASD), which is a lifelong disorder helped me understand thoroughly the behavioral patterns of autistic people. However, autism cannot be cured, there are various treatments, therapies, and interventions for autistic people to prepare them for their future.

The importance of research on a thesis project is

- understanding the need for inclusivity and a universal design approach
- understand how architecture affects behavior that is the idea that the environment may control or amend how people behave in a space
- understand more about design guidelines and space requirements of individuals with autism
- understand how incorporating nature in design increases productivity and the environment of a working
- understands the concept of therapeutic and healing space

1.4 Problem statement

Autism is one such disorder that is by far the most challenging developmental disorder which has been overlooked by architects as a condition that influences building design. In April 2018, the CDC reported that 1 in 59 children in the US had a diagnosis of autism. The current study, however, updates this figure and estimates that roughly 1 in 40 children in the US have a diagnosis of autism spectrum disorder. According to the World Health Organization (WHO), approximately 1 in 160 children worldwide has ASD.

According to a report by the Autism Care Nepal Society, about 300,000 children suffer from autism in Nepal. “Kathmandu valley only needs 15+ autism care centers to facilitate the children with autism” said by Sangita Karki, principal of HOPE. In Nepal, awareness about autism is very scarce and next to nonexistent in most parts of the nation. Its been a challenge the integration of children with autism who become adults with autism into society. Also, various autism centers providing services are currently run in the residential building, adjusting interior functions, and layout of the available space. Meanwhile, the proper physical and natural environment required for the treatment is compromised. Thus making the existing centers non-effective.

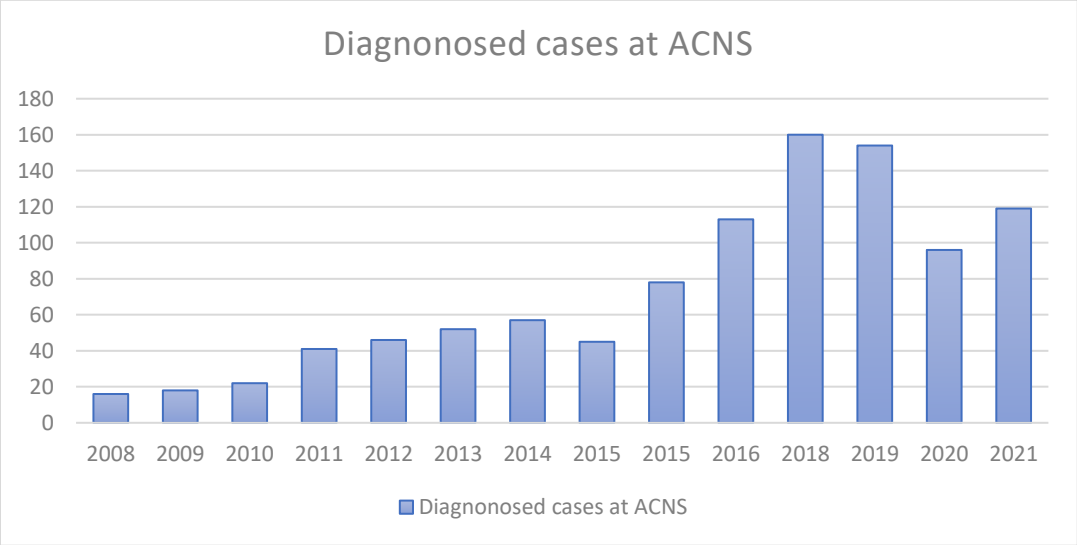


Figure 1 Bar Diagram showing autism diagnosed in ASNS

1.5 Objective

The thesis project on the autism centers aims to cater to children of age group 5 to 16, vocational training centers for autistic adults, and a training hall for an employee.

The overall objective of the project is:

- To understand and design physical and environmental space for the intervention of children with autism.
- To understand the enabling aspects of environment/sensory design that might improve the functional performance of children with autism in educational spaces and rehabilitation spaces
- To design a building that is inclusive to all people through a universal design approach.

1.6 Proposed methodology

This project will be oriented toward fulfilling the requirements for the completion of a bachelor's degree in architecture. However, even though it is an academic project all the designs are based on reality through the various findings during this project. the methodology followed in this project is in two-phase and as follows

In this phase, available literature materials relevant to the topic and that can be helpful in the design phases were studied thoroughly. Important facts, data, and numbers required for the design process were collected. Then case studies of existing care centers for autism, small existing organizations working in this sector, and other relevant projects are to be done. The national case studies are through primary sources and international through secondary sources.

Thus, the main process in this phase are :

Phase I: Literature review

- National case study
- International case study

Phase II: Design Phase

- Site selection

  A suitable site will be selected according to the site criteria and a comprehensive study of the site will be carried out to find the best design approach to the project

- Program formulation

  Detailed program formulation according to the studied standards and data will be prepared

- Conceptual design

  Concept formation according to literature studies and design philosophy.

- Zoning
- Planning
- Evaluation of output
- Required drawings, 3D model, report, and sheet preparation

2 Literature review

2.1 About Autism

2.1.1 Autism

The autism spectrum is a range of neurodevelopmental conditions primarily characterized by significant difficulties in social interactions, differences in communication, and presentations of rigid and repetitive behavior. Unusual responses to sensory input, including high or low sensitivity, sensory discrimination, and sensory-based motor differences are also highly prevalent. It is commonly referred to as autism and is officially designated autism spectrum disorder (ASD).

"Autism is a severe disorder of communication, socialization, and flexibility in thinking and behavior, which involves a different way of processing information and of seeing the world." (Jordan, R. 1999). It is a neurological disorder that limits a person's ability to function normally. Behavioral abnormalities, social limitations, and impaired ability to communicate are the main issues in this multifaceted disorder.

The history of autism begins in 1911, when Swiss psychiatrist Paul Eugen Bleuler coined the term, using it to describe what he believed to be the childhood version of schizophrenia. 1 Since then, our understanding of autism has evolved, culminating in the current diagnosis of autism spectrum disorder (ASD) and informed by many notable events impacting autism clinical research, education, and support.

2.1.2 Etiology

Autism has a strong genetic basis, although the genetics of autism are complex and it is unclear whether ASD is explained more by rare mutations with major effects, or by rare multigene interactions of common genetic variants. Many genes have been associated with autism through sequencing the genomes of affected individuals and their parents. Autism may be underdiagnosed in women and girls due to an assumption that it is primarily a male

condition, but genetic phenomena such as imprinting and X- linkage can raise the frequency and severity of conditions in males, and theories have been put forward for a genetic reason why males are diagnosed more often, such as the imprinted brain hypothesis and the extreme male brain theory.

Maternal nutrition and inflammation during preconception and pregnancy influence fetal neurodevelopment. Intrauterine growth restriction is associated with ASD, in both term and preterm infants. Maternal inflammatory and autoimmune diseases may damage fetal tissues, aggravating a genetic problem or damaging the nervous system. Exposure to air pollution during pregnancy, especially heavy metals and particulates, may increase the likelihood of an autism diagnosis. Environmental factors that have been claimed, without evidence, to contribute to or exacerbate autism include certain foods, infectious diseases, phenols used in plastic products, pesticides, brominated flame retardants, alcohol, smoking, illicit drugs, vaccines, and prenatal stress.

2.1.3 Common behavioral patterns

An individual with autism often affects a child's ability to communicate, understand language, play, and relate to others (Boyce, Hunter, & Howlett, 2003). They also identified the symptoms as repetitive activities, stereotyped movements, struggle to adapt to the environment and the daily routine, and unusual responses to sensory experiences. ASD is characterized by social communication and social interaction (Yeo & Teng, 2015). They are not only having poor social especially poor eye contact, lack of joint attention, pedantic or odd speech patterns, lack of social problem-solving ability, lack of empathy, and difficulties interpreting body language but also restricted repetitive patterns of behavior, interests, and activities (Boyce et al., 2003).

Children with ASD are having difficulties in developing their language skills, hearing, and communicating. Therefore, they express themselves with exhibit unconventional behaviors such as being aggressive, bad temper, or injuring themselves. Children who are diagnosed with autism have common symptoms and characteristics that affect school participation, including sensory processing difficulties, stereotyped behaviors, communication and language difficulties, low muscle tone, and sleep disturbances (Kinnealey, Pfeiffer, Miller, Roan,

Shoener, Ellner, 2012). They may have difficulty engaging in typical occupations of childhood, such as activities of daily living, social participation, play, and education (Phillips, Minjarez, Mercier, Feinstein, & Hardan, 2011).

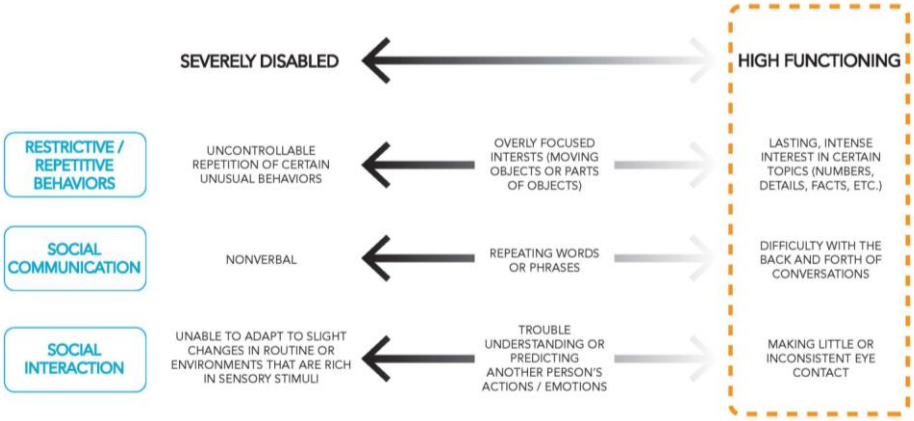


Figure 2 Behavior pattern of autism spectrum disorder

2.1.4 Prevalence of autism

Autism is one such disorder that is by far the most challenging developmental disorder which has been overlooked by architects as a condition that influences building design. In April 2018, the CDC reported that 1 in 59 children in the US had a diagnosis of autism. The current study, however, updates this figure and estimates that roughly 1 in 44 children in the US have a diagnosis of autism spectrum disorder. According to the World Health Organization (WHO), approximately 1 in 100 children worldwide has ASD. Autism is a common developmental condition, affecting approximately 1 in 44 children in the United States. Far more boys are diagnosed with autism than girls (3.7% of boys versus .9% of girls). Many experts believe the prevalence of ASD worldwide to be much higher than the reported rate of 1 in 100. The frequency of autism in many low- and middle-income countries is widely unknown, and some global studies have reported much higher prevalence statistics. Regardless of the current rate of autism around the world, data does show that the prevalence of ASD around the world is increasing in 2022.

According to a report by the Autism Care Nepal Society, about 300,000 children suffer from autism in Nepal. Awareness about autism is very scarce and next to nonexistent in most parts of the nation. It's been a challenge the integration of children with autism who become adults with autism into society. Also, various autism centers providing services are currently run in the residential building, adjusting interior functions, and layout of the available space.

2.1.5 Diagnosis

There is no known biological marker for autism. That means that no blood or genetic test can diagnose the disorder. Instead, clinicians rely on observation, medical histories, and questionnaires to determine whether an individual has autism.

Physicians and specialists may use one or several of the following screening tools:

Modified Checklist for Autism in Toddlers, Revised (M-CHAT), a 20-question test designed for toddlers between 16 and 30 months old.

The Ages and Stages Questionnaire (ASQ), is a general developmental screening tool with sections targeting specific ages used to identify any developmental challenges a child may have.

Screening Tool for Autism in Toddlers and Young Children (STAT), an interactive screening tool, comprises 12 activities that assess play, communication, and imitation.

2.1.6 Treatment

2.1.6.1 ABA THERAPY

ABA aims to build a positive change in behavior using the premise people improve their behavior when given positive consequences or rewards. It is a variety of techniques used to teach people with autism a new skill or to lessen undesirable behavior. A clinical psychologist and professor at the University of California, Dr. Ole Lovaas, pioneered ABA and was the first to prove the method effective in modifying autism behavior in children.

ABA therapy focuses more on rewarding good behavior. When children with autism behave a certain way with the promise of a reward, they are more likely to repeat the behavior in the future.

ABA uses an observation tool called the ABCs.

A: Antecedent: the events, actions, or circumstances that happen before a behavior

B: Behavior: the behavior that results from the antecedent

C: Consequences: the action or response that follows the behavior

2.2 Sensory sensitivity

The term Sensory processing refers to the method of the nervous system in which the brain has trouble receiving and responding to information that comes in through the senses. Henshall added the sensory systems act as a route via which the brain receives information. The brain must then derive meaning from this information to develop and implement a response. Whereas, children and adults develop and process sensory information frequently without difficulties, unlike a person with autism. Researchers have widely recognized and debated that people with ASD have unusual sensory experiences (Henshall, 2008). Henshall explained that these individuals may actively seek out or avoid sensory information, for example by putting their hands over their ears to block out sounds. In addition, children may have difficulties engaging with others because of atypical sensory responses. The seven sensory systems are within the nervous system: sound, touch, vision, taste, smell, movement, and body position.

- Vision- the faculty of seeing
- Hearing- the faculty of perceiving sounds
- Vestibular system- the structure within the inner ear which detect movement and changes in the positions of the head
- Olfaction (sense of smell)- faculty for perceiving odors and scents
- Gustation (sense of taste)- faculty for perceiving the sensation of a soluble substance in the mouth and throat by contact with that substance

- Tactile system- the faculty of perceiving touch, pressure, pain, and temperature
- Proprioceptive system- the faculty of perceiving stimuli produced within an organism, especially relating to the movement and position of the body.

At one end of the spectrum, as illustrated above, is the hyposensitive person. People who identify as hyposensitive experience difficulty seeing, hearing, or feeling the acute sensory details in a given environment. In other words, these people require to be overstimulated or need more sensory stimuli to successfully process the sensory information. These people enjoy environments with bright lights, crowds, noisy areas, rich scents, and the proximity of tight hugs and tight clothes. In environments that are not stimulating enough, these people tend to self-stimulate by moving their fingers in front of their eyes or creating noise by yelling or tapping on surfaces. Because these people struggle to understand sensory information, they typically have trouble processing sensory feedback like pain and temperature. Hyposensitive individuals also struggle with locating objects because they often only see the outline of the object without being able to understand the characteristic details of that object.

On the opposite side of the spectrum are individuals who identify as hypersensitive. People who are hypersensitive process the details of sensory stimuli to a degree that is too magnified. These people dislike environments that have elements like bright lights, crowds, and unfamiliar scents, textures, or temperatures. They don't do well with proximity to others, being touched, uneven surfaces, or the manipulation of small objects. Environments that are neutral and predictable support the needs of hypersensitive people.

2.3 Sensory dysfunction

Intensity

Hyper sensitive autistic people perceives light , color , smell with higher intensity where as hyposensitive perceives in lower intensity than that of neurotypical people.

Sensory overload

Sensory overload happens when there is too much information to process and it becomes overwhelming for the individual. The brains of autistic individuals are not able to filter out irrelevant information such as background noise, patterns on walls, the feeling of clothing or people moving.

Gestalt perception

Gestalt perception is the inability to filter foreground and background information, so everything is perceived as a ”whole” rather than a combination of different items. This can happen in any of the senses. Someone who experiences visual gestalt has difficulty focusing on a single detail of a scene and finds it almost impossible to separate it from the whole picture.

Fragmented perception

When too much information needs to be processed at the same time, people with autism may not be able to break down the whole picture into meaningful units, this is referred to as fragmented perception. An individual might process part of a scene or sentence and completely ignore the other parts.

Delayed perception

Delayed processing is when the process of perception takes a much longer time for those with autism than neurotypical individuals. This makes it hard to understand or learn new things. Processing can become delayed if there is too much information coming at once

Distorted perception

Distorted perception is when senses get distorted or misinterpreted such as seeing a small shop as smaller than it is, poor awareness of ones one body, double vision, or seeing everything in two dimensions. Distorted perception becomes worse in a state of information overload.

Sensory shut down

Sensory shutdowns happen when someone can't deal with all the information coming in such as when they are experiencing a sensory overload. All or some of the senses are being overloaded and the person is unable to cope. They manage the overload by shutting down one or some of their sense to block out the stimuli and enable another sense to work better. Often individuals will withdraw and retreat into their world by ignoring any stimuli around them.

2.4 Theory of design in autism

2.4.1 The autism ASPECTSS design index

The Sensory Design Theory was developed by Magda Mostafa after being given the project of designing the first education center for autism in Egypt. The theory builds on the sensory-sensitive approach in that it stipulates that favorably altering the sensory environment can be conducive to positive and constructive autistic behavior. According to Mostafa, "Sensory design theory presents a flexible and adaptable tool which acts as a catalyst for architectural design criteria development for architectural environments based on their sensory qualities, and in response to autistic sensory needs."

By looking at a series of common sensory environment problems, such as acoustics, texture, and lighting Mostafa developed a set of design principles summarized by the acronym ASPECTSS: Acoustics, Spatial sequencing, Escape spaces, Compartmentalization, Transition Zones, Sensory Zoning, and Safety.

Acoustics

This criterion proposes that the acoustical environment be controlled to minimize background noise, echo, and reverberation within spaces used by individuals with ASD. The level of such acoustical control should vary according to the level of focus required in the activity at hand within the space, as well as the skill level and the severity of the autism of its users. For example, a gym could handle a higher level of acoustics than a classroom.

Spatial Sequencing

This criterion is based on the idea of the affinity of individuals with autism to routine and predictability. The criteria require that spaces be organized in a logical order based on the typical schedule of such spaces. The organization of spaces should reflect the schedule of the students and how they move throughout the day. There should be minimal disruption between spaces.

Escape Spaces

Spaces need to be provided that offer respite for the autistic user from the overstimulation found in their environment. Such spaces may include a small partitioned area or crawl space in a quiet section of a room, or throughout a building in the form of quiet corners. These spaces should provide a neutral sensory environment with minimal stimulation that can be customized by the user to provide the necessary sensory input.

Compartmentalization

There needs to be a limit to the sensory input within each space or environment. Each compartment should include a single and clearly defined function and consequent sensory quality. The sensory qualities of each space should be used to define its function and separate it from its neighboring compartment.

Transition zones

The presence of transition zones helps the user recalibrate their senses as they move from one level of stimulus to the next. Zones can take on a variety of forms from a distinct node that indicates a shift in circulation to a full sensory room that allows the user to re-calibrate.

Sensory Zoning

Spaces should be organized following their sensory quality rather than their programmatic function, which is typical in architectural design. Grouping spaces according to their allowable stimulus level, spaces are organized into zones of high- stimulus and low stimulus.

2.5 Approaches of design

2.5.1 Sensory design theory

The prevalence of sensory difficulties for people with autism is still under debate while "a question mark hangs over the sensory phenomena, which are often reported but not currently required for diagnosis." Regardless, architecture solutions that take into consideration the sensory development of patients have been proven successful. Similar to the concept of a "sensory diet", Sensory Design Theory explores the manipulation of the environment for the benefit of autistic people. Developed by arch. Magda Mostafa, this method aims to create an appropriate basis for autistic therapy. By altering the space in such a manner that patients feel secure and comfortable in their surroundings, the levels of focus and concentration rise, making therapy sessions more efficient. Furthermore, behavior modification and the acquisition of new skills benefit from this type of controlled environment.

Applying this theory to a treatment facility for people with autism means rigorously separating the space into two distinct areas: a high stimulus area that functions as a developed public interface with training and conference rooms and a low stimulus area that is destined for treatment activities. Since the two spaces differentiate from one another both by function and by building environment character, usually they require two separate volumes. Therefore, the treatment facility needs to be integrated into an introverted type of layer that communicates only with its inside spaces and properly controlled outside environments, while the public interface becomes an extroverted space that needs to communicate and interrelate with the public environment surrounding the institution.

The theory is meant to provide the best situations for all the varieties of autistic spectrum disorders. Because it can adapt the space to the patient's needs, it can provide autistic people safety and comfort, but it can also become an environment that forces them to adapt to certain situations. By altering space characteristics such as color, texture, perspective, sound, orientation, lighting, etc., to accommodate each individual's requirements, therapy has proven to be more effective, especially when dealing with acoustics.

The Sensory Design Theory also implies a deeper analysis of context and community, navigation and spatial sequencing, classroom spaces, therapy spaces, and outdoor learning areas. All these aspects come to support the different therapeutic sessions for skill acquirement, context, and community being the only part that focuses directly on the capacities of people with autism to adapt and integrate into society.

2.5.2 Neurotypical approach

The Neuro-Typical Approach is almost in opposition to the sensory design theory. Although both target the development of skills necessary for the integration of people with autism spectrum disorders, the Neuro-Typical method focuses on a more direct approach to integration in basic day-to-day circumstances. Because it concentrates more on the ability to generalize context rather than the capacity of people with autism to acquire skills and knowledge, the method is centered around the creation of a physical environment that patients would come across in their everyday use of space. Therefore, concerning the therapy, patients have emerged into a highly stimulating environment that should force them to develop a sense of familiarity with the different circumstances that they might observe in normal public spaces.

The Neuro-Typical Design Theory focuses on improving autistic people's skills to generalize space and its function. By creating environments that have the same function but have different sensory characteristics, patients should develop the capacity to adapt to variations of the same kind of space. Also, because the environment is similar to usual urban and public places, autistic people are bound to adapt over time to this kind of highly stimulating context. As a result, treatment institutions have areas designed in such a manner that they mimic usual outside spaces: transit areas look like streets and alleys, therapy rooms look like classrooms or libraries, the cafeteria looks like a restaurant, and so on.

In contrast with the sensory design theory, the Neuro-Typical Approach doesn't have any empirical evidence of its effectiveness. Although this is definitely in favor of the first design method, the results have still to be discovered regarding Neuro-Typical treatment facilities.

2.6 Principles of design for Autism

A series of design principles were created through the analysis of literature, precedent studies, and interviews. These principles are designed to be applied to any building that will house an autistic user. The principles are broken into three categories: distractibility, tectonics and materiality, and spatial organization. The principles of distractibility relate to the stimuli that students can receive within the building and a way to control the various stimuli. Tectonics and materiality relate to the way the building is physically put together and the materials involved. Spatial organization refers to how the spaces of the building are organized with each other and how someone moves through the space.

2.6.1 Distractibility

Figure 3 Ways the built environment can distract students with autism

Acoustics

Parents and teachers ranked acoustics as the most influential feature of the sensory environment on autistic behavior. Loud noises and sounds from things such as movement and systems should be mitigated through design. In most cases, the sense of calm that comes with quieter spaces encourages better behavior in students and allows them to focus on learning.

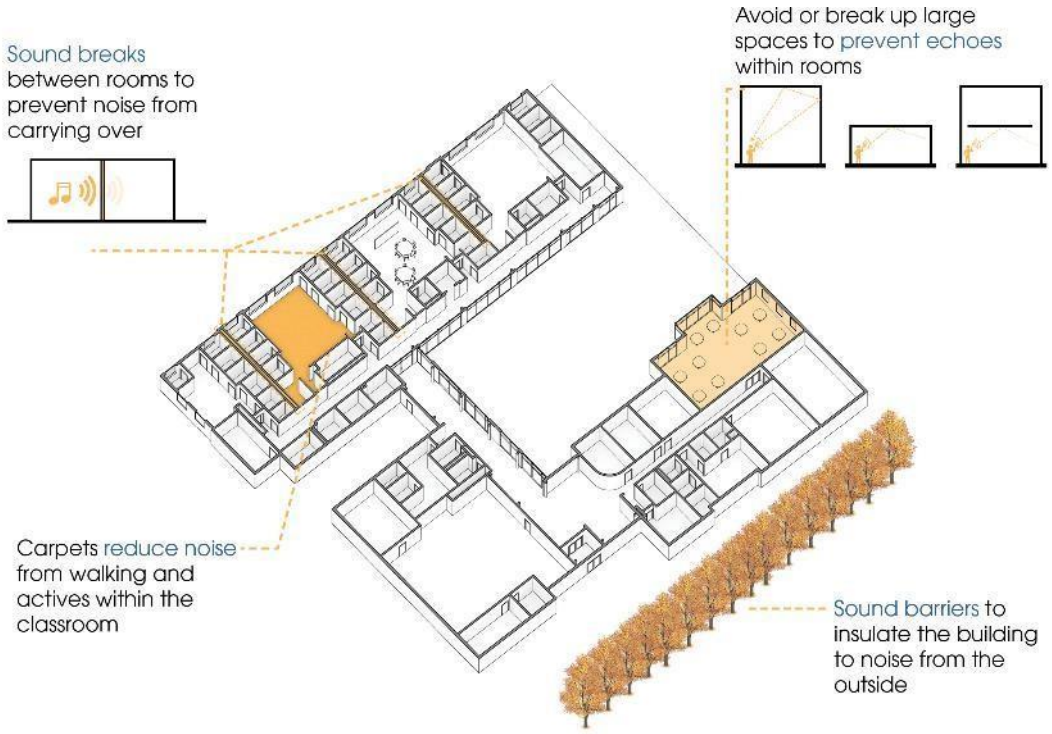


Figure 4 Design implementation to control acoustics

Design Guidelines

- Carpets on the floor reduce the impact of foot traffic and absorb sound
- Rough and textured finishes can break up sound waves and reduce noise reverberations
- Classrooms should be placed at an appropriate distance from the road to reduce the noise from traffic and sound barriers should be used to mitigate the noise
- There should be ample insulation between rooms to prevent noise from other areas of the school from penetrating rooms

Lighting

The use of direct fluorescent lighting should be avoided. Individuals with autism are very vulnerable to the sub-visible flicker, which can cause headaches, eyestrain, and increased repetitive behavior. Lighting also needs to be controllable because different

activities require different amounts of light. Natural light improves academic performance, relaxes students, permits better concentration, and reduces hyperactivity in children. However, views of the outside and other distractions should also be controllable to prevent students from being distracted by what is happening outside.

Design Guidelines:

- Natural light should be provided in all rooms and used as much as possible
- Windows should be placed above eye levels, such as skylights and clearstories to reduce the view to the exterior, or should be translucent to allow light in but block views
- Lights in classrooms should be equipped with dimmers to allow greater control over the lighting
- Florescent lights should never be used

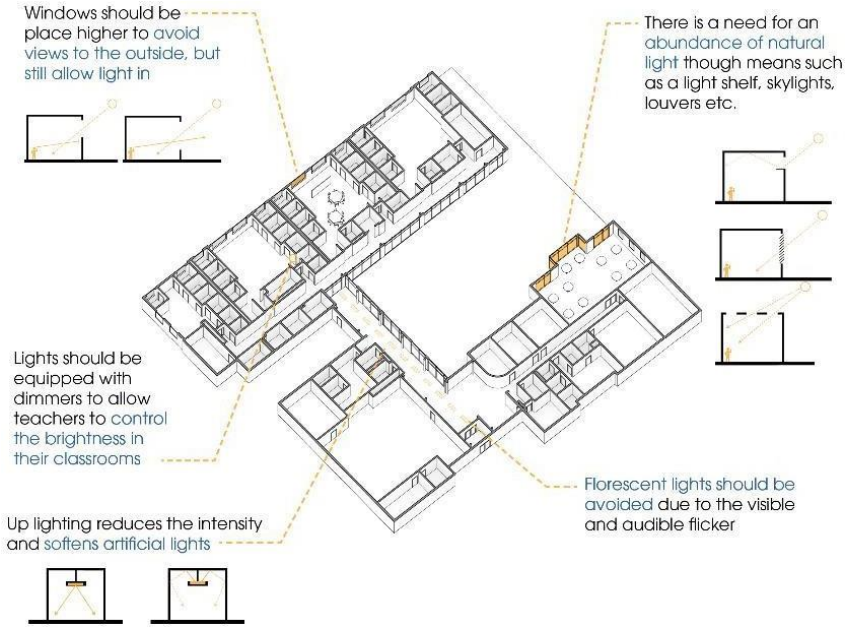


Figure 5 Design implementation to control light

Colors and materiality

85% of autistic children see colors with far greater intensity than neurotypical students. Because autistic individuals may have a significant increase in color differentiation, small color changes can dramatically affect their behavior. Grids and busy patterns should be minimized in areas that require the student to focus, such as a classroom. Minimizing any offending stimuli can help improve autism spectrum students' ability to perform successfully in the classroom.

Design Guidelines:

- Cheerful colors, whether subtle or bold depending on the user population,
- eliminate the users' and visitors' impression of institutionalism and create a better environment.
- Cooler colors such as blues, greys, and purples have a calming effect on students
- Different colors should be used to differentiate different areas of activity within a space and from space to space.
- Wall surfaces should be simple and devoid of geometric or complex patterns

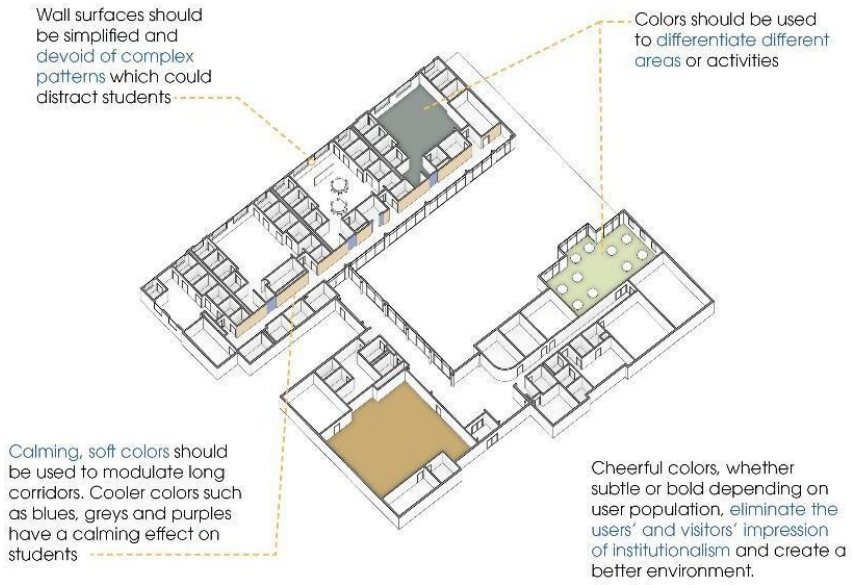


Figure 6 Design implementation for color

2.6.2 Spatial Organization

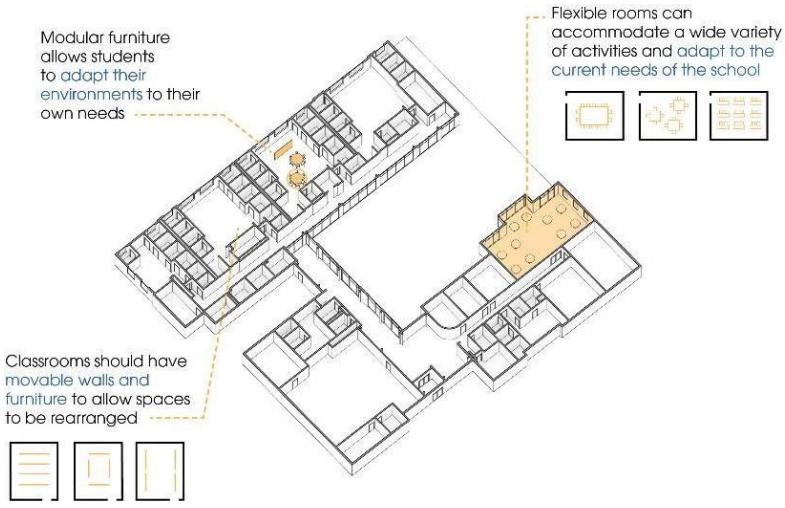
Figure 7 Spatial consideration for designing environments for autistic individuals

Adaptability

Spaces should be allowed to change to the children's needs and allow the students and teachers to rearrange or subdivide the spaces as needed. Finishing, materials, and spatial organization should be able to be manipulated not only by the staff but also by students. An environment that can adapt and change to the user's needs can perform more functions than a room with a set purpose. The environment could also change stimulus level based on the activity, divide the space up into multiple small areas of activity, or exist as one large space. However, if the environment is too flexible an individual might live in constant fear that the environment will suddenly be changed.

Design Implementations;

- Moveable walls in classrooms and gathering spaces would allow multiple arrangements in rooms
- Modular furniture can be turned and stacked in different ways
- Creating an open floor plan that can be adapted to the individual needs of the teacher or student



Transitions

Spaces should flow as seamlessly as possible from one activity to the next and should be organized by their sensory quality rather than the typical architectural approach of functional zoning. With transitions between areas of high stimulus to areas of low stimulus or from one activity space to the next, there should be a threshold space that allows the student to recalibrate their senses. Without the transition space, the shock of going from an area of low stimulus to a high stimulus could send students into fits.

Design implementations;

- Transition spaces should activate all the senses- sight, sounds, smell, touch, and taste
- Spaces could be anything from a node to a shift in circulation to a full sensory room which allows the student to reorient themselves.
- The spaces should allow students to anticipate the environment in which they are headed.

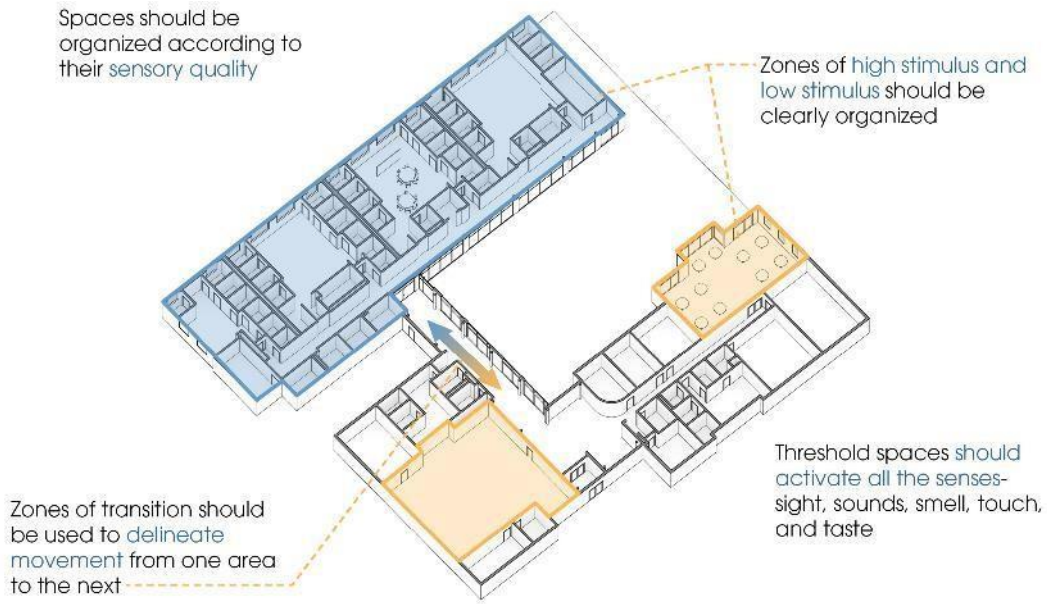


Figure 8 design implementations of transitions

Predictability

Students with ASD will often feel nervous when navigating spaces that are unfamiliar to them so the arrangement of structures should be easily understood and encourage choices as well as problem-solving and discovery. The importance of legibility, imaginability, and redundant cueing come into play when those with ASD are navigating buildings. Classrooms and schools should be easy to read with clear signage, numbering, and configuration. The environment must be memorable and describable in terms of specific landmarks to create a space for students to be able to recall.

Design Implementations;

- Patterns and materials can be used to help guide students through space by clearly defining circulation paths
- Children should be allowed to view spaces from a safe vantage point, so they can see where they are going and what to prepare for
- Rooms should have easily identifiable markers such as colors and patterns
- Landmarks should be used to orient spaces and allow individuals to orient themselves using spaces such as a courtyard

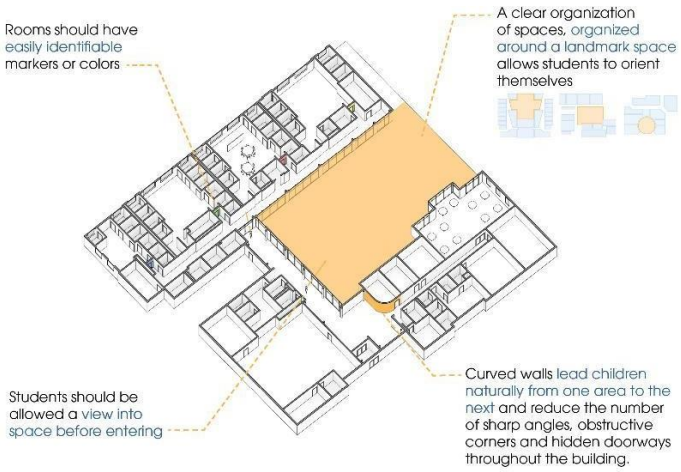


Figure 9 Design implementation of predictability.(Leestma)

Escape Spaces

Students need spaces that provide areas of respite from the over-stimulation in their environments. Having such spaces in a school has been shown to have a hugely positive effect on students in a learning environment because the class and other students can often overwhelm the sensory input of an autistic individual through the stimuli that accompany a neurotypical classroom setting. Being able to experience an outdoor environment is also important as the fresh air and nature can have a calming effect on the students. Creative outdoor areas can provide students and adults with special needs the opportunity to explore social contact, as well as provide places for tranquility.

Design Implementations;

- The spaces should provide a neutral sensory environment with minimal stimulation
- Escape spaces should allow a degree of customization for the user
- Walking paths and gardens on the school ground create soothing outdoor environments which help to calm students down

- Spaces should also allow areas for the children to exercise

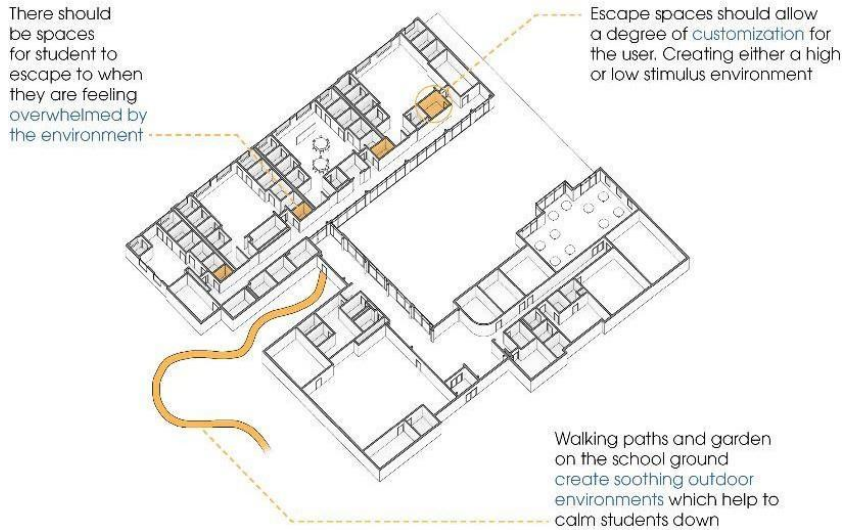


Figure 10 Design implementation of escape space.(Leestma)

2.6.3 Tectonics and Materiality

Figure 11 Tectonic and material consideration that need to be taken in to account

Safety

Children with autism occasionally have an altered sense of spatial orientation, depth perception, and general proprioception, or the ability to sense stimuli arising within the body regarding position, motion, and equilibrium. The miscommunication within the sense makes individuals with autism prone to self-injury. They are also prone to displaying aggressive behaviors and tantrums making them dangerous to themselves and others. The high frequency of those with autism injuring themselves due to being unfamiliar with their environment, means precautions need to be taken to ensure that the children are being constantly looked after. Autistic individuals also have stronger reactions to dirt, germs, and toxins, so the

materials selected within an environment need to take into consideration the chemicals used to create them.

Design Implementations;

- Soft surfaces such as rubber and carpet can reduce injuries.
- Hard materials such as concrete and brick should be avoided or covered.
- Materials should be free of all toxins.
- Locks on doors and stairs prevent students from accidentally injuring themselves.

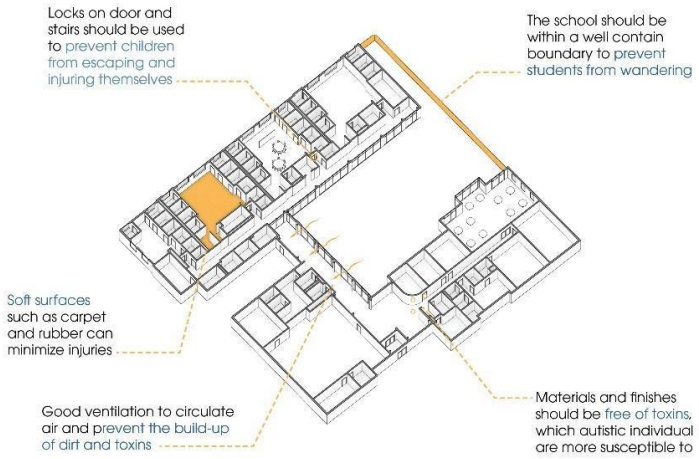


Figure 12 Design implementation of safety. (Leestma)

Distractibility

Emotional disturbance issues, such as intermittent explosive disorder or bipolar, frequently cohabitate with ASD. Due to this, there exists a need to use durable materials that not only resist the wear and tear of children but are safe enough that they do not cause injury to the students. The materials will also have to be easy to clean as children with ASD often have trouble with bathroom procedures and will sometimes soil themselves or vomit in class.

Design Implementations;

- Materials used in the design must be easy to clean and durable.
- Hard shiny surfaces provide surfaces that are easy to maintain.

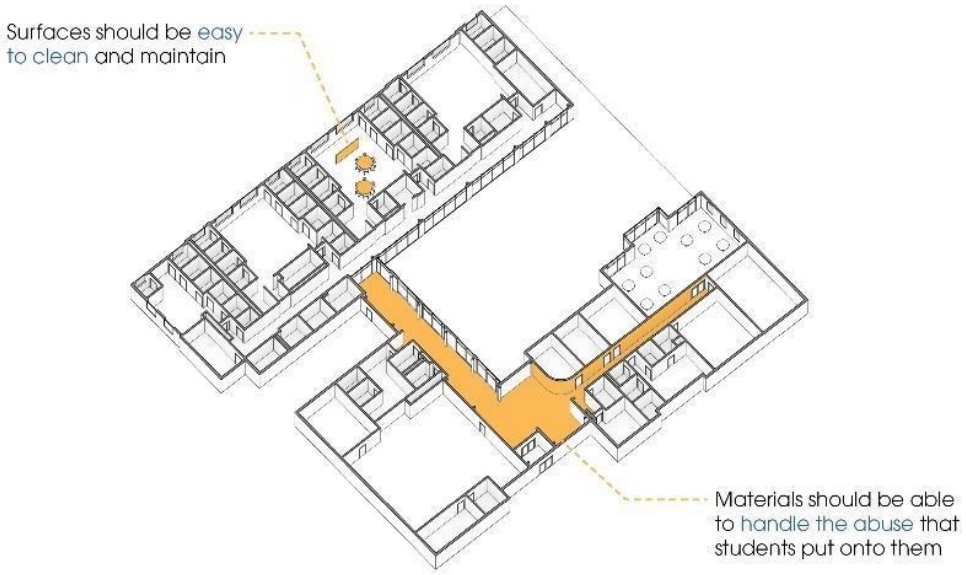


Figure 13 Design implementation for durability

2.7 Services for people with Autism

2.7.1 Medical and psychological services

Appropriate facilities for a good health evaluation and accurate diagnosis come the first requirement. it is desirable to have facilities for psychological assessments of the child's strengths and weaknesses, which can form a base for future training. children with sensory issues have difficulty filtering sensory input. Their sensory systems may be either hyperactive or hypoactive, and unable to properly block out signals that should be heeded. Children with hyperactive sensory systems may avoid motions, be very prone to motion sickness, and resist engaging in activities like climbing or descending stairs. they may seek support from other people while walking. In contrast, children with hypoactive sensory systems may actively seek out motion, enjoy swinging and climbing activities, and not become dizzy after spinning. sensory integration activities address children’s sensor needs by either lessoning or amplifying the intensity of various forms of sensory stimulation they receive. A medical room of 15-25sq m is recommended for CWA.

2.7.2 Training in self-help, social and practical skills.

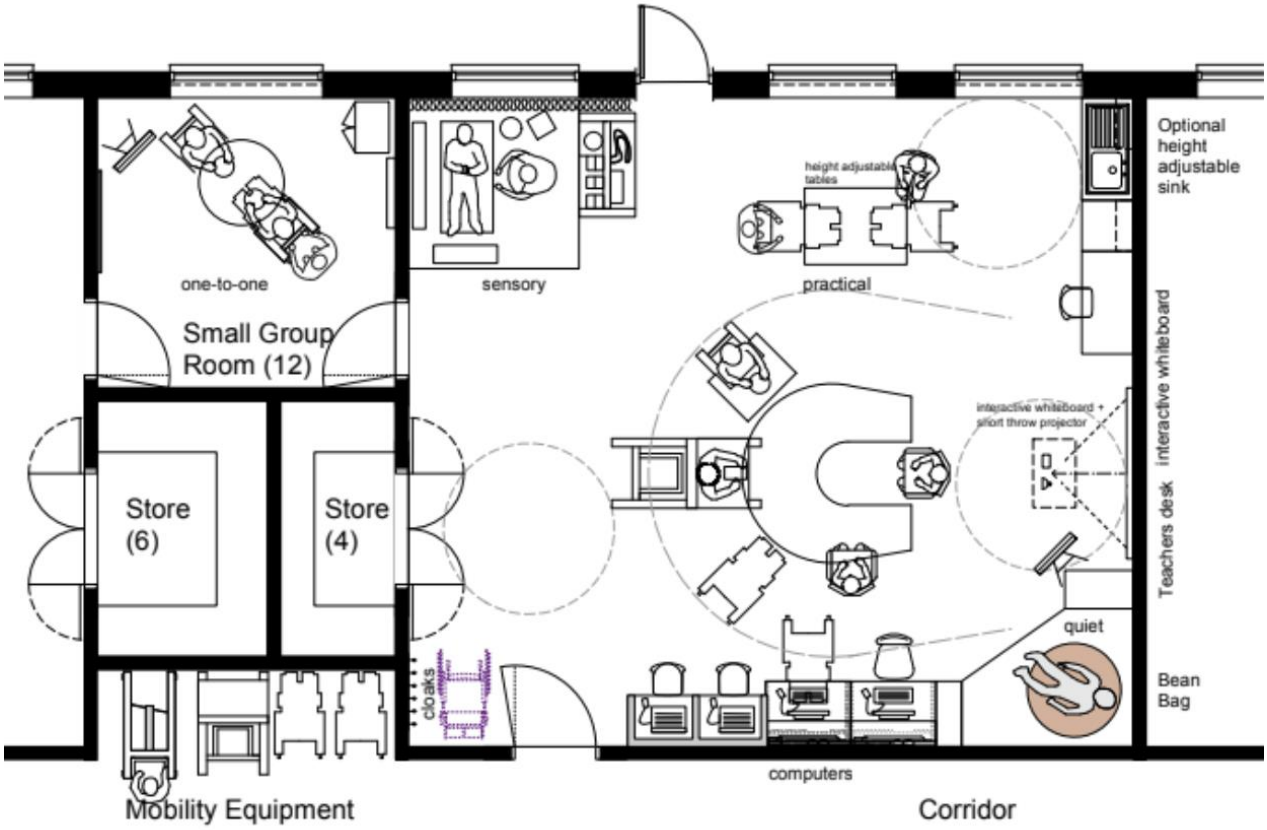
Children learn the skills of daily living such as feeding, dressing, and toilet training, and social skills such as playing, mixing, and interacting with others easily by watching others and with some adult guidance and teaching. But CWA often does not learn skills on their own. Through Systematic efforts and using proper techniques, it is possible to teach and train them in these skills. Behavior modification techniques are very useful and effective in teaching. These includes:

- Rewarding or positive reinforcement: Paying attention, praising the child, and giving some material reward whenever the child shows desirable behavior or makes an attempt to learn.
- Modeling: showing the child how a particular skill, can be broken up into several small, sequential steps. The child can be taught these skills step by step.
- Physical guidance: if the child cannot learn by modeling, he or she can be taught the activities by holding hands and showing them how the task is done. After many such repetitions, the physical guidance can be slowly withdrawn so that the child to do the task independently.

1. Modern research has established the utility of these behavioral techniques in imparting many kinds of skills.

Education

As they grow up and master activities of daily living, children with autism need to be imparted education like other children. Going to school is essential for them to learn not only academic skills for community living. Though they are slow in learning, experience, and research has shown that by applying the right kind of educational techniques, it is possible to impart the basic skill of reading, writing and arithmetic to many with autism. The typical learning and teaching spaces of 60 sq m are sufficient for 8-10 students suffering from autism.



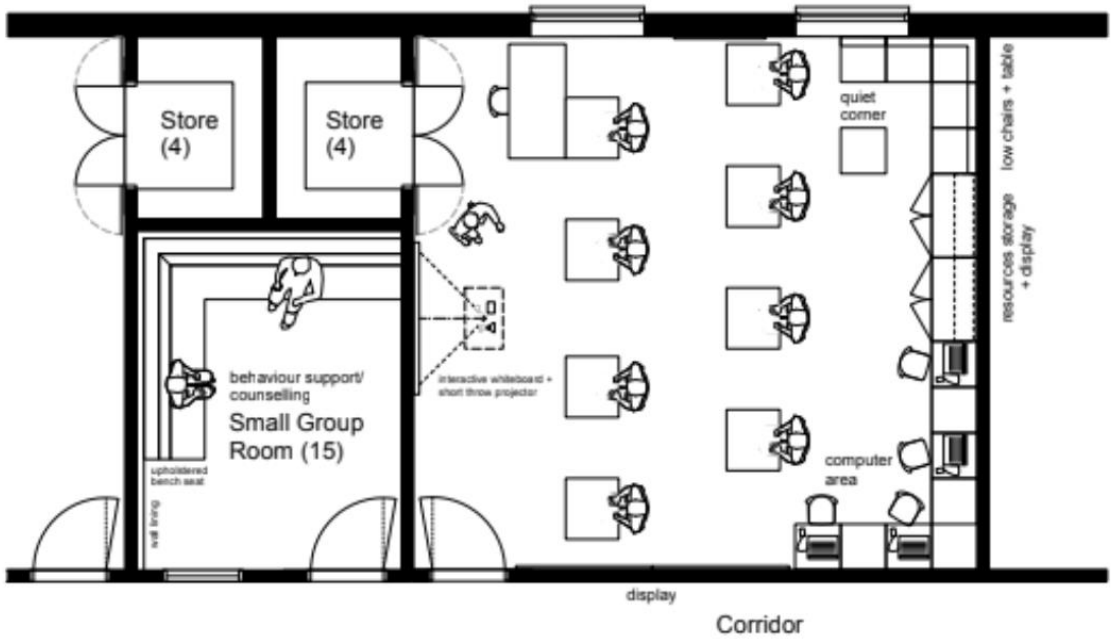


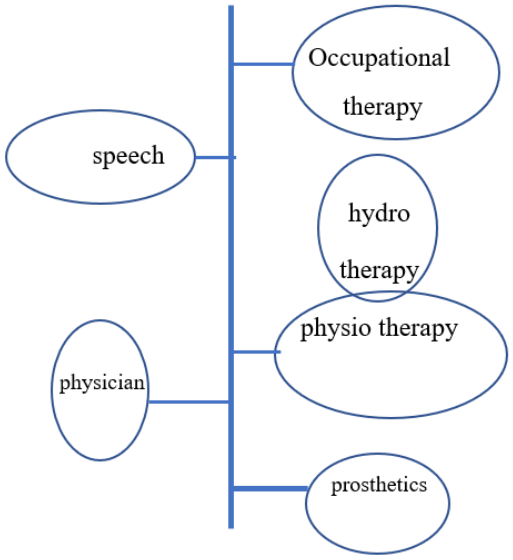
Figure 15 Typical classroom layout for special education

2.7.3 Vocational training

Studies have shown that people with autism acquire various vocational skills with proper training. With the tendency to follow patterns of the process they tend to excel in works following patterns and rhythms such as weaving, beading, candle making, bakery, computer training, etc, providing CWA with the opportunity to learn these vocational skills and lifestyle skills enables them to become independent

2.7.4 Therapy units

There are various therapies given to children with autism. All the therapy rooms should be connected. The flow diagram of therapy units is shown below:



2.7.4.1 Occupational therapy

Occupational therapists (OTs) in school settings advise on learning aids, ICT requirements, furniture, equipment, and environmental adaptations for the school and home, usually in a teaching space, group room, or therapy base. For older children developing independent living skills, the post–16 tutorial or social base may be used. Storage facilities for rehabilitation equipment may be needed. OTs will also use the visiting professionals' office.

2.7.4.2 Physiotherapy

In a school setting, a physiotherapist carries out assessments and devises treatment plans, working with teaching and support assistants to instruct them on how to deliver programs to meet the needs of children individually or in small groups. Some physiotherapy can be carried out in the corner of a teaching space or SEN resource base, set out with matting and mirrors (which should be protected). Alternatively, it may take place in one of the following:

- a multi-purpose support space (25– 30m2) (if suitably fitted out, e.g. with a couch, a clinical wash hand basin, and a curtained or screened changing space)
- a large medical room (18–25m2) with an adjustable height couch and equipped with a ceiling-mounted hoist (If portable hoists are used, 25–30m2 may be needed.)
- a fully equipped physiotherapy room (25–30m2 is recommended) – where there is a higher level of need it may also be used by other therapists, as appropriate, on a timetabled basis
- Storage space (4–10 m2) will be needed to support any of these spaces, for inflatables, physical aids, and equipment. It should be directly accessible from the space, with outward-opening doors.

A physiotherapy room should be robust and functional, daylit, with a pleasant outlook. The walls and ceiling construction will need to be able to support the fixing and use of hoists and the force involved in children pulling themselves up on equipment. Wall and floor finishes need to be easily maintained and have visual contrast. The room should have enough clear space for the therapist to work and to transfer a child from a wheelchair using a hoist, where appropriate. There will also need to be space for the use and storage of equipment such as wheelchairs and standing frames, and for:

- a clinical wash-hand basin
- display, full-height mirrors, and parallel bars
- an adjustable height electrically operated therapy couch (about 900 x 1800mm minimum)
- a desk, PC, and a lockable filing cabinet (although sometimes this could be part of a centralized visiting professionals' office) There should be an accessible toilet/ changing room nearby.

2.7.4.3 Speech therapy

The speech and language therapist (SLT) works with children in the classroom or a separate quiet room. Sometimes a dedicated speech and language therapy base is provided34. A room

of 12–15m2 will support individual or small group work. For larger groups of between six and eight, a space of 39–65m2 may be needed. A room for SLT will typically need:

- a desk and chairs
- personal computer
- lockable filing cabinet
- full-height storage cupboard (for records and resources)
- free wall space for visual display
- a mirror for speech articulation work
- a wash-hand basin
- good quality lighting
- blinds to windows
- good quality acoustics and sound insulation
- an induction loop or hearing aid facilities

Allowances may also need to be made for specialist SLT aids, audiovisual equipment, and children's communication aids. A large number of electrical and/or electronic power points and battery-charging outlets will be needed.

2.7.4.4 Hearing impairment support

Sometimes there are specialist facilities in special schools for children with hearing impairment. In mainstream schools, the sensory impairment support service may use a small group room, as long as it is quiet and provides suitable acoustic conditions.

An audiology suite may also have dual use for speech and language therapy. An audiology room (20–24m2) will be used for testing and assessing children with hearing impairment. It may be combined with an observation room (10–12m2), with a one-way window in between for training purposes.

Audiology rooms need to have a high degree of sound insulation from adjacent spaces. The reverberation time and level of sound absorption within the space will depend on the equipment used. There may need to be triple-glazed windows, acoustic lined walls and ceiling, and an

acoustic floating floor. Appropriate heating and ventilation will also be needed. Sound-proofed accommodation should be provided to standards for acoustic test methods suitable for children.

2.7.4.5 Hydrotherapy

Hydrotherapy is included in some special schools, principally for treatment and exercise for students with physical and/or sensory disabilities. Warm water provides an effective medium for muscle relaxation and is a pleasurable, therapeutic experience that may encourage the development of communication and interaction skills. Work is undertaken in a small group or on a one-to-one basis with a physiotherapist or another adult, with careful supervision provided by an out-of-water adult. Types of pool A typical hydrotherapy pool needs an overall space of 85m2, with:

- a pool of 24m2
- a surround of 2–2.5m wide (ensuring safe movement)

The following spaces are also needed:

- wet changing areas for pupils – 30m2 each for boys and girls separately
- staff changing of 4m2 to 6m2 each for males and females separately
- pool plant and chemical storage of about 20m2 and 6m2 respectively

2.7.4.6 Art therapy

art therapy can help open pathways into underdeveloped areas of the brain and provide an avenue for non-verbal expression. When a child creates art, he or she is communicating on a symbolic level. This process, in turn, can foster the development of more direct communication skills by employing techniques such as shared drawing tasks and mirroring/mimicking the client's behavior and art-making, which works to get their attention and engage them in interpersonal interaction. When the art therapist builds a relationship with a child, he or she is provided a corrective attachment experience. A typical art space of 60-65 sq m is sufficient for one teacher, support staff, and 6-8children with an art source of 6-9sq. m.

2.7.5 Sensory spaces

Multi-sensory spaces contain light, sound, and other equipment for multi-sensory work. Sensory rooms, used for one-to-one and small group work, are highly resourced spaces, often entirely white or black, which use a range of equipment to create different light, sound, and other stimuli for multi-sensory work. Mirrors and mirror balls, bubble tubes, fiber optics, and interactive switch equipment are often used (but too many stimuli may confuse or limit effective use). 'Dark rooms' tend to have black walls and ceilings and/or perimeter black curtaining to support light-stimulation work for a child with very poor vision.

Visually tracking moving lights can help children develop coordination skills. Provision varies but typically a school may have one large white room of 24–32m2 or two small rooms of 12–16m2 to provide separate 'light' or 'dark' rooms. Some schools may choose to create a temporary sensory environment in the corner of a learning space. Typically for sensory rooms, there should be:

- a clear area just inside the door, with enough space for the removal of shoes or outer clothing
- sufficient clear space to transfer from wheelchairs (by hoist) to the main cushioned platform area
- an appropriate ceiling height and construction for overhead hoists (2.6– 2.8m high is suitable)
- plastic covered cushioned linings to walls, to half or full height (fire-rated foam products should be checked for health, safety, and fire prevention with the supplier.
- wall construction that can support wall linings, shelving, and specialist equipment
- a firm slip-resistant floor, with soft carpet or cushioned sheet flooring
- furnishings and equipment that are safe, durable, and easily maintained, with appropriate use of color
- no sharp edges or projections that could cause harm
- blind and black-out facilities
- dimmer switches to adjust light levels

- plentiful power and data supplies for electrical equipment, positioned for adult use (usually at a high level), with a switch control panel and avoiding trailing leads
- materials that allow for frequent cleaning

2.7.6 Library

The library space should be light, airy, quiet, calm, and orderly, where books and ICT resources can provide an interactive environment.

- Children will use access technology such as Braille readers, touch screens, audiovisual or video displays, and associated resources.
- Shelves and search systems should be at an appropriate height for everyone, including wheelchair users.
- There are usually loose tables, screened workstations, and low seating.
- Blackout or dim-out blinds may be needed for ICT projection.

If the library is open plan, it must be designed to resolve issues of fire, security, distraction, and disruption

2.7.7 Halls and dining

Secondary special schools generally have two large spaces to be used for PE, assembly, performance, and dining. These are typically provided as Either:

- a sports hall of around 306m2 (17m x 18m) enabling children to participate in a full range of activities, including basketball and five-a-side football, and
- a dining, assembly, and performance space of 80–120m2 or:
- a multi-functional space of 140– 180m2 for PE and movement, assembly and performance and
- a dining room of 80-120m2

Where space is used for more than one type of activity, all curriculum needs must be met. It is useful to look at the whole school day, taking into account the time needed to move equipment and furniture and the fact that some schools assemble in the hall at the end of

the day before buses arrive for departure. Careful detail design will be needed, for example, floor finishes, lighting, and acoustics, to ensure functions are not unduly compromised.

2.7.8 Outdoor spaces

Experiencing the outdoor environment is an important part both of learning and leisure for children with autism, and a clear rationale should be developed so that outdoor spaces enrich learning, teaching, and recreation. Outdoor activities at primary special schools can be adventurous and support children's skill-based learning and enjoyment of play. A range of spaces should be provided, including:

- Outdoor PE facilities
- Informal social and recreational areas
- Habitat and outdoor classroom areas to support the outdoor curriculum, physical and sensory needs, and social and independence skills.

Outdoor PE facilities typically comprise:

- Sports pitches of grass or artificial surfaces (required for children aged 8 and over)
- Hard-surfaced games courts such as multi-games, tennis courts, and skill practice areas

2.7.9 Sensory garden

A sensory garden is a garden environment that is designed to stimulate the senses. The stimulation occurs courtesy of plants and the use of materials that engage one's senses of smell, sight, touch, taste, and sound. These types of gardens are beneficial to both children and adults, especially those who have sensory processing issues, including autism and other disabilities. A sensory garden can be very therapeutic for people who suffer from sensory problems. It may be used as a calming place and as a gentle way to stimulate the senses. This type of environment can become a place where CWA and other sensory processing disorders feel safe and comfortable in exploring their senses without feeling overwhelmed by them. Depending on the child's need, a sensory garden can primarily focus on one sense, or it can incorporate all of them. For children who are hyperreactive to stimuli, the sensory garden should provide a

relaxing environment, and for children who tend to be under reactive to stimuli, the garden is a great way to stimulate the senses. For children who do not suffer from a disability, a sensory garden is beneficial as a fun educational tool that allows them to explore and learn about their senses and nature.

Features of a sensory garden

- Sensory gardens are designed to be accessible to all age groups and people with disabilities. The common focus of all sensory gardens is to create an immersive experience that appeals to one or more of the five senses. The sensory garden is divided into five sections to match the senses. Sight, taste, smell, touch, and sound are stimulated by various plants and different natural as well as man-made elements.
- Sight: color, shape, and special features can be used to evoke visual stimulus. Flowering plants with a variety of colors, and water features like ponds, fountains, etc. can be used to create a visually pleasing environment.
- Smell: aromatic plants and herbs can be used near pathways or seating to give pleasing scents to the environment
- Sound: Birds, wind chimes, crunching gravel, moving water, wind, whistling, leaves, etc bring a variety of sounds to the garden.
- Touch: Plants with different textures such as large fleshy leaves, velvety or furry leaves as well as feathery ferns give different feelings through the sensation of touch. Different types of surfaces along walkways such as tiles, crushed gravel, and stone slabs can be used to provide cues to the users. Plants and trees are planted close to the walkways so that anyone ambling along the paths is brushed by foliage and can feel them.

Principles of designing a sensory garden

- Simplicity is essential in designing healing gardens to keep the space easy to understand. The space should be simple and calming

- Along with being simple in design, it should include a variety of forms, textures, seasonal interests, and colors to provide sensory stimulation. Not having enough interest can be stressful for the users of the space.
- There should be balance and the space should feel stable as a whole.
- Creation of sequence or smooth transitions from one area of the landscape to another.
- It is important to use an appropriate scale. The space should be so arranged that it can be experienced on a human scale

2.8 Nature and autism

2.8.1 Biophilic designs

The biophilic design strives to connect people to nature in the buildings where they live, work, and play. It's not just adults who have become indoor animals; today's children are nature-starved at record levels. Research shows that simply taking a walk in the park can boost the concentration of children with ADHD, and these behavior-modifying effects extend to kids with autism as well.

"Students with autism are far more sensitive to temperature, noise, texture, and acoustics; these factors become stressors that affect the learning experience. As designers, we understand that the built environment impacts human behavior. While biophilic design principles benefit everyone, they can be harnessed to address issues symptomatic of students on the spectrum," Meacock shared.

2.9 Universal design concepts

Universal design is a design that's usable by all people, to the greatest extent possible, without the need for adaptation or specialized design. It may be impossible to accommodate all people, all the time, but the ultimate objective is to consider as many people in as many situations as possible. The seven principles of Universal Design are:

Principle 1: Equitable Use.

The design is useful and marketable to people with diverse abilities.

Principle 2: Flexibility in Use

The design accommodates a wide range of individual preferences and abilities.

Principle 3: Simple and Intuitive Use.

The use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level.

Principle 4: Perceptible Information

The design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities.

Principle 5: Tolerance for Error

The design minimizes hazards and the adverse consequences of accidental or unintended actions.

Principle 6: Low Physical Effort

The design can be used efficiently and comfortably and with a minimum of fatigue.

Principle 7: Size and Space for Approach and Use

Appropriate size and space are provided for approach, reach, manipulation, and use regardless of the user's body size, posture, or mobility.

2.10 Technical details

2.10.1 Ramps

Gradients should be as shallow as practicable, as steep gradients create difficulties for some wheelchair users who lack the strength to propel themselves up a slope or have difficulty slowing down or stopping.

• Some children who can walk but have restricted mobility can find it more difficult to negotiate a ramp rather than a short stair, so a choice of routes should be provided.

• Approved Document notes that ramps have a surface width of 1500mm between walls. Wider ramps should be considered where there is likely to be a high proportion of disabled users

Table 1 Standard for ramps and landing

Clear width (between walls/upstands)
1200mm minimum –1800mm preferred (1500mm minimum in Approved Document M)
Gradient
1 in 12 for 2m length (166mm max rise) 1 in 15 for 5m length (333mm max rise) 1 in 20 for 10m length (500mm max rise)
Landings
1200mm long at foot and head, 1500mm long at intermediate landings Intermediate landings of 1800x1800mm should be provided as passing places when it is not possible for a wheelchair user to see from one end of the ramp to the other, or the ramp has three flights or more. **NB** These are minimum dimensions, clear of any door swing or obstruction.

2.10.2 Stairs and landings

The following should be considered:

- The minimum clear width permitted by Approved Document M is 1200mm but this is only advisable in schools for little-used stairs. Standard Specifications, Layouts, and Dimensions (SSLD) 6 recommends a clear width of 1600mm, which enables two adults to pass each other with ease and permits three people to safely carry down a wheelchair.
- There should be visual contrast between stair nosings and the treads and risers. For external steps, tactile information should be provided, such as corduroy tactile paving to the top and bottom of the steps.
- There should be safely protected refuges of a suitable size on all staircases for evacuation, with appropriate communication links.
- Additional low handrails should be provided for children under 12.

Rise

- 150mm–170mm (150mm preferred for schools)

Going

- 250mm minimum (280mm preferred for schools)
- Clear width between handrails 1200mm minimum (1600mm preferred)

Handrails

- To both sides, extend 300mm past the top and bottom of each flight.
- For children under 12, 40mm–45mm diameter, at a height of 600mm from the pitch line of the stair or ground level.

Landings

- 1200mm long minimum.

2.10.3 Lifts

Lifts are essential for vertical circulation for wheelchair users. To calculate the number, size, and location of lifts, the following need to be taken into account:

- The number of children, staff, and visitors expected

- How many are going to be using wheelchairs and other aids, the size of these aids, and how many will need assistance alongside
- The density and frequency of use, including the peak times of use – a flow analysis should assess peak change over time. An appropriate speed, size, and waiting time should be identified. The minimum waiting time should be at least 'good' as defined by CIBSE
- The maintenance strategy – i.e. action in the eventuality of breakdowns and repairs

Lifts should be well-lit and user-friendly, without looking purpose designed for disabled users. The following should be provided:

- Lift doors (with visual contrast to the surrounding wall) that are wide enough and operate slowly enough to allow people in wheelchairs to enter and exit the lift safely
- A mirror is positioned to help children and adults who cannot turn their wheelchairs around reverse out of the lift, and a handrail
- Suitable signage, accessible controls at the correct height, speech announcements, visual and tactile indicators, visual and audible alarms, and an emergency communication system with an induction loop.

2.10.4 Doors and openings

- The minimum clear opening width required by Approved Document M is 800mm. In some special schools, a wider opening may help those who need more assistance.
- Usually, a clear door opening width of 900mm on a corridor width of 1500mm–1800mm (preferably 2000mm–3000mm) allows access for a range of wheelchair users.
- Where there is a narrow corridor (under 1500mm wide), or larger wheelchairs or equipment, an extra side door leaf or a clear opening width of 1000– 1100mm can be provided.
- Vision panels between 500mm and 1500mm high with safety glass should be provided indoors for visibility and supervision, except where security is required.

2.10.5 Windows and screening

Internal glazed screens can be used to provide borrowed light and enable passive supervision by teachers. They also let children see what is happening and not feel enclosed. Blinds may be required to avoid distraction, or to give privacy.

Low-level windows with safety glazing allow very young children and children lying down to have a view out. However, some children can be distracted by views of the outside and activities taking place. All fittings need to be tamper-proof and prevent children from climbing out if they are distressed.

2.10.6 Disable toilets

Accessible toilets and changing facilities should be conveniently located around the school to avoid loss of curriculum time and supervision problems.

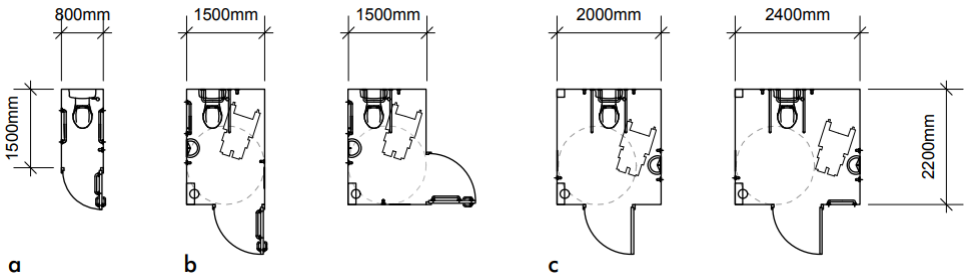


Figure 14 Typical disable toilet layout options

2.10.7 Parking

The type, size, and shape of a turning place in road use in that particular area. The interest of the fire and refuse collection services have to be taken into account in deciding on the road turning places. turning circles and loops are preferable, as motor vehicles can drive straight around them without having to stop.

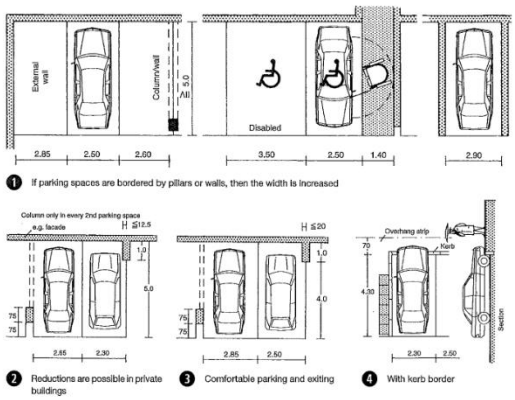


Figure 15 Parking for wheelchair users

2.11 Energy and Environment consideration

Natural lighting and ventilation

Natural sunlight is another element for designing energy-efficient buildings, it promotes the maximization of sunlight application to penetrate directly and indirectly into the building. It can be built through proper directional glass windows or reflective panels. At the same time, solar panels can be installed also on top of the roof to receive power to channel the electricity on electrical appliances, and water heaters and there is also a possibility to couple with a ventilator to get dual function. The market has a range of products such as solar-powered exhaust fans, solar ventilators solar fans, and other names. These products are so incredible that they combine several features that can be useful to the building, bringing sunlight to the building to eliminate the usage of lighting during day time, storing heat energy to convert to mechanical force for electricity and natural or its associated wind power to make energy-saving ventilation.

Figure 16 Passive design techniques

Noise reduction

Research suggests that many people with ASD find noise unpleasant and even shocking. Street noises, the noise from furnace ducts, and even a whistle coming from an air conditioner can be so distracting it means the end of the ability to learn for someone with autism. Various insulating materials must be used to design buildings for autistic children. The acoustic panels, fork, and foam boards can be used as insulating materials. Besides the orientation of the building also play an important role.

Noise from the roads and streets can also be controlled by differentiating landforms and greeneries as a barrier between noise-emitting source and receiver.

Use of green building materials

Locally available materials like bamboo, wood, mud, and straw thatch used in building not only reduces the cost of the building but it is also beneficial for autistic children as they impart different texture. The local building materials impart authenticity to the building and children are more connected to natural fewer carbon emissions materials.

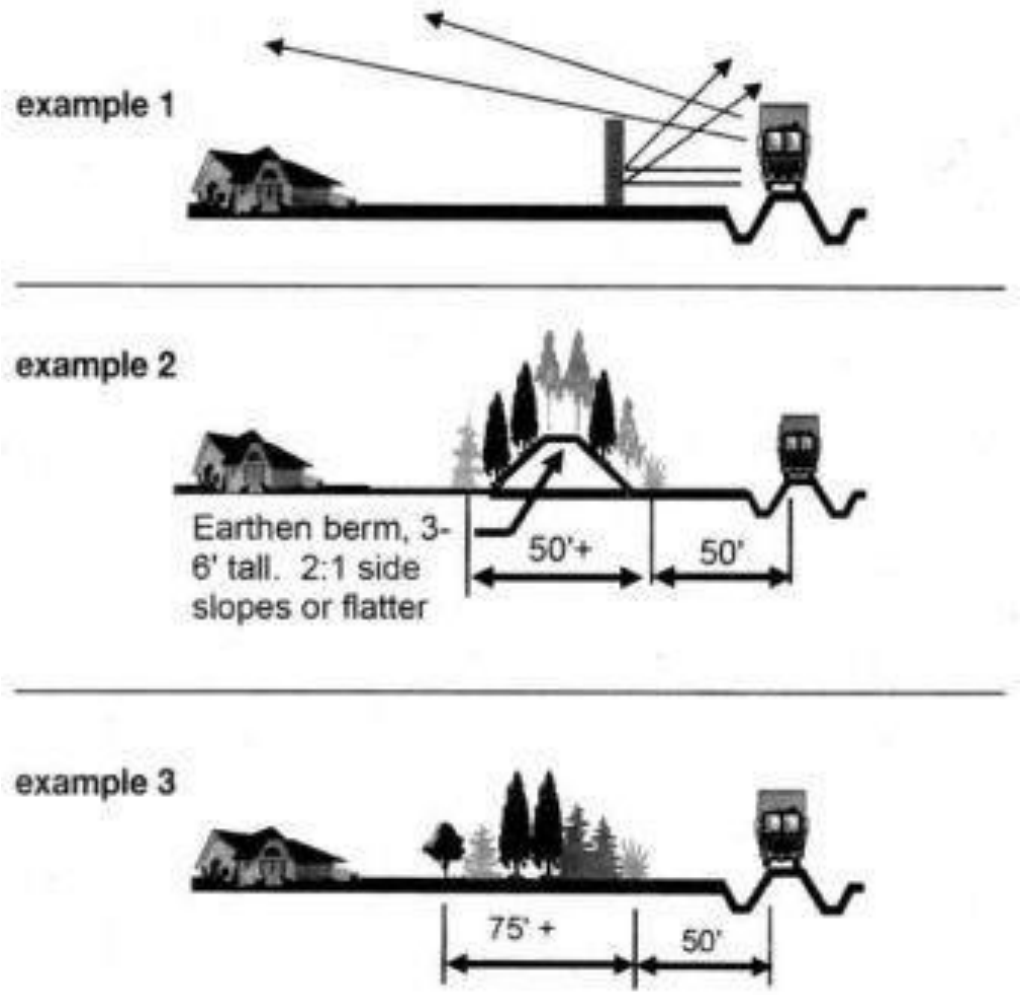


Figure 17 How landforms and berms reduce noise

3 Interviews

3.1 With therapist (Hope Center For Child Development And Research Center)

Name = Sangita Karki

Occupation: Therapist and trainer

1. Since when have you been working in this institution?
   - Hope Center is a newly established institution for autism on Poush 2078 and I have been working from the very first day of its establishment. Before that, I was a therapist at the Center For autism with experience of 5 years.
2. How many students do you address daily?
   - Daily I address 10- 12 students with autism. We have 4 classes with each class having 6 students. Along with that I also engage in various therapy works.
3. Describe the variety of students and they behave in the classroom.
   - In autism every child is unique and we observe their behavior and treat them accordingly. Among the various cases, most of them have difficulty in communication. Some may speak very little while some don't want to speak at all. Along with that, they have varied interests, some being highly intelligent and can pick up things quickly while some can't grasp things and information. When things don't go according to them they show temper tantrums. Besides their nature, they also have various sensitivity issues. Luckily we haven’t found highly sensitive children in our institution.
4. Are there any parent-child activities in the school?
   - Yes, there are lots of activities in which the presence of parents is very important because these children spend their maximum time in home if they don't receive a proper environment at home then our therapies also won't work properly. To avoid that we give proper training and even prepare sessions for parents to teach them how to deal with the students.

5. Why there is a need for a special school?
   - Special schools are very imponent in the life of autistic children to train them now in real-world work, it's very important for them to spend some time away from home, their safe zone. Especially as soon as the child starts receiving early intervention the more the child has chances to perform better in a normal school. There are changes that 1% of children can continue their normal education when early intervention is provided.
6. What is your recommendation to a designer for the design of centers for autistic children?
   - Autistic children can be easily distracted by the environment hence space should be small, compartmented, and less cluttered. The use of calming colors like blue, green, and soft pink can be recommended. Besides this safety must be the utmost priority as they tend to harm themselves when things don't go their way. Light, sound, and smell factors should also be considered.

3.2 PARENTS OF AUTISTIC CHILDREN

Name = Milli Shrestha

Relationship: Sibling

Care Center Attended By Child: Center For Autism, Baluwatar

1. At what age he was diagnosed with Autism?
   - He was diagnosed with autism at the age of 7 which is considered to be late.
2. What did you learn after confirmation?
   - After being diagnosed, we took him to Autism Care Center and also took him for speech therapy. We took him to see a psychologist too.
3. Is anything specific that bothers your brother?
   - He gets annoyed with crowds and people and he has his routine and if it is not done his way he gets bothered and gets very angry.
4. Does he like to go to natural places like gardens and swinging pools?
   - I am not sure about natural places but he likes going for a small walk once in a while.
5. Was there a breaking point?
   - At the age of 8 and nine, he was aggressive and he used to run from home we once had to call the police to search him but now since he is 15 -16 years old, he is tamed and calm.
6. Does he need assistance while eating, bathing, and using the washroom?
   - No, he doesn't need assistance in a lot of things but he needs assistance in eating.
7. How do you prepare him for real life?
   - We take him shopping and also buy groceries sometimes. We have taken him to school for future
8. Does he feel scared when he is with other kids?
   - He is not scared but he is uncomfortable with others.
9. Does he have an obsession with something?
   - He gets obsessed with using mobile and other technologies.

4 CASE STUDIES

4.1 International case studies

4.1.1 Eden Institute of autism

Figure 18 Eden institute of Autism

Project name: Eden Autism Education and Outreach Center

Location: NJ

Architect: KSS Architects

Project type: Education

Size: 38,300 sq. feet

Year completed: 2011

Awards:2013 AIA - State/Regional Awards

Purpose :

- To understand services provided in the autism center
- To understand concepts for inclusion in the practical world

Introduction

The Eden Institute, the founding program of the private nonprofit organization Eden Family of Services, provides families and their children affected by autism with year-round educational and outreach services. Impressed with the organization's mission and role in the community, KSS was honored to help Eden find a new home. Determined to give Eden the best location and design, KSS identified and analyzed many sites and eventually selected a site on the periphery of Princeton Forrestal Village, a mixed-use development.

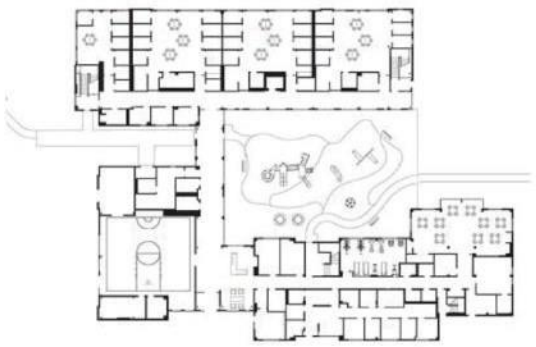
Services

The school centers on its vocational and therapy areas envisioned as a house and an office. The house, a space for students to learn routine activities such as making their bed, also has lounge areas. The office serves as a vocational resource for learning how to perform administrative work. A school store, in partnership with Wawa, gives older students experience in retail and public interaction. The L-shaped building is configured around a central courtyard for younger students to play and explore.

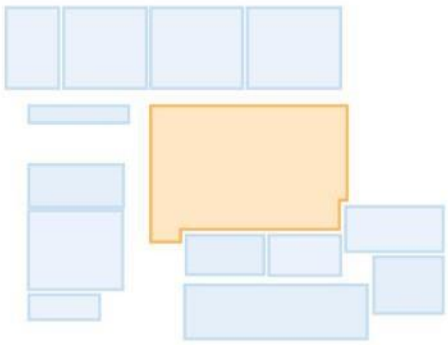
Spaces and planning

The main building is organized around a large courtyard, with clear circulation running the length of the U-shaped plan. The school is organized around the programmatic features by placing the learning and classroom spaces of the school on the northern part of the building and the utilities and administrative space on the southern half. This separates the program by what the student will be using and the stimulus in those rooms is due to their specific program type. Programs such as the gym and cafeteria are placed away from classrooms as these areas are much higher in stimulus than a classroom and moving between them would be too harsh for the students.

The institute connects to a large park by a curving pathway, creating a series of interlocking exterior and interior spaces. Several corridors are lined with floor-to-ceiling glazing strengthening the connection to the outdoor courtyard. Colored tiles mark classroom entrances to support wayfinding. Classrooms are located along a single corridor to the northwest, each connected to a series of individual therapy rooms. This sequence allows for a gradual transition from higher to lower sensory spaces and from group spaces into progressively more individualized spaces. The architects took steps to further eliminate distractions by using indirect natural light, acoustical separations, and neutral colors.

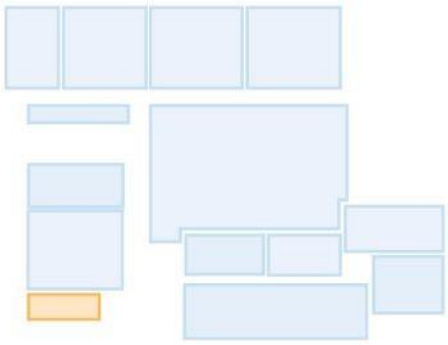


Floor Plan

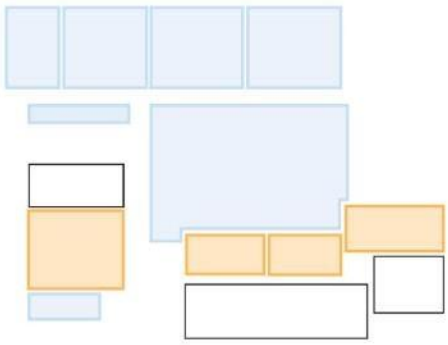


Central Organization Space

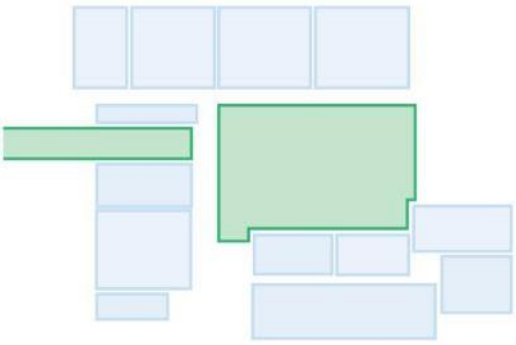
Program



Sensory Room



Stimulus level



Connection to Green Space

Figure 19 Spatial zoning

Figure 20 Interior lobby of Eden Institute

Figure 21 Classroom

4.1.2 Northern institute

Project name: Northern institute of autism

Location: Australia

Architect: HEDE Architects

Project type: Education

Size: 38,300 sq. feet

Year completed: 2011

Awards:2013 AIA State/Regional Awards

Figure 22 Northen institute , Australia

Introduction

The Northern School for Autism is in Australia and is one of two campuses. There is a total of 144 students attending the school, all of whom are diagnosed within the spectrum. Teacher-to-students ratio is 1 :3. With a large range of age- groups the brief required the students in separate sub-schools based on their position in the spectrum scale. The students are divided into 4 groups-Senior schools, middle school, and intermediate school.

Support a variety of learning styles for delivering instruction:

Internally classrooms have limited windows aimed at the outside, limited internal distraction, and subdued earthly color. The design of this school enables students to develop skills in self-calming through the provision of small learning spaces and access to the outside.

Support the learning environment activities:

This school groups the student learning spaces around the central courtyard and provides individual access direct to play for all learning areas. Classrooms are assembled around

strongly curved circulation routes that are purposefully non-interactive with learning area to reduce distractions.

Appropriate use of material, and systems:

Bike trails and sand pits are provided in all play areas as these elements are highly regarded by students with ASD for sensory activities. The color scheme selected used earthly, subdued colors as students are very sensitive to environmental factors.

Each learning unit has **-1)Main learning area** (intermediate)

2)WithdrawaI room (Quiet Learning)

3)**Outdoor Withdrawal Zone**

4)**Undercover Area** (Roofline)- Undercover but with north sun access and access to the sub-school space

Figure 23 Class room spaces in Northern Institute

5)**Outdoor Playspace-** Deliberately free from trees and landscaping due to students' prosperity to eat/destroy them. However, bike riding, climbing, and sand play are highly enjoyed by students.

Figure 24 Site plan of Northern institute

4.1.3 Hazelwood school of autism

Figure 25 Hazelwood school, Glasgow

The school caters to 60 students with multiple disabilities, aged from 2 to 19. Each student has a combination of two or more of the following impairments: acute visual impairment, and hand hearing impairment. All the pupils are autistic, they will never be able to lead totally independent lives, and each will require lifetime support. "The new school an Life Skills House (150 square meters) is 2660 square meters.

- The single storey structure is in natural material.
- The school contains eleven classrooms in a single-story structure, providing a nursery
- for secondary education.
- The distinctive curving interior spine meets the complex demands of an intuitive

Wayfinding system.

- Design of the sensory gardens, trampoline area, and Hydrotherapy pool created
- opportunities for children to explore, extend their skills, and gain confidence.

Access

- Vehicular access to the school is off the more quiet and safe streets to the north of
- the site.

Internal Organisation

- Users and visitors enter directly into the large foyer. This space divides the classroom wing from the gym/pool area and the administration area. This division allows the pool and gym area to be used after hours while the classroom area stays closed/ secure.

Acoustic Protection

- A high slate wall protects site from the heavy traffic noise from Dumbreck road. The Classroom faces north and open onto the quietest part of the site.

Light and Views

Fully glazed curved circulation space faces south and looks over the large gardens. Classrooms take advantage of north light.

Figure 26 Site plan of Glasgow school

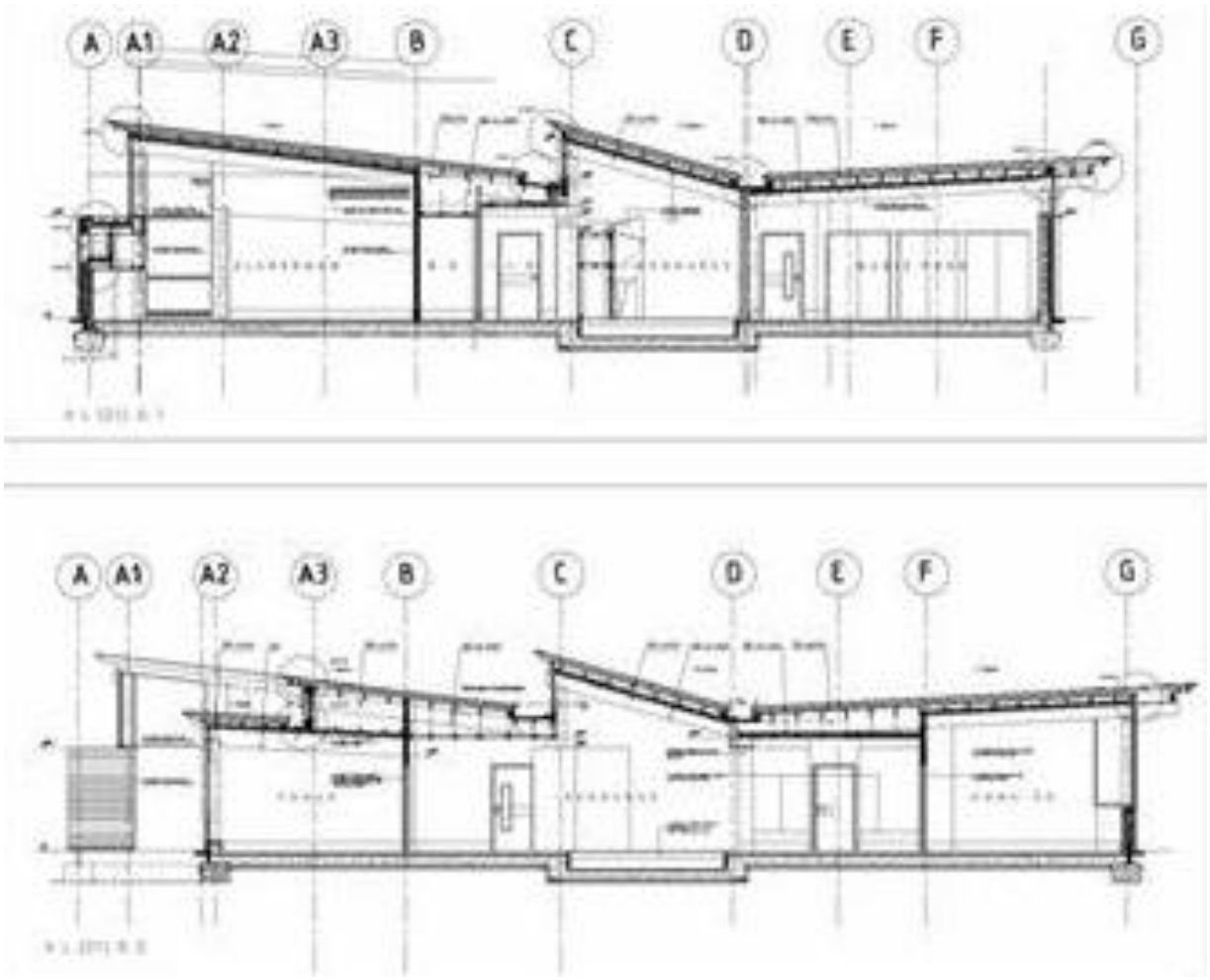


Figure 27 Section, Glasgow school

4.1.4 Action for Autism

Location: Pocket 8, Jasola Vihar, New Delhi

Area: App 600 sq.m.

Founded in 1991,

Building typology = Residential

Purpose of study

- To understand the approach and services being provided for individuals with autism in a regional context.

Figure 28 Action For Autism, New Delhi

Introduction

Action for Autism (AFA), New Delhi is the pioneering, national, and non-profit autism society of India. The organization provides support and services to individuals with autism and those who work with them in South Asia. The center was started by Merry Barua along with other parents whose children are autistic, in a small room at Chiragali. Currently she is the Head of the institution which comprises of 60 students and 25 teachers individuals of age 3years to 34 years.

Services

These 4 storeyed centres comprise 8 classrooms for the secondary children, 5 Parent-child intervention rooms, 2 Sensory rooms, 2 Occupational therapy rooms, a library, and a Research unit. The center caters to 60 individuals of age 3years to 34 years.

Spaces and Planning

Ground floor: reception area, office room, seating area, cafeteria, library, storage, swimming pool, outdoor play, and bathroom.

First floor: parent-child intervention wing 5 rooms, 3 classrooms 1 sensory room, and bathroom.

Second floor: 4 classroom for secondary children (high functioning), 3 classrooms for primary children (low functioning), 1 sensory room, 1 storage area and bathroom.

Third floor: the entire floor is dedicated to the research and diagnostic unit. Meeting space for teachers and parents. It can be seen that the building has been put to adaptive reuse.

Parent-teacher wing: this area is in an early intervention zone where the child is taught to understand the behavioral and cultural aspects of the children.

Sensory area: This is one to one intervention area where the child is taught by projecting videos and pictures on the wall. Low-functioning children use this space as it is dangerous to let them play outside without assistance.

4.2 National case studies

4.2.1 Hope center for child development and research center

Figure 30 HOPE child development and research center

Location: Baluwatar , Kathmandu

Building typology: Adaptive reuse

Site area = 8 anna

Establishment = 2078

Introduction

"Hope" is a newly established care center for children with autism. With the growing demand for autism centers. Hope was established to provide daycare services including various therapies for children with autism. Around 200 children are diagnosed with autism by the diagnostic center of HOPE. It provides daycare services for children ranging from age 3- 12 years.

Services:

This care center provides daycare services to 25 students with a student-teacher ratio of 2:1. The various therapies provided in this institution are music therapy. Occupational therapy, speech therapy, and behavioral therapy. The institution provides academic classes to 25 students and has three classrooms. Along with the classrooms, the institution also provides sensory rooms and outdoor spaces with a playground.

Spaces and planning.

Basement

The ground floor consists of outdoor spaces with a playground along with the administration.

Ground floor: 1 speech therapy, 1 occupational therapy, 1 sensory room, w/c, and behavioral therapy

First floor: huge halls converted into 3 classrooms, kitchen and dining area

Second floor: 2 psychologist rooms, observation area, w/c and store

Third floor: music and dance room, terrace

Lighting

The institution being reused in residential buildings doesn't serve the proper lighting required for the autism-friendly design. Some spaces receive glare that has been proven to affect hypersensitive people. Some spaces don't receive natural lighting and there is the use of artificial lighting.

Acoustics

The building doesn't have acoustic treatment and is located along the road thus resulting in a noisy and disturbing environment.

Safety

Various safety techniques were used in the spaces. Double-layered carpets. formboard and the outdoor spaces were covered with artificial glass. Similarly, the void of the railing was covered with rope to provide safety.

Color and texture

The interior spaces were painted with blue color to provide a sense of calmness.

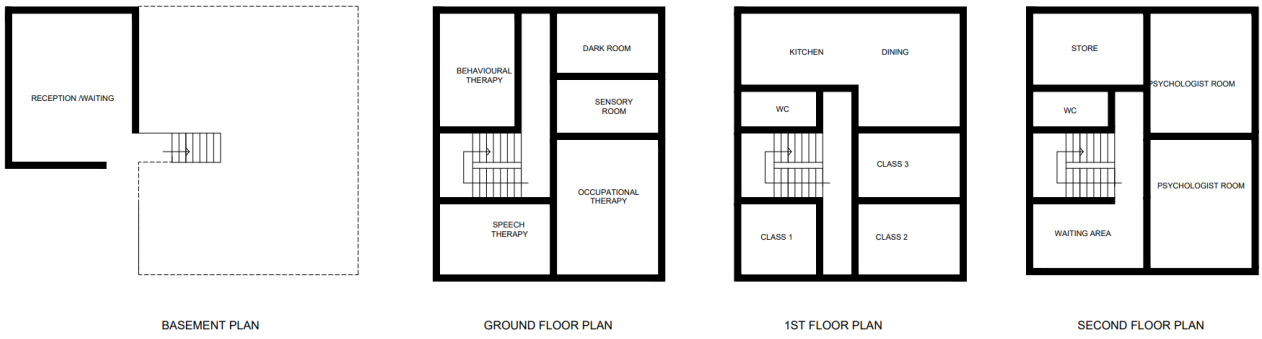


Figure 31 Floor plans and Space Zoning

4.2.2 SERC (Special education and rehabilitation center)

Project Overview

Location: Chapagaun, Lalitpur

Building typology: Institutional

Establishment year: 2017 AD

Site area: 9 ropani

Architect: Ar. Rajib Awale

Figure 32 SERC , Chapagaun Lalitpur

Introduction:

Special education and rehabilitation center is an educational and rehabilitation institution for mentally disabled children. The institution was initially located in the Baluwatar and later shifted to the Chapagaun area. Currently, it provides educational services to students in the age group 4 -12 years old. Similarly, it also provides residential facilities for children within the school area. Students along with special education, the institution also provide vocational training for children in the age group 12- 16 years old. SERC is the only special school designed under British Design Guidelines for children with special needs. The school currently provides services to 100 children with various disorders like Seizure, mental retardation, ADSD, and an autism spectrum disorder. The main objective of this school is to provide skills development training along with job facilities.

Purpose

To understand the design guidelines for an autism-friendly environment and to understand the services for children with a neurodevelopmental disorder

Facilities/services

SERC is a large institution that provides basic education, therapies, and vocational training for children with neurodevelopmental disorders. The institution also provides spaces for a library, cafeteria, convenience store, meeting hall, guest rooms, etc

Site and surrounding

SERC is located in a peaceful area away from the main city and is accessible 10 minutes from the bus stop. The area is surrounded by greenery and water bodies that give a very calming and pleasant environment free from noise. the central courtyard is formed by buildings surrounded from along sides. The building units are academic units and therapy units. Administrative units and dormitories. Proper zoning is considered while designing this institution.

Figure 33 Site plan

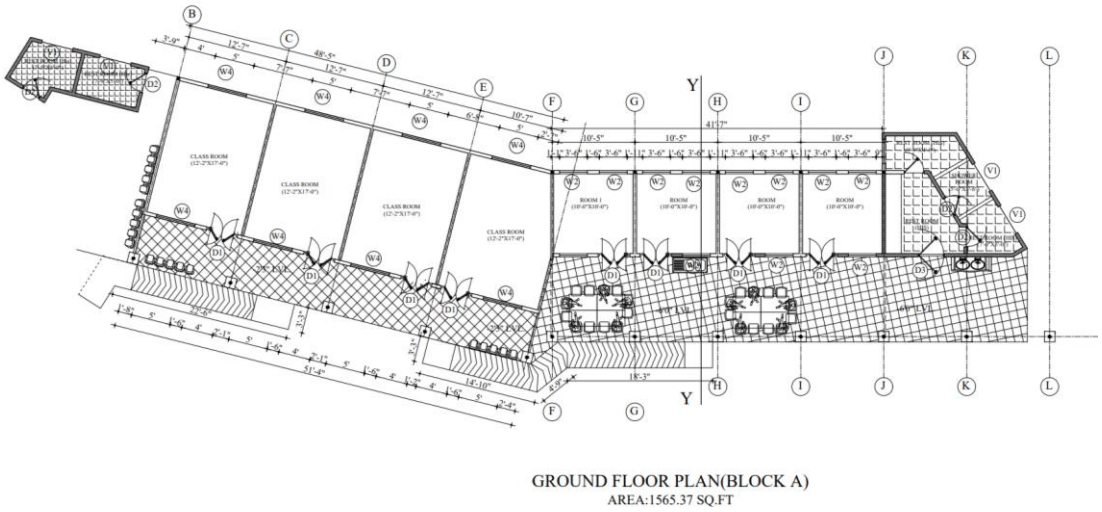


Figure 34 Academic Block

Classrooms

The classroom is of standard size 12’ x17’ and life skill learning rooms are 10’x10’. The class consists of a table and a shelf as furniture. Proper light and air circulation in the class. The vocational training room has a partition wall for observation. Generally, all the classes are on the ground floor for easy access by a wheelchair user. The door width is 1m considering the access for a wheelchair user. Yellow color walls room on the interior of the classes.

Therapy units.

The institution consists of physiotherapy, occupational therapy, and a sensory integration room for sensory issues. The interior walls are painted blue for a calming effect. All the rooms and spaces are easily accessible by wheelchair users.

Dormitories

The dormitories are divided into boys and girls separately with a capacity of 20 boys and 20 girls along with a toilet area. The hostel also provides space for caretaker within it. The cafeteria serves the children of the institution as well as students of hostels.

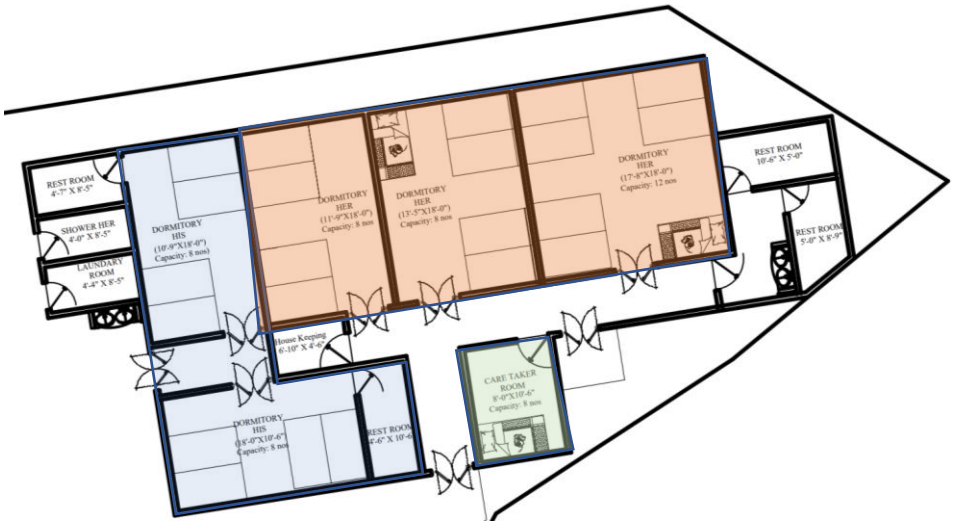


Figure 35 Dormitories block floor plan

Light and ventilation.

The buildings are well-lit with natural light. The direct light is shaded by the porch followed by the classroom. Skylight inside the spaces for good lighting. Similarly, there is a proper flow of air inside the building spaces.

Acoustics.

SERC is located at 10 min distance from main road area and surrounded by greenery and water bodies. Hence, the noise level in that location is very less and Hence no disturbance was seen in the area.

Disable friendly design

The design of the school focuses on accessibility to most of the users. The contour of a site helps in level difference. likewise, each space is accessible through ramps by wheelchair users. The width of the door is 1m for easy access to ramps. Along with the classroom spaces, the institution also provides a disable friendly washroom as per user needs.

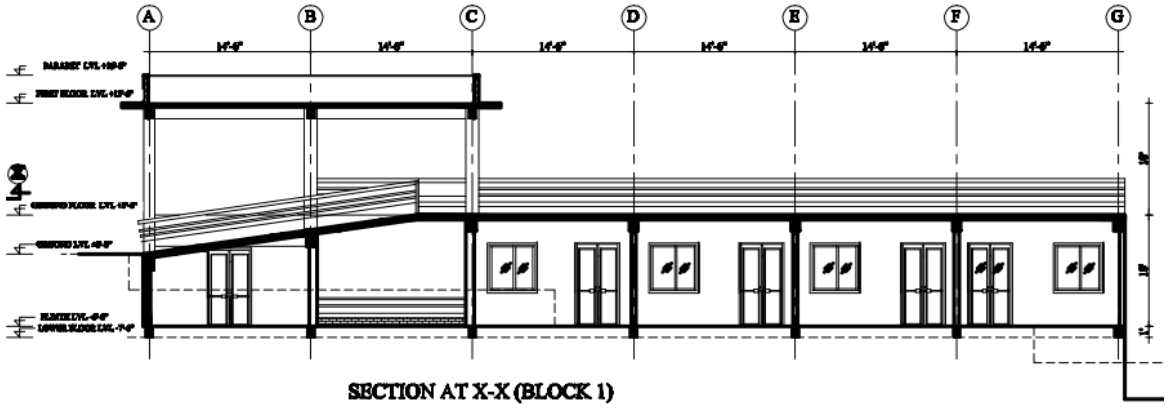


Figure 36 Section of Academic Block

Figure 37 Academic classroom units

4.3 Inference from Case study

4.3.1 International case study

4.3.1.1 Eden Institute For Autism

- Use of convenience stores for inclusion in society.
- Provision of escape spaces within every classroom
- Use of soft light and calming colors inside building spaces
- Centrally located green spaces and courtyard

4.3.1.2 Northern School For Autism

- Classroom spaces are divided into the main learning area, withdrawal room, and outdoor withdrawal room
- In one way circulation, space flows seamlessly from one point to another.

4.3.1.3 Hazelwood School

- Use of vegetation as buffer space
- Use of soft light and calming colors
- Maximum use of indirect natural light and ventilation

4.3.1.4 Action For Autism

- Inclusion of Parent-Child intervention Block
- Intimate classroom of 10 sq. m, for six children
- Sensory rooms on each floor
- Screening on windows to avoid distraction.

4.3.2 National Case study

4.3.2.1 Hope Center for Child Development and research center

- Use of Double layered carpets for safety and insulation

Huge spaces are compartmentalized to create small intimate space

- Use of Blue color in the interior spaces for calming effect

4.3.2.2 SERC (Special Education and Rehabilitation Center)

- Spaces are divided into academic and rehabilitation zones
- Centrally located courtyard as activity space
- Use of natural lighting inside the buildings along with skylight
- Use of ramps and disabled Toilets for Disable Friendly Design.

5 Site analysis

5.1 Site selection criteria

Various criteria for site selection were implemented and used as a means to judge the potential of sites. It would have a direct impact on the design and architectural implications of the center. Some of the selection guidelines for determining an appropriate site for this center are listed below:

- Accessibility
- The connection between urban and suburban
- Residential nature
- Natural setting
- Safety
- Sense-sight
- Doesn't produce any intolerable smell
- Noise-free environment
- Proximity to hospital

5.2 Site introduction

The site for the care center for people with autism is located in ward no 8. Budhanilkantha, Kathmandu. The site located in the Budhanilkantha is easily accessible from the main road and is in a sparsely dispersed residential locality. The site is free from any loud noises and is surrounded by trees the site is located in reasonable proximity to well-known medical institutions as well as schools and daycare center.

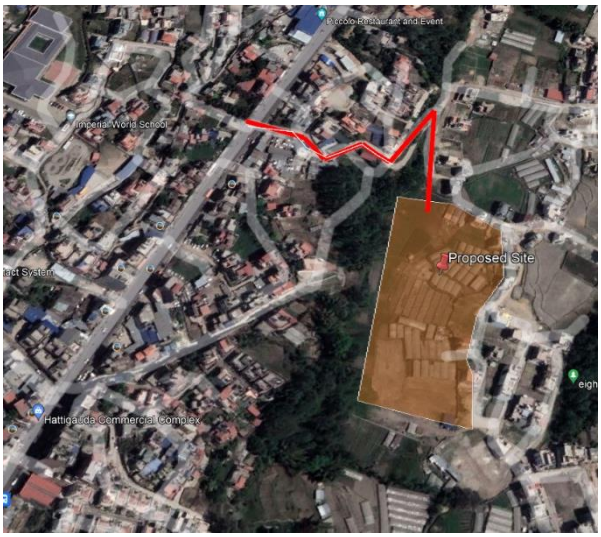


Figure 38 Site Map (GOOGLE EARTH)

Location: Ward 8, Budhanilkantha, Kathmandu

Access to the site

The site is accessed through a 5m road on the north side. The access road is graveled and is 250 away from the main bus stop road and 2.3km away from the Chakrapath area. Similarly, another pedestrian road connects the site east of the site.

Site surrounding

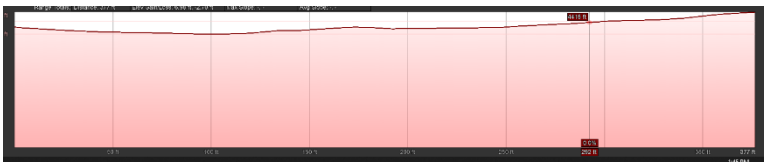
The site is located in a sparsely dispersed residential area. Most of the surroundings are still barren land.

East = Residential Buildings

West = Forest

North = residence

South = Forest



Natural factors

Site area = 23317 sq. m/ 46 ropanies

Figure 39 Site topography section (google earth)

Topography

Flat land with slight contours on the west.

Vegetation

Being agricultural land, there is a fair amount of vegetation in the surrounding area. There are a few sizes of forests on the west and south of the site.

Climate

The climate here is mild and generally warm and temperate. In winter, there is much less rainfall than in summer. In Budhanilkantha, the average annual temperature is 16.2 °C | 61.2 °F. Precipitation here is about 2812 mm | 110.7 inches per year.

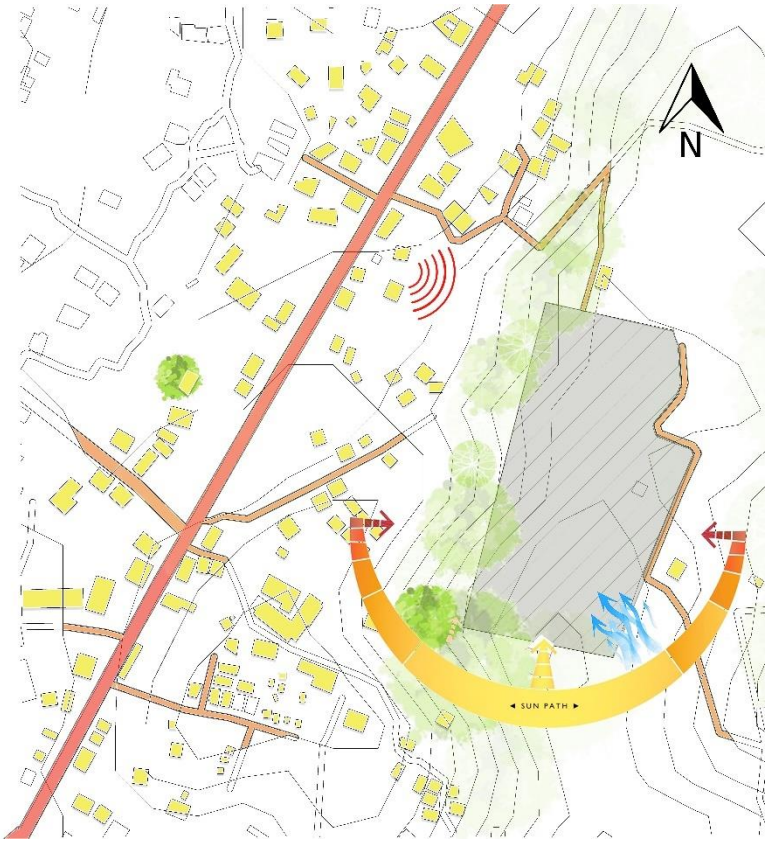


Figure 40 Site analysis

The month with the highest relative humidity is July (91.20 %). The month with the lowest relative humidity is April (55.37 %). The month with the highest number of rainy days is July (28.97 days). The month with the lowest number of rainy days is December (4.87 days).

Existing Feature

Most of the site area is barren land while some of the areas are used as a farm. Temporary structures are erected which serve as a greenhouse for different harvests of the farm. The other side across the site is also barren land with very few residential buildings.

5.3 SWOT analysis

Figure 41 Existing road leading to site

Strength

- The area has plenty of open area with plenty of vegetation
- It is located away from the core city but still easily accessible by vehicle.
- Calm pleasant and noise-free environment
- Proximity to other institutions and hospitals

Weakness

- There are no blacktopped roads connected to the site
- Some portions of the site are still used for agriculture

Figure 42 Small forest near site

Opportunity

- To create a calm environment
- Connection with the community

Threats

- Destruction of fertile agricultural land
- Possibility of crowding in future.

6 PROGRAM FORMULATION

The care center will cater to 100 children between the ages of 5 to 16 years.

Students in each class are 10, 4 class primary, 4 class secondary, and 4 senior class.

The teacher-student ratio is considered 1 : 3.

Table 2 Program Formulation

BLOCK A			
ADMINISTRATION			
DESCRIPTION	N0. S	CAPACITY	AREA
ACCOUNT SECTION	1	2	12
MANAGER	3	3	36
DIRECTOR	1	1	12
OFFICE	1	6	36
STORE			7
PANTRY			8
WC	6		10
MEETING HALL	2	20	56
			177
DIAGNOSIS			
DIAGNOSIS ROOM	1	1	19
OBSERVATION ROOM	1		22
COUNSEING ROOM	3		40
DOCTORS LOUNGE	1		12
WC	6		10
			103

	THERAPY	2	36

PHYSIO THERAPY		1	1
VISION THERAPY	1	1	9
SENSORY INTEGRATION	2	2	14
ABA THERAPY	2	2	14
SPEECH THERAPY	2	2	14
WC	3	3	10
			140
TRAINING			
MULTIPURPOSE HALL		40	123
LOBBY AND CIRCULATION			473
			596
TOTAL			1710

BLOCK B			
SENIOR AND VOCATIONAL			
SENIOR LEVEL			
DESCRIPTION	N0. S	CAPACITY	AREA
CLASSROOM	4	10	120
SENSORY ROOM	2		30
ART CLASS	1		34
LIBRARY	1		40
INFIRMARY	1		15
TEACHER LOUNGE			30
WC			16
COMPUTER LAB	1	10	28
			313

VOCATIONAL UNIT			
BAKERY	1		16

CANDLE MAKING	1		16
POTTERY	1		16
MULTIPURPOSE WORKSHOP	2		40
STORE	3		18
WC			22
CIRCULATION			312
			440
TOTAL			753

BLOCK C			
ACADEMIC BLOCK			
DESCRIPTION	N0. S	CAPACITY	AREA
CLASSROOM WITH INDIVIDUAL SPACE	12	120	360
SENSORY R0OM	5	1	30
PRINCIPAL ROOM	1	1	30
CO-ORDINATOR ROOM	1	1	30
TEACHERS LOUNGE	1	4	30
WC			20
CIRCULATION			164
			664

BLOCK D			
CAFETERIA			
DESCRIPTION	N0. S	CAPACITY	AREA
DINING SPACE		50	120
KITCHEN			40
STORE			20
WC			10
			190

STAFF ACCOMODATION			
AREA FOR 1 UNIT	1	1	63
AREA OF 16 UNIT	16		1008
CIRCULATION 30%			302
TOTAL			**1400**

TOTAL BUILT UP AREA = 4717 SQ M

Area Calculation		
	Program	**Area**
	Built up area	**4717 SQ M**
	Parking	**767**
	Total Site Area	**19, 064 sq m**

7 Conceptual Design Development.

7.1 Introduction

In this chapter the overall design concept and thought process during formation of the design for this CENTER FOR CHILDREN WITH AUTISM will be explored. The concept of any design project is the heart of the project, and the design development is the product of this conceptual idea. The design creation approach combines results from earlier chapters on architecture for autism friendly environments with intangible notions like quiet enabling environment for cohesive design. The design idea is established in many processes after reviewing literature, case studies, programming needs and site information.

7.2 Design evolution

Site inference

Various site inferences have been taken for the design development based on the site study, because the location is in the middle of suburban residential neighborhood, noise levels and vistas had to be taken into account, and full use of natural light in all major areas was one if the most important consideration,

The following factors were taken into account when placing various components of block.

- Accessibility
- Residential nature
- Natural setting
- Safety
- Sense – sight
- Smell

7.3 Design concept

7.3.1 Bridging the gap

The typical school for autism does not involve every member of an autistic individual's life in the education process. In the current school system only the teachers and students are present and other key individuals are missing; the doctors who diagnose the students and the parent who are raising the students. The students are often separated, themselves, throughout the education process. They will move to different schools for different levels in their education and there is little overlap between the different age groups associated with the autistic user.

Figure 43 Proposed model for involving parents, teachers, doctors and student

7.3.2 Site axis

The axis acts as the main circulation area that connects various blocks and the landscapes.

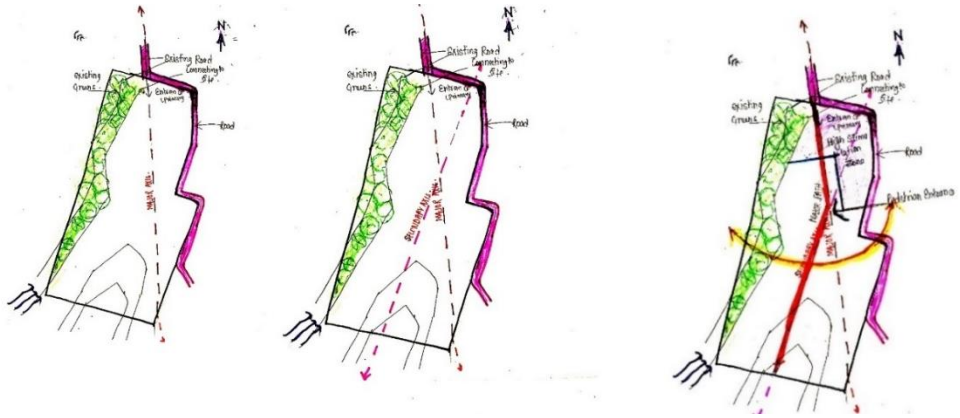


Figure 44 Two axis are created and the common axis is formed

7.3.3 Keeping in peace with nature

Nature has soothing effect and humans have an innate tendency to connect with nature. Green spaces provide us with opportunity to recalibrate ourselves and in case of autism need of these kind of spaces is significant during periods of overstimulation. So, pocket of green spaces which acts as the major transition zone between various spaces of differing stimulus levels has been proposed where the children can recalibrate and adjust with the changes. Creation of various green pocket spaces that can be used as escape has also been taken into consideration.

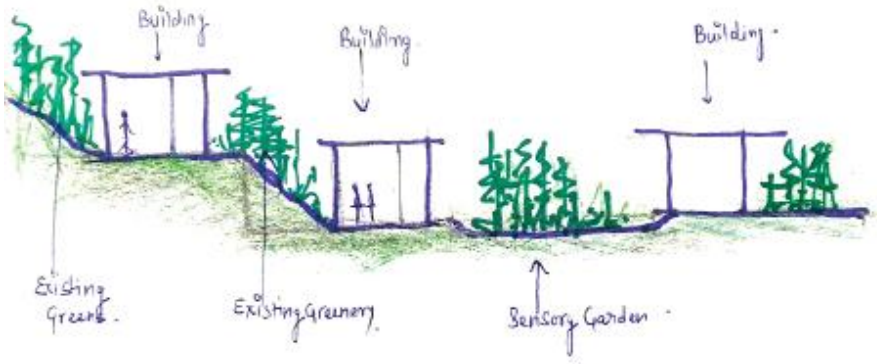
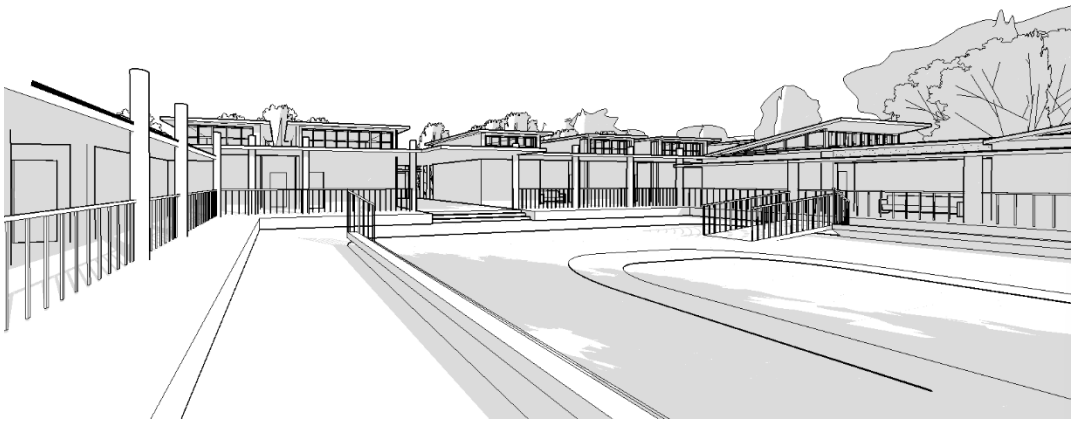


Figure 45 Blocks are divided by natural greens and void as transition

7.3.4 Predictability and Way finding

- Visual penetrability helps to magnify space
- Creates inside outside relation and enhances the public nature
- Diminish the ideas of physical separation
- 

7.3.5 Zoning

Spaces are organized in accordance to their sensory quality rather than typical architectural approach of functional zoning where there is high stimulus zones and low stimulus zone separated by transition zones. Generally classes and vocational training units are placed close to existing green forest in order to maintain peaceful environment. Likewise accommodation building are placed at lower level of site for privacy purpose.

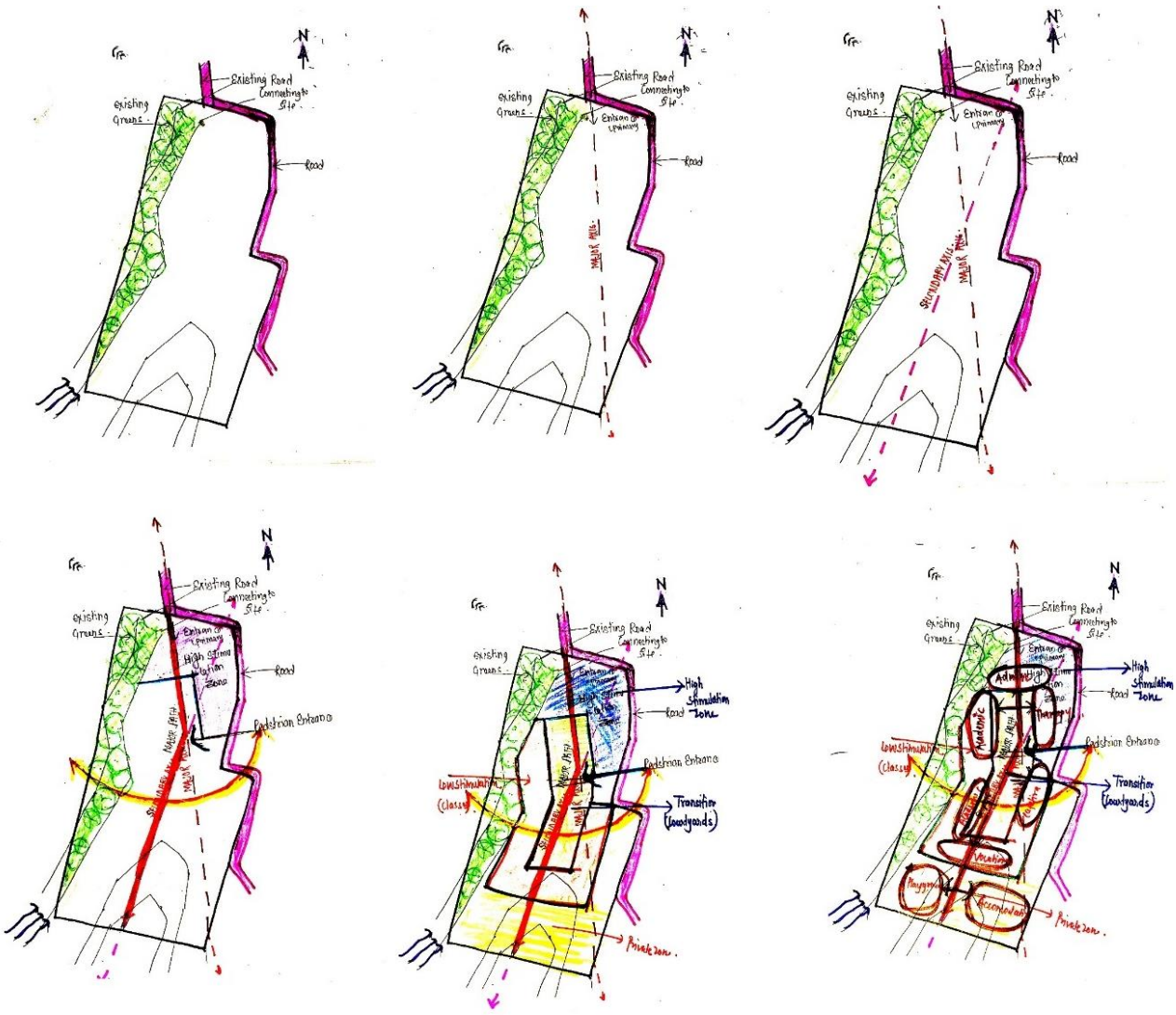


Figure 46 Site zoning and Form development

7.3.6 Elevation design approach

Fluctuating skyline is created using various rooflines. The concept is to provide diffused north light inside the spaces that cater autistic children. With the aim of introducing maximum light but again by minimizing unnecessary distraction in the classrroms, skylight is provides in the classroom area.

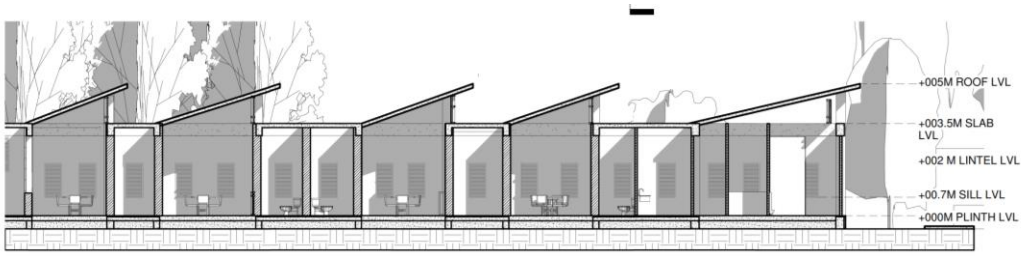


Figure 47 Northlight roof to eliminate west glare and bring diffused north light in class

Likewise the existing site contours also helps in balancing the building elevation.

Figure 48 Site Section showing Accommodation at lower level

8 Component Blocks

8.1 Administration block

The administrative block is easily visible from entrance and is accessed through the main circulatory axis. The unit houses administrative services and parents training area. The entrance directly leads to the information desk from where visitors can be guided. The admin section provides various administration activities with offices and there is staircase leading to the parents training area.

Figure 49 Administration and Therapy block

8.2 Diagnosis and therapy block

This block is directly visible from entrance and is accessed through main circulatory lobby. Various diagnosis and counseling activities are carried in this block. The block generally serves doctors and therapist. After the diagnosis, therapy services are provided in the same building. The unit provides various therapies for children with autism. The therapies includes speech therapy, behavioral therapy, sensory integration. physiotherapy and occupational therapy along with diagnosis rooms. The unit can also be accessed main courtyard by autistic children. Since the block facilitates autistic children. Indirect light is provided in the class and louvers windows for ventilation.

8.3 Academic blocks

The academic units are visible from children's entrance and could be accessed through primary entrance. Considering existing site feature, the west of site consists of existing greeneries that creates calming environment. The blocks are separated from therapy and administration through primary courtyard. The academic blocks are further divided into three categories: primary, secondary and senior blocks which are divided on the basis of their ability. the academic blocks consist of classroom which is divided into one to one quiet room and has an access to landscape.

Junior block is directly accessible through courtyard and is single storey structure . each classroom is provided with toilet and an individual room which helps to recalibrate students during sensory overload. Since the classes are located in the west side of site, northlight roof structure is used to provide north light inside building.

Secondary and senior blocks area also single storey that contains individual room and and sensory rooms in the lobby. Considering the ability of children's toilets are provided at the corner of the block. For the proper interaction among autistic children's of different level, a courtyard is provided so that they can learn from each other.

Figure 50 Academic and Vocational units

Figure 51 Primary Block

8.3.1 Classroom

The interiors of classrooms designed for children with autism are crucial in providing a conducive learning environment that caters to their sensory needs. The classrooms that I

designed incorporate several features that support the unique needs of these students. The flexible furniture arrangement provides ample space for different students, including those with physical and neurodevelopmental disorders, to move around freely.

To ensure the safety of the students, the classrooms have wall paneling up to 1.5 meters to protect children with autism from injuries caused by hard surfaces. The flooring materials used in the classrooms are vinyl tiles with double layer carpeting, which provide a soft surface that is comfortable for the children to walk or sit on.

Lighting is a crucial aspect of classroom design, especially for children with high sensitivity to light. The northlight in the classrooms is focused in a way that prevents disturbance to these students. In addition, acoustic design is also critical in ensuring a calm and conducive learning environment. Proper insulation in the one-foot-thick walls minimizes noise, creating a peaceful environment for the students.

Color schemes are equally important in designing classrooms for children with autism. Primary colors can be triggering to some children with high sensitivity, so I incorporated various tones of blues and muted earth colors in the classrooms with a capacity of 10 students. These colors have a soothing and calming effect, making the classroom environment more comfortable for the students.

In conclusion, the interiors of classrooms for children with autism require a careful consideration of the sensory needs of these students. The flexible furniture arrangement, wall paneling, flooring materials, lighting, acoustic design, and color schemes in the classrooms I designed all support the unique needs of these students, ensuring they have a safe and comfortable learning environment.

Figure 52 Interior of classroom

8.3.2 Quiet room

The quiet room is an essential component of any facility designed for children with autism. The purpose of the quiet room is to provide a safe and calming environment where children can retreat when they feel overwhelmed. The quiet room I designed for autistic children incorporates several features that promote relaxation and comfort.

One crucial consideration in designing a quiet room is the choice of colors. Blue is a color that has a calming effect on the mind and body, and it was the primary color used in the room. The quiet room is entirely paneled with soft materials to provide a safe environment for the children, considering their tendency to engage in head-banging activity. The room also features a swing for children with autism, which provides them with the necessary sensory input to regulate their emotions and behavior.

Additionally, the quiet room includes sensory boards, which help stimulate the senses of the children in a controlled environment. These boards feature a variety of textures and shapes,

allowing the children to engage their sense of touch and sight, which can help them feel more relaxed and focused.

In conclusion, the quiet room is a vital space in facilities designed for children with autism. The room should be designed to provide a safe and calming environment where children can retreat when they feel overwhelmed. The inclusion of soft paneling, a calming color scheme, a swing, and sensory boards can help promote relaxation and comfort, allowing children to regulate their emotions and behavior more effectively.

Figure 53 Interior of quiet room

8.3.3 Academic corridors

The academic corridor designed for children with autism is a unique space that caters to their specific needs. Circular pockets on the walls serve as escape spaces (ECSPE) for children who may feel overwhelmed or need some quiet time. The lobby area features these pockets in a curved layout to provide a hiding space that feels more organic and comforting for the children. The corridors themselves feature a play of mass and void, creating a connection to the outside environment. The color theme of green shapes is used throughout the corridor as it is known to revitalize the body and mind and create a balance between emotions. Overall, this academic corridor is designed to create a safe and comfortable environment for children with autism to learn and thrive.

Figure 54 Corridor detailing

8.4 Cafeteria

Cafeteria block is accessed by the children from entrance and is located at the heart of the site.

Figure 55 Cafeteria

8.5 Vocational units

This unit is adjacent to academic block. It consists of various programs considering repetitive activities of the children. This block is for children of higher age group (above 12) in order to prepare them for future by teaching various skills like, candle making. Pottery, computer works, handloom works, cooking classes and so on. The courtyard connects the vocational blocks with senior blocks and courtyard acts as interactive space between those children's, where they can learn from each other. Similarly library art class, halls are provided considering the abilities and need of children.

8.6 Space in voids

Courtyards are created inside the center . the courtyards acts as the interactive spaces between autistic and non-autistic and also among senior autistic children.

Figure 56 Cetral Courtyard

8.7 Playgrounds

Playground includes basketball court in the south of the site. Considering the natural topography of site. The basketball court is at lower level which is accessed by ramps and the stairs acts as the viewing area. On the north of the basketball court there is landscaping area which acts as the connection between the academic blocks and the existing greens of the site.

Figure 57 Playground area

8.8 Sensory garden

The sensory garden that I designed for children with autism located in the East is an all-encompassing experience that stimulates all five senses - taste, smell, touch, sight, and sound. I have incorporated various elements that allow the children to engage with nature and interact with it in a safe and therapeutic way. To stimulate the sense of sight, the garden is filled with colorful flowers, and pergolas are strategically placed to allow light and shadows to play. The sound element is provided by wind bells, and the bamboo barriers act as a source of sound while also providing functional boundaries.

To cater to the sense of touch, I have designed pathways of mud and sand that produce a unique sound underfoot. I have also incorporated various plants such as lamb, aloe vera, and touch me not to provide different textures for the children to touch and feel. At the center of the garden, a sandy sculpture has been placed, encouraging the children to play and interact with it.

The garden also features edible plants such as tulsi, mint, and various fruits, which cater to the sense of taste. Lastly, for the sense of smell, I have incorporated scent-producing plants such as chamomile, lavender, and thyme into the design, ensuring that the garden provides a complete sensory experience for the children. The sensory garden is a safe and therapeutic space that provides a welcoming environment for children with autism to engage and interact with nature, ultimately leading to their holistic development.

Touch : Lambs (softest plant), Aloe vera, and resilient plants that can be touched regularly by little hands

Taste: Mint, Strawberry, Fruits Herbs like Tulsi, Neem, etc

Smell: Lavender. Thyme, Chamomile, etc

Sight : Cordylines, Daisy, Marigold, Pansy, etc

Sound : Bamboo, large leaf plants etc

Figure 58 Sensory garden and landscape

Figure 59 Sensory Garden stimulating five senses

Figure 60 Sensory Garden At West

8.9 Accommodation block

Accommodation for 20% of the staff has been provided. The block is located on the south of the site and could be accessed by the pedestrian entrance. Considering the topography of the site, the accommodation blocks are at the lower level inorder to maintain privacy. Similarly, the blocks are two storey and lying on the lower level, the building beings balance to the overall site elevations.

Figure 61 Accommodation units

8.10 3d models

Figure 62 3d model

8.11 Structure

In designing the care center for children with autism, structural and material considerations were given utmost importance. As per the project requirements, the building cannot exceed more than two floors, and all the classrooms and spaces used by the children are single-story structures. The lighting requirements were also taken into account, and interesting roof design was introduced through the north light roof system. To add more interesting features, some of the roofs were made hyperbolic. However, considering the limitation on the load-bearing structure, a frame structure was suggested.

To maximize the clear opening, the flat slab system was introduced where the column is directly connected to the slab. This system eliminated the need for beams and provided a seamless ceiling, which is ideal for spaces used by children with autism. In addition, the flat slab system allowed for the efficient use of materials, reducing the overall weight of the structure, and providing a more cost-effective solution.

Overall, the structural and material considerations in designing the care center for children with autism focused on safety, functionality, and cost-effectiveness. The result is a space that is not only visually appealing but also serves its purpose efficiently, providing a safe and therapeutic environment for children with autism.

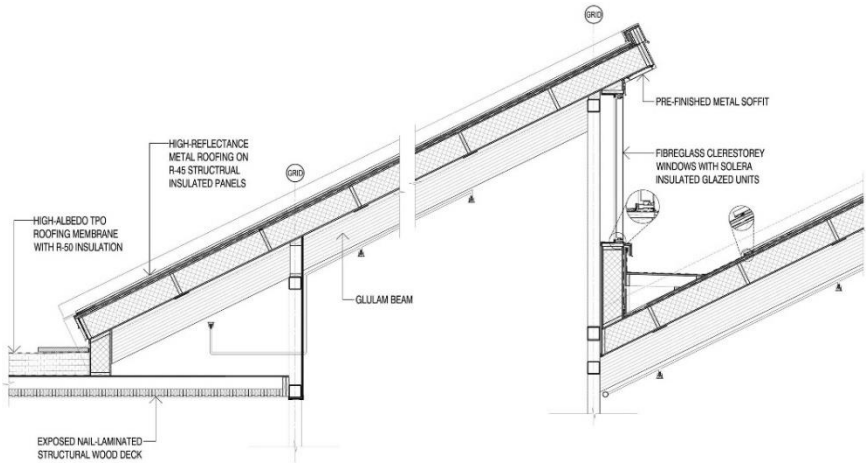


Figure 63 Details of Northlight roof

8.12 Building services

Table 3 Water requirement calculation

S. No	Description	No. of people	Overhead capacity	Total
1	Administration	25	40	1000
2	Diagnosis and Therapy	40	30	1200
3	Primary Block	50	30	1500
4	Secondary and senior block	80	20	1600
5	Vocational Block	25	25	625
6	Training Unit	50	25	1250
7	Cafeteria	90	25	1500
8	Staff Accommodation	50	100	5000
	Total	370		14,425 L

Total = 14,425L per head per day about 14 cu. M

Size of water tank= 14 x 3 = 42 cu. M

Fire Tank = 50 cu . m a/c to NBC

Total Under Ground water = 92 cu. M

Tank size = 100 cu.m = 6 x 4.5 x 4 m

8.12.1 Septic tank calculation

Table 4 Septic Tank Calculation

Primary users		Secondary users	
Administration	25	Cafeteria	90
Academic	130	Training hall	50
Accommodation	50	Total	140
Vocational	25	20% of total	28
Therapy	40		
Total	270		

Required volume = 270 + 28 = 298 x 3= 894 cu. Ft

Taking H = 1.8 m

Size of septic tank = 6.5 x 2.2 x 1.8 cu m

Soak pit = 4 x sp.6 (Sp.6 = Dia 5m and depth 2.75)

9 Conclusion

The present study is an attempt to understand the psychology and deficits of autistic people and the roles played by architectural elements in their intervention. Since, ASD is a developmental disability causing social, communication, and behavioral challenges which cause individuals to communicate, interact and learn differently from their peers, it is very important to shape the physical space with a range of needs to learn. The physical spaces where students learn have an active role in shaping their experience and their state of mind. Also, the spatial and sensory needs have to be addressed within learning spaces considering all these design parameters, the main goal of this research is to design a suitable space that enhances positive learning and healing among autistic children.

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ANNEX